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Cyber Security

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Cyber Security

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Cyber Security

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Unit 1: Introduction to Cyber Space

1

Unit Structure

1.1 INTRODUCTION

Internet is among the most important inventions of the 21st century which have affected our life. Today internet have crosses every barrier and have changed the way we use to talk, play games, work, shop, make friends, listen music, see movies, order food, pay bill, greet your friend on his birthday/ anniversary, etc. You name it, and we have an app in place for that. It has facilitated our life by making it comfortable. Gone are the days when we have to stand in a long queue for paying our telephone and electricity bills. Now we can pay it at a click of a button from our home or office. The technology have reached to an extent that we don"t even require a computer for using internet. Now we have internet enabled smartphone, palmtops, etc. through which we can remain connected to our friends, family and office 24x7. Not only internet has simplified our life but also it has brought many things within the reach of the middle class by making them cost effective. It was not long back, while making an ISD or even a STD call; the eyes were stricken on the pulse meter. The calls were very costly. ISD and STD were used to pass on urgent messages only and the rest of the routine communication was done using letters since it was a relatively very cheap. Now internet have made it possible to not only talk but use video conference using popular applications like skype, gtalk etc. at a very low price to a level where a one hour video chat using internet is cheaper that the cost of sending a one page document from Delhi to Bangalore using speed-post or courier service. Not only this, internet has changed the use of the typical devices that were used by us. Television can be used not only for watching popular tv shows and movies but can be used for calling/ video chatting with friend using internet. Mobile phone is not only used for making a call but viewing a latest movie. We can remain connected to everyone, no matter what our location is. Working parents from office can keep eye on their children at home and help them in their homework. A businessman can keep eye on his staff, office, shop, etc. with a click of a button. It has facilitated our life in more than one way. Have you ever wondered from where this internet came? Let us discuss the brief history of internet and learn how this internet was invented and how it evolved to an extent that now we cannot think of our lives without it.

1.1.1 History of Internet

I don’t know what the cold war between USA and Russia gave to the world, but defiantly the internet is one of those very useful inventions whose foundation was laid during cold war days. Russia Launched the world’s first satellite, SPUTNIK into the space on 4th October, 1957. This was clearly the victory of Russia over the cyber space and as a counter step, Advanced Research Projects Agency, the research arm of Department of Defence, United States, declared the launch of ARPANET(Advanced Research Projects Agency NETwork) in early 1960‟s. This was an experimental network and was designed to keep the computers connected to the this network to communicate with each other even if any of the node, due to the bomb attack, fails to respond. The first message was sent over the ARPANET, a packing switching network, by Leonard Kleinrock's laboratory at University of California, Los Angeles (UCLA). You will be surprised to know that the fist message that was sent over internet was “LO”. Actually they intended to send work “LOGIN” and only the first two letters reached its destination at second network node at Stanford Research Institute (SRI) and before the last three letters could reach the destination the network was down due to glitch. Soon the error was fixed and the message was resent and it

The major task that ARPANET have to play is to develop rules for communication i.e. protocols for communicating over ARPANET. The ARPANET in particular led to the development of protocols for internetworking, in which multiple separate networks could be joined into a network of networks. It resulted in the development if TCP/IP protocol suite, which specifies the rules for joining and communicating over APRANET.

Soon after, in 1986 NSF (national Science Foundation) backbone was created to and five US universities‟ computing centres were connected to form NSFnet. The participating Universities were:

- Princeton University -- John von Neumann National Supercomputer Center, JvNC
- Cornell University -- Cornell Theory Center, CTC
- University of Illinois at Urbana-Champaign -- National Center for Supercomputing Applications, NCSA
- Carnegie Mellon University -- Pittsburgh Supercomputer Center, PSC
- General Atomics -- San Diego Supercomputer Center, SDSC

NFSnet, the successor of ARPAnet, become popular by 1990 and ARPANET was decommissioned. There were many parallel networks developed by other Universities and other countries like United Kingdom. In 1965, National Physical Laboratory (NPL) proposed a packing switching network. Michigan Educational Research Information Triad formed MERIT network in 1966 which was funded and supported by State of Michigan and the

National Science Foundation (NSF). France also developed a packet switching network, known as CYCLADES in 1973.

Now there were many parallel systems working on different protocols and the scientist were looking for some common standard so that the networks could be interconnected. In 1978, TCP/IP protocol suits were ready and by 1983, the TCP/IP protocol were apopted by ARPANET.

In 1981, the integration of two large networks took place. NFS developed Computer Science Network (CSNET) and was connected to ARPANET using TCP/IP protocol suite. Now the network was not only popular among the research community but the private played also took interest in the network. Initially NFS supported speed of 56 kbit/s. It was upgraded to 1.5 Mbit/s in 1988 to facilitate the growth of network by involving merit network, IBM, MCA and the state of Michigan.

After the corporates took realized the strength and merit of this network, they participated in the development of the network to ripe its benefits. By late 1980s many Internet Service Providers(ISPs) emerged to provide the backbone for carrying the network traffic. By 1991, NFSNET was expended and was upgraded to 45Mbit/s. Many commercial ISPs provided backbone service and were popular among the corporate. To facilitate the commercial use of the network, NFSNET was decommissioned in 1995 and now the Internet could carry commercial traffic.

Now more and more Universities and research centres throughout the world connected to it. Now this network was very popular among the research community and in 1991 National Research and Education Network (NREN) was founded and the World Wide Web was released. Initially the role of internet was only limited to file transfer. The credit of internet what we see it today goes to Tim Berners-Lee who introduced www.With the advent of www, there was a transformation on how the network was used. Now this web of information can be used to retrieve any information available over the internet. Software called, browser was developed to browse the internet. It was developed by researchers at University of Illinois in 1992 and named as Mosaic. This browser enables to browse the internet the way we browse it today.

1.1.1.1 Internet Addresses

With so many devices connected to the internet, we require some mechanism to uniquely identify every device that is connected to the internet. Also we require some centralized system which takes care of this mechanism so that the signs which are used to identify each device are not duplicate; else the whole purpose is defeated. To take care of this, we have a centralized authority known as Internet Assigned Numbers Authority (IANA), which is responsible for assigning a unique number known as IP(Internet Protocol) address. An IP address is a 32-bit binary number which is divided into four octets and each octet consists of 8 binary digits and these octet are separated by a dot(.). An example of an IP address is

11110110.01011010.10011100.1111100

Each 8-bits in an octet can have two binary values i.e. 0 and 1. Therefore, each octet can have minimum value 0. i.e. 00000000 to maximum value 256 i.e. 11111111 and in total have 2^8= 256 different combinations.

Again to remember this 32-bit address in binary is bit difficult, so for the better understanding of the human being, it is expressed in a decimal format. But this decimal format is for human understanding only and the computer understands it in binary format only. In decimal, the above IP address is expressed as 123.45.78.125

These octets are used to create and separate different classes. An IP address consists of two parts viz. **Network** and **Host.** Network part identifies the network different network and the host part identifies a device of a particular network.

This address uniquely identifies a devices connected to the internet similar to the postal system where we identify any house by fist identifying the county, then state, district, post office, cluster/block and finally the house number. These IP addresses are classified into five categories based on the availability of IP range. These categories/classes are:

Table 1: IP Address Classes

Class	**Address range**	**Supports**
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each of 2 million networks
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups
Class E	240.0.0.0 to 254.255.255.254	Reserved for future use, or Research and Development Purposes.

IANA decentralizes that task of assigning the IP addresses by allocating the large chunk of IP addresses to five Regional Internet Registries (RIRs), which are further responsible to allocate the IP addresses in their zone. These RIRs along with their area of operations are listed below:

- APNIC- This RIR is responsible for serving the Asia Pacific region
- AfriNIC- This RIR is responsible for serving the African region
- ARIN- This RIR is responsible for serving North America and several Caribbean and North Atlantic islands
- LACNIC- This RIR is responsible for serving Latin America and the Caribbean, and
- RIPE NCC- This RIR is responsible for serving Europe, the Middle East, and parts of Central Asia

For liaison and coordinating between these five RIRs, there is an organization called Number Resource Organization(NRO). These organizations are

1.1.1.2 DNS

Whenever we browse any website in the internet, we type name something like www.uou.ac.in and we rarely deal with IP address like 104.28.2.92 but the fact is even if we type http:\\ 104.28.2.92 in the URL, it will land us to the same webpage. The fact is we are very comfortable using and remembering the names instead of a number. Moreover, these IP address changes over time and some of the sites have multiple IP address. Also, the transfer of the data over internet is only possible using IP addresses because the routing of the packet of data sent over internet is done using IP address. There is a server called Domain Name System(DNS) which take cares of this translation job to simplify and to save us from remembering these changing IP address numbers, the DNS. Whenever you type an address like http:\\www.uou.ac.in, there is a process called DNS name resolution, takes place in the background. The computer keeps the track of recently visited sites and locally maintains a database in DNS cache. In case, the IP address of the site you have requested for is not found in the DNS cache of your local computer, then the next probable place to find it is DNS server of your Internet Service Provider(ISP). These DNS servers of ISP also maintain the cache of the recently visited pages. Just in case, the information is not found here also, the DNS server of the ISP forward the query to the root nameservers. The root name servers publish the root zone file to other DNS servers and clients on the Internet. The root zone file describes where the authoritative servers for the DNS top-level domains (TLD) are located. There are currently 13 rootname servers. They are:

- A - VeriSign Global Registry Services

- B - University of Southern California - Information Sciences Institute
- C - Cogent Communications
- D - University of Maryland
- E - NASA Ames Research Center
- F - Internet Systems Consortium, Inc.
- G - U.S. DOD Network Information Center
- H - U.S. Army Research Lab
- I - Autonomica/NORDUnet
- J - VeriSign Global Registry Services
- K - RIPE NCC
- L - ICANN
- M - WIDE Project

These root nameservers directs the query to the appropriate Top-Level Domain(TLD) nameservers by reading the last part of the URL first. In our example the url was http:\\www.uou.ac.in. The last part is .in. Some of the examples of TLD name servers are .com, .biz, .org, .us, .in, etc. These TLD nameservers acts as a switchboard and direct the query to the appropriate authoritative nameserver maintained by each domain. These authoritative nameserver maintains DNS records along with other useful information. This address record is returned back to the requesting host computer via TLD nameservers, nameservers, ISP"s DNS server. These intermediaty server keeps the recond of this IP address in their DNS cache, so that if the same request is encountered again , they don"t have to go through this process again. If the same URL is requested again, the DNS cache of the local host computer will return the IP address of the URL.

1.1.1.3 Internet Infrastructure

Internet, as the name suggests, in a network of network i.e. it is a collection of several small, medium and large networks. This clearly indicates to one fact, nobody is a single owner of the internet and it is one of the proven example of collaborative success. Now you must be surprised how such a large network which is spread across the continents can run without the any problem. Yes it is correct that to monitor such a large network, we require an international body which can frame the rules, regulation and protocols to join and use this network. Therefore, an international organization, known as “The Internet Society” was formed in 1992 to take care of such issues.

Let us now discuss, how this internet works? How the email you sent to your friend is received by your friend‟s computer located at another country/continent. When you are working in your laptop/desktop in your home without connecting to the internet, your computer is a standalone system. But, whenever you connect to the internet by dialling to your Internet Service Provider(ISP) using your modem, you become the part of the network. The ISP is the link between the internet backbone, through which the entire data route, and the user. The ISP connects to the internet backbone at Network Access Points(NAP). These NAPs are the provided by the large telecommunication companies at various regions. These large telecommunication companies connect the countries and the continents by building and maintaining the large backbone infrastructure to route data from NAP to NAP. ISPs are connected to this backbone at NAP and are responsible build and manage network locally. So when you dial internet through modem, you first become part of the local ISP, which in turn connects to the internet backbone through NAP. The data is routed through this backbone and sent to the destination NAP, where the ISP of your friend‟s network is located. As soon as your friend dials his modem to connect to the internet, the data is delivered to your friend‟s computer.

1.1.1.4 World Wide Web

Sometimes we interchangeably use the term internet and world wide web or simply the web, as it is popularly known as. But web is only one of the several the utilities that internet provides. Some of the popular service that internet provides other then web is e-mail, usenet, messaging service, FTP, etc. The web use HTTP protocol to communicate over internet and to exchange information. The web was developed at CERN (Europeen de Reserches Nucleaires), Switzerland) by a UK scientist Tim Berners-Lee in 1989. It consists of all the public web sites and all the devices that access the web content. WWW is an information sharing model which is developed to exchange information over the internet. There are plenty of public websites, which is a collection of web pages, available over the internet. These web-pages contain plenty of information in a form of text, videos, audio and picture format. These web pages are access using a application software called a web browser. Some of the examples of the popular web browser are: Internet explorer, Chrome, Safari, Firefox, etc.

So this was a little introduction about internet and how it functions. Now let us discuss about cybercrime.

1.2 INTRODUCTION TO CYBER CRIME

The internet was born around 1960‟s where its access was limited to few scientists, researchers and the defence only. Internet user base have evolved exponentially. Initially the computer crime was only confined to making a physical damage to the computer and related infrastructure. Around 1980‟s the trend changed from causing the physical damaging to computers to making a computer malfunction using a malicious code called virus. Till then the effect was not so widespread because internet was only confined to defence setups, large international companies and research communities. In 1996, when internet was launched for the public, it immediately became popular among the masses and they slowly became dependent on it to an extent that it have changed their lifestyle. The GUIs were written so well that the user doesn’t have to bother how the internet was functioning. They have to simply make few click over the hyperlinks or type the desired information at the desired place without bothering where this data is stored and how it is sent over the internet or weather the data can accessed by another person who is connected to the internet or whether the data packet sent over the internet can be snoofed and tempered. The focus of the computer crime shifted from merely damaging the computer or destroying or manipulating data for personal benefit to financial crime. These computer attacks are increasing at a rapid pase. Every second around 25 computer became victim to cyber-attack and around 800 million individuals are affected by it till 2013. CERT-India have reported around 308371 Indian websites to be hacked between 2011-2013. It is also estimated that around $160 million are lost per year due to cyber-crime. This figure is very conservative as most of the cases are never reported.

According to the 2013-14 report of the standing committee on Information Technology to the 15th Lok Sabha by ministry of communication and information technology, India is a third largest number do Internet users throughout the world with an estimated 100 million internet users as on June, 2011 and the numbers are growing rapidly. There are around 22 million broadband connections in India till date operated by around 134 major Internet Service Providers(ISPs).

Before discussing the matter further, let us know what the cyber-crime is?

The term **cyber-crime** is used to describe a unlawful activity in which computer or computing devices such as smartphones, tablets, Personal Digital Assistants(PDAs), etc. which are stand alone or a part of a network are used as a tool or/and target of criminal activity. It is often commited by the people of destructive and criminal mindset either for revenge, greed or adventure.

1.2.1 Classification of Cyber Crimes

The cyber-criminal could be internal or external to the organization facing the cyber attack. Based on this fact, the cyber crime could be categorized into two types:

- *Insider Attack:* An attack to the network or the computer system by some person with authorized system access is known as insider attack. It is generally performed by dissatisfied or unhappy inside employees or contractors. The motive of the insider attack could be revenge or greed. It is comparatively easy for an insider to perform a cyber attack as he is well aware of the policies, processes, IT architecture and wellness of the security system. Moreover, the attacker has an access to the network. Therefore it is comparatively easy for a insider attacker to steel sensitive information, crash the network, etc. In most of the cases the reason for insider attack is when a employee is fired or assigned new roles in an organization, and the role is not reflected in the IT policies. This opens a vulnerability window for the attacker. The insider attack could be prevented by planning and installing internal intrusion detection systems (IDS) in the organization.
- *External Attack:* When the attacker is either hired by an insider or an external entity to the organization, it is known as external attack. The organization which is a victim of cyber-attack not only faces financial loss but also the loss of reputation. Since the attacker is external to the organization, so these attackers usually scan and gathering information. An experienced network/security administrator keeps regular eye on the log generated by the firewalls as external attacks can be traced out by carefully analyzing these firewall logs. Also, Intrusion Detection Systems are installed to keep an eye on external attacks.

The cyber-attacks can also be classified as structure attacks and unstructured attacks based on the level of maturity of the attacker. Some of the authors have classified these attacks as a form of external attacks but there is precedence of the cases when a structured attack was performed by an internal employee. This happens in the case when the competitor company wants the future strategy of an organization on certain points. The attacker may strategically gain access to the company as an employee and access the required information.

- *Unstructured attacks:* These attacks are generally performed by immature who don't have any predefined motives to perform the cyber-attack. Usually these immature try to test a tool readily available over the internet on the network of a random company.
- *Structure Attack:* These types of attacks are performed by highly skilled and experienced people and the motives of these attacks are clear in their mind. They have access to sophisticated tools and technologies to gain access to other networks without being noticed by their Intrusion Detection Systems (IDSs). Moreover, these attackers have the necessary expertise to develop or modify the existing tools to satisfy their purpose. These types of attacks are usually performed by professional criminals, by a country on other rival countries, politicians to damage the image of the rival person or the country, terrorists, rival companies, etc.

Cyber-crimes have turned out to be a low-investment, low-risk business with huge returns. Now-a-days these structured crimes are performed are highly organized. There is a perfect hierarchical organizational setup like formal organizations and some of them have reached a level in technical capabilities at par with those of developed nation. They are targeting large financial organizations, defence and nuclear establishments and they are also into online drugs trading.

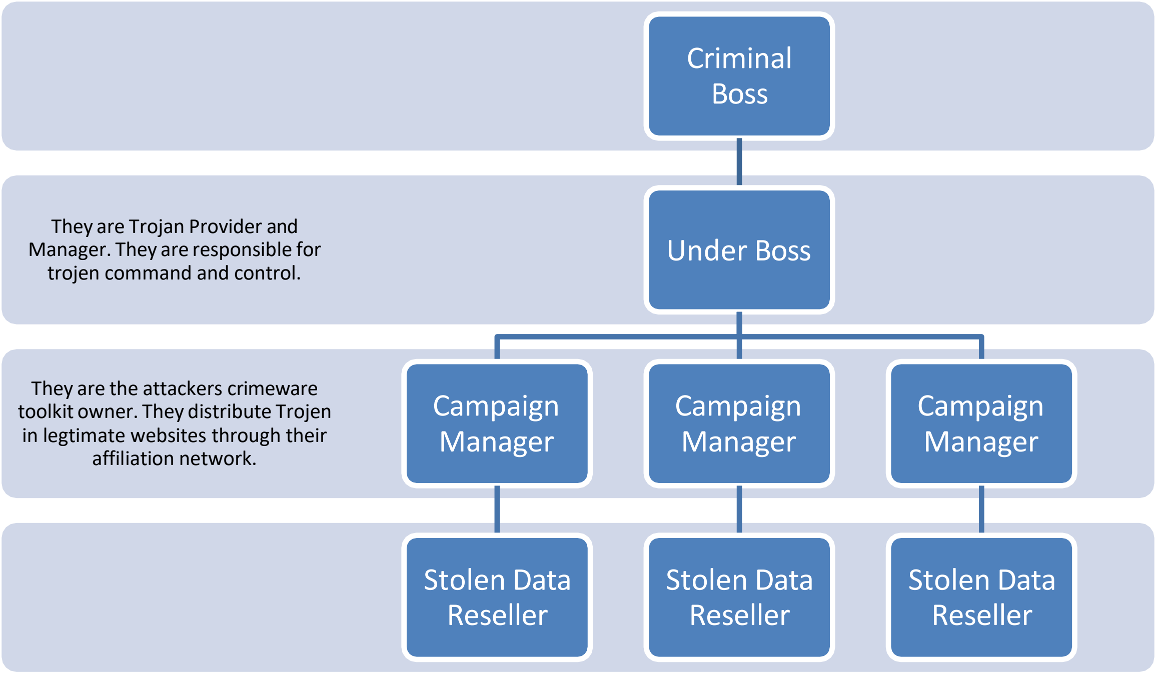

Criminal Boss
They are Trojan Provider and Manager. They are responsible for trojen command and control.
Under Boss
They are the attackers crimeware toolkit owner. They distribute Trojen in legtimate websites through their affiliation network.
Campaign Manager
Campaign Manager
Campaign Manager
Stolen Data Reseller
Stolen Data Reseller
Stolen Data Reseller

Figure 1 : Hierarchical Organizational Structure

The role of all the people in the hierarchy remain changing and it is based on the opportunity. If a hacker who have hacked sensitive data from an organization may use it for financially exploiting the organization himself. In case, the hacker himself has the technical expertise for it, he will do it himself, otherwise he may find a buyer who is interested in that data and have the technical expertise.

There are some cyber criminals' offers on-demand and service. The person, organization or a country may contact these cyber criminals for hacking an organization to gain access to some sensitive data , or create massive denial-of –service attack on their competitors. Based on the demand of the customer the hackers write malware, virus, etc. to suit their requirements. An organization effected by a cyber-attack, not only faces financial loss, but its reputation is also adversely affected, and the competition organization will definitely benefited by it.

1.2.2 Reasons for Commission of Cyber Crimes

There are many reasons which act as a catalyst in the growth of cyber-crime. Some of the prominent reasons are:

a. *Money:* People are motivated towards committing cyber-crime is to make quick and easy money.

b. *Revenge:* Some people try to take revenge with other person/organization/society/ caste or religion by defaming its reputation or bringing economical or physical loss. This comes under the category of cyber terrorism.

c. *Fun:* The amateur do cyber-crime for fun. They just want to test the latest tool they have encountered.

d. *Recognition:* It is considered to be proud if someone hack the highly secured networks like defense sites or networks.

e. *Anonymity*- Many time the anonymity that a cyber space provide motivates the person to commit cyber-crime as it is much easy to commit a cyber-crime over the cyber space and remain anonymous as compared to real world.

   It is much easier to get away with criminal activity in a cyber-world than in the real world. There is a strong sense of anonymity than can draw otherwise respectable citizens to abandon their ethics in pursuit personal gain.

f. *Cyber Espionage:* At times the government itself is involved in cyber trespassing to keep eye on other person/network/country. The reason could be politically, economically socially motivated.

1.3 MALWARE AND ITS TYPE

Malware stands for "*Malicious Software*" and it is designed to gain access or installed into the computer without the consent of the user. They perform unwanted tasks in the host computer for the benefit of a third party. There is a full range of malwares which can seriously degrade the performance of the host machine. There is a full range of malwares which are simply written to distract/annoy the user, to the complex ones which captures the sensitive data from the host machine and send it to remote servers. There are various types of malwares present in the Internet. Some of the popular ones are:

1.3.1 Adware

It is a special type of malware which is used for forced advertising. They either redirect the page to some advertising page or pop-up an additional page which promotes some product or event. These adware are financially supported by the organizations whose products are advertised.

1.3.2 Spyware

It is a special type of which is installed in the target computer with or without the user permission and is designed to steal sensitive information from the target machine. Mostly it gathers the browsing habits of the user and the send it to the remote server without the knowledge of the owner of the computer. Most of the time they are downloaded in to the host computer while downloading freeware i.e. free application programmes from the internet. Spywares may be of various types; It can keeps track of the cookies of the host computer, it can act as a keyloggers to sniff the banking passwords and sensitive information, etc.

1.3.3 Browser hijacking software

There is some malicious software which is downloaded along with the free software offered over the internet and installed in the host computer without the knowledge of the user. This software modifies the browsers setting and redirect links to other unintentional sites.

1.3.4 Virus

A virus is a malicious code written to damage/harm the host computer by deleting or appending a file, occupy memory space of the computer by replicating the copy of the code, slow down the performance of the computer, format the host machine, etc. It can be spread via email attachment, pen drives, digital images, e-greeting, audio or video clips, etc. A virus may be present in a computer but it cannot activate itself without the human intervention.

Until and unless the executable file(.exe) is execute, a virus cannot be activated in the host machine.

1.3.5 Worms

They are a class of virus which can replicate themselves. They are different from the virus by the fact that they does not require human intervention to travel over the network and spread from the infected machine to the whole network. Worms can spread either through network, using the loopholes of the Operating System or via email. The replication and spreading of the worm over the network consumes the network resources like space and bandwidth and force the network to choke.

1.3.6 Trojan Horse

Trojan horse is a malicious code that is installed in the host machine by pretending to be useful software. The user clicks on the link or download the file which pretends to be a useful file or software from legitimate source. It not only damages the host computer by manipulating the data but also it creates a backdoor in the host computer so that it could be controlled by a remote computer. It can become a part of *botnet(*ro*bot-net*work*)*, a network of computers which are infected by malicious code and controlled by central controller. The computers of this network which are infected by malicious code are known as zombies. Trojens neither infect the other computers in the network nor do they replicate.

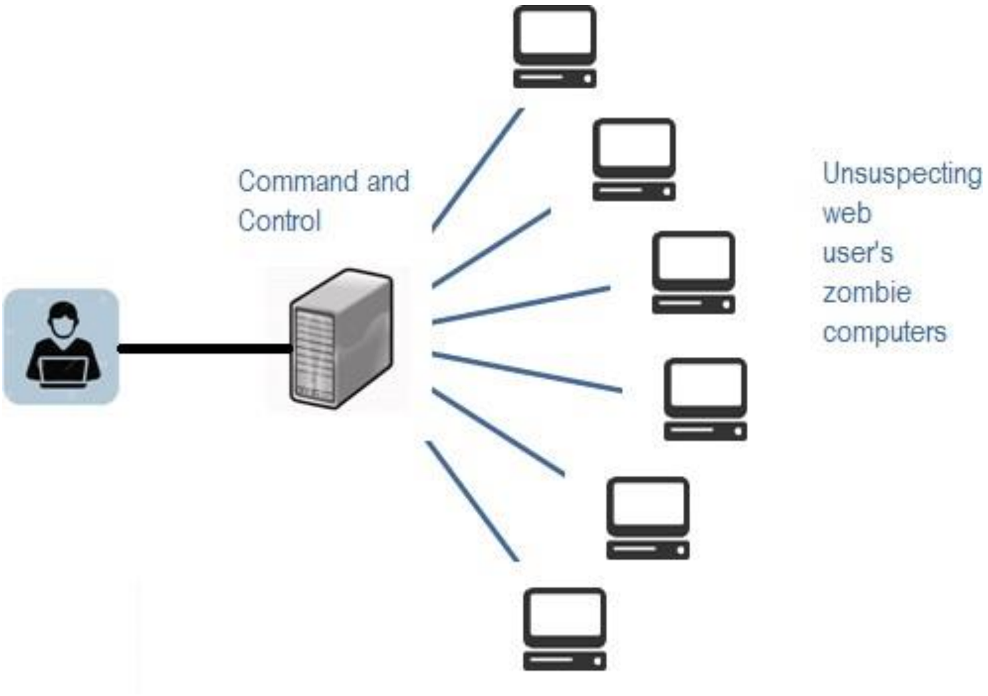
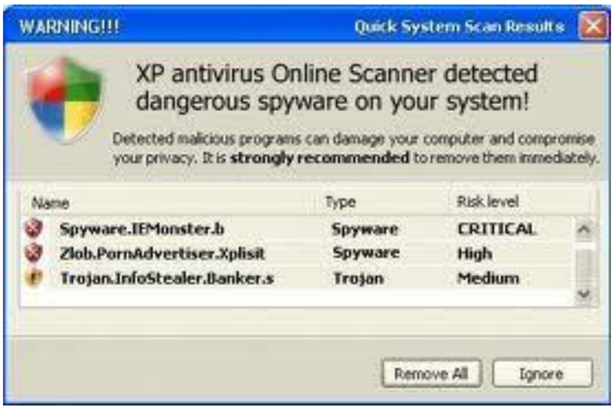


Figure 2: A typical botnet

1.3.7 Scareware

Internet has changed how we talk, shop, play etc. It has even changed the way how the criminal target the people for ransom. While surfing the Internet, suddenly a pop-up alert appears in the screen which warns the presence of dangerous virus, spywares, etc. in the user's computer. As a remedial measure, the message suggests the used download the full paid version of the software. As the user proceeds to download, a malicious code, known as scareware is downloaded into the host computer. It holds the host computer hostage until the ransom is paid. The malicious code can neither be uninstalled nor can the computer be used till the ransom is paid. A sample message alert of a scareware is shown below in Fig 3[1]



XP antivirus Online Scanner detected dangerous spyware on your system!

Detected malicious programs can damage your computer and compromise your privacy. It is **strongly recommended** to remove them immediately.

Name	Type	Risk level
Spyware.IEMonster.b	Spyware	CRITICAL
Zlob.PornAdvertiser.Xplisit	Spyware	High
Trojan.InfoStealer.Banker.s	Trojan	Medium

Figure 3: Sample Warning Message of a Scareware[1]

1.4 KINDS OF CYBER CRIME

Various types of cyber-crimes are:

1.4.1 Cyber Stalking

It is an act of stalking, harassing or threatening someone using Internet/computer as a medium. This is often done to defame a person and use email, social network, instant messenger, web-posting, etc. as a using Internet as a medium as it offers anonymity. The behavior includes false accusations, threats, sexual exploitation to minors, monitoring, etc.

[1] Image courtesy: https://www.flickr.com/photos/alamagordo/2372928527

1.4.2 Child Pornography

It is an act of possessing image or video of a minor (under 18), engaged in sexual conduct.

1.4.3 Forgery and Counterfeiting

It is a use of computer to forgery and counterfeiting is a document. With the advancement in the hardware and the software, it is possible to produce counterfeit which matches the original document to such an extent that it is not possible to judge the authenticity of the document without expert judgment.

1.4.4 Software Piracy and Crime related to IPRs

Software piracy is an illegal reproduction and distribution for personal use or business. It comes under crime related to IPR infringement. Some of the other crimes under IPR infringement are: download of songs, downloading movies, etc.

1.4.5 Cyber Terrorism

It is defined as the use of computer resources to intimidate or coerce government, the civilian population or any segment thereof in furtherance of political or social objectives.

1.4.6 Phishing

It is a process of acquiring personal and sensitive information of an individual via email by disguising as a trustworthy entity in an electronic communication. The purpose of phishing is identity theft and the personal information like username, password, and credit card number etc. may be used to steal money from user account. If a telephone is used as a medium for identity theft, it is known as *Vishing* (voice phishing). Another form of phishing is *Smishing*, in which SMS is used to lure customers.

1.4.7 Computer Vandalism

It is an act of physical destroying computing resources using physical force or malicious code.

1.4.8 Computer Hacking

It is a practice of modifying computer hardware and software to accomplish a goal outside the creator's original purpose. The purpose of hacking a computer system may vary from simply demonstrations of the technical ability, to sealing, modifying or destroying information for social, economic or political reasons. Now the corporate are hiring hackers, a person who is engaged in hacking computers, to intentionally hack the computer of an organization to find and fix security vulnerabilities.

The hackers may be classified as:

- White Hat: white hat hackers are the persons who hack the system to find the security vulnerabilities of a system and notify to the organizations so that a preventive action can be taken to protect the system from outside hackers. White hat hackers may be paid employee of an organization who is employed to find the security loop-holes, or may be a freelancer who just wants to prove his mantle in this field. They are popular known as ethical hackers.
- Black Hat: in contrast to the white hat, the black hat hack the system with ill intentions. They may hack the system for social, political or economically motivated intentions. They find the security loopholes the system, and keep the information themselves and exploit the system for personal or organizational benefits till organization whose system is compromised is aware of this, and apply security patches. They are popularly known as crackers.
- Grey Hat: Grey hat hackers find out the security vulnerabilities and report to the site administrators and offer the fix of the security bug for a consultancy fee.
- Blue hat: A blue hat hacker is someone outside computer security consulting firms who is used to bug-test a system prior to its launch, looking for exploits so they can be closed.

1.4.9 Creating and distributing viruses over internet

The spreading of an virus can cause business and financial loss to an organization. The loss includes the cost of repairing the system, cost associated with the loss of business during downtime and cost of loss of opportunity. The organization can sue the hacker, if found, for the sum of more than or equivalent to the loss borne by the organization.

1.4.10 Spamming

Sending of unsolicited and commercial bulk message over the internet is known as spamming. An email can be classified as spam, if it meets following criteria:

a. Mass mailing:- the email is not targeted to one particular person but to a large number of peoples.
b. Anonymity:- The real identify of the person not known
c. Unsolicited:- the email is neither expected nor requested for the recipient.

These spams not only irritate the recipients and overload the network but also waste the time and occupy the valuable memory space of the mailbox.

1.4.11 Cross Site Scripting

It is an activity which involves injecting a malicious client side script into a trusted website. As soon as the browser executes the malicious script, the malicious script gets access to the cookies and other sensitive information and sent to remote servers. Now this information can be used to gain financial benefit or physical access to a system for personal interest.

1.4.12 Online Auction Fraud

There are many genuine websites who offers online auction over internet. Taking the advantage of the reputation of these websites, some of the cyber criminals lure the customers to online auction fraud schemes which often lead to either overpayment of the product or the item is never delivered once the payment is made.

1.4.13 Cyber Squatting

It is an act of reserving the domain names of someone else's trademark with intent to sell it afterwards to the organization who is the owner of the trademark at a higher price.

1.4.14 Logic Bombs

These are malicious code inserted into legitimate software. The malicious action is triggered by some specific condition. If the conditions holds true in future, the malicious action begins and based on the action defined in the malicious code, they either destroy the information stored in the system or make system unusable.

1.4.15 Web Jacking

The hacker gain access to a website of an organization and either blocks it or modify it to serve political, economic or social interest. The recent examples of web jacking are some of the websites of the educational institutes were hacked by Pakistani hackers and an animation which contains Pakistani flags were flashed in the homepage of these websites. Another example is Indian hackers hacked website of Pakistani railways and flashed Indian flag in the homepage for several hours on the occasion of Independence Day of India in 2014.

1.4.16 Internet Time Thefts

Hacking the username and password of ISP of an individual and surfing the internet at his cost is Internet Time Theft.

1.4.17 Denial of Service Attack

It is a cyber-attack in which the network is chocked and often collapsed by flooding it with useless traffic and thus preventing the legitimate network traffic.

1.4.18 Salami Attack

It is an attack which proceeds with small increments and final add up to lead to a major attack. The increments are so small that they remain unnoticed. An example of salami attack is gaining access to online banking of an individual and withdrawing amount in such a small amounts that it remains unnoticed by the owner. Often there is default trigger set in the banking website and transactions below say, Rs. 1000 withdrawal are not reported to the owner of the account. Withdrawing amount of Rs. 1000 over a period of time will lead to total withdrawal of a large sum.

1.4.19 Data Diddling

It is a practice of changing the data before its entry into the computer system. Often, the original data is retained after the execution on the data is done. For example, DA or the basic salary of the person is changed in the payroll data of an individual for pay calculation. Once the salary is calculated and transferred to his account, the total salary is replaced by his actual salary in the report.

1.4.20 Email Spoofing

It is a process of changing the header information of an e-mail so that its original source is not identified and it appears to an individual at the receiving end that the email has been originated from source other than the original source.

Unit 2: Cyber Security Techniques

2

Unit Structure

There are many cyber security techniques to combat the cyber security attacks. The next section discusses some of the popular techniques to counter the cyber-attacks.

2.1 AUTHENTICATION

It is a process of identifying an individual and ensuring that the individual is the same who he/she claims to be. A typical method for authentication over internet is via username and password. With the increase in the reported cases of cyber crime by identity theft over internet, the organizations have made some additional arrangements for authentication like *One Time Password* (OTP), as the name suggest it is a password which can be used one time only and is sent to the user as an *SMS* or an email at the mobile number/email address that he have specified during the registration process. It is known as two-factor authentication method and requires two type of evidence to authentication an individual to provide an extra layer of security for authentication. Some other popular techniques for two-way authentication are: biometric data, physical token, etc. which are used in conjunction with username and password.

The authentication becomes more important in light of the fact that today the multinational organizations have changed the way the business was to be saying, 15 years back. They have offices present around the Globe, and an employee may want an access which is present in a centralized sever. Or an employee is working from home and not using the office intranet and wants an access to some particular file present in the office network. The system needs to authenticate the user and based on the credentials of that user, may or may not provide access to the used to the information he requested. The process of giving access to an individual to certain resources based on the credentials of an individual is known as authorization and often this process is go hand-in-hand with authorization. Now, one can easily understand the role of strong password for authorization to ensure cyber security as an easy password can be a cause of security flaw and can bring the whole organization at high risk. Therefore, the password policy of an organization should be such that employees are forced to use strong passwords (more than 12 characters and combination of lowercase and uppercase alphabets along with numbers and special characters) and prompt user to change their password frequently. In some of the bigger organizations or an organization which deals in sensitive information like defence agencies, financial institutions, planning commissions, etc. a hybrid authentication system is used which combines both the username and password along with hardware security measures like biometric system, etc. Some of the larger organizations also use *VPN* (Virtual Private Network), which is one of the methods to provide secure access via hybrid security authentication to the company network over internet.

2.2 ENCRYPTION

It is a technique to convert the data in unreadable form before transmitting it over the internet. Only the person who have the access to the key and convert it in the readable form and read it. Formally encryption can be defined as a technique to lock the data by converting it to complex codes using mathematical algorithms. The code is so complex that it even the most powerful computer will take several years to break the code. This secure code can safely be transmitted over internet to the destination. The receiver, after receiving the data can decode it using the key. The decoding of the complex code to original text using key is known as decryption. If the same key is used to lock and unlock the data, it is known as symmetric key encryption.

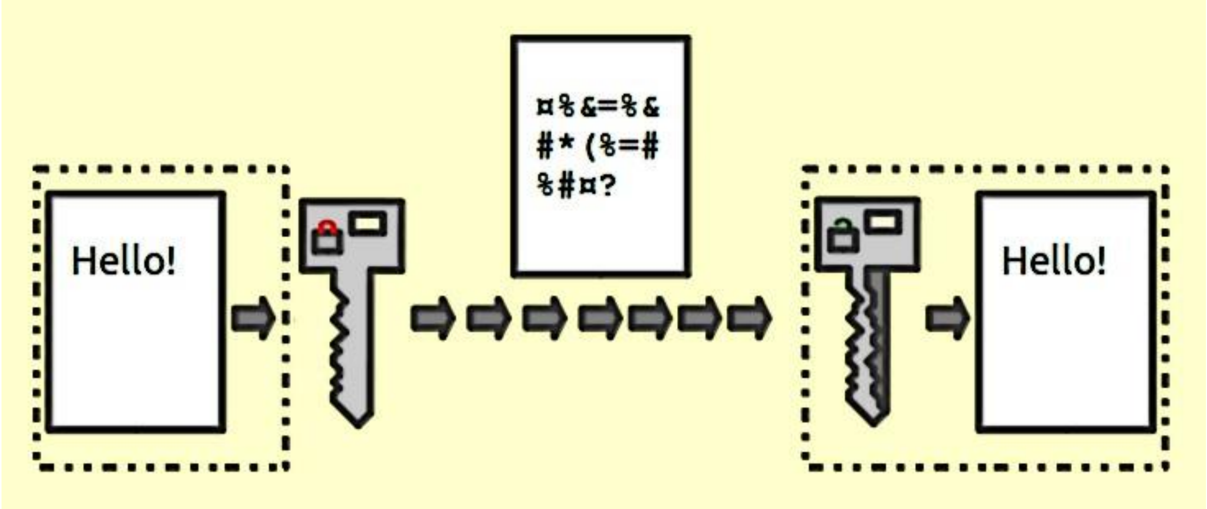


Figure 4: Encryption[2]

In symmetric key encryption, the after coding of data, the key is sent to the destination user via some other medium like postal service, telephone, etc. because if the key obtained by the hacker, the security of the data is compromised. Key distribution is a complex task because the security of key while transmission is itself an issue. To avoid the transfer of key a method called asymmetric key encryption, also known as public key encryption, is used. In

[2] Image courtesy: https://upload.wikimedia.org/wikipedia/commons/b/bc/Public_key_encryption_keys.png

asymmetric key encryption, the key used to encrypt and decrypt data are different. Every user possesses two keys viz. public key and private key. As the name suggest, the public key of every user is known to everyone but the private key is known to the particular user, who own the key, only. Suppose sender A wants to send a secret message to receiver B through internet. A will encrypt the message using B‟s public key, as the public key is known to everyone. Once the message is encrypted, the message can safely be send to B over internet. As soon as the message is received by B, he will use his private key to decrypt the message and regenerate the original message.

2.3 DIGITAL SIGNATURES

It is a technique for validation of data. Validation is a process of certifying the content of a document. The digital signatures not only validate the data but also used for authentication. The digital signature is created by encrypting the data with the private key of the sender. The encrypted data is attached along with the original message and sent over the internet to the destination. The receiver can decrypt the signature with the public key of the sender. Now the decrypted message is compared with the original message. If both are same, it signifies that the data is not tempered and also the authenticity of the sender is verified as someone with the private key(which is known to the owner only) can encrypt the data which was then decrypted by his public key. If the data is tempered while transmission, it is easily detected by the receiver as the data will not be verified. Moreover, the massage cannot be re-encrypted after tempering as the private key, which possess only by the original sender, is required for this purpose.

As more and more documents are transmitted over internet, digital signatures are essential part of the legal as well as the financial transition. It not only provides the authentication of a person and the validation of the document, it also prevents the denial or agreement at a later stage. Suppose a shareholder instructs the broker via email to sell the share at the current price. After the completion of the transaction, by any chance, the shareholder reclaims the shares by claiming the email to be forge or bogus. To prevent these unpleasant situations, the digital signatures are used.

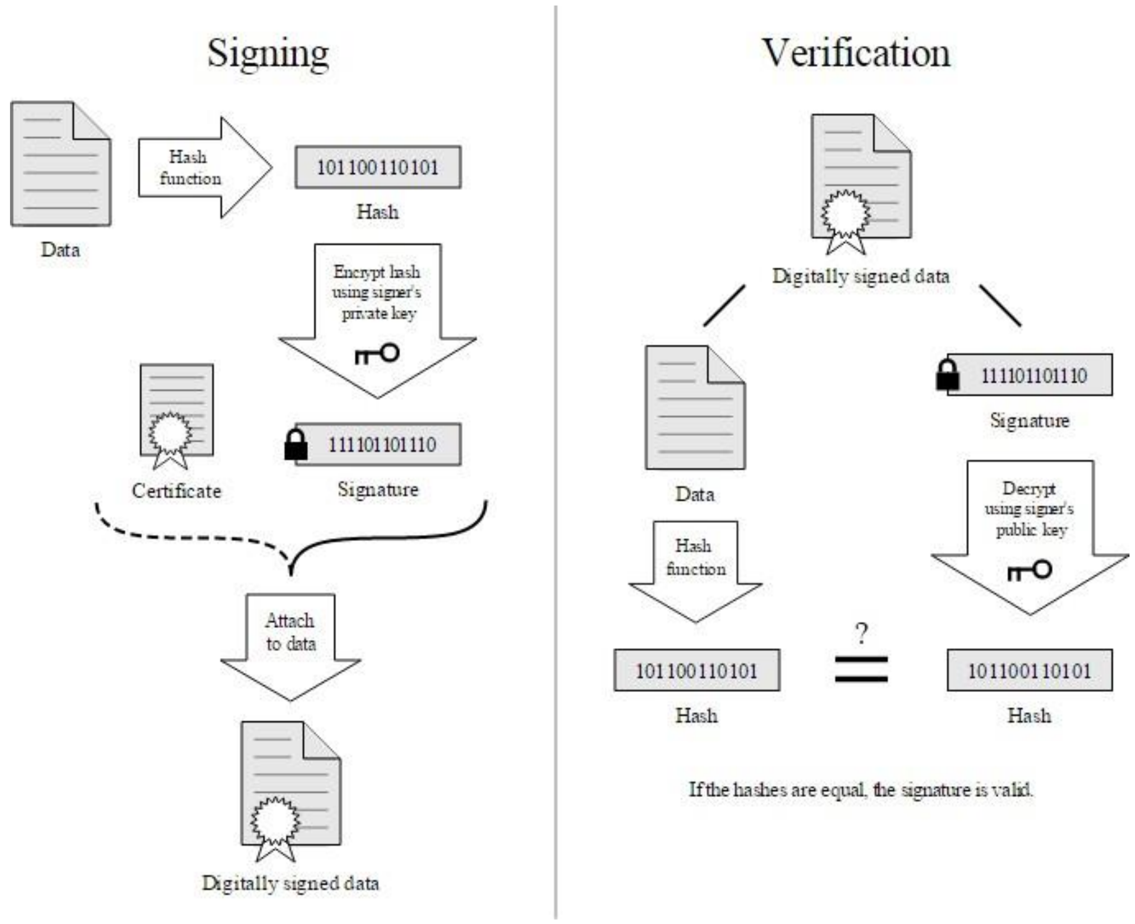


Figure 5: Digital signature[3]

2.4 ANTIVIRUS

There are verities of malicious programs like virus, worms, trojan horse, etc that are spread over internet to compromise the security of a computer either to destroy data stored into the computer or gain financial benefits by sniffing passwords etc. To prevent these malicious codes to enter to your system, a special program called an anti-virus is used which is designed to protect the system against virus. It not only prevents the malicious code to enter the system but also detects and destroys the malicious code that is already installed into the system. There are lots of new viruses coming every day. The antivirus program regularly updates its database and provides immunity to the system against these new viruses, worms, etc.

[3] Image courtesy: https://upload.wikimedia.org/wikipedia/commons/2/2b/Digital_Signature_diagram.svg

Figure 6: Different antivirus available on the market[4]

2.5 FIREWALL

It is a hardware/software which acts as a shield between an organization's network and the internet and protects it from the threats like virus, malware, hackers, etc. It can be used to limit the persons who can have access to your network and send information to you.

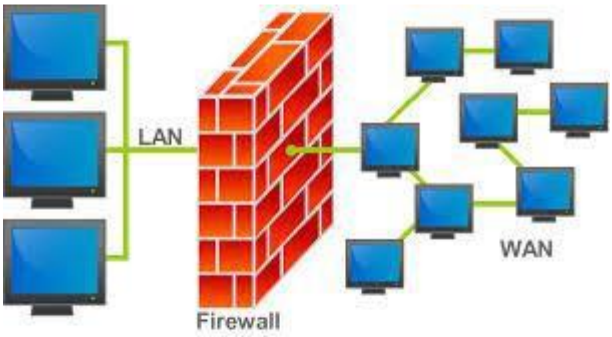


Figure 7: Firewall[5]

There are two type of traffic in an organization viz. inbound traffic and outbound traffic. Using firewall, it is possible to configure and monitor the traffic of the ports. Only the packets from trusted source address can enter the organization's network and the sources which are blacklisted and unauthorized address are denied access to the network. It is important to have firewalls to prevent the network from unauthorized access, but firewall does not guarantee this until and unless it is configured correctly. A firewall can be implemented using hardware as well as software or the combination of both.

[4] Image courtesy: https://www.flickr.com/photos/thomasguest/3027199004
[5] Image courtesy: https://upload.wikimedia.org/wikipedia/commons/5/5b/Firewall.png

- Hardware Firewalls: example of hardware firewalls are routers through which the network is connected to the network outside the organization i.e. Internet.
- Software Firewalls: These firewalls are installed and installed on the server and client machines and it acts as a gateway to the organizations‟ network.

In the operating system like Windows 2003, Windows 2008 etc. it comes embedded with the operating system. The only thing a user needs to do is to optimally configure the firewall according to their own requirement. The firewalls can be configured to follow “rules” and “policies” and based on these defined rules the firewalls can follow the following filtering mechanisms.

- Proxy- all the outbound traffic is routed through proxies for monitoring and controlling the packet that are routed out of the organization.
- Packet Filtering- based on the rules defined in the policies each packet is filtered by their type, port information, and source & destination information. The example of such characteristics is IP address, Domain names, port numbers, protocols etc. Basic packet filtering can be performed by routers.
- Stateful Inspection: rather than going through all the field of a packet, key features are defined. The outgoing/incoming packets are judged based on those defined characteristics only.

The firewalls are an essential component of the organizations‟ network. They not only protect the organization against the virus and other malicious code but also prevent the hackers to use your network infrastructure to launch DOS attacks.

2.6 STEGANOGRAPHY

It is a technique of hiding secret messages in a document file, image file, and program or protocol etc. such that the embedded message is invisible and can be retrieved using special software. Only the sender and the receiver know about the existence of the secret message in the image. The advantage of this technique is that these files are not easily suspected.

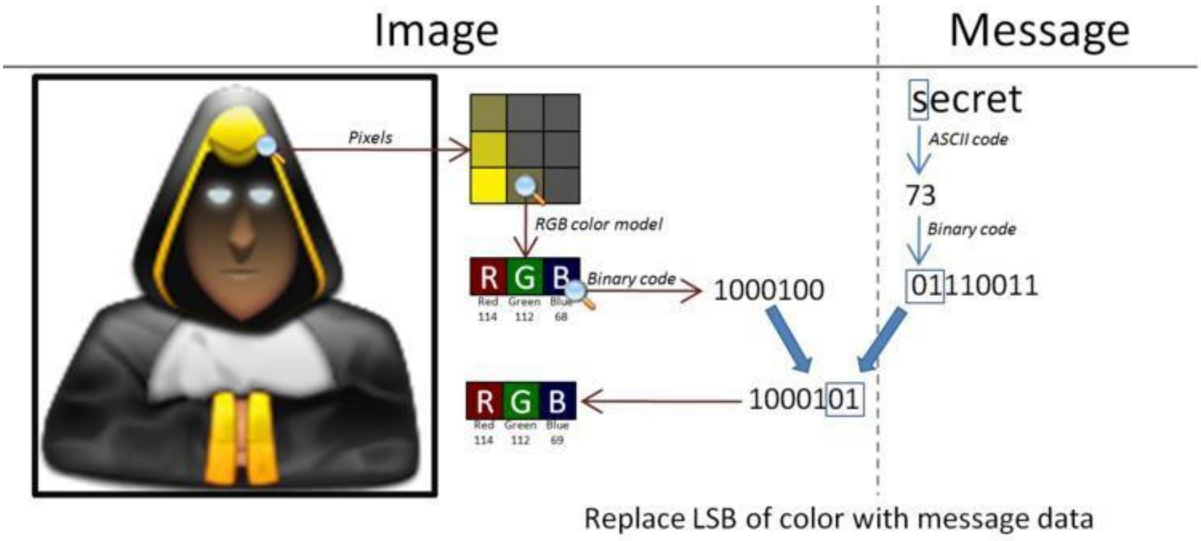


Figure 8: Steganography[6]

There are many applications of steganography which includes sending secret messages without ringing the alarms, preventing secret files from unauthorized and accidental access and theft, digital watermarks for IPR issues, etc.

Let us discuss how the data is secretly embedded inside the cover file(the medium like image, video, audio, etc which is used for embed secret data) without being noticed. Let us take an example of an image file which is used as a cover medium. Each pixel of a high resolution image is represented by 3 bytes (24 bits). If the 3 least significant bits of this 24 bits are altered and used for hiding the data, the resultant image, after embedded the data into it, will have un- noticeable change in the image quality and only a very experienced and trained eyes can detect this change. In this way, every pixel can be used to hide 3 bits of information. Similarly, introducing a white noise in an audio file at regular or random interval can be used to hide data in an audio or video files. There are various free softwares available for Steganography. Some of the popular ones are: QuickStego, Xiao, Tucows, OpenStego, etc.

[6] Image courtesy: https://upload.wikimedia.org/wikipedia/commons/b/b8/Seformatbmp-embedding_full.png

Unit 3: Investigating Cyber Crimes: Introduction to Cyber Forensics

3

Unit Structure

In the preceding chapters, we have discussed the prevention techniques for cyber-attack. What if one have encounter cyber-attack? What Next? The next step is to report the cyber-crime. But if a person is exposed to cyber forensic principles, the chances that the person accidently destroys the vital cyber evidences are minimized.

3.1 COMPUTER FORENSICS

Cyber forensic is a branch of science which deals with tools and techniques for investigation of digital data to find evidences against a crime which can be produced in the court of law. It is a practice of preserving, extracting, analyzing and documenting evidence from digital devices such as computers, digital storage media, smartphones, etc. so that they can be used to make expert opinion in legal/administrative matters.

The computer forensic plays a vital role in an organization as our dependency on computing devices and internet is increasing day-by-day. According to a survey conducted by University of California[7], 93% of all the information generated during 1999 was generated in digital form, on computers, only 7% of the remaining information was generated using other sources like paper etc. It not always easy to collect evidences as the data may be temperd, deleted, hidden or encrypted. Digital forensic investigation is a highly skilled task which needs the expose of various tools, techniques and guidelines for finding and recovering the digital evidences from the crime scene or the digital equipment used in the crime. With digital equipment like smartphone, tablets, palmtops, smart tv, etc having increasing processing capabilities and computation speed, the possibility of use of these devices in cyber-crime cannot be ruled out. A forancis investigator must not only have deep understanding of the working of these devices and also hands-on exposure to the tools for accurate data retrieval so that the value and integrity of the data is preserved.

[7] http://www.isfs.org.hk/publications/ComputerForensics_part1.pdf

A computer can be used intentionally or unintentionally to cyber-crime. The intentional use is to use your computer to send hate mails or installing cracked version of an otherwise licensed software into your computer. Unintentional use is the computer you are using contains virus and it is spread into the network and outside the network causing major loss to someone in financial terms. Similarly a computer can be directly used to commit a digital crime. For example, your computer is used to access the sensitive and classified data and the data is sent someone inside/outside the network who can use this data for him own benefit. The indirect use of computer is when while downloading a crack of a software, a Trojan horse is stored in the computer, while creates a backdoor in the network to facilitate hacker. Now the hacker logs into your computer and use it for committing cyber-crime. An experienced computer forensic investigator plays a crucial role in distinguishing direct and indirect attack. Computer forensic experts are also useful for recovery of accidental data loss, to detect industrial espionage, counterfeiting, etc.

In large organization, as soon as a cyber-crime is detected by the incident handling team, which is responsible for monitoring and detection of security event on a computer or computer network, initial incident management processes are followed[8]. This is an in-house process. It follows following steps:

1. *Preparation:* The organization prepares guidelines for incident response and assigns roles and the responsibilities of each member of the incident response team. Most of the large organizations earn a reputation in the market and any negative sentiment may negatively affect the emotions of the shareholders. Therefore, an effective communication is required to declare the incident. Hence, assigning the roles based on the skill-set of a member is important.
2. *Identification:* based on the traits the incident response team verifies whether an event had actually occurred. One of the most common procedures to verify the event is examining the logs. Once the occurrence of the event is verified, the impact of the attack is to be assessed.
3. *Containment:* based on the feedback from the assessment team, the future course of action to respond to the incident is planned in this step.

[8] http://countuponsecurity.com/2012/12/21/computer-security-incident-handling-6-steps/

4. *Eradication:* In this step, the strategy for the eradication or mitigate of the cause of the threat is planned and executed.
5. *Recovery:* it is the process of returning to the normal operational state after eradication of the problem.
6. *Lesson Learned:* if a new type of incident is encounter, it is documented so that this knowledge can be used to handle such situations in future.

The second step in the process is forensic investigation is carried out to find the evidence of the crime, which is mostly performed by 3rd party companies. The computer forensic investigation involves following steps:

1. *Identify incident and evidence*: this is the first step performed by the system administrator where he tries to gather as much information as possible about the incident. Based on this information the scope and severity of the attack is assessed. Once the evidence of the attack is discovered, the backup of the same is taken for the investigation purpose. The forensic investigation is never performed on the original machine but on the data that is restored from the backup.
2. *Collect and preserve evidence:* Various tools like Helix, WinHex, FKT Imager, etc. are used to capture the data. Once the backup of the data is obtained, the custody of the evidence and the backup is taken. MD5(message digest) hash of the backup is calculated and matched with the original one to check the integrity of the data. Other important sources of information like system log, network information, logs generated by Intrusion Detection Systems(IDS), port and process information are also captured.
3. *Investigate:* The image of the disk is restored from the backup and the investigation is performed by reviewing the logs, system files, deleted and updates files, CPU uses and process logs, temporary files, password protected and encrypted files, images, videos and data files for possible stegnographic message, etc.
4. *Summarize and Presentation:* The summery of the incident is presented in chronological order. Based on the investigation, conclusions are drawn and possible cause is explained.

While carrying out the digital forensic investigation, rules and procedure must be applied. Specially while capturing the evidence. It should be ensured that the actions that are taken for capturing the data do not change the evidence. The integrity of the data should be maintained. It must be ensured that the devices used for capturing the backup are free from contamination.

Moreover, all the activities related to seizure, access, storage or transfer of digital evidence must be fully documented, preserved and available for review[9]. Prevention is always better than cure. It is always recommended to fine tune your intrusion detection system like firewall occasionally perform penetration tests on your network to avoid pray to hacker. Last but not the least, report the crime.

3.2 WHY SHOULD WE REPORT CYBER CRIME?

Some of the companies do not report a cyber crime incident because they fear this will harm their reputation amongst its shareholders. Some of the data are very sensitive and its disclosure may impact their business negatively. But, the fact is until and unless a cyber crime incident is reported, the cyber criminals will never be crabbed by the law enforcement agencies. This will further worsen the conditions and encourage the criminals to repeat these types of incidents with the same or the other organizations. So it is very important to identify and prosecute them. This will help not only to identify the existing threats to the economy and the infrastructure but also new threats are identified. Depending on the scope of a cyber crime, the cyber crime should be reported to nearest cyber cell of your locality, state cyber cell, central investigating agencies like CBI, IB or the international bodies like Interpol.

Some of the addresses of the cyber coordinating units are:

Assam **Address:** CID HQ,Dy.SP., Assam Police ***Contact Details****:* Ph: +91-361-252-618, +91 9435045242 ***E-mail id****:* ssp_cod@assampolice.com	**Haryana** **Address:** Cyber Crime and Technical Investigation Cell, Joint Commisioner of Police, Old S.P.Office complex,Civil Lines, Gurgaon ***E-mail:*** jtcp.ggn@hry.nic.in
Mumbai **Address:** Cyber Crime Investigation Cell, Office of Commissioner of Police office,Annex -3 Building, 1st floor, Near Crawford Market, Mumbai-01.	**Chennai** **Address:** Asst. Commr. of Police, Cyber Crimes Cell, Vepery, Chennai 7 ***Contact Details:*** 04423452348, 04423452350

[9] http://www.isfs.org.hk/publications/011009/Collins-CIO&CeO.pdf

Contact Details: +91-22-22630829, +91-22-22641261 ***Web site:*** http://www.cybercellmumbai.com ***E-mail id**:* officer@cybercellmumbai.com **Thane** **Address:** 3rd Floor, Police Commissioner Office, Near Court Naka, Thane West, Thane 400601. ***Contact Details:*** +91-22-25424444 ***Web site:*** www.thanepolice.org **E-Mail:** police@thanepolice.org	***E-mail id:*** cybercrimechn@yahoo.com **For Rest of Tamil Nadu,** **Address:** A-Wing, III rd Floor, Rajaji Bhawan, Besant Nagar, Chennai-600090 ***Contact Details***: 044-24461959, 24468889, 24463888 ***E-mail id:*** hobeochn@cbi.gov.in
Bangalore (for whole of the Karnataka) **Address:** Cyber Crime Police Station, C.O.D Headquarters, Carlton House, # 1, Palace Road, Bangalore - 560 001 ***Contact Details*:** +91-80-2220 1026, +91-80-2294 3050, +91-80-2238 7611 (FAX) ***Web* site:** http://www.cyberpolicebangalore.nic.in ***Email-id*:** ccps@blr.vsnl.net.in, ccps@kar.nic.in	**Hyderabad** **Address:** Cyber Crime Police Station, Crime Investigation Department, 3rd Floor, D.G.P. office, Lakdikapool, Hyderabad – 500004 ***Contact Details*:** +91-40-2324 0663, +91-40-2785 2274, +91-40-2785 2040, +91-40-2329 7474 (Fax) ***Website:*** http://www.cidap.gov.in/cybercrimes.aspx ***E-mailid:*** cidap@cidap.gov.in, info@cidap.gov.in, cybercell_hyd@hyd.appolice.gov.in
Delhi **CBI Cyber Crime Cell:** Superintendent of Police, Cyber Crime Investigation Cell, Central Bureau of Investigation, 5th Floor, Block	**Pune** **Address** : Deputy Commissioner of Police(Crime), Office of the Commissioner Office, 2, Sadhu Vaswani Road, Camp,Pune 411001

No.3, CGO Complex, Lodhi Road, New Delhi – 3 ***Contact Details:*** +91-11-4362203, 011-26851998 011-26515229, +91-11-4392424 ***Web site:*** http://cbi.nic.in **Asst. Commissioner of Police,** Cyber Crime Cell, EOW, Crime Branch,2nd Floor, Police Training School, Malaviya Nagar, New Delhi-110 017 ***E-Mail:*** cbiccic@bol.net.in, dcp-eow-dl@nic.in	***Contact Details:*** +91-20-26123346, +91-20-26127277 +91-20-2616 5396, +91-20-2612 8105 (Fax) ***Website:*** www.punepolice.gov.in ***E-Mail:*** crimecomp.pune@nic.in, punepolice@vsnl.com
Himachal Pradesh **Address** : CID Office ,Dy.SP, Himachal Pradesh ***Contact Details****:* +91-94180 39449 ***E-mail****:*soodbrijesh9@gmail.com	**Gujarat** DIG, CID, Crime and Railways. Fifth Floor, Police Bhavan Sector 18, Gandhinagar 382 018 ***Contact Details:*** +91-79-2325 4384, +91-79-2325 0798, +91-79-2325 3917 (Fax)
Jharkhand **Address:** IG-CID,Organized Crime, Rajarani Building, Doranda Ranchi – 834002 ***Contact Details:****:* +91-651-2400 737, +91-651-2400 738 ***E-mail:*** a.gupta@jharkhandpolice.gov.in	**Kerala** **Address** : Hitech Cell, Police Head Quarters, Thiruvananthapuram ***Contact Details****:* +91-471 272 1547, +91-471 272 2768 ***E-mail****:* hitechcell@keralapolice.gov.in
Jammu **Address**: SSP-Crime, CPO Complex,Panjtirthi, Jammu-180004 ***Contact Details:*** +91-191-257-8901	**Orissa** **Address**: CID,Crime Branch, Orissa ***Contact Details:*** +91 94374 50370 ***E-mail****:* splcidcb.orpol@nic.in

E-mail: sspcrmjmu-jk@nic.in	
Meghalaya **Address**: SCRB,Superintendent of Police Meghalaya ***Contact Details:*** +91 98630 64997 ***E-mail***: scrb-meg@nic.in	**Punjab** **Address**: Cyber Crime Police Station, DSP Cyber Crime, S.A.S Nagar,Patiala, Punjab ***Contact Details:*** +91 172 2748 100
Bihar **Address**: Cyber Crime Investigation Unit, Dy.S.P.Kotwali Police Station, Patna ***Contact Details:*** +91 94318 18398 ***E-mail***: cciu-bih@nic.in	**West Bengal** **Address**: CID, Cyber Crime, West Bengal ***Contact Details:*** +9133 24506163 ***E-mail***:occyber@cidwestbengal.gov.in
Uttar Pradesh **Address**: Cyber Complaints Redressal Cell, Nodal Officer Cyber Cell Agra, Agra Range 7,Kutchery Road, Baluganj,Agra-232001, Uttar Pradesh ***Contact Details***: +919410837559 ***E-mail:*** info@cybercellagra.com	**UttaraKhand** **Address**: Special Task Force Office Sub Inspector of Police, Dehradoon **Contact Details:** +91 135 264098, +91 94123 70272 **E-mail**:dgc-police-us@nic.in

Unit 4: Some Recent Cyber Security Attacks

4

Unit Structure

4.1 INTRODUCTION

The proliferation of Internet among the population is getting deep day-by-day. This not only increase the scope of e-governance and e-commerce in the area of healthcare, banking, power distribution, etc. but also expose these sectors to cyber threats like hacking, credential thefts, data tempering, account hijacking, etc. According to a report, there were around 62,189 cyber security incidents, originating mainly from Countries including US, Europe, Brazil, Turkey, China, Pakistan, Bangladesh, Algeria and the UAE, in the period from Jan-May, 2014. Also, around 10,000 Indian government sites were compromised in this period. India has a serious shortage of IT Security professional to deal with such treats in effective manner. According to a report, India needs around one million cyber security professionals to deal with cyber threats effectively.

4.2 SOME RECENT CYBER CRIME INCIDENTS

In the current section, we will discuss some of the common cyber crimes and fruads incidents over internet so that you could appreciate how these little ignorance could lead to a big disaster.

1. Paypal, an international online money transfer service, which allows you to safely transfer money through an Internet using various encryption techniques and provides an alternative to other traditional payment methods like Cheques , money orders, etc. It have an active user base of over 100 million active users in 190 countries and performs over 9 million payments daily. It is one of the popular medium of payment over online auction sites like ebay etc. It is a convenient medium for trading particularly of the buyers and sellers are from different countries and have different currencies.

   Romanian Hacker TinKode aka Razvan Cernaianu, explioted a loophole in the code of the chargeback process of PayPal. Due to this, a user can double its money en every attempt. Suppose the user have Rs.1000, this using this loophole, the amount will be doubled to Rs.2000 in the first attempt. Now this Rs. 2000 will be doubled to Rs. 4000 in the second attempt. Further Rs. 4000 will be doubled to Rs. 8000. Likewise this process will continue endlessly.

2. In Australia, a website called MP3/WMA Land, which offers a large number of pirated songs, music video clips for free download to its users. This resulted in heavy financial losses to the artists and the producers of those songs. The complain was loudeged by an organizations called Music Industry Piracy Investigations.

   The owners of the website, Ng, Tran and Le, who were the students of Australian

University, were framed for Australia‟s largest copyright infrigement case(Urbas, 2012).

3. One of the interesting case of online stalking was registered by Mrs. Ritu Kohli at Delhi Police (Kaur, 2013). She reported that someone is using her identity over the Internet in the website www.mirc.com for chatting, and distributed her address and phone number. As a result she received a large number of phone calls from all over including Dubai, Ahemdabad, Mumbai, etc. at odd hours. This caused a lot of mental frustration and she decided to report the case. Based on her complain, Delhi Police tracced the IP address and finally traced the address of accused, Manish Kathuria and arrested him. A Dubai based NRI was blackmailed, and by the time the case was reported, he had already approximatly 1.25 crore to the accused (Madhya Pradesh State Cyber Police, 2013). The NRI met a girl over Internet and after a series of long chatting sessions, the girl won the love and trust of the NRI. In the meantime, she introduces him with several of her friends. Due to some reasons, the relation could not last long. After some time, one of the girl‟s friend, who was introduced to him by the girl, reports him that due to the mental stress of the broken relationship, the girl have commited sucide and police is investigating the case. Many fake copies of the letters from CBI, High Court of Calcutta, New York police and Punjab University etc. were also sent to the NRI. The NRI seeked help from the girl‟s friend, who in turn introduced her with a law firm based at Kolkata. The owner of the law firm agreed to take this case. A huge some of money was demanded by the law firm and a total of more that 1.26 crore were transfered on different occassions and he still demamded more money. The NRI smell something fishy and reported the case to Mumbai Police. The NRI forwarded all the email that he recieved from the girl, her friend and the owner of the law firm. After the forensic invertigation for the email, the IP address of all the three persons were found to be originated from the same source. After investigation, it was found that the identity of the girl and her friends were all virtual i.e. they does not exist. The owner of the law firm was the mastermind who assumed false identity of all the persons and created this false story to blackmail the NRI.

4. Iran‟s necular facility at Natanz was attacked by virus, *Stuxnet* which is belived to be developed by US (Shubert, 2011). It was not possible to inject the virus though the Internet as the network of the Iran’s nuclear facility is a private network and was isolated from rest of the world. The virus first infected the third party utility which is used by Natanz facility and gained access to the network. The virus was designed to attack a specfic system software which controls the operation of Siemens controllers.

The virus speeds up or slow down the centrifuges and thus wearing them out prematurely. Moreover, it hijacked the system and send false signals about the health and status of the necluer plant. Therefore, by the time the effect of the virus was detected, it was too late and the virus have done much harm to the nuclear facility.

5. A Trojan mail was used to hack the user name and the password of the current account of Mumbai based firm RPG Group and siphoned off Rs. 2.41 crore by Real Time Gross Sattlement(RTGS) (Narayan, 2013). Th bank officials suspected when they notice the huge amount of money transfer. They confirmed the same from the companies officials who denied the transfer of the money to the designated accounts. Based on the names and the address of the of the account holders who have received the money, the police came to know that the account holders have permitted the main accused to use their account in return of huge commission.
6. Chennai police cracked a case of credit card fraud, where two BPO employees with the help of the son of the accused, increased the credit card limit and the communication address of the credit card owner (Madhya Pradesh State Cyber Police, 2013). They illegally hacked into their company's computer to find out the details of the credit card owner. They credit card company was cheated for about 7 lakhs before the incident was noticed. Due to the chance of the communication address, the owner of credit card could not receive monthly statements generated at the month's end. The case was register with the Chennai police. After the digital forensic investigation of the BPO‟s compute system, it was found that its two employees have illegally access to the computer to steel the customer record.
7. A case of copyright infringement was lodged in Andhra Pradesh (Nandanwar, 2013). A well-known mobile service operator company launched a promotional campaign, in which it offered a mobile phone at a very low cost to its customers with a lock-in period of 3-years. The software of the phone was configured in such a way that, in the lock-in period the SIM of any other company cannot work with the handset. A competitor of that company lured the existing customers of the company which gave the mobile phone to "unlocked" the phone by cracking the software of the mobile so that any other SIM can be used with the handset. The company reported the crime and the case were registered under copyright infringement u/s 63 of copyrights act.
8. A gang of criminals is active over the cyber space, which steels the credit card data of the cardholders from the POS at shopping malls, petrol pumps, restaurants, hotels, etc. and uses these cards to book air tickets online. According to the reports, over 15000 credit cards were fraudulently used by these criminals to book online tickets which account for approximately Rs. 17 crore revenue losses. These criminals use public

infrastructure like cyber cafe, etc. to book these tickets so that it is difficult to trace them. The fraud came to the notice when the customers who were charged for booking an air ticket and these customers reported at the card issuing banks claiming that these tickets were never booked by them.

9. In the year 2000, a worm known as Love Bug worm or VBS/Loveletter, which specially target Windows operating system based computer system, caused damage costing approx. Rs. 22,000 crore. An spam mail containing “ILOVEYOU” in the subject line and LOVE-LETTER-FOR-YOU.TXT.vbs as an attachment is received. If the used clicked the attachment, the machine gets infected and the worm start searching all the drive of the computer and start corrupting the files. It also start forwarding the copies of the email to all the outlook contacts added in the address book of the user. Nearly 10% machines connected to the Internet were infected within no time (Madhya Pradesh State Cyber Police, 2013). Many large organizations which includes British parliament, Pentagon have to shut down the email system to stop this worm spreading into their network.
10. Online degree frauds are very popular these days over internet where accredited online degrees are offered by fake Universities (Gollin, 2003). These diploma mills offer to turn your work experience into a degree in exchange of money. The transcripts are also issued to the students on the basis of self-evaluation. Its only when the student is rejected on account of fake degree, he realizes that he fell prey to online fraud.
11. Can you believe a fake tweet message can cost $136 billion loss within seconds (Fisher, 2013). The US stock markets crashed in response to a fake twitter message send via hacked twitter account of Associated Press, USA which reported two explosions in the White House and that President Barack Obama had been injured. Later, Syrian Electronic Army, a terrorist group claimed responsibility on its own Twitter feed for the AP hack. The hacking was performed by sending a phishing e-mail. As soon as the link in the phishing e-mail was clicked, a spyware was installed in the computer and the information stored in the system were sent to remote servers. Using this information the account of AP was hacked and the hoax was created which effected sentiments of the investor of NY Stock Exchange and resulted in heavy loss.
12. Recently a new virus, which infects the Point of Sale (POS) machines and steals the payment record of credit card of the customers. These confidential data like PIN codes, credit card numbers, expiration date, CCV number, etc. are tracked and sent to the hackers so that this information can be misused for committing financial frauds (US-CERT, 2014).
13. The people with ill intentions are not only looking for your private and confidential

data, but are in search of your communication infrastructure so that your identity can be used for hiding their identity so that they are not caught after creating neusence. The terrorist outfit Indian Mujahideen(IM) used the unprotected Wi-Fi network of a Mumbai based US citizen, Kenneth Haywood. They hacked his Wi-Fi network used send an e-mail, which contains his IP address, to a news agency just 5 minutes before the Ahmedabad blast (Chowdhury, Nair, & Johnson, 2008).

14. The terrorist used open Wi-Fi network of Matunga's Khalsa College of Arts, Science and Commerce, Mumbai to send a terror mail to media house (The Indian Express, 2008). The terrorists remotely access the router and deleted the system logs after using the network so that it becomes difficult for the investigating to trace the origin of the email.
15. Pune based software engineer, Asma Sandip Thorve was arrested by economic offences wing of Pune police for illegally steeling source code of the software product and other confidential information of Brainvisa Technologies due to which the company lost Rs. 46.5 crores (Times of India, 2009).
16. There is a new type of crime evolving over internet where a prospective business partner will offer you a home-based business opportunity with no investment and very lucrative commission (Castillo, 2007). Once the person agrees to work with the company, the prospective business partner will ask for the details like address, phone numbers, photo identity, date of birth, etc. After some time, the person will receive parcel at the address with repackaging instructions along with the list of addresses where these parcels are to be dispatched abroad. Actually these goods are purchased using stolen credit cards and the goods are delivered at the address provided by the person. The person will be held responsible if address of the delivery of the goods is traced by the investigators. The real trouble begins when your commission arrives. It is in the form of third party cheque and is of the higher amount then you expected. Some days later an instruction to return the excess amount electronically is received. Once the excess fund is electronically transferred, the bank will discover that the cheque is fake and the person will be held responsible for this act.
17. Some of the customers of ICICI bank were victim phishing attack (Nair, 2009). Some of the customers received an email from a person who claimed to be an official of ICICI bank. He asked the customers to update their account information using a link which redirects the customers to a page which is very similar to ICICI bank’s webpage. The case was registered by the bank officials when this fraud came to the knowledge of the bank when some of the customers got suspicious and informed the IT department of the bank to verify the source of such email. The bank officials were

surprised to find out that the website, which very closely resembled the bank's official website. If the customer used that link to update his account credentials by logging into the fake website using their user id and the password, these details would reached the hackers and they can later use this information to login into the customer's account and transfer money and purchase goods online.

18. The cyber criminals have targeted the gas filling station in the US to skim the credit card and debit card data. The hacker planted Bluetooth enabled credit card skimmers in most of the gas stations located in the Southern United States. The customer data which includes information like account number, PIN, CVV, etc easy used by the hackers to withdraw more than $2 million from the ATM mostly located at Manhattan.
19. The hackers used the tools used by the law enforcement agencies to parse data from iPhones to steel the private photographs of female celebrities in the US (Hazen, 2014). The hackers are believed to be using software called Elcomsoft Phone Password Breaker and iBrute to log into apple's site and download the backupfiles into their machines.
20. There are many incidents were non- friendly countries launch cyber attacks to gain access to the sensitive information. One such event is Russia is suspected for his involvement in hacking of US financial system (Farberov, 2014). One of the leading banks JPMorgan Chase was reported to be attacked by Russian hackers. The hackers were successful in steeling the sensitive data from the bank's server.
21. Recently, a Chinese mobile company, Xiaomi was found guilty for sending the sensitive data to Chinese servers (Kumar, 2014). This information includes SMS, Photographs, contact list, etc. without the knowledge of the users. It's not the first time that a Chinese company was help suspected for espionage and US government have banned the use of Chinese equipment in some of its major establishments.

Unit 5: Cyber Security Initiatives in India

5

Unit Structure

5.1 INTRODUCTION

With the growth of internet, the dependence on computers has increased exponentially. The challenge is to protect critical information infrastructure, like civil aviation sector, Railways" passenger reservation system and communication network, port management, companies and organisations in power, oil and natural gas sectors, banking and finance, telecom sector, etc. from cyber attacks. India is ranked fourth among the top 50 countries in terms of the number of cyber crime complaints reported to the Internet Crime Complaint Centre (IC3), preceded only by the US, Canada and the UK based on the 2014 IC3 annual report (The Telegraph, 2015).

Shortage of trained cyber security workforce is of serious concern to India. In comparison to China, US and Russia that have 125000, 91080 and 7300 trained cyber experts respectively; India has merely 556 cyber experts deployed in various government agencies (Joshi, 2013). India is considered an IT superpower that is a major exporter of software and hosts major ITES-based outsourced businesses. Therefore, IT constitutes a major share of Indian economy. Recently, European Union has picked holes in India's data security system and suggested that a joint expert group be set up to propose ways on how the country should tighten measures for qualifying as a data secure nation (Sen, 2013). Therefore, India needs look seriously into upgrading its Information Security infrastructure and reframe cyber policies to get data secure status from EU. This is crucial for India to retain high-end outsourced business, which has a potential of increasing from the existing $20 billion to $50 billion.

5.2 COUNTER CYBER SECURITY INTIATIVES IN INDIA

To counter cyber security attacks, Government of India have taken some initiatives which are listed below:

1. **National Counter Terrorism Center (NCTC):** After 26/11 attack in 2008, suddenly the Indian government realized the importance of Counter terrorism initiatives and proposed National Counter Terrorism Center (NCTC) to provide intelligence inputs to the decision makers to plan for counter terrorist activities. The NCTC is supposed to coordinate between various State and Central govt. agencies and serve as a single and

Effective point of control and coordination of all counter terrorism measures. It is modeled on the American NCTC and Britain's Joint Terrorism Analysis Centre and will derive its powers from the Unlawful Activities Prevention Act, 1967 (Mrunal, 2012).

2. **National Information Security Assurance Programme (NISAP):** To create the awareness among the people in the government and critical sector organization, CERT-In has taken an initiative called National Information Security Assurance Programme (NISAP), to develop and implement information security policy and information security best practices based on ISO/IEC 27001 for protection of their infrastructure. CERT-in has established the facility for Computer Forensics for investigation of cyber-crimes and to provide hands on training to the law enforcement agencies and judiciary. This infrastructure is being augmented to include network forensics and mobile forensics investigation facility. CERT-In is cooperating with defence, banks, judiciary and law enforcement agencies in training their officials as well as extending the support in investigation of cybercrimes (Srinath, 2006).
3. **Computer Emergency Response Team-India (CERT-In):** The Indian Computer Emergency Response Team was created in 2004 by Department of Information Technology. The purpose of creating CERT-In was to respond to computer security incidents, report on vulnerabilities and promote effective IT security practices throughout the country and is also responsible for overseeing administration of the IT act (CERT-In, 2014).
4. **Indo US Cyber Security Forum (IUSCSF):** The India-US Cyber Security Forum was established in 2001 and is dedicated to protecting the critical infrastructure of the knowledge-based economy. The members of the forum are various government and private sector organizations, both from India and the United States, working under the Forum's auspices, have identified risks and common concerns in cyber security and crafted an action-oriented work plan on securing networked information systems. The Forum focuses on cyber-security, cyber-forensics and related research and works towards enhancing co-operation among law enforcement agencies on both sides in dealing with cyber-crime. Defense services of both the countries will enhance their interaction through exchange of experience in organizational, technological, and procedural aspects. Ongoing co-operation between India's STQC and the US National Institute of Standards and Technology (NIST) will expand to new areas including harmonization of standards. CII and their US counterpart have decided to set up an

India Information Sharing and Analysis Centre (ISAC) and India Anti-Bot Alliance („bot" refers to software that can be tasked to invade computers and undertake malicious activities remotely on behalf of hackers) (Press Information Bureau, 2006).

5. **National Critical Information Infrastructure Protection Centre (NCIPC) of India:** It is declared as a nodal agency for the protection of critical information infrastructure of India and is responsible for all measures including R&D for protection of critical information infrastructure. Some of the activities that NCIIPC performs are (Chander, 2013):
    a. Identification of Critical Sub-sectors
    b. Study of Information Infrastructure of identified critical sub-sectors
    c. Issue of Daily / Monthly cyber alerts / advisories
    d. Malware Analysis
    e. Tracking zombies and Malware spreading IPs
    f. Cyber Forensics activities
    g. Research and Development for Smart and Secure Environment.
    h. Facilitate CII owners in adoption of appropriate policies, standards, best practices for protection of CII.
    i. Annual CISO Conference for Critical Sectors.
    j. Awareness and training
    k. 24X7 operation and helpdesk
6. **National Intelligence Grid (Natgrid) project of India:** It is the integrated intelligence grid developed by C-DAC-Pune connecting databases of core security agencies of the Government of India (C-DAC, 2014). It is a counter terrorism measure that collects and collates a host of information from government databases including tax and bank account details, credit card transactions, visa and immigration records and itineraries of rail and air travel (Yasmeen, 2013). This combined data will be made available to 11 central agencies, which are: Research and Analysis Wing, the Intelligence Bureau, Central Bureau of Investigation, Financial intelligence unit, Central Board of Direct Taxes, Directorate of Revenue Intelligence,Enforcement Directorate, Narcotics Control Bureau, Central Board of Excise and Customs and the Directorate General of Central Excise Intelligence.
7. **Crime and Criminal Tracking Networks and Systems (CCTNS) project of India:** It is a project under National e-Governance Plan(NeGP) covering all 28 States and 7

UTs which aim at creation of a nation-wide networking infrastructure for evolution of IT-enabled sophisticated tracking system around 'investigation of crime and detection of criminals (PTI, 2013). The goals of the CCTNS are to facilitate collection, storage, retrieval, analysis, transfer and sharing of data and information at the police station and between the police station and the State Headquarters and the Central Police Organizations. CCTNS would provide a comprehensive database for crimes and criminals, and it would be easier for the law enforcement agencies to track down a criminal moving from one place to another.

8. **National Cyber Coordination Centre (NCCC):** National Cyber Coordination Centre is a proposed cyber security and e-surveillance agency in India. It is intended to screen communication metadata and co-ordinate the intelligence gathering activities of other agencies. Some of the components of NCCC include a cyber-attack prevention strategy, cyber-attack investigations and training, etc.
9. **Botnet Cleaning Center:** As a part of the Digital India programme, the Government is setting up a centre that will detect malicious programmes like „botnets‟ and help people remove such harmful softwares from their devices. " The Government is setting up „botnet‟ cleaning and malware analysis centre" according to media reports. Botnet is a network of malicious software. It can steal information, take control of device function and carry out cyber-attacks like Distributed Denial-of-Service (DdoS).
10. **E-mail policy of Government of India:** In present date Email is considered to be as the major source of communication between individuals and organization as well. The same applies to Govt. of India (GOI) as well. E-mail has become major mode of communications for the entire government. With the increasing use of Emails to communicate among different Govt. Agencies, the Email Policy was laid down by Government of India (GOI) in October 2013. Here we will cover some of the important clause of policy; readers are advised to download policy from Department of Electronics and IT website.
11. **Ministry of Home Affairs (MHA):** The Ministry of Home Affairs (MHA) is a ministry of the Government of India. An interior ministry, it is mainly responsible for the maintenance of internal security and domestic policy. Readers are advised to read annual report of the Ministry of Home Affairs. The Ministry of Home Affairs (MHA) has multifarious responsibilities, the important among them being-internal security, border management, Centre State relations, administration of Union Territories, management of Central Armed Police Forces, disaster management, etc.

12. **National Crime Records Bureau (NCRB):** NCRB shall endeavor to empower Indian Police with Information Technology and Criminal Intelligence to enable them to effectively & efficiently enforce the law & improve public service delivery. This shall be achieved through coordination with police forces at National & International level, upgrade of crime analysis technology, developing IT capability & IT enabled solutions.
13. **Data Security Council of India (DSCI):** Data Security Council of India (DSCI) is a premier industry body on data protection in India, setup by NASSCOM, committed to making the cyberspace safe, secure and trusted by establishing best practices, standards and initiatives in cyber security and privacy. DSCI brings together national governments and their agencies, industry sectors including IT-BPM, BFSI, Telecom, industry associations, data protection authorities and think tanks for public advocacy, thought leadership, capacity building and outreach initiatives. To further its objectives, DSCI engages with governments, regulators, industry associations and think tanks on policy matters. To strengthen thought leadership in cyber security and privacy, DSCI develops best practices and frameworks, publishes studies, surveys and papers. It builds capacity in security, privacy and cyber forensics through training and certification program for professionals and law enforcement agencies and engages stakeholders through various outreach initiatives including events, awards, chapters, consultations and membership programs. DSCI also endeavors to increase India's share in the global security product and services market through global trade development initiatives. These aim to strengthen the security and privacy culture in the India.

Unit 6: Guidelines for Secure Password, Two Step Verification and Using Free Antivirus

6

Unit Structure

6.1 GENERATING SECURE PASSWORD

6.1.1 Guideline for setting secure Password[10]

Choosing the right password is something that many people find difficult, there are so many things that require passwords these days that remembering them all can be a real problem. Perhaps because of this a lot of people choose their passwords very badly. The simple tips below are intended to assist you in choosing a good password.

Basics

- ✓ Use at least eight characters, the more characters the better really, but most people will find anything more than about 15 characters difficult to remember.
- ✓ Use a random mixture of characters, upper and lower case, numbers, punctuation, spaces and symbols.
- ✓ Don't use a word found in a dictionary, English or foreign.
- ✓ Never use the same password twice.

Things to avoid

- ✓ Don't just add a single digit or symbol before or after a word. e.g. "apple1"
- ✓ Don't double up a single word. e.g. "appleapple"
- ✓ Don't simply reverse a word. e.g. "elppa"
- ✓ Don't just remove the vowels. e.g. "ppl"
- ✓ Key sequences that can easily be repeated. e.g. "qwerty","asdf" etc.
- ✓ Don't just garble letters, e.g. converting **e** to **3**, **L** or **i** to **1**, **o** to **0**. as in "z3r0-10v3"

Tips

- ✓ Choose a password that you can remember so that you don't need to keep looking it up, this reduces the chance of somebody discovering where you have written it down.
- ✓ Choose a password that you can type quickly, this reduces the chance of somebody discovering your password by looking over your shoulder.

Bad Passwords

[10] http://www.lockdown.co.uk/?pg=password_guide

- ✓ Don't use passwords based on personal information such as: name, nickname, birthdate, wife's name, pet's name, friends name, home town, phone number, social security number, car registration number, address etc. This includes using just part of your name, or part of your birthdate.
- ✓ Don't use passwords based on things located near you. Passwords such as "computer", "monitor", "keyboard", "telephone", "printer", etc. are useless.
- ✓ Don't ever be tempted to use one of those oh so common passwords that are easy to remember but offer no security at all. e.g. "password", "letmein".
- ✓ Never use a password based on your username, account name, computer name or email address.

Choosing a password

- ✓ Use good password generator software.
- ✓ Use the first letter of each word from a line of a song or poem.
- ✓ Alternate between one consonant and one or two vowels to produce nonsense words. eg. "taupouti".
- ✓ Choose two short words and concatenate them together with a punctuation or symbol character between the words. eg. "seat%tree"

Changing your password

- ✓ You should change your password regularly, I suggest once a month is reasonable for most purposes.
- ✓ You should also change your password whenever you suspect that somebody knows it, or even that they may guess it, perhaps they stood behind you while you typed it in.
- ✓ Remember, don't re-use a password.

Protecting your password

- ✓ Never store your password on your computer except in an encrypted form. Note that the password cache that comes with windows (.pwl files) is NOT secure, so whenever windows prompt you to "Save password" don't.
- ✓ Don't tell **anyone** your password, not even your system administrator
- ✓ Never send your password via email or other unsecured channel
- ✓ Yes, write your password down but don't leave the paper lying around, lock the paper away somewhere, preferably off-site and definitely under lock and key.
- ✓ Be very careful when entering your password with somebody else in the same room.

Remembering your password

Remembering passwords is always difficult and because of this many people are tempted to write them down on bits of paper. As mentioned above this is a very bad idea. So what can you do?

- ✓ Use a secure password manager, see the download page for a list of a few that won't cost you anything.
- ✓ Use a text file encrypted with a strong encryption utility.
- ✓ Choose passwords that you find easier to remember.

Bad Examples

- ✓ "fred8" - Based on the users name, also too short.
- ✓ "christine" - The name of the users girlfriend, easy to guess
- ✓ "kciredref" - The users name backwords
- ✓ "indescribable" - Listed in a dictionary
- ✓ "iNdesCribaBle" - Just adding random capitalisation doesn't make it safe.
- ✓ "gandalf" - Listed in word lists
- ✓ "zeolite" - Listed in a geological dictionary
- ✓ "qwertyuiop" - Listed in word lists
- ✓ "merde!" - Listed in a foreign language dictionary

Good Examples

None of these good examples are actually good passwords, that's because they've been published here and everybody knows them now, always choose your own password don't just use somebody else’s.

- ✓ "mItWdOtW4Me" - **M**onday **i**s **t**he **w**orst **d**ay **o**f **t**he **w**eek **f**or **me**.

How would a potential hacker get hold of my password anyway?

There are four main techniques hackers can use to get hold of your password:

1. **Steal it.** That means looking over you should when you type it, or finding the paper where you wrote it down. This is probably the most common way passwords are compromised, thus it's very important that if you do write your password down you keep the paper extremely safe. Also remember not to type in your password when somebody could be watching.

2. **Guess it.** It's amazing how many people use a password based on information that can easily be guessed. Psychologists say that most men use 4 letter obscenities as passwords and most women use the names of their boyfriends, husbands or children.

3. **A brute force attack.** This is where every possible combination of letters, numbers and symbols in an attempt to guess the password. While this is an extremely labour intensive task, with modern fast processors and software tools this method is not to be underestimated. A Pentium 100 PC might typically be able to try 200,000 combinations every second this would mean that a 6 character password containing just upper and lower case characters could be guessed in only 27½ hours.

4. **A dictionary attack.** A more intelligent method than the brute force attack described above is the dictionary attack. This is where the combinations tried are first chosen from words available in a dictionary. Software tools are readily available that can try every word in a dictionary or word list or both until your password is found. Dictionaries with hundreds of thousands of words, as well as specialist, technical and foreign language dictionaries are available, as are lists of thousands of words that are often used as passwords such as "qwerty", "abcdef" etc.

6.2 USING PASSWORD MANAGER[11]

We use passwords to ensure security and the confidentiality of our data. One of the biggest modern day crimes is identity theft, which is easily accomplished when passwords are compromised. The need of the hour is good password management. Have you ever thought of an alternative to remembering your passwords and not repeatedly entering your login credentials? Password managers are one of the best ways to store, back up and manage your passwords. A good password is hard to remember and that’s where a password manager

[11] http://opensourceforu.efytimes.com/2015/01/peek-top-password-managers/

comes in handy. It encrypts all the different passwords that are saved with a master password, the only one you have to remember.

6.2.1 What is a password manager?

A password manager is software that helps a user to manage passwords and important information so that it can be accessed anytime and anywhere. An excellent password manager helps to store information securely without compromising safety. All the passwords are saved using some kind of encryption so that they become difficult for others to exploit.

6.2.2 Why you should use it?

If you find it hard to remember passwords for every website and don‟t want to go through the „Forgot password?‟ routine off and on, then a password manager is what you are looking for. These are designed to store all kinds of critical login information related to different websites.

6.2.3 How does it work?

Password managers may be stored online or locally. Online password managers store information in an online cloud, which can be accessed anytime from anywhere. Local password managers store information on the local server, which makes them less accessible. Both have their own advantages, and the manager you use would depend on your need.

Online password managers use browser extensions that keep data in a local profile, syncing with a cloud server. Some other password managers use removable media to save the password so that you can carry it with you and don't have to worry about online issues. Both these options can also be combined and used as two-factor authentication so that data is even more secure.

6.2.4 Some popular Password managers

The passwords are saved using different encryptions based on the services that the companies provide. The best password managers use a 256-bit (or more) encryption protocol for better security, which has been accepted by the US National Security Agency for top secret information handling. If you have considered using a password manager and haven‟t decided on one, this section features the top five.

1. **KeePassX:** KeePassX is an open source, cross-platform and light weight password management application published under the terms of the GNU General Public License. It was built based on the Qt Libraries. KeePassX stores information about user names, passwords and other login information in a secure database. KeePassX uses its own random password generator, which makes it easier to create strong

passwords for better security. It also includes a powerful and quick search tool with which a keyword of a website can be used to find login credentials that have been stored in the database. It allows users to customize groups, making it more user friendly. KeePassX is not limited to storing only usernames and passwords but also free-form notes and any kind of confidential text files.

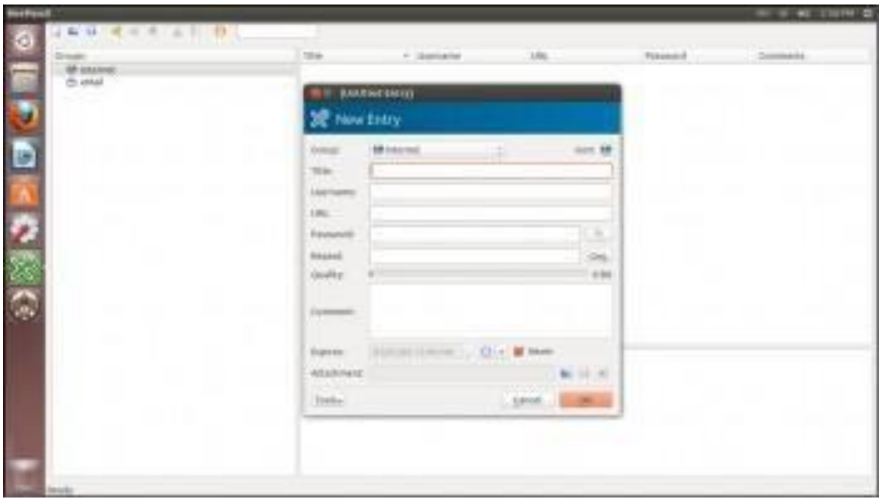


Figure 9: KeePassX

Features

- *Simple user interface:* The left pane tree structure makes it easy to distinguish between different groups and entries, while the right pane shows more detailed information.
- *Portable media access:* Its portability makes it easy to use since there’s no need to install it on every computer.
- *Search function:* Searches in the complete database or in every group.
- *Auto fill:* There’s no need to type in the login credentials; the application does it whenever the Web page is loaded. This keeps it secure from key loggers.
- *Password generator:* This feature helps to generate strong passwords that make it difficult for dictionary attacks. It can be customized.
- *Two factor authentication:* It enables the user to either unlock the database by a master password or by a key from a removable drive.
- *Adds attachments:* Any type of confidential document can be added to the database as an attachment, which allows users to secure not just passwords.

- *Cross-platform support:* It works on all supported platforms. KeePassX is an open source application, so its source code can be compiled and used for any operating system.
- *Security:* The password database is encrypted with either the AES encryption or the Twofish algorithm, which uses 256-bit key encryption.
- *Expiration date*: The entries can be expired, based on a user defined date.
- *Import and export of entries: Entries:* from PwManager or Kwallet can be imported, and entries can be exported as text files.
- *Multi-language support:* It supports 15 languages.

2. **Clipperz:** Clipperz is a Web-based, open source password manager built to store login information securely. Data can be accessed from anywhere and from any device without any installation. Clipperz also includes an offline version when an Internet connection is not available.

Figure 10: Clipperz

Features

- *Direct login*: Automatically logs in to any website without typing login credentials, with just one click.
- *Offline data*: With one click, an encrypted local copy of the data can be created as a HTML page.
- *No installation:* Since it's a Web-based application, it doesn't require any installation and can be accessed from any compatible browser.

- *Data import:* Login data can be imported from different supported password managers.
- *Security:* The database is encrypted using JavaScript code on the browser and then sent to the website. It requires a passphrase to decrypt the database without which data cannot be accessed.
- *Support:* Works on any operating system with a major browser that has JavaScript enabled.

3. Password Gorilla: Password Gorilla is an open source, cross-platform, simple password manager and personal vault that can store login information and notes. Password Gorilla is a Tcl/Tk application that runs on Linux, Windows and Mac OS X. Login information is stored in the database, which can be accessed only using a master password. The passwords are SHA256 protected and the database is encrypted using the Twofish algorithm. The key stretching feature makes it difficult for brute force attacks.

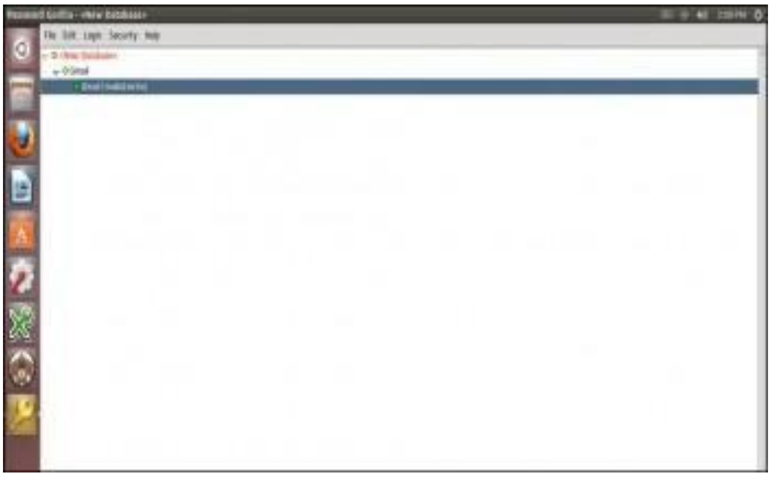

Password Gorilla - <New Database>
File Edit Login Security Help
<New Database>
Gmail

Figure 11: Password Gorilla

Features

- *Portable:* Designed to run on a compatible computer without being installed.
- *Import of database:* Can import the password database saved in the CSV format.
- *Locks the database when idle:* It automatically locks the database when the computer is idle for a specific period of time.
- *Security:* It uses the Twofish algorithm to encrypt the database.
- *Can copy credentials:* Keyboard shortcuts can be used to copy login credentials to the clipboard.

- *Auto clear:* This feature clears the clipboard after a specified time.
- *Organises groups:* Groups and sub-groups can be created to organise passwords for different websites.

4. **Gpassword Manager:** Gpassword Manager is a simple, lightweight and cross-platform utility for managing and accessing passwords. It is published under the terms of the Apache License. It allows users to securely store passwords/URLs in the database. The added entries can be marked as favorites, which then can be accessed by right-clicking the system tray icon. The passwords and other login information shown in the screen can be kept hidden based on user preferences.

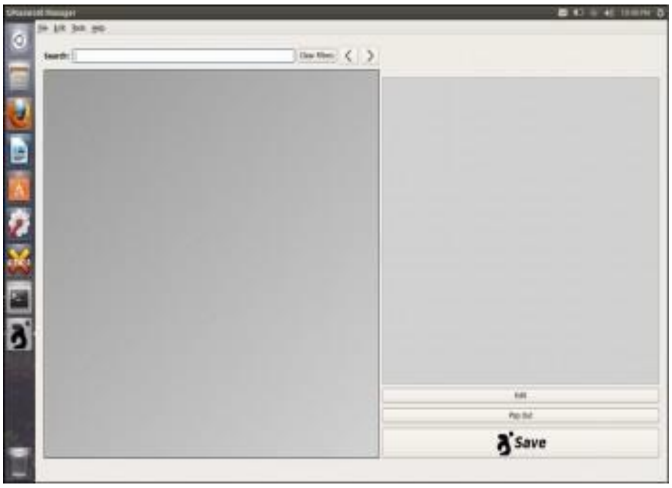


Figure 12: Gpassword manager

Features

- *Access to favorite sites:* A list of favorite Web pages can be accessed quickly from the convenient „tray" icon.
- *Quick fill:* Passwords and other information can be clicked and dragged onto forms for quick filling out.
- *Search bar*: The quick search bar allows users to search passwords that are needed.
- *Password generator:* Passwords with user-defined options can be generated with just a click.
- *Quick launch:* Favorite websites can be launched by right-clicking the tray icon.

5. **Password Safe:** Password Safe is a simple and free open source application initiated by Bruce Schneier and released in 2002. Now Password Safe is hosted on

SourceForge and developed by a group of volunteers. It’s well known for its ease of use. It is possible to organise passwords based on user preference, which makes it easy for the user to remember. The whole database backup and a recovery option are available for ease of use. Passwords are kept hidden, making it difficult for shoulder surfing. Password Safe is licensed under the Artistic license.

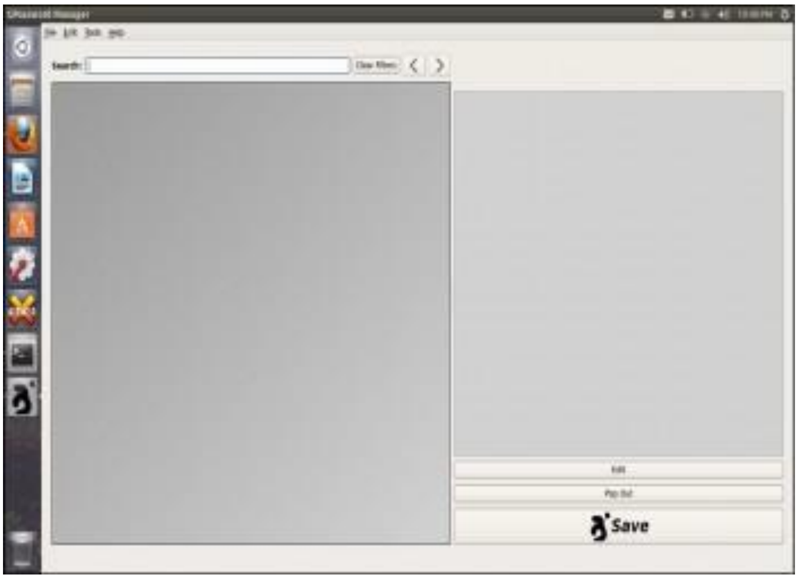


Figure 13: Password Safe

Features

- *Ease of use*: The GUI is very simple, enabling even a beginner to use it.
- *Multiple databases:* It supports multiple databases. And different databases can be created for each category.
- *Safe decryption:* The decryption of the password database is done in the RAM, which leaves no trace of the login details in the hard drive.
- *Password generator*: Supports the generation of strong, lengthy passwords.
- *Advanced search:* The advanced search function allows users to search within the different fields.
- *Security:* Uses the Twofish algorithm to encrypt the database.

6.3 ENABLING TWO-STEP VERIFICATION[12]

Every day, tens of thousands of personal accounts are hacked. Personal information is compromised, passwords are cracked, and lives are put in jeopardy. If you ever use one password for multiple accounts, you are exponentially increasing your vulnerability to being hacked. Thankfully, Google has launched its **2-step verification system**: anytime an unknown device is used to sign into your Google account, the user has to provide a verification code *in addition* to the password. So it's not enough for hackers to just get your password; they'll also need physical control of your phone or computer to access your account.

Step 1: Sign into your Gmail account. Click on a thumbnail of your avatar on the right side of the top menu bar, and then click "Account" to update your settings.

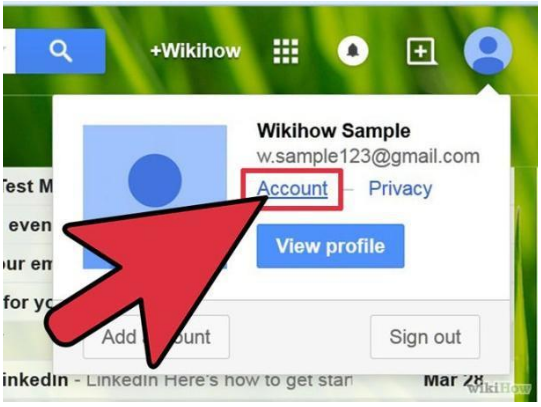
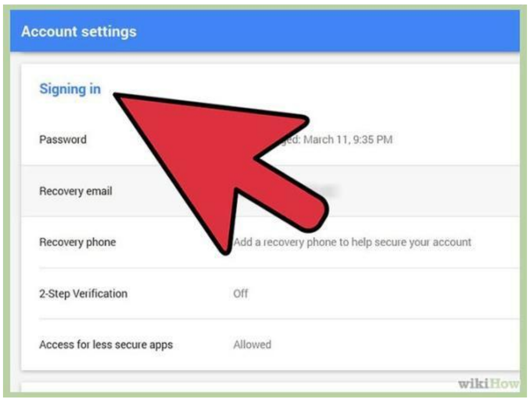


Figure 14: Account setting

Step 2: You will land on your Account Settings page. Scroll down until you find a blue bar that says "signing in".



Account settings

Signing in

Password ...ed: March 11, 9:35 PM

Recovery email

Recovery phone Add a recovery phone to help secure your account

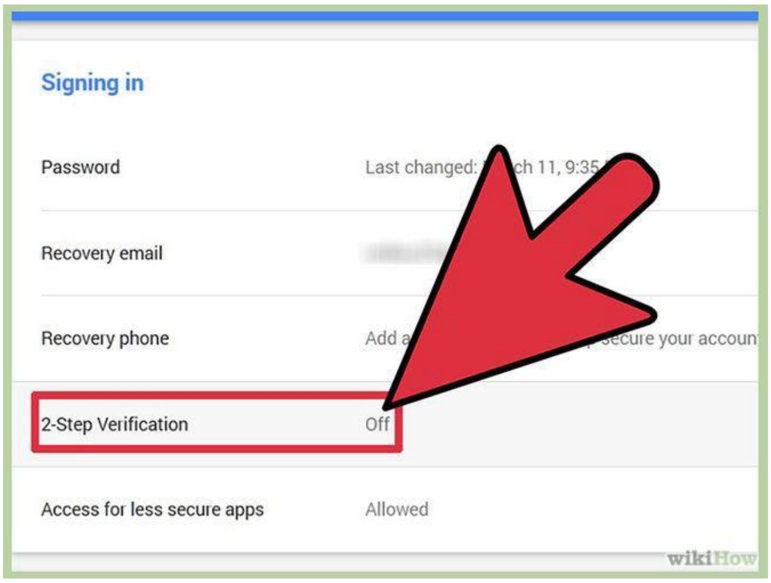
2-Step Verification Off

Access for less secure apps Allowed

Figure 15: Signing in

[12] http://www.wikihow.com/Set-up-2-Step-Verification-in-Gmail available under an Attribution-Noncommercial-Share Alike 3.0 Creative Commons License

Step 3: In the 2-step verification section, you'll see if you already have 2-step verification turned on. If it says "OFF," click "Edit" to set the feature up.



Signing in

Password   Last changed: ch 11, 9:35

Recovery email

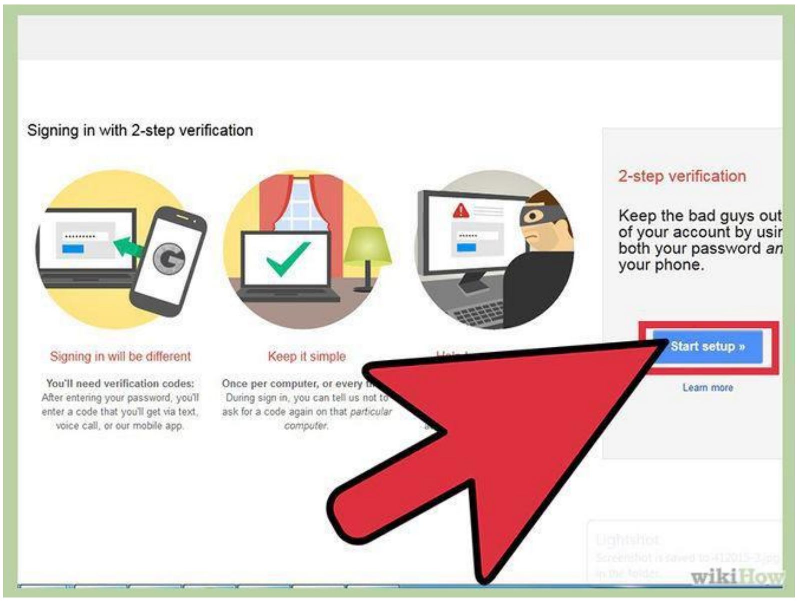
Recovery phone   Add a ecure your accoun

2-Step Verification   Off

Access for less secure apps   Allowed

Figure 16: Turning on two steps verification[13]

Step 4: You'll see a page that briefly walks through the steps of setting up 2-step verification. Hover over the steps for more detail. Once you're ready, click "Start setup."



Signing in with 2-step verification

Signing in will be different

You'll need verification codes: After entering your password, you'll enter a code that you'll get via text, voice call, or our mobile app.

Keep it simple

Once per computer, or every t During sign in, you can tell us not to ask for a code again on that *particular* computer.

2-step verification

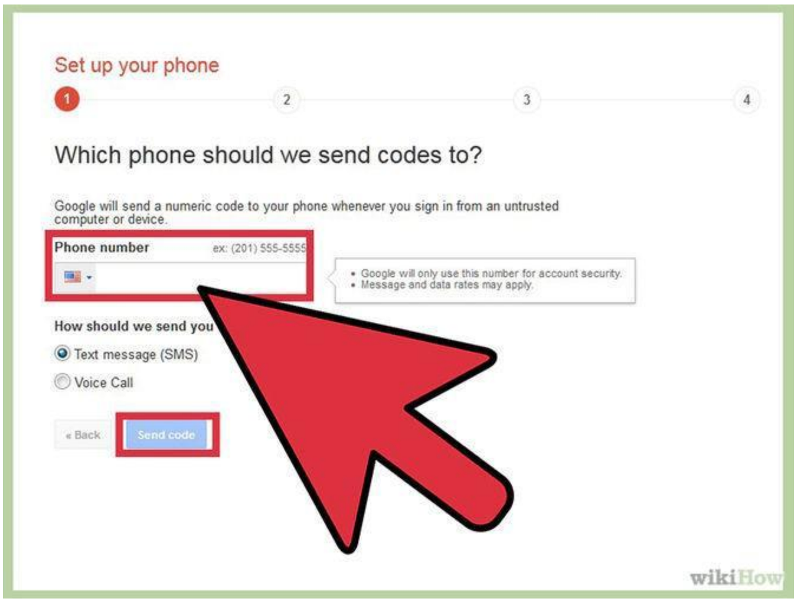
Keep the bad guys out of your account by usir both your password *an* your phone.

Figure 17: Start setup

Step 5: Type in your cell phone number. This will be the phone associated with your Google account. Anytime you sign into your Google account from an unknown device (e.g., a public

[13] Image courtesy: Figure 14 to 30 are adopted from http://www.wikihow.com/Set-up-2-Step-Verification-in-Gmail available under an Attribution-Noncommercial-Share Alike 3.0 Creative Commons License.

computer), Google will send a verification code to your phone and you will need to enter that before you can sign in.



Set up your phone

Which phone should we send codes to?

Google will send a numeric code to your phone whenever you sign in from an untrusted computer or device.

Phone number ex: (201) 555-5555

- Google will only use this number for account security.
- Message and data rates may apply.

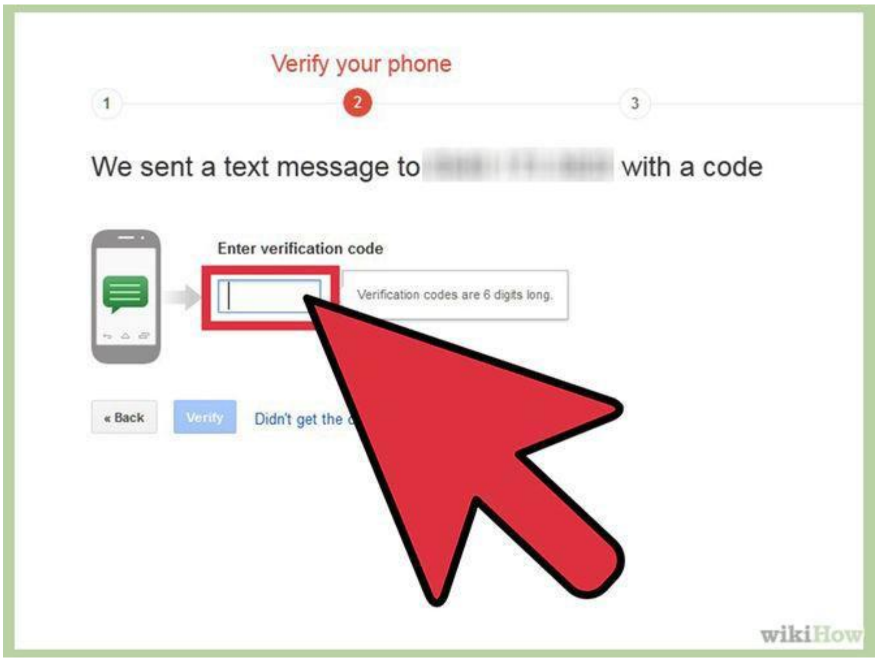
How should we send you

● Text message (SMS)

○ Voice Call

Figure 18: Entering mobile number for verification

Step 6: Select whether you'd like to receive a text message or Google Voice call with your verification code. Press submit. Then wait for the code to arrive to your phone and enter it in.



Verify your phone

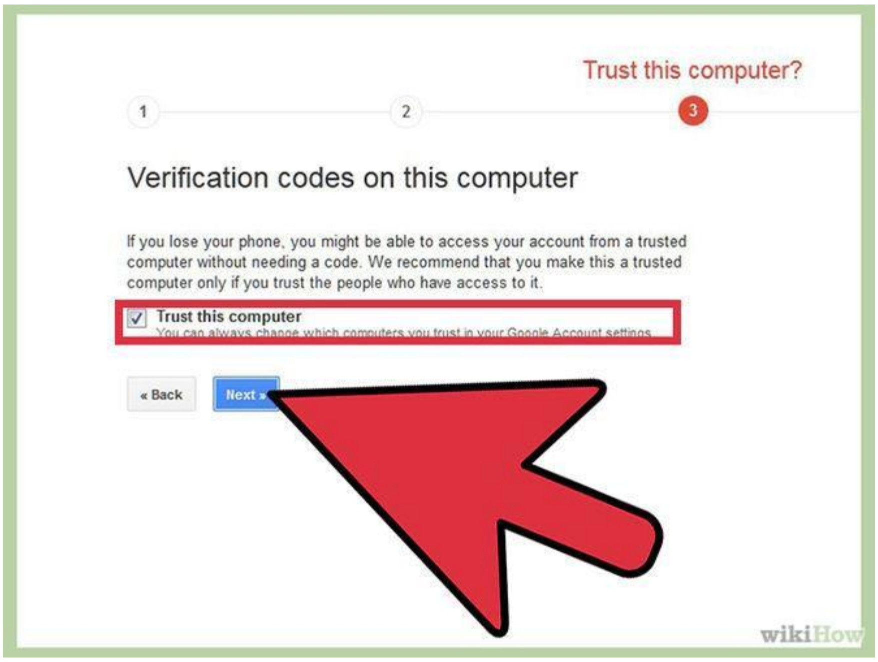
We sent a text message to [redacted] with a code

Enter verification code

Verification codes are 6 digits long.

Figure 19: Entering verification code

Step 7: Decide whether to trust this device. If you are turning on 2-step verification from a personal computer or trusted device, check the "trust this device" box. You will only be asked to enter a verification code when you sign into this account once per 30 days.



Trust this computer?

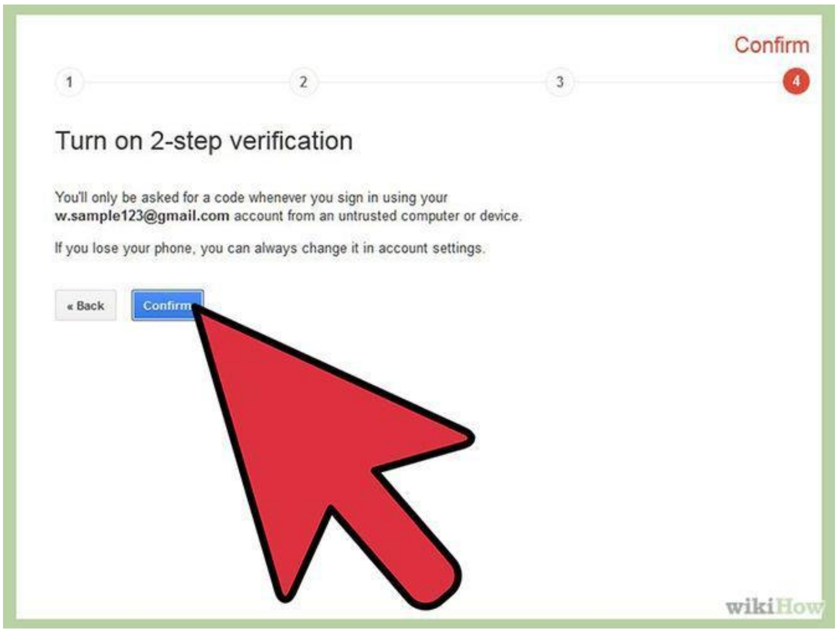
Verification codes on this computer

If you lose your phone, you might be able to access your account from a trusted computer without needing a code. We recommend that you make this a trusted computer only if you trust the people who have access to it.

☑ Trust this computer
You can always change which computers you trust in your Google Account settings.

Figure 20: Setting up trust setting of the computer

Step 8: Press OK, and you have just set up 2-step verification for your Google account! Skip any additional steps that seem unfamiliar or confusing for now -- we will address all of them in successive sections of this article.



Confirm

Turn on 2-step verification

You'll only be asked for a code whenever you sign in using your **w.sample123@gmail.com** account from an untrusted computer or device.

If you lose your phone, you can always change it in account settings.

Figure 21: Confirmation

Step 9: Print a list of backup verification codes and store it in a secure but accessible place, like your wallet. If you ever need to sign into your Google account but don't have your primary phone with you, you can enter one of these codes instead.

- Go to your 2-step verification settings page.
- Under "How to receive codes," click on the "Show backup codes" link. Print this page.

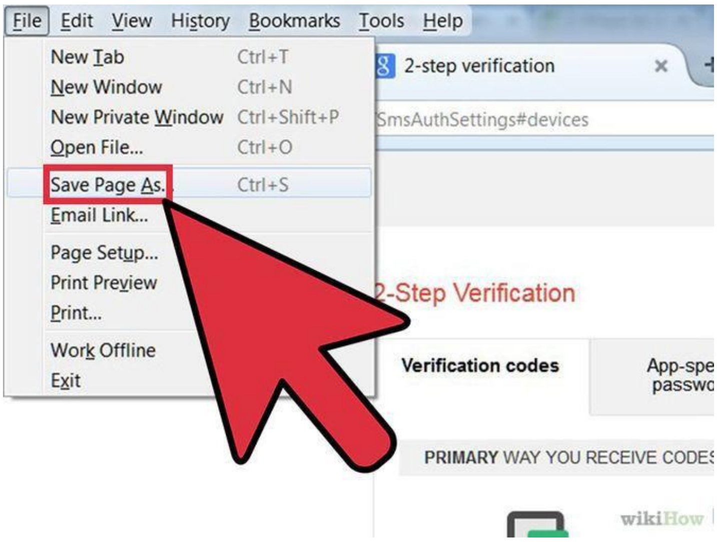
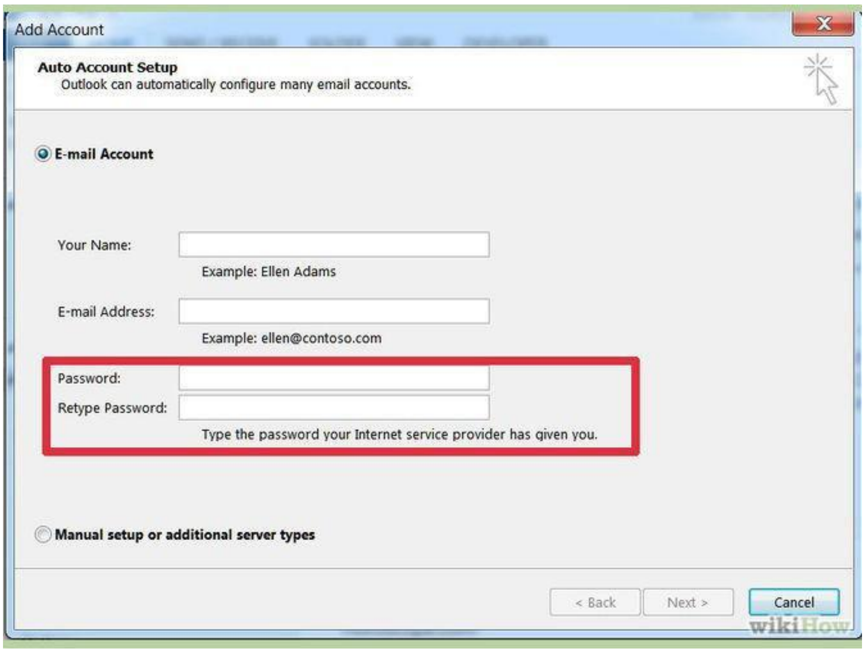


Figure 22: Saving the page

Method 1 of 2: Application-Specific Passwords



Add Account

Auto Account Setup
Outlook can automatically configure many email accounts.

● **E-mail Account**

Your Name:
Example: Ellen Adams

E-mail Address:
Example: ellen@contoso.com

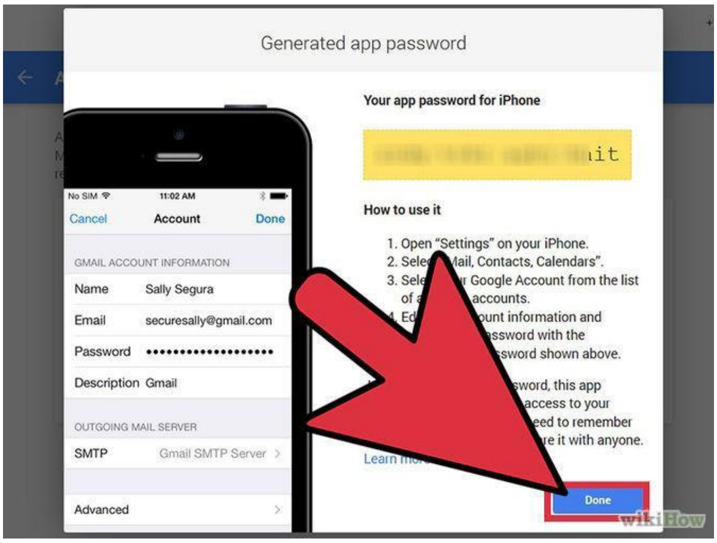
Password:
Retype Password:
Type the password your Internet service provider has given you.

○ **Manual setup or additional server types**

< Back   Next >   Cancel

Figure 23: Setting up application specific password

Step 1: Understand the need for application-specific passwords**.** With 2-step verification, Google has you covered every time you sign into your account from a web browser. However, if you use your Google account with other applications, such as Microsoft Outlook or a mobile device's mail application, those systems cannot ask you for a verification code. Therefore, you will need to sign into those systems *once* with an application-specific password. You will only need to re-enter an application-specific password if you choose to reset it and generate a new one for that device.



Generated app password

Your app password for iPhone

How to use it

1. Open "Settings" on your iPhone.
2. Sele Mail, Contacts, Calendars".
3. Sele r Google Account from the list of a accounts.
4. Ed unt information and ssword with the sword shown above.

sword, this app access to your eed to remember re it with anyone.

Name Sally Segura

Email securesally@gmail.com

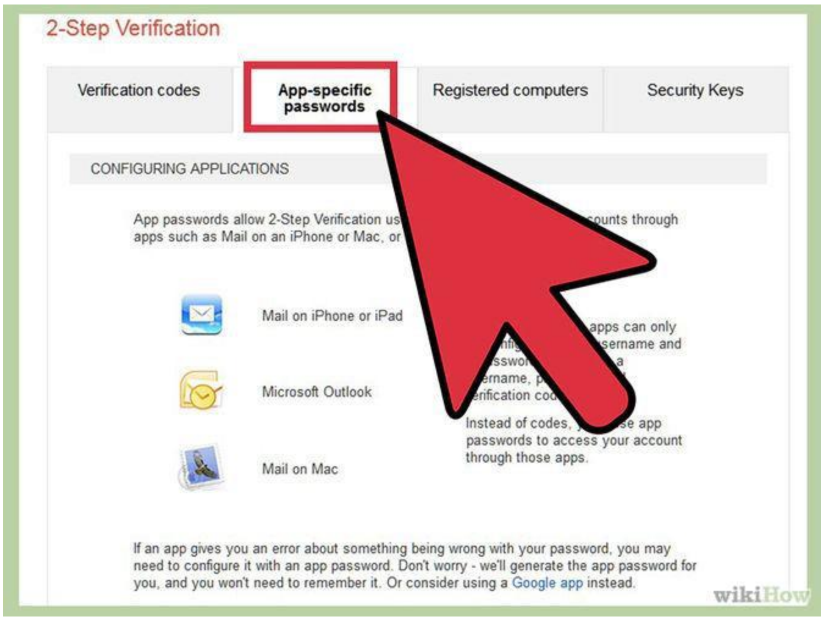
Password •••••••••••••••••••

Description Gmail

SMTP Gmail SMTP Server

Figure 24: Generating app password

Step 2: Generate application-specific passwords for your devices. Go to your 2-step verification settings page or click "Edit" next to 2-step verification on the Security Account Settings page (steps 1-3 above). Scroll down and click on "Manage application-specific passwords."



2-Step Verification

CONFIGURING APPLICATIONS

App passwords allow 2-Step Verification us ounts through apps such as Mail on an iPhone or Mac, or

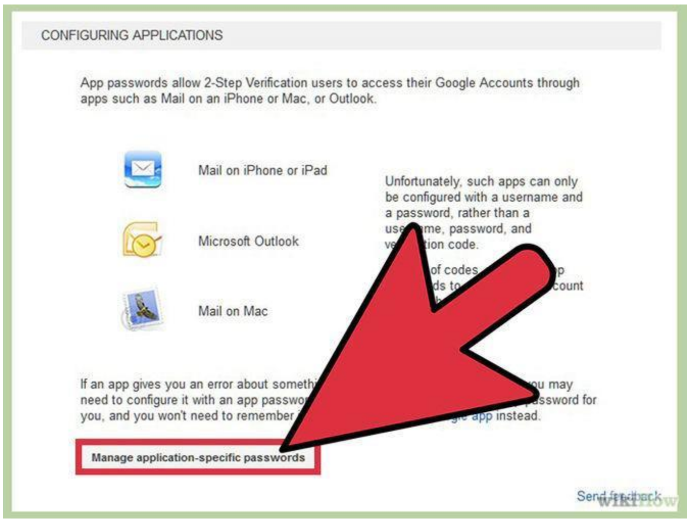
apps can only sername and a sswo ername, p erification cod

Instead of codes, se app passwords to access your account through those apps.

If an app gives you an error about something being wrong with your password, you may need to configure it with an app password. Don't worry - we'll generate the app password for you, and you won't need to remember it. Or consider using a Google app instead.

Figure 25: Managing application specific passwords

Step 3: At the top of the page, you will see a list of sites, applications and devices to which you have granted some level of access to your account. If you allowed a third-party website (e.g., LinkedIn, Twitter, Foursquare) to comb your Gmail Contacts to find friends, for example, you will see that listed. If you use other Google applications, you will also see those listed. Feel free to revoke access to any site or program you no longer wish to use.



CONFIGURING APPLICATIONS

App passwords allow 2-Step Verification users to access their Google Accounts through apps such as Mail on an iPhone or Mac, or Outlook.

Mail on iPhone or iPad

Microsoft Outlook

Mail on Mac

Unfortunately, such apps can only be configured with a username and a password, rather than a use me, password, and ve tion code.

of codes p ds to count

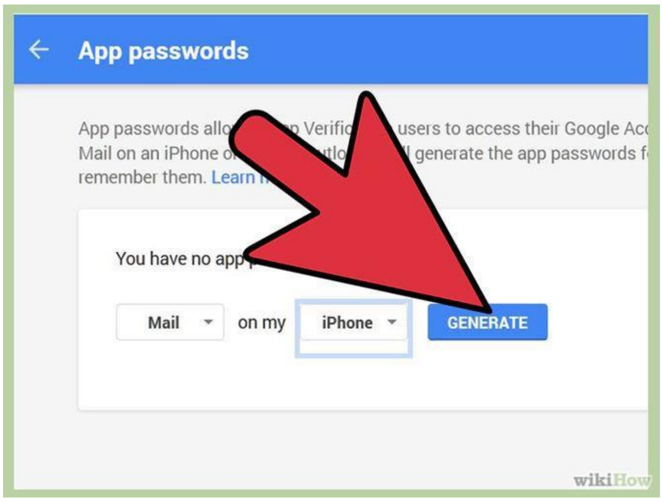
If an app gives you an error about someth you may need to configure it with an app passwo ssword for you, and you won't need to remember app instead.

Manage application-specific passwords

Send feedback

Figure 26: Configuring applications

Step 4: Scroll down to the field at the bottom for entering the name of a device. Enter in something that will help you remember what this application-specific password is for -- e.g., Mail App on iPhone, Google App on iPhone, Chrome Sync, Outlook, Thunderbird, or whatever describes your application. Click "Generate password". You should generate a new application-specific password for *each* application.



App passwords

App passwords allo Verific users to access their Google Acc Mail on an iPhone o utlo l generate the app passwords f remember them. Learn

You have no app

Mail ▾ on my iPhone ▾ GENERATE

Figure 27: Generating app password

Step 5: Open up the application. Go to the settings page where you enter in your Google Account information. Type in your Google account name as usual. Now instead of your account password, type in the application-specific password in the password field. You have now granted this application full access to your Google account. You will only need to enter this password once. There is no need to write it down or memorize it, and it will not be displayed by Google again.

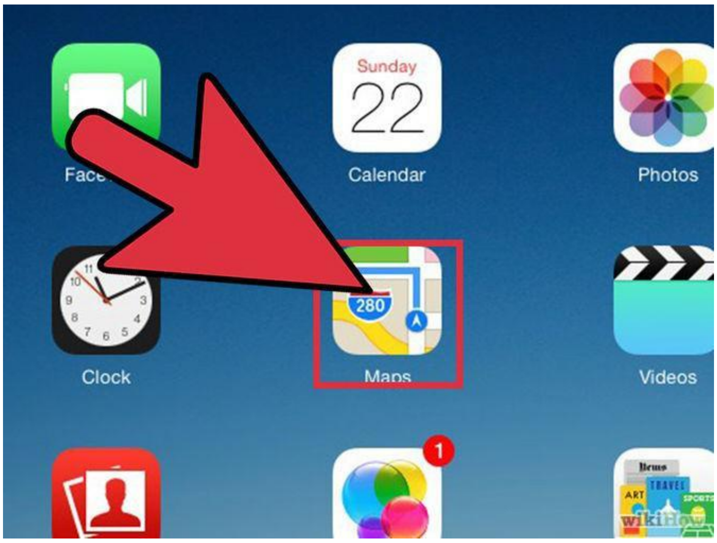
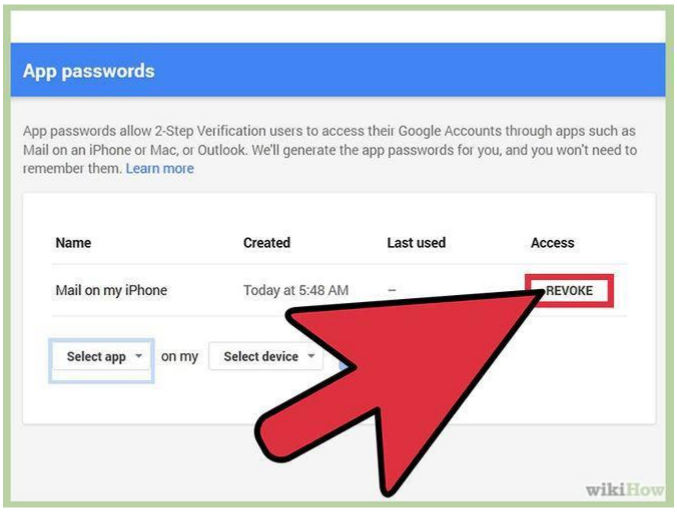


Figure 28: Testing the password

Step 6: Click "Done" on your web browser once you have successfully entered the application-specific password.



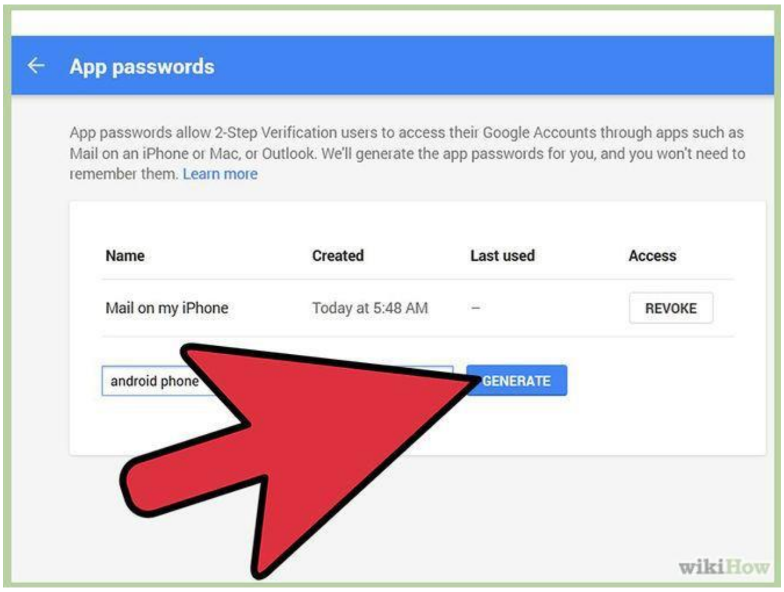
App passwords

App passwords allow 2-Step Verification users to access their Google Accounts through apps such as Mail on an iPhone or Mac, or Outlook. We'll generate the app passwords for you, and you won't need to remember them. Learn more

Name	Created	Last used	Access
Mail on my iPhone	Today at 5:48 AM	–	REVOKE

Figure 29: Revoke the password

Step 7: Know how to revoke an app's access to your Gmail account. If you don't want to use an app anymore, or you lost your phone and want to stop anyone who has it from accessing your Gmail, simply click on the "Revoke" button in your application-specific password settings page.



App passwords

App passwords allow 2-Step Verification users to access their Google Accounts through apps such as Mail on an iPhone or Mac, or Outlook. We'll generate the app passwords for you, and you won't need to remember them. Learn more

Name	Created	Last used	Access
Mail on my iPhone	Today at 5:48 AM	–	REVOKE

android phone

Figure 30: Generating password for android phone

Step 8: Create new application-specific passwords for *each* application that you connect your Google Account to! This means if you sync your Google Account to two mail apps and a chat client, you should have *three* application-specific passwords.

Method 2 of 2: If You Lose Your Phone

If you lose your phone and have 2-step verification turned on, you *can* still access your Gmail account. You also can and should follow these steps to stop strangers from gaining access to your Google accounts.

Step 1: Revoke your current application-specific passwords. If you have a smartphone with apps linked to your Google account, they will automatically be signed out. When you get a new phone, you can generate new application-specific passwords (see previous section) and enter them into your new devices.

Step 2: Change your Gmail password. Even if someone else has your verification code, they can't get into your Gmail account without your new password. While it's unlikely that the person who has your phone also has cracked your Gmail password, you can never be too sure. If you are logged into Google from any web browser on your mobile device, you'll now also automatically be signed out.

Step 3: Add a backup phone number if you have a second mobile device. Go to your2-step verification settings page and click "Add a phone number" in the "Backup phones" section.

Step 4: If you don't have a backup phone, use your list of printable backup codes to access your account. On your 2-step verification settings page, click "Show backup codes". If you haven't done so already, print out this page and keep it in a safe but accessible place -- such as your wallet.

Step 5: If you get phone and change your phone number, be sure to revoke access to your previous number on the 2-step verification settings page.

6.4 SECURING COMPUTER USING FREE ANTIVIRUS[14]

As computers become more and more integrated in to our lives, we end up leaving many sensitive data on our computer-from passwords, official email id, bank account to personal notes, business plans and other confidential information. So, good security software is a must for everyone. Here is a list of 11 free anti-virus software and its common features which you can select (home users) for your online security. All are listed in alphabetical order

1. Avast Antivirus– Avast is one of the best free anti-virus software available that provides a complete protection against security threats. This full-featured antivirus package has the following feature: Built in Anti-spyware, Anti-Rootkit, Web shield, Strong self-protection, P2P and IM shield, Anti-Virus kernel, resident protection, Network shield, Automatic update, System integration, Windows 64 bit support, Integrated Virus Cleaner. It can be downloaded from *https://www.avast.com/index*

2. AVG Antivirus – AVG anti-virus free edition provides basic antivirus and anti-spyware protection for Windows. Following features included in the free edition: Anti-virus , anti-spyware and Safe surf feature. It can be downloaded from *http://free.avg.com/*

3. Avira AntiVir Personal - Avira is a comprehensive, easy to use antivirus program, designed to reliable free of charge virus protection to home-users. Features included are: Protection from virus worms and Trojans, Anti-rootkit, Anti-fishing, Anti dialers. It can be downloaded from *http://www.free-av.com/*

4. BitDefender - Free Edition uses the same ICSA Labs certified scanning engines found in Pro version of BitDefender , allowing you to enjoy basic virus protection for no cost at all. Features includes: On demand Virus Scanner and Remover and Scheduled scanning. It can be downloaded from *http://www.bitdefender.com/PRODUCT-14-en--BitDefender-Free-Edition.html*

[14] http://shaifulaueo.blogspot.in/p/free-antivirus_13.html

5. Blink Personal – An all-in one security suite with antivirus limited for one year. Blink personal Security suite features – Antivirus and Anti spyware, Anti root kit, Built-in Firewall protection and Identity protection. It can be downloaded from *http://free-antivirus.eeye.com/*

6. Calmwin antivirus–An open source, free Antivirus program for Windows 98/Me/2000/XP/2003 and Vista. Features include - high detection rates for viruses and spyware; automatic downloads of regularly updated Virus Database, Standalone virus scanner. It does not include an on-access real-time scanner. It can be downloaded from *http://www.clamwin.com/*

7. Comodo Antivirus - has all the functionality of a paid AV without the price – Features includes- Detects and remove viruses from computers and networks. On Access Scanning conducts a real-time, scheduled virus scan. Host Intrusion Detection allows you to Intercept viruses, spyware, and other malware before they infect your computer.Get updates of the latest virus definitions everyday so you can stay protected against the latest threats. It can be downloaded from *http://antivirus.comodo.com/*

8. Moon Secure Antivirus - Aims to be the best Free Antivirus for Windows under GPL license. It offers multiple scan engines, Net shield, Firewall, On access, on Exec scanner and rootkits preventions plus features from Commercial Antivirus applications. It can be downloaded from *http://sourceforge.net/projects/moonav/*

9. PCTools Antivirus- with PC Tools AntiVirus Free Edition you are protected against the most nefarious cyber-threats attempting to gain access to your PC and personal information. It protects you fromVirus, worm, Trojan and has Smart Updates, IntelliGuard Protection, file guard and email guard. It can be downloaded from *http://www.pctools.com/free-antivirus/*

10. Rising Antivirus – Rising Antivirus Free Edition is a solution with no cost to personal users for the life of the product while still provides the same level of detection and protection capability as RISING Antivirus. It protects your computers against all types of viruses, Trojans, worms, rootkits and other malicious programs. Ease of use and Smartupdate technology make it an "install and forget" product and entitles you to focus on your own jobs with your computer. It can be downloaded from *http://www.freerav.com/*

11. Threatfire Lite – Provides Comprehensive protection against viruses, worms, Trojans, spyware, rootkits, keyloggers & buffer overflows. And have Real-time behavior-based malware detection, malware quarantine & removal, etc. It can be downloaded from *http://www.threatfire.com/download/*

ACTIVITY

1. Compare the feature of some of the popular free antiviruses.
2. What is the difference between free antivirus and paid antivirus? Is it safe to use free antivirus in your machine?
3. Use the guidelines to for generating secure passwords and evaluate whether your current passwords can be considered as safe or unsafe passwords.
4. Based on the above guidelines, change your unsafe passwords to safe ones.
5. Find out some popular password managers and evaluate them based on their characteristics‟.
6. Based on the above comparison, choose one of the best password managers for yourself.
7. Create two step verification for your Gmail account
8. Find out how many sites, other than Gmail provide two steps verification.

Unit 7: Configuring Firewall 7

Unit Structure

7.1 CONFIGURING FIREWALL ON MAC COMPUTER[15]

Every Mac ships with a built-in firewall - a service that can be configured to disallow information from entering your Mac. But what is a firewall, and why do you need to use it on your Mac?

Every time you request information from the Internet, such as a web page or email message, your Mac sends data packets to request the information. Servers receive the packets, and then send other packets back to your Mac. This all happens in a matter of seconds. Once your Mac has reassembled the packets, you'll see something, like an email message or web page.

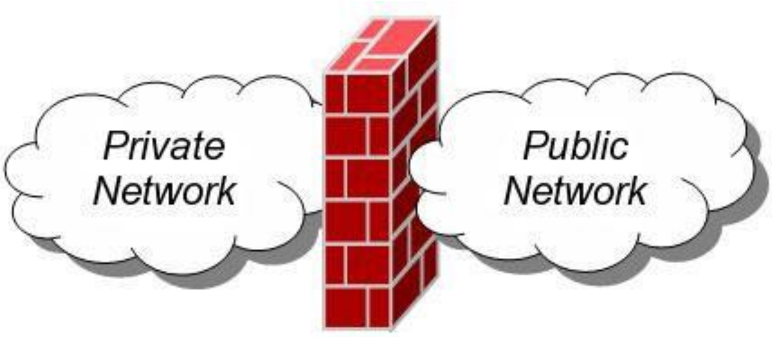


Figure 31: Firewall

A firewall can help prevent bad packets from entering your Mac. Hackers love to run automated applications that can scan thousands of computers (including your Mac) for open ports that can be exploited. To ensure that random individuals do not gain unauthorized access to your Mac, you should enable Mac OS X's built-in firewall. It will close your Mac's open ports and disallow random network scans.

7.1.1 Turning on and Configuring the Mac OS X Firewall

Here's how to turn on and configure your Mac's built-in firewall:

1. From the Apple menu, select **System Preferences**. The window shown below appears.

[15] Content and image courtesy(figure 31 to 35): http://www.macinstruct.com/node/165 available under Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License

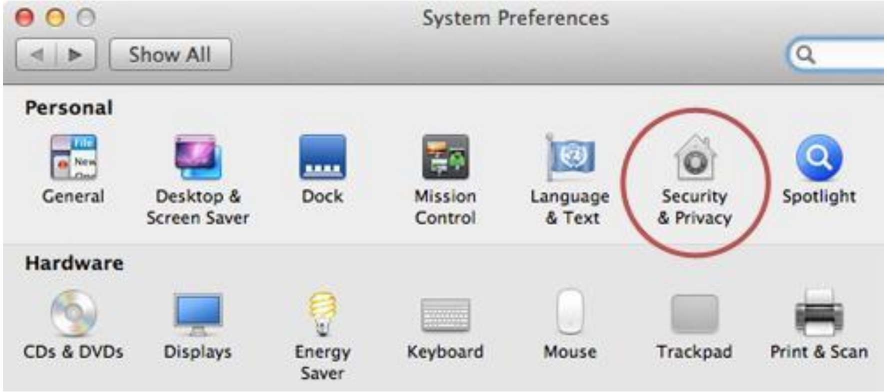
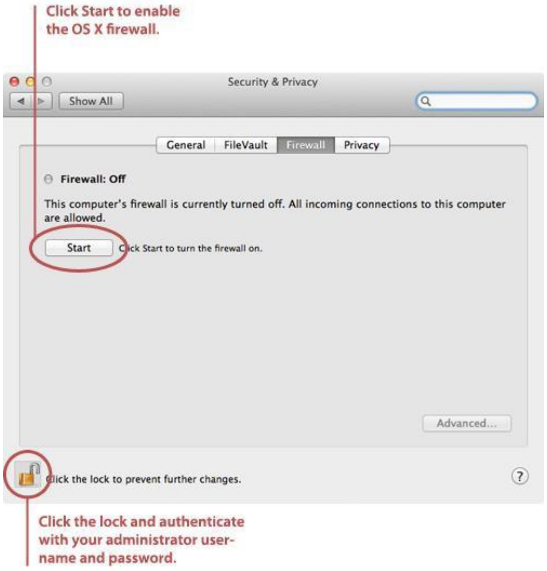


Figure 32: System preference dashboard

2. Select **Security & Privacy**.

3. Click the **Firewall** tab.

4. Click the lock icon and authenticate with your administrator username and password. The window shown below appears.



Click Start to enable the OS X firewall.

Firewall: Off

This computer's firewall is currently turned off. All incoming connections to this computer are allowed.

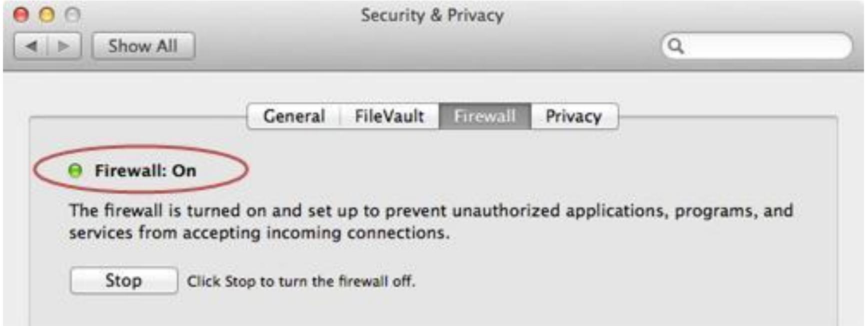
Click Start to turn the firewall on.

Click the lock to prevent further changes.

Click the lock and authenticate with your administrator user-name and password.

Figure 33: Security and privacy dashboard

5. Click **Start**. The firewall turns on - you'll know it's enabled when you see the green light and the **Firewall: On** message, as shown below.



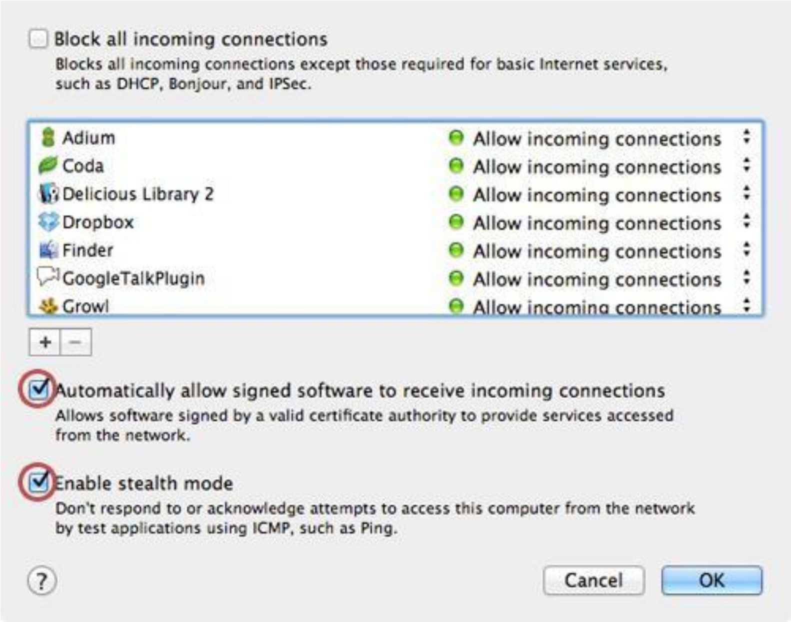
● Firewall: On

The firewall is turned on and set up to prevent unauthorized applications, programs, and services from accepting incoming connections.

Stop   Click Stop to turn the firewall off.

Figure 34: Turning on firewall

6. Click **Advanced**. The window shown below appears.



□ Block all incoming connections
Blocks all incoming connections except those required for basic Internet services, such as DHCP, Bonjour, and IPSec.

Adium	● Allow incoming connections
Coda	● Allow incoming connections
Delicious Library 2	● Allow incoming connections
Dropbox	● Allow incoming connections
Finder	● Allow incoming connections
GoogleTalkPlugin	● Allow incoming connections
Growl	● Allow incoming connections

☑ Automatically allow signed software to receive incoming connections
Allows software signed by a valid certificate authority to provide services accessed from the network.

☑ Enable stealth mode
Don't respond to or acknowledge attempts to access this computer from the network by test applications using ICMP, such as Ping.

Figure 35: Configuring firewall

7. Select the **Automatically allow signed software to receive incoming connections** checkbox. This allows the applications on your Mac to communicate with the outside world.

8. Select the **Enable stealth mode** checkbox. This prevents your Mac from responding to port scans and ping requests.

9. Click **OK** to close the *Advanced* settings.

10. Close System Preferences. Your Mac is now protected by the built-in firewall!

7.2 WORKING WITH WINDOWS FIREWALL IN WINDOWS7[16]

7.2.1 Firewall in Windows 7

Windows 7 comes with two firewalls that work together. One is the **Windows Firewall**, and the other is **Windows Firewall with Advanced Security (WFAS)**. The main difference between them is the complexity of the rules configuration. Windows Firewall uses simple rules that directly relate to a program or a service. The rules in WFAS can be configured based on protocols, ports, addresses and authentication. By default, both firewalls come with predefined set of rules that allow us to utilize network resources. This includes things like browsing the web, receiving e-mails, etc. Other standard firewall exceptions are File and Printer Sharing, Network Discovery, Performance Logs and Alerts, Remote Administration, Windows Remote Management, Remote Assistance, Remote Desktop, Windows Media Player, Windows Media Player Network Sharing Service.

With firewall in Windows 7 we can configure inbound and outbound rules. By default, all outbound traffic is allowed, and inbound responses to that traffic are also allowed. Inbound traffic initiated from external sources is automatically blocked.

Sometimes we will see a notification about a blocked program which is trying to access network resources. In that case we will be able to add an exception to our firewall in order to allow traffic from the program in the future.

Windows 7 comes with some new features when it comes to firewall. For example, "full-stealth" feature blocks other computers from performing operating system fingerprinting. OS fingerprinting is a malicious technique used to determine the operating system running on the host machine. Another feature is "boot-time filtering". This features ensures that the firewall is working at the same time when the network interface becomes active, which was not the case in previous versions of Windows.

When we first connect to some network, we are prompted to select a network location. This feature is known as Network Location Awareness (NLA). This feature enables us to assign a network profile to the connection based on the location. Different network profiles contain different collections of firewall rules. In Windows 7, different network profiles can be

[16] Contents and image courtesy(Figure 31 o 43):http://www.digitalcitizen.life/gain-additional-control-using-windows-firewall-advanced-security available under Creative Commons Attribution-Noncommercial-Share Alike 4.0 International.

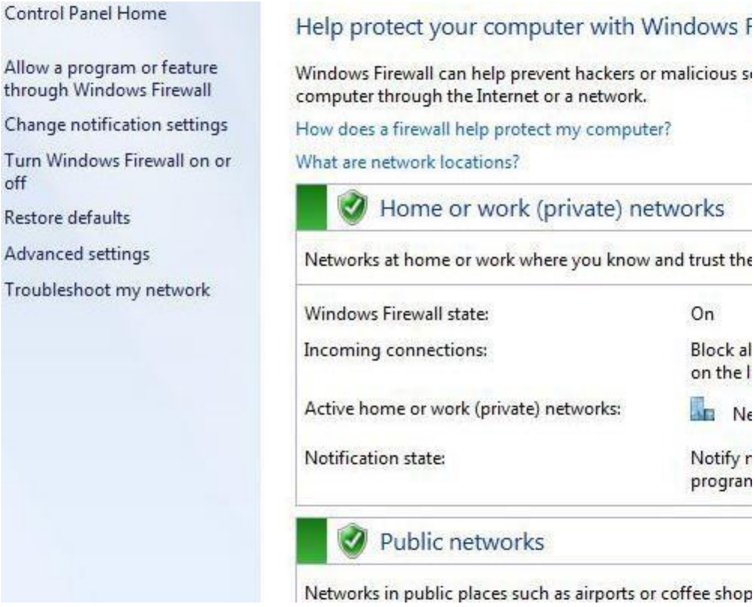
configured on different interfaces. For example, our wired interface can have different profile than our wireless interface. There are three different network profiles available:

- Public
- Home/Work - private network
- Domain - used within a domain

We choose those locations when we connect to a network. We can always change the location in the Network and Sharing Center, in Control Panel. The Domain profile can be automatically assigned by the NLA service when we log on to an Active Directory domain. Note that we must have administrative rights in order to configure firewall in Windows 7.

7.2.2 Configuring Windows Firewall

To open Windows Firewall we can go to **Start > Control Panel > Windows Firewall**.



Control Panel Home

Allow a program or feature through Windows Firewall

Change notification settings

Turn Windows Firewall on or off

Restore defaults

Advanced settings

Troubleshoot my network

Help protect your computer with Windows F

Windows Firewall can help prevent hackers or malicious s computer through the Internet or a network.

How does a firewall help protect my computer?

What are network locations?

Home or work (private) networks

Networks at home or work where you know and trust the

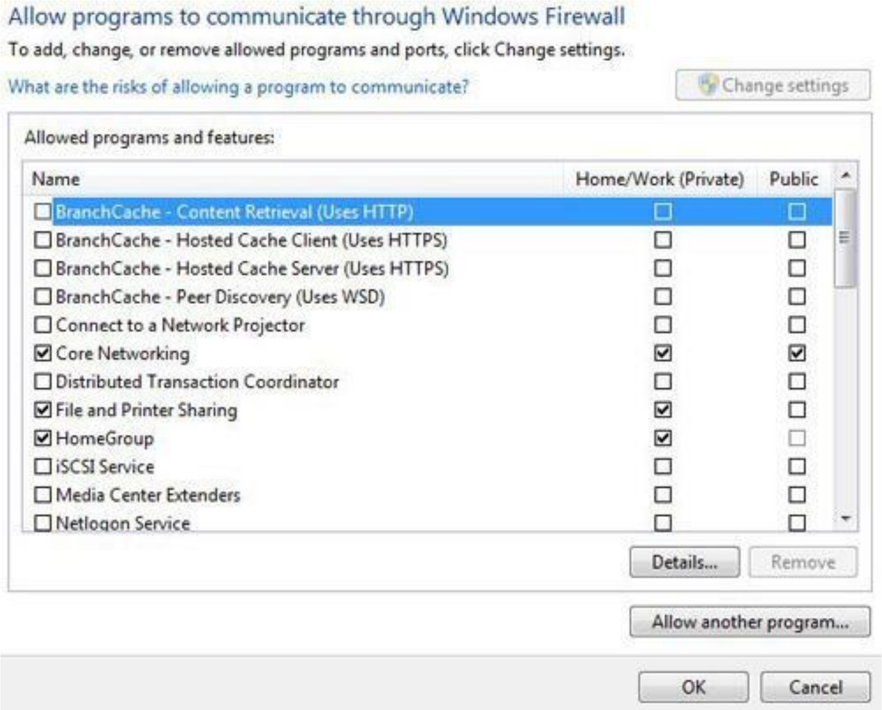
Windows Firewall state:	On
Incoming connections:	Block al on the l
Active home or work (private) networks:	Ne
Notification state:	Notify r progran

Public networks

Networks in public places such as airports or coffee shop

Figure 36: Control pandel dashboard on Windows machine

By default, Windows Firewall is enabled for both private (home or work) and public networks. It is also configured to block all connections to programs that are not on the list of allowed programs. To configure exceptions we can go to the menu on the left and select "Allow a program or feature trough Windows Firewall" option.



Allow programs to communicate through Windows Firewall

To add, change, or remove allowed programs and ports, click Change settings.

What are the risks of allowing a program to communicate?

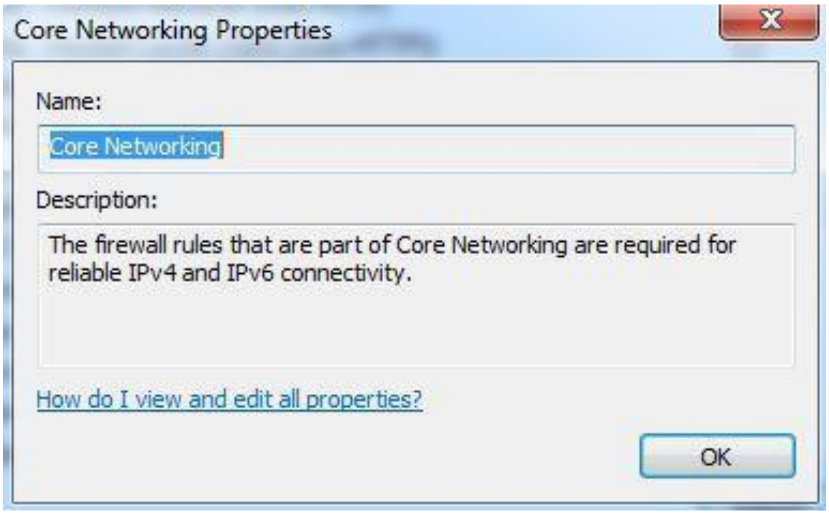
Allowed programs and features:

Name	Home/Work (Private)	Public
☐ BranchCache - Content Retrieval (Uses HTTP)	☐	☐
☐ BranchCache - Hosted Cache Client (Uses HTTPS)	☐	☐
☐ BranchCache - Hosted Cache Server (Uses HTTPS)	☐	☐
☐ BranchCache - Peer Discovery (Uses WSD)	☐	☐
☐ Connect to a Network Projector	☐	☐
☑ Core Networking	☑	☑
☐ Distributed Transaction Coordinator	☐	☐
☑ File and Printer Sharing	☑	☐
☑ HomeGroup	☑	☐
☐ iSCSI Service	☐	☐
☐ Media Center Extenders	☐	☐
☐ Netlogon Service	☐	☐

Figure 37: Configuring firewall setting

Exceptions

To change settings in this window we have to click the "Change settings" button. As you can see, here we have a list of predefined programs and features that can be allowed to communicate on private or public networks. For example, notice that the Core Networking feature is allowed on both private and public networks, while the File and Printer Sharing is only allowed on private networks. We can also see the details of the items in the list by selecting it and then clicking the Details button.



Core Networking Properties

Name: Core Networking

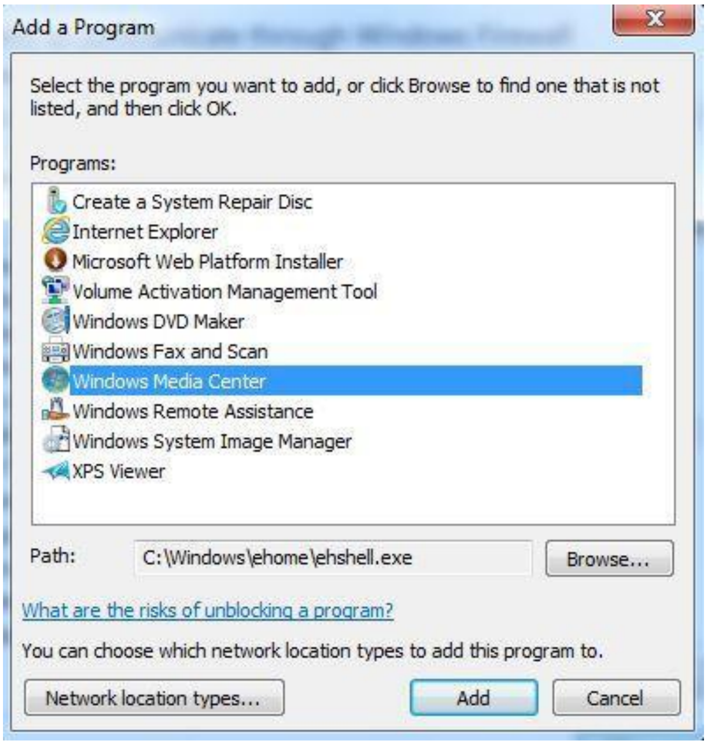
Description: The firewall rules that are part of Core Networking are required for reliable IPv4 and IPv6 connectivity.

How do I view and edit all properties?

Figure 38: Setting exceptions

Details

If we have a program on our computer that is not in this list, we can manually add it by clicking on the "Allow another program" button.



Add a Program

Select the program you want to add, or click Browse to find one that is not listed, and then click OK.

Programs:

- Create a System Repair Disc
- Internet Explorer
- Microsoft Web Platform Installer
- Volume Activation Management Tool
- Windows DVD Maker
- Windows Fax and Scan
- Windows Media Center
- Windows Remote Assistance
- Windows System Image Manager
- XPS Viewer

Path: C:\Windows\ehome\ehshell.exe

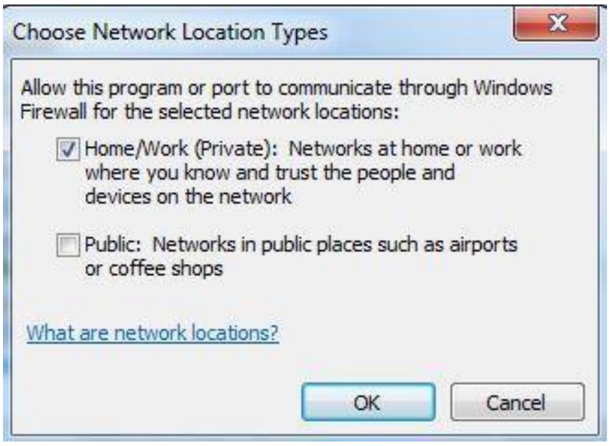
What are the risks of unblocking a program?

You can choose which network location types to add this program to.

Figure 39: Selecting programs not present in the list

Add a Program

Here we have to browse to the executable of our program and then click the Add button. Notice that we can also choose location types on which this program will be allowed to communicate by clicking on the "Network location types" button.



Choose Network Location Types

Allow this program or port to communicate through Windows Firewall for the selected network locations:

☑ Home/Work (Private): Networks at home or work where you know and trust the people and devices on the network

□ Public: Networks in public places such as airports or coffee shops

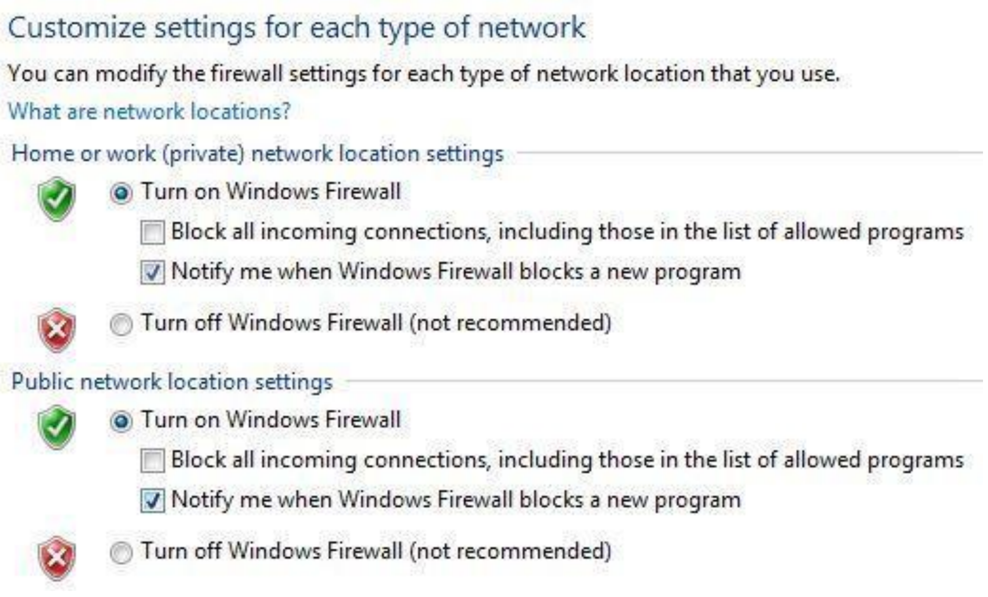
What are network locations?

Figure 40: Adding a program

Network Locations

Many applications will automatically configure proper exceptions in Windows Firewall when we run them. For example, if we enable streaming from Media Player, it will automatically configure firewall settings to allow streaming. The same thing is if we enable Remote Desktop feature from the system properties window. By enabling Remote Desktop feature we actually create an exception in Windows Firewall.

Windows Firewall can be turned off completely. To do, we can select the "Turn Windows Firewall on or off" option from the menu on the left.



Customize settings for each type of network

You can modify the firewall settings for each type of network location that you use.

What are network locations?

Home or work (private) network location settings

● Turn on Windows Firewall

□ Block all incoming connections, including those in the list of allowed programs

☑ Notify me when Windows Firewall blocks a new program

○ Turn off Windows Firewall (not recommended)

Public network location settings

● Turn on Windows Firewall

□ Block all incoming connections, including those in the list of allowed programs

☑ Notify me when Windows Firewall blocks a new program

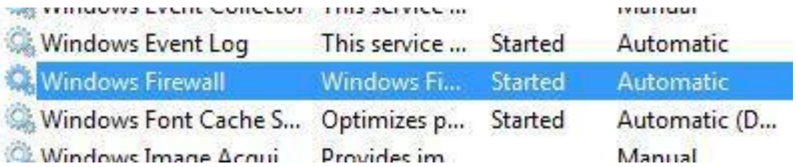
○ Turn off Windows Firewall (not recommended)

Figure 41: Customize settings

Firewall Customization

Note that we can modify settings for each type of network location (private or public). Interesting thing here is that we can block all incoming connections, including those in the list of allowed programs.

Windows Firewall is actually a Windows service. As you know, services can be stopped and started. If the Windows Firewall service is stopped, the Windows Firewall will not work.

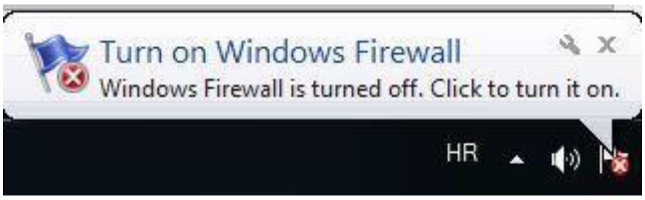


Windows Event Collector	This service ...		Manual
Windows Event Log	This service ...	Started	Automatic
Windows Firewall	Windows Fi...	Started	Automatic
Windows Font Cache S...	Optimizes p...	Started	Automatic (D...
Windows Image Acqui...	Provides im...		Manual

Figure 42: Enabling firewall from Windows services

Firewall Service

In our case the service is running. If we stop it, we will get a warning that we should turn on our Windows Firewall.



Turn on Windows Firewall

Windows Firewall is turned off. Click to turn it on.

Figure 43: Firewall notification

Warning

Remember that with Windows Firewall we can only configure basic firewall settings, and this is enough for most day-to-day users. However, we can't configure exceptions based on ports in Windows Firewall any more. For that we have to use Windows Firewall with Advanced Security, which will be covered in next section.

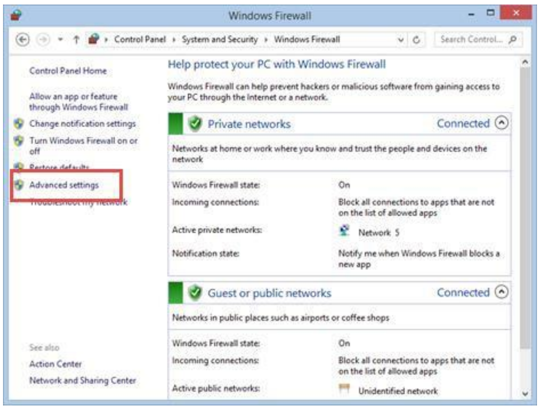
7.2.3 How to Start & Use the Windows Firewall with Advanced Security[17]

The *Windows Firewall with Advanced Security* is a tool which gives you detailed control over the rules that are applied by the *Windows Firewall*. You can view all the rules that are used by the *Windows Firewall*, change their properties, create new rules or disable existing ones. In this tutorial we will share how to open the *Windows Firewall with Advanced Security*, how to find your way around it and talk about the types of rules that are available and what kind of traffic they filter.

7.2.3.1 How to Access the Windows Firewall with Advanced Security

You have several alternatives to opening the *Windows Firewall with Advanced Security*:

One is to open the standard Windows Firewall window, by going to *"Control Panel -> System and Security -> Windows Firewall"*. Then, click or tap *Advanced settings*.



Windows Firewall
Control Panel › System and Security › Windows Firewall
Search Control...
Control Panel Home
Allow an app or feature through Windows Firewall
Change notification settings
Turn Windows Firewall on or off
Restore defaults
Advanced settings
Troubleshoot my network
See also
Action Center
Network and Sharing Center

Help protect your PC with Windows Firewall

Windows Firewall can help prevent hackers or malicious software from gaining access to your PC through the Internet or a network.

Private networks — Connected

Networks at home or work where you know and trust the people and devices on the network

Windows Firewall state: On

Incoming connections: Block all connections to apps that are not on the list of allowed apps

Active private networks: Network 5

Notification state: Notify me when Windows Firewall blocks a new app

Guest or public networks — Connected

Networks in public places such as airports or coffee shops

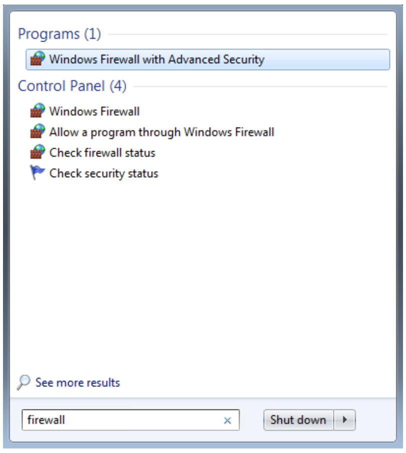
Windows Firewall state: On

Incoming connections: Block all connections to apps that are not on the list of allowed apps

Active public networks: Unidentified network

[17] http://www.digitalcitizen.life/gain-additional-control-using-windows-firewall-advanced-security

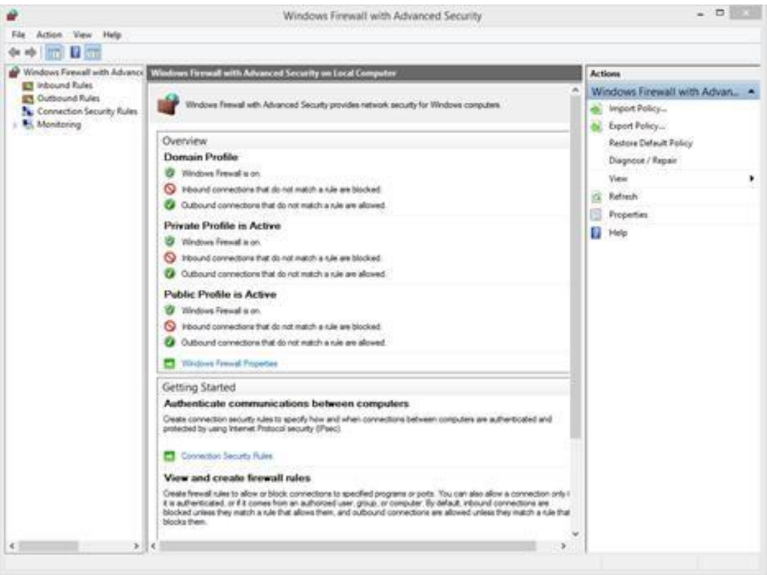
In Windows 7, another method is to search for the word *firewall* in the *Start Menu* search box and click the *"Windows Firewall with Advanced Security"* result.



firewall

In Windows 8.1, *Windows Firewall with Advanced Security* is not returned in search results and you need to use the first method shared above for opening it.

The *Windows Firewall with Advanced Security* looks and works the same both in Windows 7 and Windows 8.1. To continue our tutorial, we will use screenshots that were made in Windows 8.1.


Windows Firewall with Advanced Security
File
Action
View
Help
Windows Firewall with Advance
Inbound Rules
Outbound Rules
Connection Security Rules
Monitoring
Windows Firewall with Advanced Security on Local Computer
Actions
Windows Firewall with Advan...
Import Policy...
Export Policy...
Restore Default Policy
Diagnose / Repair
View
Refresh
Properties
Help

Windows Firewall with Advanced Security provides network security for Windows computers.

Overview

Domain Profile
- Windows Firewall is on.
- Inbound connections that do not match a rule are blocked.
- Outbound connections that do not match a rule are allowed.

Private Profile is Active
- Windows Firewall is on.
- Inbound connections that do not match a rule are blocked.
- Outbound connections that do not match a rule are allowed.

Public Profile is Active
- Windows Firewall is on.
- Inbound connections that do not match a rule are blocked.
- Outbound connections that do not match a rule are allowed.

Windows Firewall Properties

Getting Started

Authenticate communications between computers

Create connection security rules to specify how and when connections between computers are authenticated and protected by using Internet Protocol security (IPsec).

Connection Security Rules

View and create firewall rules

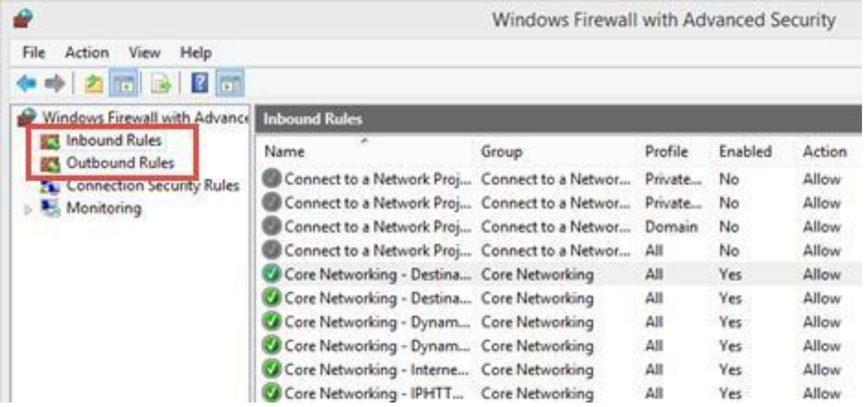
Create firewall rules to allow or block connections to specified programs or ports. You can also allow a connection only i it is authenticated, or if it comes from an authorized user, group, or computer. By default, inbound connections are blocked unless they match a rule that allows them, and outbound connections are allowed unless they match a rule that blocks them.

7.2.3.2 What Are The Inbound & Outbound Rules?

In order to provide the security you need, the *Windows Firewall* has a standard set of inbound and outbound rules, which are enabled depending on the location of the network you are connected to. Inbound rules are applied to the traffic that is coming from the network and the Internet to your computer or device. Outbound rules apply to the traffic from your computer to the network or the Internet.

These rules can be configured so that they are specific to: computers, users, programs, services, ports or protocols. You can also specify to which type of network adapter (e.g. wireless, cable, virtual private network) or user profile it is applied to.

In the *Windows Firewall with Advanced Security*, you can access all rules and edit their properties. All you have to do is click or tap the appropriate section in the left-side panel.

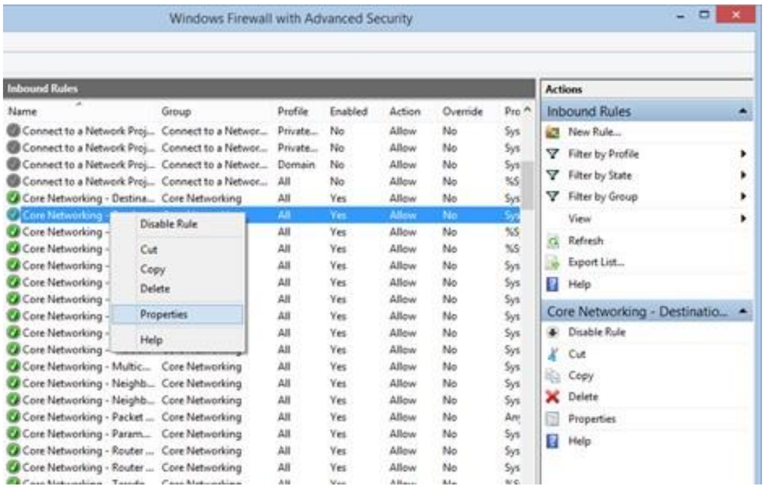

Windows Firewall with Advanced Security
File
Action
View
Help
Windows Firewall with Advance
Inbound Rules
Outbound Rules
Connection Security Rules
Monitoring

Inbound Rules

Name	Group	Profile	Enabled	Action
Connect to a Network Proj...	Connect to a Networ...	Private...	No	Allow
Connect to a Network Proj...	Connect to a Networ...	Private...	No	Allow
Connect to a Network Proj...	Connect to a Networ...	Domain	No	Allow
Connect to a Network Proj...	Connect to a Networ...	All	No	Allow
Core Networking - Destina...	Core Networking	All	Yes	Allow
Core Networking - Destina...	Core Networking	All	Yes	Allow
Core Networking - Dynam...	Core Networking	All	Yes	Allow
Core Networking - Dynam...	Core Networking	All	Yes	Allow
Core Networking - Interne...	Core Networking	All	Yes	Allow
Core Networking - IPHTT...	Core Networking	All	Yes	Allow

The rules used by the *Windows Firewall* can be enabled or disabled. The ones which are enabled or active are marked with a green check-box in the *Name* column. The ones that are disabled are marked with a gray check-box.

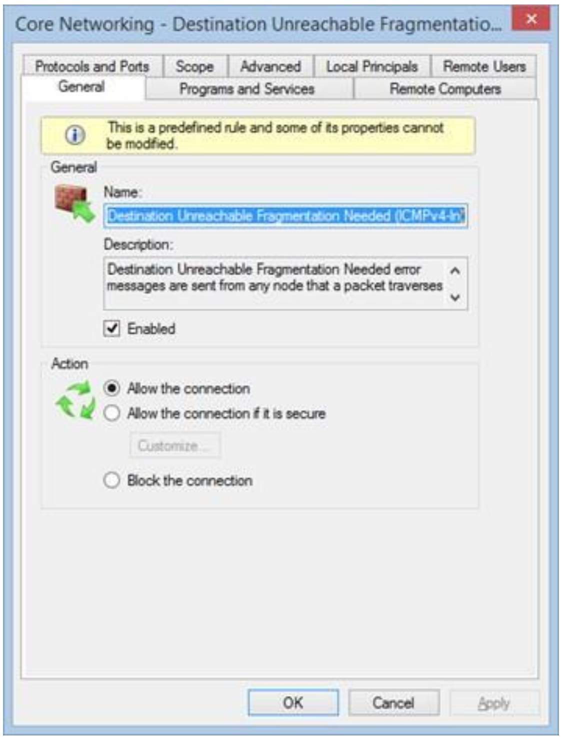
If you want to know more about a specific rule and learn its properties, right click on it and select *Properties* or select it and press *Properties* in the column on right, which lists the actions that are available for your selection.



Inbound Rules

Name	Group	Profile	Enabled	Action	Override	Pro
Connect to a Network Proj...	Connect to a Networ...	Private...	No	Allow	No	Sys
Connect to a Network Proj...	Connect to a Networ...	Private...	No	Allow	No	Sys
Connect to a Network Proj...	Connect to a Networ...	Domain	No	Allow	No	Sys
Connect to a Network Proj...	Connect to a Networ...	All	No	Allow	No	%S
Core Networking - Destina...	Core Networking	All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	%S
Core Networking -		All	Yes	Allow	No	%S
Core Networking -		All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	Sys
Core Networking -		All	Yes	Allow	No	Sys
Core Networking - Multic...	Core Networking	All	Yes	Allow	No	Sys
Core Networking - Neighb...	Core Networking	All	Yes	Allow	No	Sys
Core Networking - Neighb...	Core Networking	All	Yes	Allow	No	Sys
Core Networking - Packet ...	Core Networking	All	Yes	Allow	No	Any
Core Networking - Param...	Core Networking	All	Yes	Allow	No	Sys
Core Networking - Router ...	Core Networking	All	Yes	Allow	No	Sys
Core Networking - Router ...	Core Networking	All	Yes	Allow	No	Sys

In the *Properties* window, you will find complete information about the selected rule, what it does and in when it is applied. You will also be able to edit its properties and change any of the available parameters.



Core Networking - Destination Unreachable Fragmentatio...

This is a predefined rule and some of its properties cannot be modified.

General

Name: Destination Unreachable Fragmentation Needed (ICMPv4-In)

Description: Destination Unreachable Fragmentation Needed error messages are sent from any node that a packet traverses

☑ Enabled

Action

● Allow the connection

○ Allow the connection if it is secure

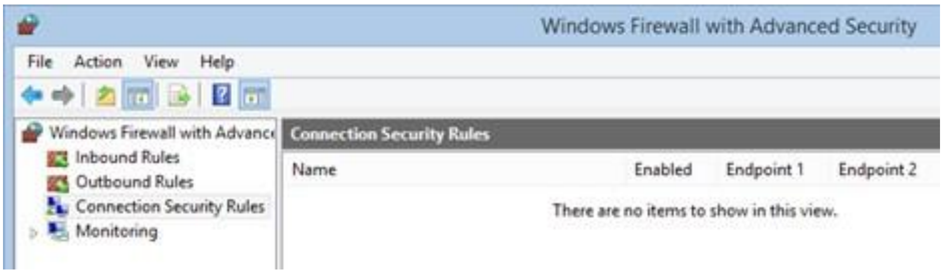
○ Block the connection

7.2.3.3 What Are The Connection Security Rules?

Connection security rules are used to secure traffic between two computers while it crosses the network. One example would be a rule which defines that connections between two specific computers must be encrypted.

Unlike the inbound or outbound rules, which are applied only to one computer, connection security rules require that both computers have the same rules defined and enabled.

If you want to see if there are any such rules on your computer, click or tap *"Connection Security Rules"* on the panel on the left. By default, there are no such rules defined on Windows computers and devices. They are generally used in business environments and such rules are set by the network administrator.



Windows Firewall with Advanced Security

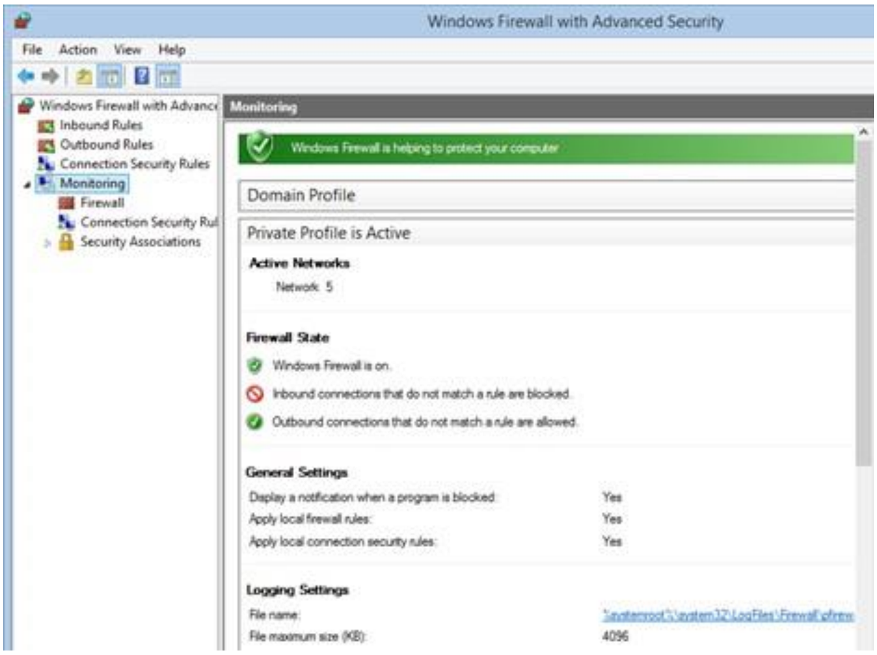
Connection Security Rules

Name	Enabled	Endpoint 1	Endpoint 2

There are no items to show in this view.

7.2.3.4 What Does the Windows Firewall with Advanced Security Monitor?

The *Windows Firewall with Advanced Security* includes some monitoring features as well. In the *Monitoring* section you can find the following information: the firewall rules that are active (both inbound and outbound), the connection security rules that are active and whether there are any active security associations.



Windows Firewall is helping to protect your computer

Domain Profile

Private Profile is Active

Active Networks

Network 5

Firewall State

Windows Firewall is on.

Inbound connections that do not match a rule are blocked.

Outbound connections that do not match a rule are allowed.

General Settings

Display a notification when a program is blocked:	Yes
Apply local firewall rules:	Yes
Apply local connection security rules:	Yes

Logging Settings

File name:	%systemroot%\system32\LogFiles\Firewall\pfirew
File maximum size (KB):	4096

You should note that the *Monitoring* section shows only the active rules for the current network location. If there are rules which get enabled for other network locations, you will not see them in this section.

The above section discussed on how to setup a firewall on two Operating Systems viz. Windows and Mac. Linux have many variants therefore it is not possible to discuss how to configure firewall on Linux. There are some links in the Recommended Videos section which discuss the procedure of setting up firewall in various variant of Linux.

Activity

1. Setup and configure a firewall in your system.
2. Find some of the free and commercially available firewalls over internet.

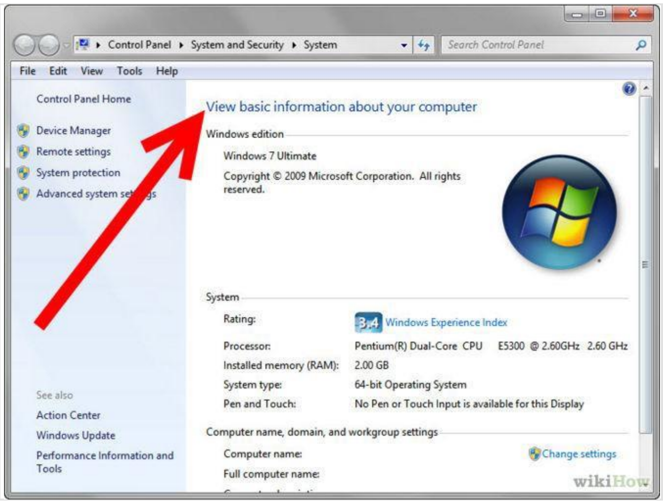
Unit 8: Choosing Best Browser to Suit Your Requirement

8

Unit Structure

8.1 FINDING THE BEST BROWSER ACCORDING TO THE USERS REQUIREMENT[18]

Browsers are the key to the Internet these days, at least for most tasks. There are many, many browsers for every platform and operating system, so the choice can be tough. However, this should help narrow the search.



View basic information about your computer

Windows edition

Windows 7 Ultimate

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System

Rating: 3.4 Windows Experience Index

Processor: Pentium(R) Dual-Core CPU E5300 @ 2.60GHz 2.60 GHz

Installed memory (RAM): 2.00 GB

System type: 64-bit Operating System

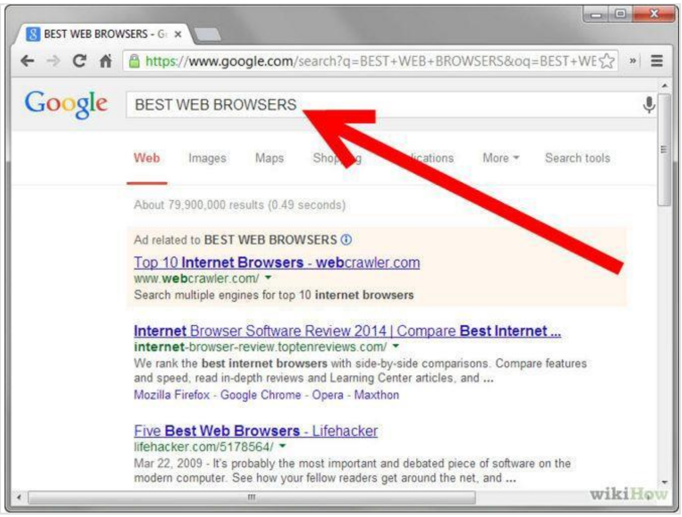
Pen and Touch: No Pen or Touch Input is available for this Display

Computer name, domain, and workgroup settings

Computer name:

Full computer name:

Step 1: Determine the age of your computer. How old is your computer? Is it a mobile device? Know your systems specifications as this may be more suited to some browsers than others.



BEST WEB BROWSERS

About 79,900,000 results (0.49 seconds)

Ad related to **BEST WEB BROWSERS**

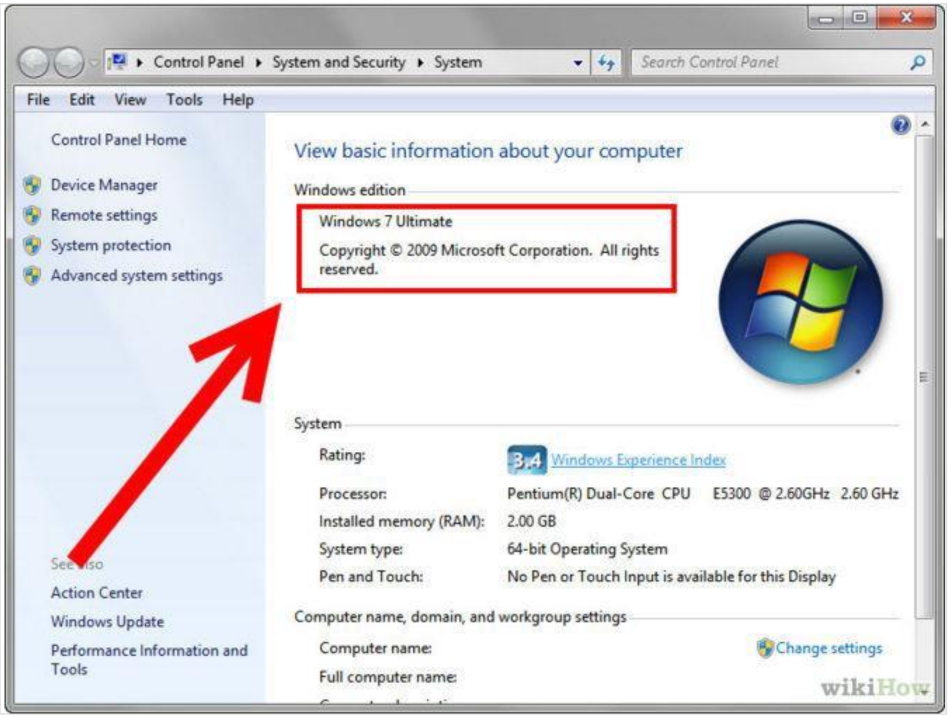
Top 10 **Internet Browsers** - **web**crawler.com
www.**web**crawler.com/
Search multiple engines for top 10 **internet browsers**

Internet Browser Software Review 2014 | Compare **Best Internet** ...
internet-browser-review.toptenreviews.com/
We rank the **best internet browsers** with side-by-side comparisons. Compare features and speed, read in-depth reviews and Learning Center articles, and ...
Mozilla Firefox - Google Chrome - Opera - Maxthon

Five **Best Web Browsers** - Lifehacker
lifehacker.com/5178564/
Mar 22, 2009 - It's probably the most important and debated piece of software on the modern computer. See how your fellow readers get around the net, and ...

[18] http://www.wikihow.com/Choose-an-Internet-Browser

Step 2: Think about your ideal browser; what would it be able to do? You may want it to be quite simple, handling only the bare necessities. You may want some basic features like web feed reading, bookmarking (favorites), or search boxes. Some browsers have a lot more, and that's where it starts to get confusing.



View basic information about your computer

Windows edition

Windows 7 Ultimate

Copyright © 2009 Microsoft Corporation. All rights reserved.

System

Rating: 3.4 Windows Experience Index

Processor: Pentium(R) Dual-Core CPU E5300 @ 2.60GHz 2.60 GHz

Installed memory (RAM): 2.00 GB

System type: 64-bit Operating System

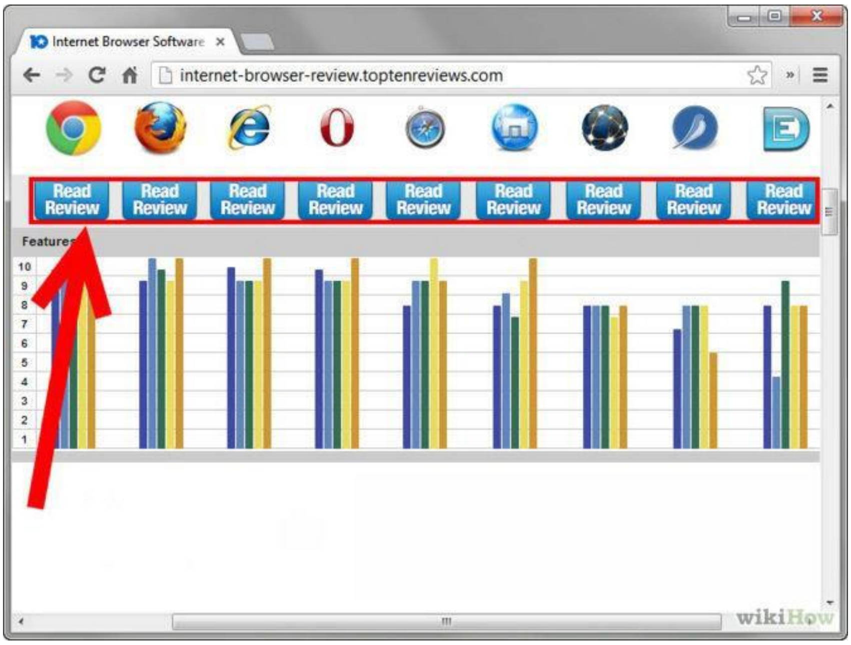
Pen and Touch: No Pen or Touch Input is available for this Display

Computer name, domain, and workgroup settings

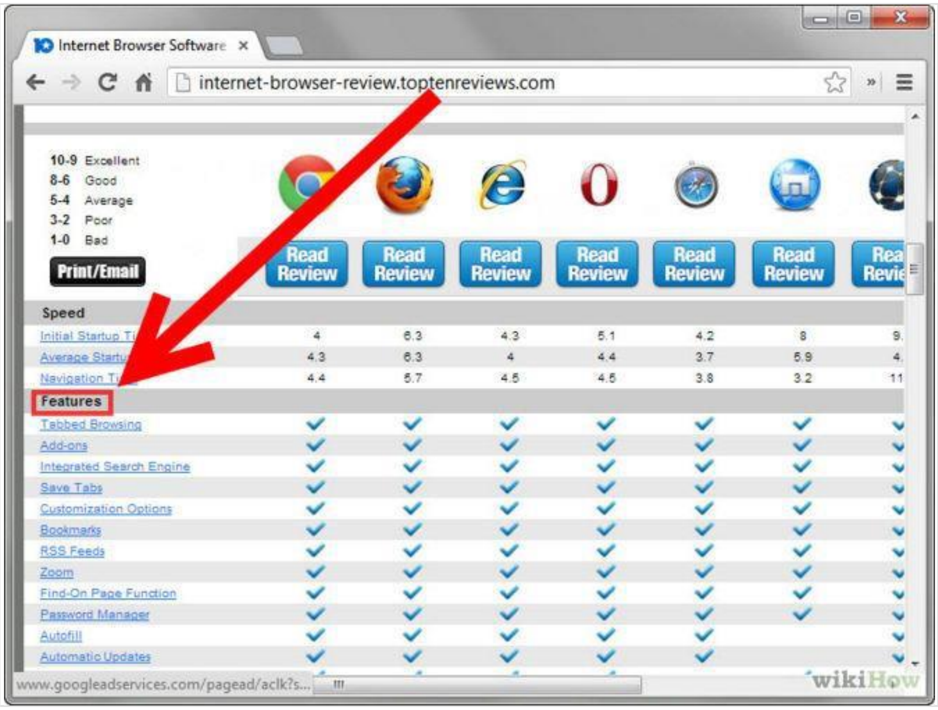
Computer name: Change settings

Full computer name:

Step 3: Make sure you know what platform you are on. Some browsers are only available to a certain operating system, or not available to one operating system.



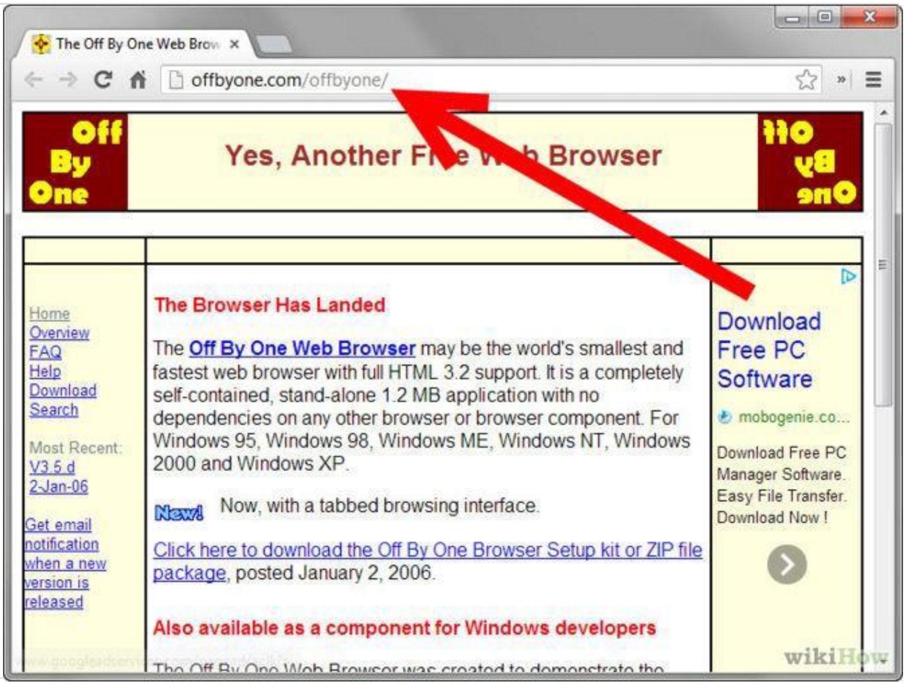
Step 4: Research browsers. Tabbed browsers include Safari (runs on OS X, iPhone and is new to Windows), Firefox (general purpose with the most plug-ins), Opera(supports torrents, handles e-mail and runs on mobile devices), Konqueror (dual purpose file manager), Seamonkey (includes HTML editor and e-mail client), Off By One (tiny) and Flock (social networking).


Internet Browser Software
internet-browser-review.toptenreviews.com
Print/Email
www.googleadservices.com/pagead/aclk?s...
wikiHow

10-9	Excellent
8-6	Good
5-4	Average
3-2	Poor
1-0	Bad

	Read Review	Read Review	Read Review	Read Review	Read Review	Read Review	Rea Revie
Speed							
Initial Startup Ti	4	6.3	4.3	5.1	4.2	8	9.
Average Startu	4.3	6.3	4	4.4	3.7	5.9	4.
Navigation Ti	4.4	5.7	4.5	4.5	3.8	3.2	11
Features							
Tabbed Browsing	✓	✓	✓	✓	✓	✓	✓
Add-ons	✓	✓	✓	✓	✓	✓	✓
Integrated Search Engine	✓	✓	✓	✓	✓	✓	✓
Save Tabs	✓	✓	✓	✓	✓	✓	✓
Customization Options	✓	✓	✓	✓	✓	✓	✓
Bookmarks	✓	✓	✓	✓	✓	✓	✓
RSS Feeds	✓	✓	✓	✓	✓	✓	✓
Zoom	✓	✓	✓	✓	✓	✓	✓
Find-On Page Function	✓	✓	✓	✓	✓	✓	✓
Password Manager	✓	✓	✓	✓	✓	✓	✓
Autofill	✓	✓	✓	✓	✓		✓
Automatic Updates	✓	✓	✓	✓	✓		✓

Step 5: See the features of all browsers you have found, and compare with what you want.


The Off By One Web Brow
offbyone.com/offbyone/
Off By One
Yes, Another Free Web Browser
Off By One
Home
Overview
FAQ
Help
Download
Search
Most Recent:
V3.5.d
2-Jan-06
Get email notification when a new version is released
Download Free PC Software
mobogenie.co...
Download Free PC Manager Software. Easy File Transfer. Download Now !
wikiHow

The Browser Has Landed

The Off By One Web Browser may be the world's smallest and fastest web browser with full HTML 3.2 support. It is a completely self-contained, stand-alone 1.2 MB application with no dependencies on any other browser or browser component. For Windows 95, Windows 98, Windows ME, Windows NT, Windows 2000 and Windows XP.

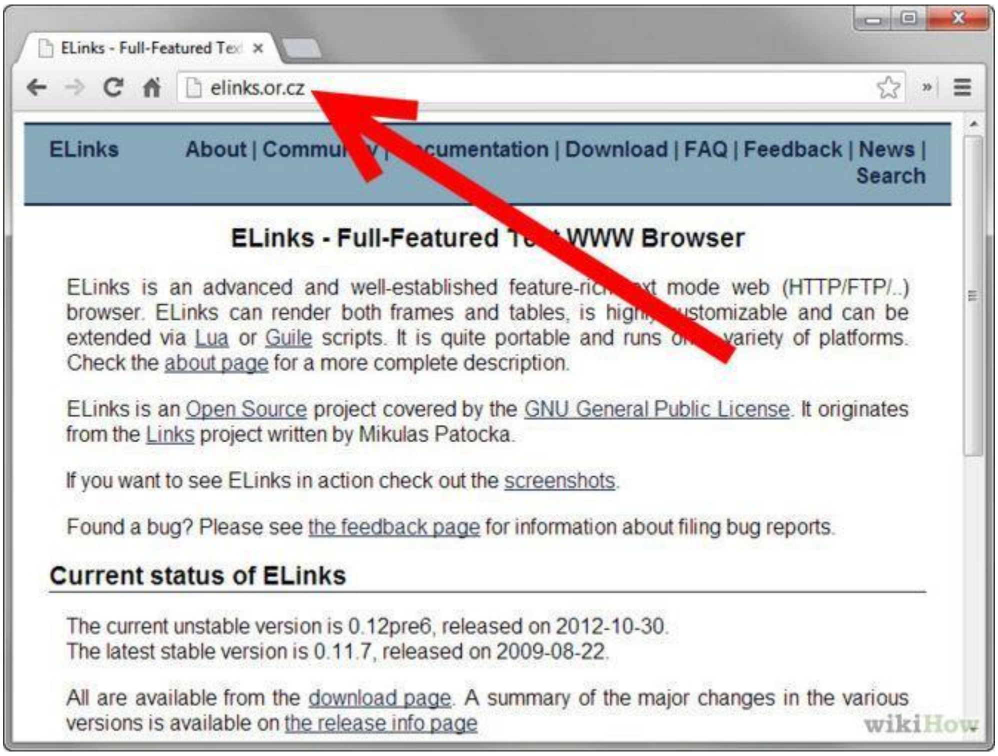
New! Now, with a tabbed browsing interface.

Click here to download the Off By One Browser Setup kit or ZIP file package, posted January 2, 2006.

Also available as a component for Windows developers

The Off By One Web Browser was created to demonstrate the

Step 6: Consider alternative lower-memory browsers, if you have low computer memory. Consider Off by One, Dillo, SkipStone and NetSurf.



ELinks About | Commu y | cumentation | Download | FAQ | Feedback | News | Search

ELinks - Full-Featured Te t WWW Browser

ELinks is an advanced and well-established feature-ric xt mode web (HTTP/FTP/..) browser. ELinks can render both frames and tables, is highl ustomizable and can be extended via Lua or Guile scripts. It is quite portable and runs o variety of platforms. Check the about page for a more complete description.

ELinks is an Open Source project covered by the GNU General Public License. It originates from the Links project written by Mikulas Patocka.

If you want to see ELinks in action check out the screenshots.

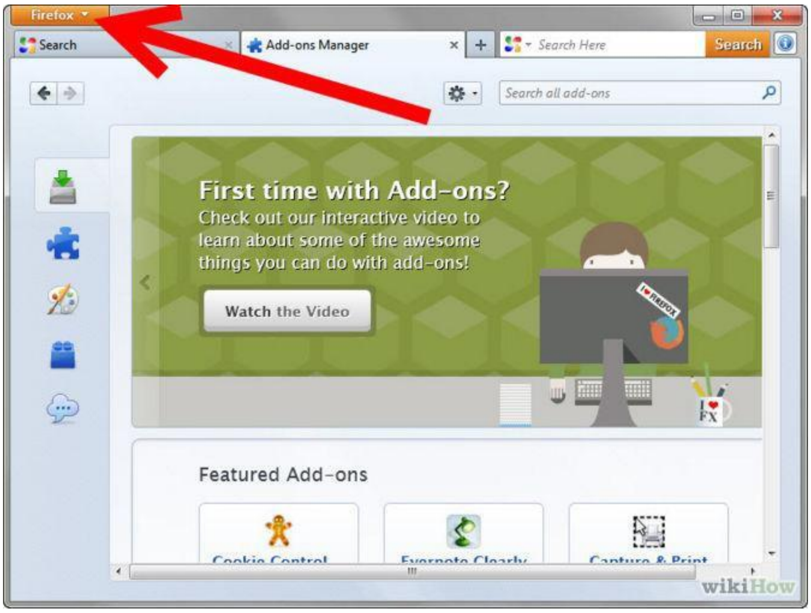
Found a bug? Please see the feedback page for information about filing bug reports.

Current status of ELinks

The current unstable version is 0.12pre6, released on 2012-10-30.
The latest stable version is 0.11.7, released on 2009-08-22.

All are available from the download page. A summary of the major changes in the various versions is available on the release info page

Step 7: Consider a text-based browser, if you want an even faster-than-fast(maximum speed/hyperdrive) experience. Consider ELinks.

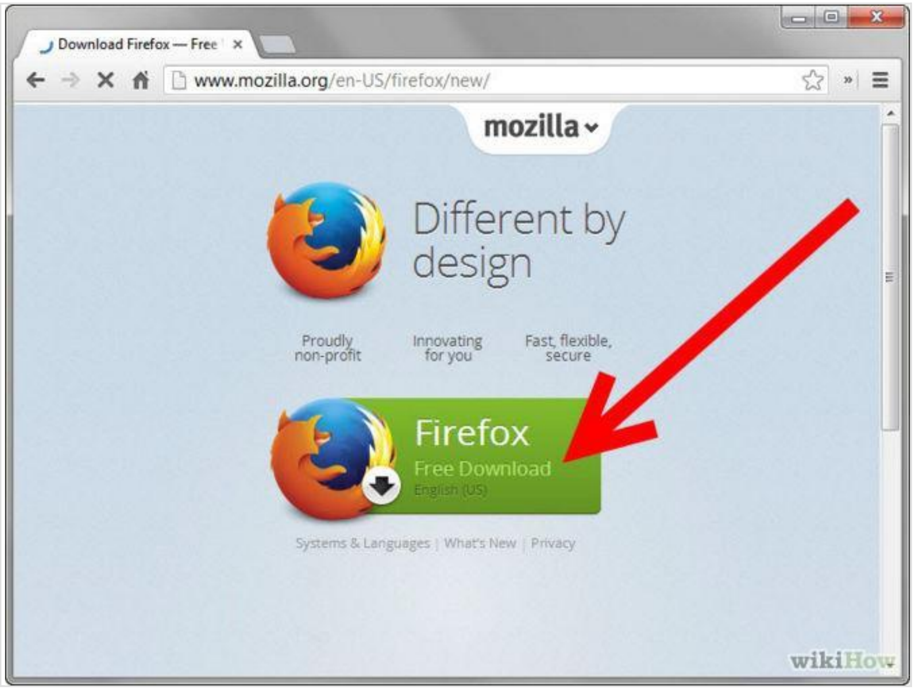


First time with Add-ons?
Check out our interactive video to learn about some of the awesome things you can do with add-ons!

Featured Add-ons

Cookie Control
Evernote Clearly
Capture & Print

Step 8: Find out if you can add features you may want or if there is an easy method to doing so such as an existing plugin or extension in the case of Firefox.



Step 9: Download and install your new browser!

Activity

1. Compare the various browsers based on their characteristics‟.

Unit 9: Guidelines for Safe Internet Browsing

9

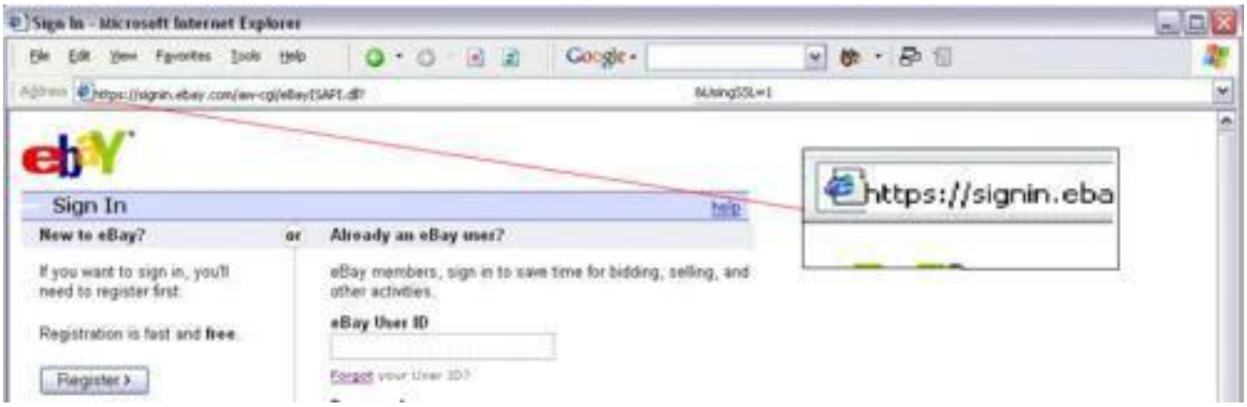
Unit Structure

9.1 SAFE BROWSING

Internet security is a matter of great concern for internet users. It is important to **know if a website is secure** or not while surfing the internet[19]. A **secure website** creates a safe connection between the website and the web browser so that entered data, such as personal information, credit card details, banking information, etc., is not accessible to unauthorized entities. When the browser opens a secured connection, "https" can be seen in the URL instead of just http. To **know if a website is secure** or not, look for the locked yellow color padlock symbol on the lower right corner of the browser window.

9.1.1 How do I know if a website is secure?

Some web sites use a secure connection between the web site and your browser. This may be important to you, for instance, if you want to pay online for a product or a service and have to enter credit card information or other personal information. To know if your browser is viewing a secure web site, you can look in the lower right part of the window. There is a small box in the frame of the window to the left of the area that describes which zone you are in (usually the Internet zone, with a globe icon). If you see a yellow padlock icon, the web site you are viewing is a "secure web site." If the box is empty, the web site does not have a secure connection with your browser.



Sign In - Microsoft Internet Explorer

Address https://signin.ebay.com/ws-cgi/eBayISAPI.dll? &UsingSSL=1

Sign In

New to eBay?

If you want to sign in, you'll need to register first.

Registration is fast and **free**.

Already an eBay user?

eBay members, sign in to save time for bidding, selling, and other activities.

eBay User ID

Forgot your User ID?

https://signin.eba

[19] http://ccm.net/faq/2-how-do-i-know-if-a-website-is-secure

9.2 TIPS FOR BUYING ONLINE[20]

Shopping online can be cheaper and more convenient for you and for businesses. However, make sure you understand your rights and the risks before you shop online or bid in an online auction.

I. **Pay securely:** Don’t make any payment unless:

   - You are on a secure website, and
   - You can make a secure payment.

   This will protect you against fraud and unauthorized credit card transactions. A secure website address will always:

   - begin with „https://‟, not „http://‟
   - display the image of a closed padlock (usually in the bottom right corner of your browser window).

   Only make a payment if you can see both of these things. Never give out your bank account details, credit card number or other personal details if you are not certain that the business is a reputable trader.

II. **Know the business:** Only buy from websites you know and trust. Check that the company has a physical street address and landline phone number. If the company operates from overseas, you might have trouble getting a refund or repair.

III. **Know the product:** Make sure you check whether:

   - the product is legal
   - the product will work in Australia
   - any warranties or guarantees offered are valid in Australia
   - the product has an authorized repairer nearby.

IV. **Check the contract:** Make sure you read and understand:

   - the terms and conditions of sale
   - the refund policy
   - the delivery details
   - Returns and repairs policies, including any associated costs.

V. **Check the full cost:** Be aware of the full cost of your purchase. Additional costs may include:

   - currency conversion
   - taxes

[20] https://www.qld.gov.au/law/your-rights/consumer-rights-complaints-and-scams/consumer-advice-rights-and-responsibilties/tips-to-become-a-smarter-shopper/tips-for-buying-online/

- postage and delivery fees
- Packaging.

It might end up being cheaper to buy the product at a local shop.

VI. **Protect your privacy:** Only buy online if you are comfortable with a business's privacy policy. Do not give out information unless they require it to complete the sale. Remember, if a deal sounds too good to be true, it probably is.

VII. **Keep records**: Always write down any reference numbers and print out copies of:

- the order form (both before and after you confirm the order)
- receipts (can come by email or in a pop-up window).

Always make sure all charges are correct by checking the receipt against your:

  - credit card statement
  - merchant account statement (such as PayPal)
  - bank statement.

The charges may be converted from another currency.

VIII. **Online auction sites:** Most online auction sites (like eBay) offer a dispute resolution process for buyers and sellers. This should be your first step to resolve a dispute if:

- you did not receive the items you bought
- you did not receive payment for items you sold
- you received items that were significantly different from their description.

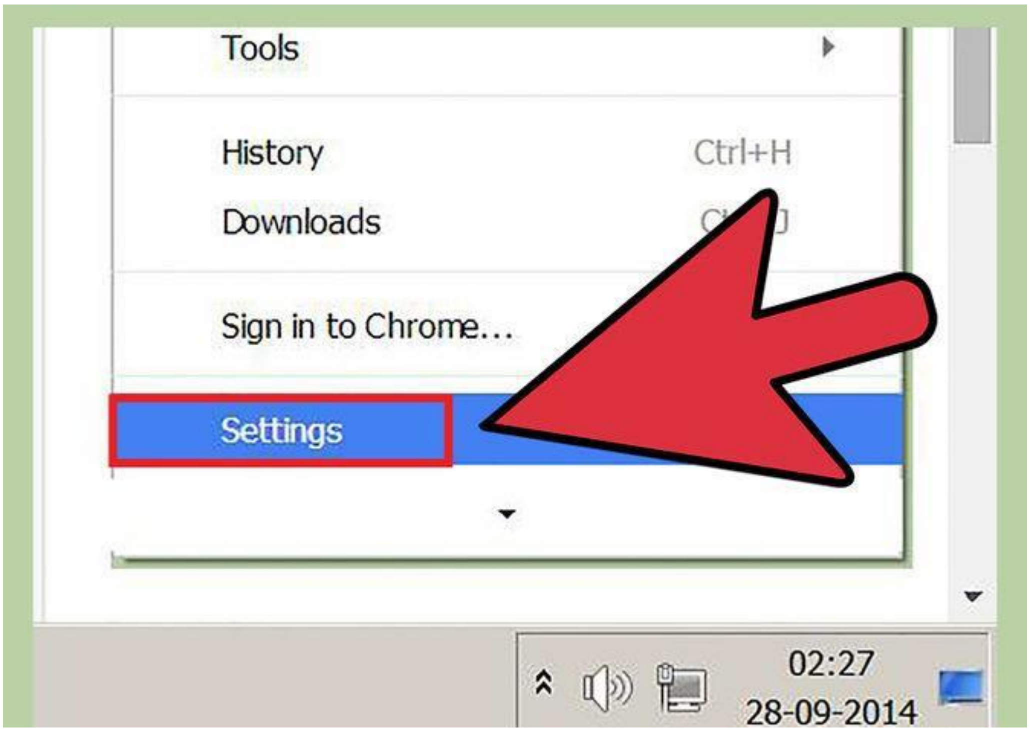
The eBay website has an example of this facility.

9.3 CLEARING CACHE FOR BROWSERS

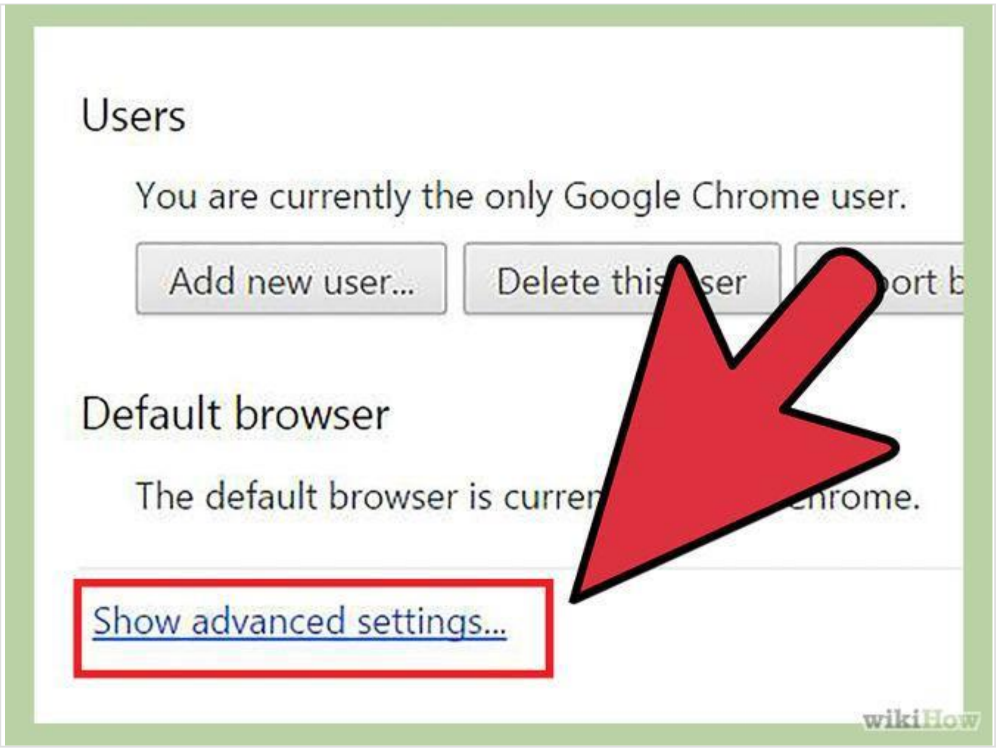
Your internet browser's cache stores certain information (snapshots) of webpages you visit on your computer or mobile device so that they'll load more quickly upon future visits and while navigating through websites that use the same images on multiple pages so that you do not download the same image multiple times[21]. Occasionally, however your cache can prevent you from seeing updated content, or cause functional problems when stored content conflicts with live content. You can fix many browser problems simply by clearing your cache. This article contains instructions with screenshots on how to clear the cache for all major browsers.

9.3.1 Clearing cache for Chrome Browsers above version 10

[21] http://www.wikihow.com/Clear-Your-Browser%27s-Cache



Step 1: Open the settings on Chrome. Click the menu icon in the upper right corner of the browser to the right. Click settings on the bottom of the menu.

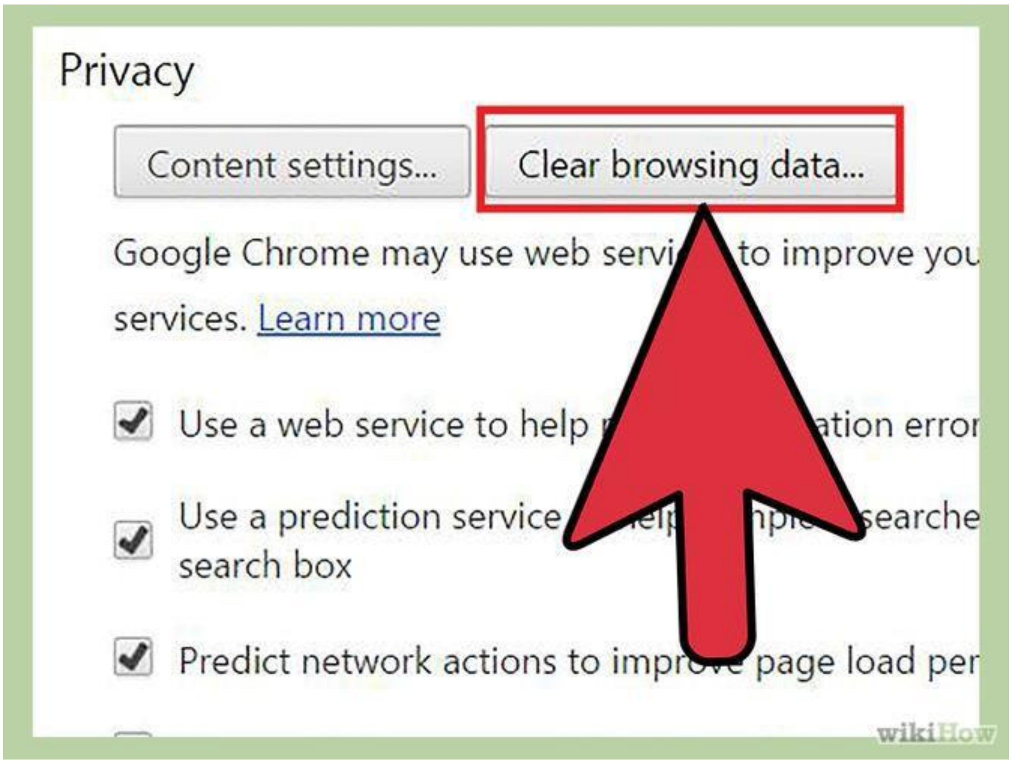

Users

You are currently the only Google Chrome user.

Default browser

The default browser is curren... hrome.

Step 2: From settings, click "Show advanced settings. It's located at the very bottom of the settings section.



Privacy

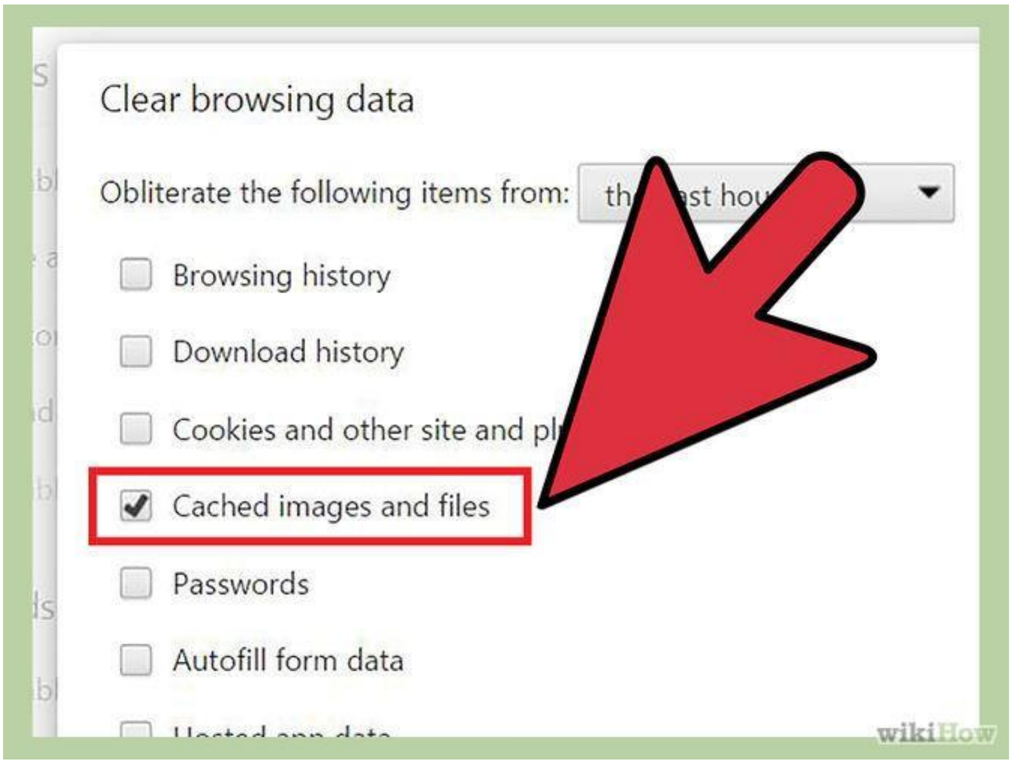
Google Chrome may use web servi to improve you services. Learn more

☑ Use a web service to help ation error

☑ Use a prediction service searche search box

☑ Predict network actions to impr page load per

Step 3: Scroll to the privacy section and click "Clear browsing data.



Clear browsing data

Obliterate the following items from: th st hou

□ Browsing history

□ Download history

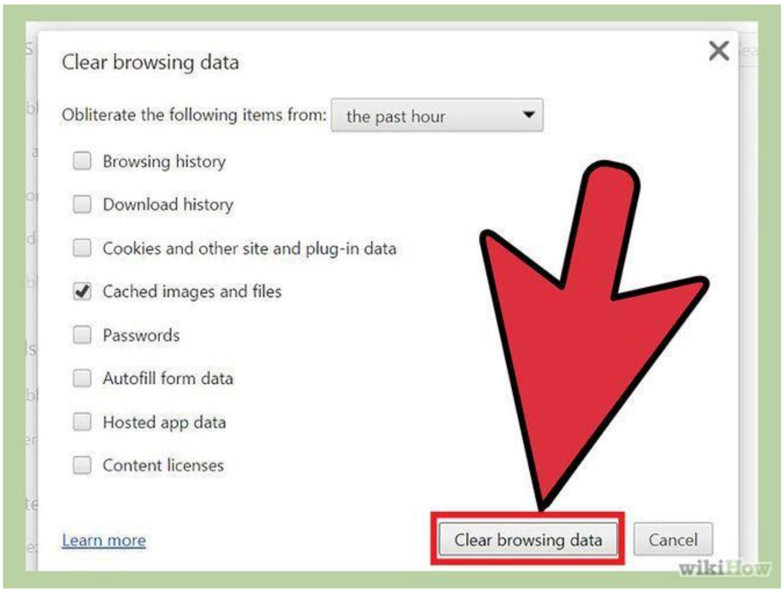
□ Cookies and other site and pl

☑ Cached images and files

□ Passwords

□ Autofill form data

Step 4: Select "Cached images and files". Uncheck all other options to avoid deleting browser history, cookies and other things you may wish to retain. Change "Obliterate the following items from" to "the beginning of time".



Clear browsing data

Obliterate the following items from: the past hour

□ Browsing history

□ Download history

□ Cookies and other site and plug-in data

☑ Cached images and files

□ Passwords

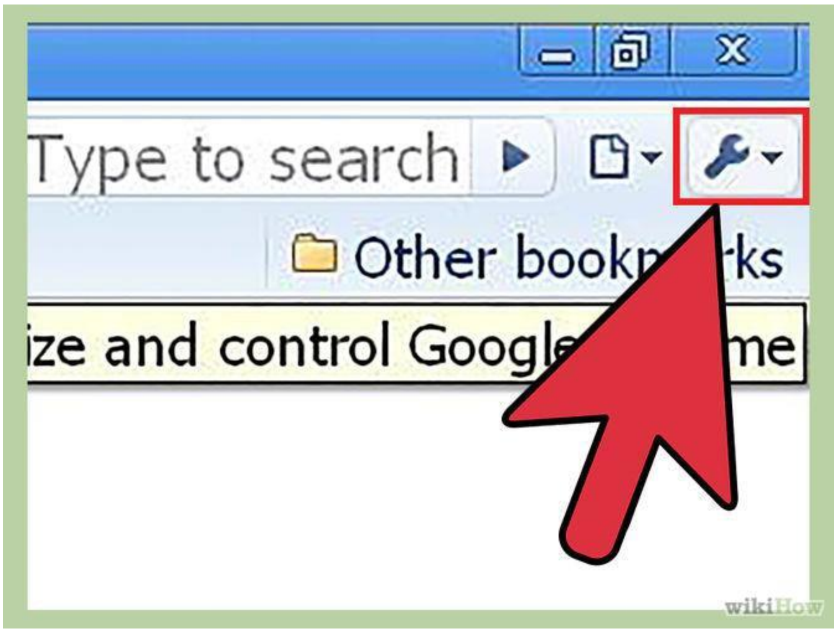
□ Autofill form data

□ Hosted app data

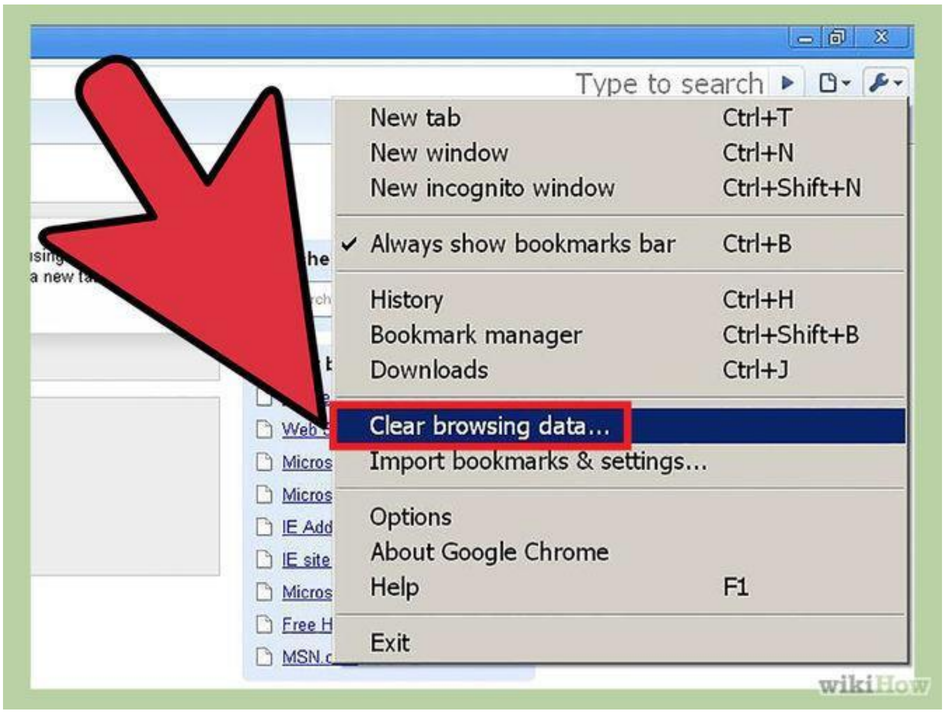
□ Content licenses

Step 5: Press "Clear browsing data". You are done!

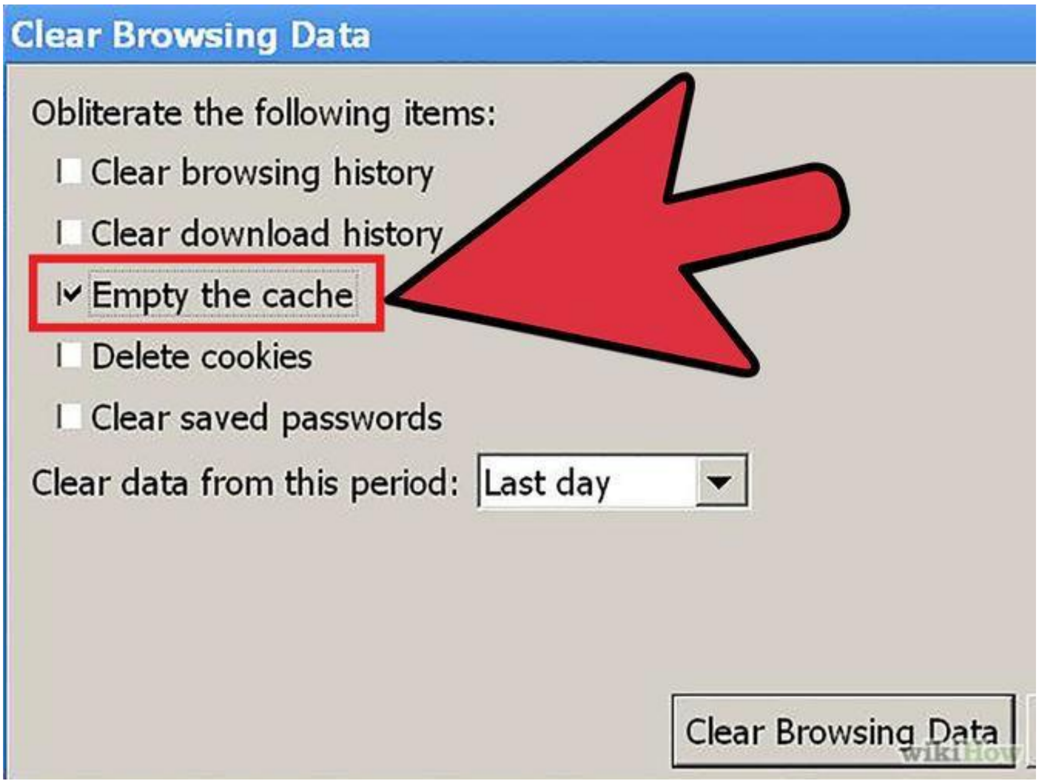
9.3.2 Clearing cache for Chrome Browsers from version 1 to 9



Step 1: Once your browser is open, select the Tools menu (the wrench in the upper-right corner) and select Options (Preferences on Mac).



Step 2: On the Under the Hood tab, click the **Clear Browsing data** button.



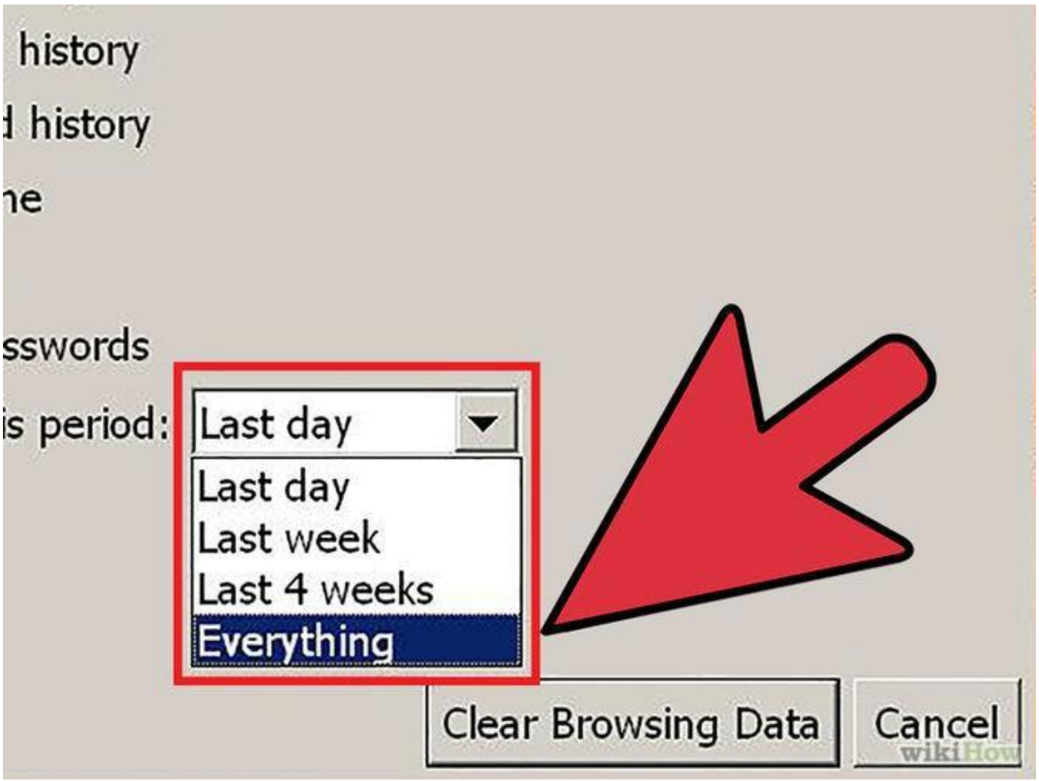
Clear Browsing Data

Obliterate the following items:

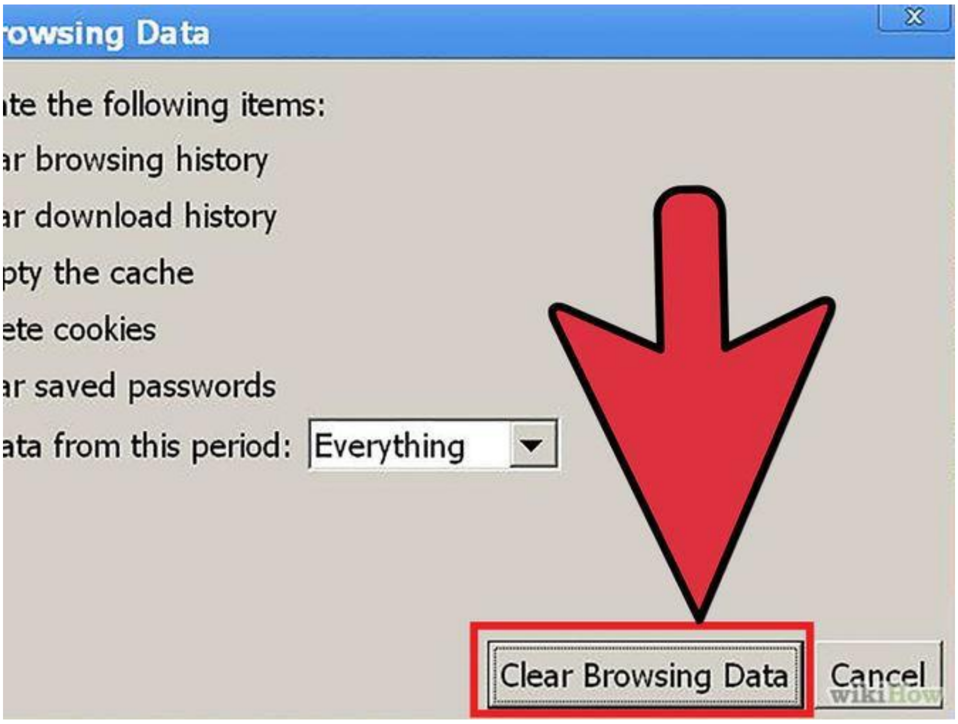
- □ Clear browsing history
- □ Clear download history
- ☑ Empty the cache
- □ Delete cookies
- □ Clear saved passwords

Clear data from this period: Last day ▼

Step 3: Select the Empty the cache check-box.

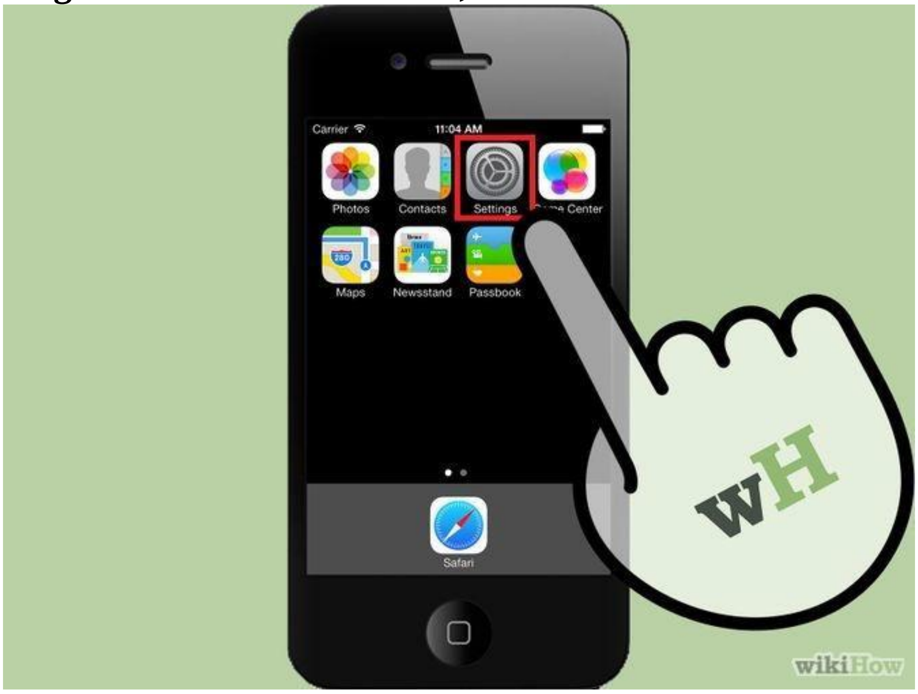


Step 4: You can also choose the period of time you wish to delete cached information using the Clear data from this period dropdown menu.

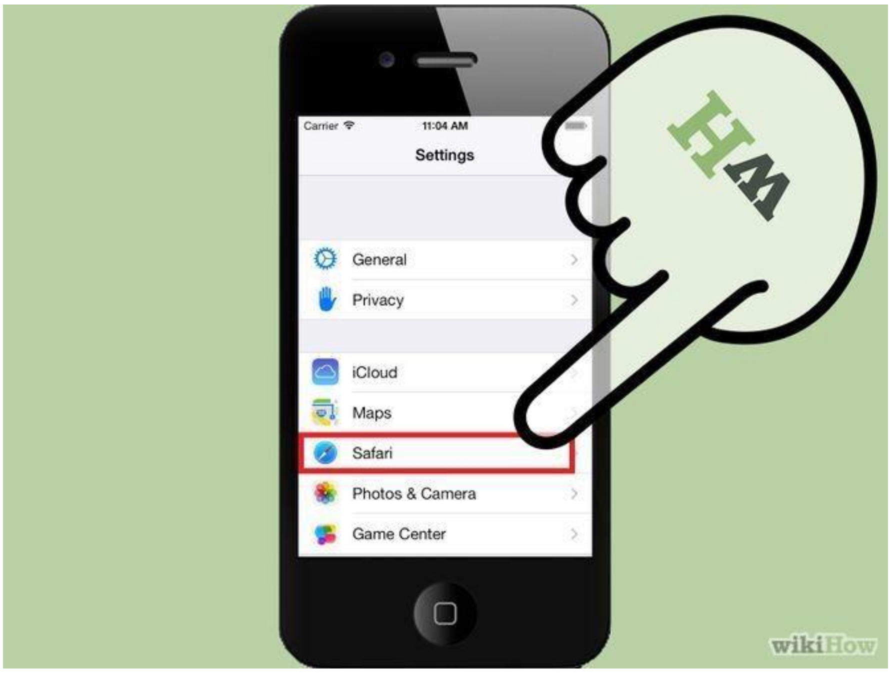


Step 5: Click the Clear Browsing Data button.

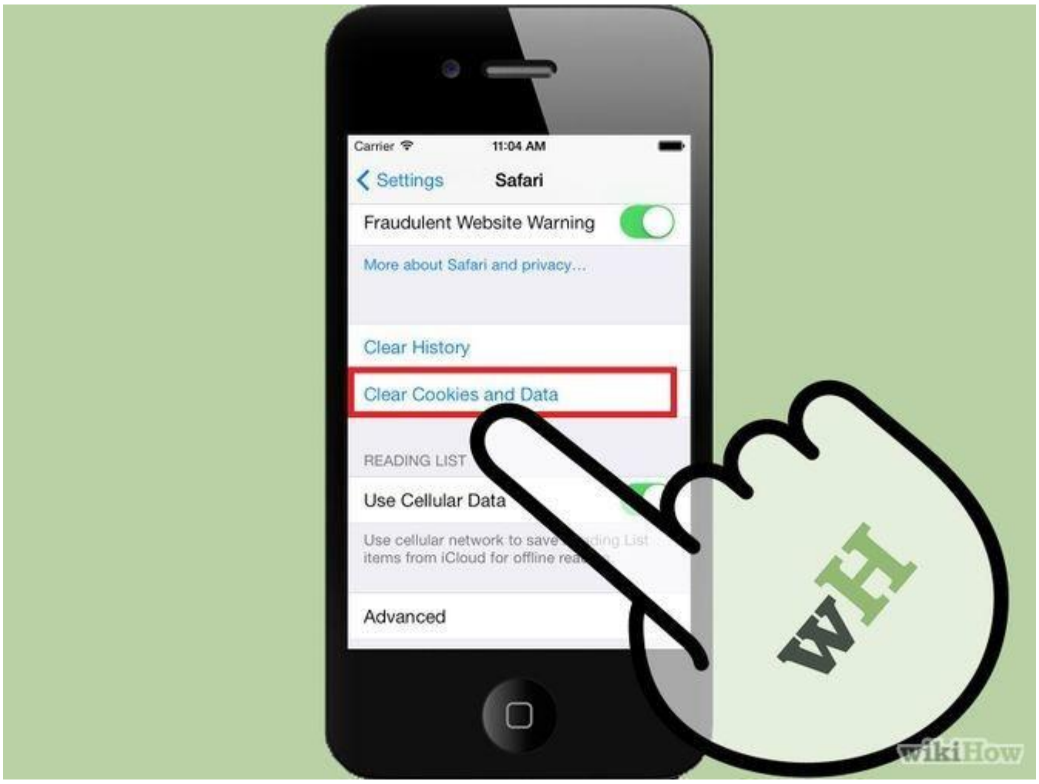
9.3.3 Clearing cache for Safari for iOS, iPhone and iPad



Step 1: Click on Settings from the home page.

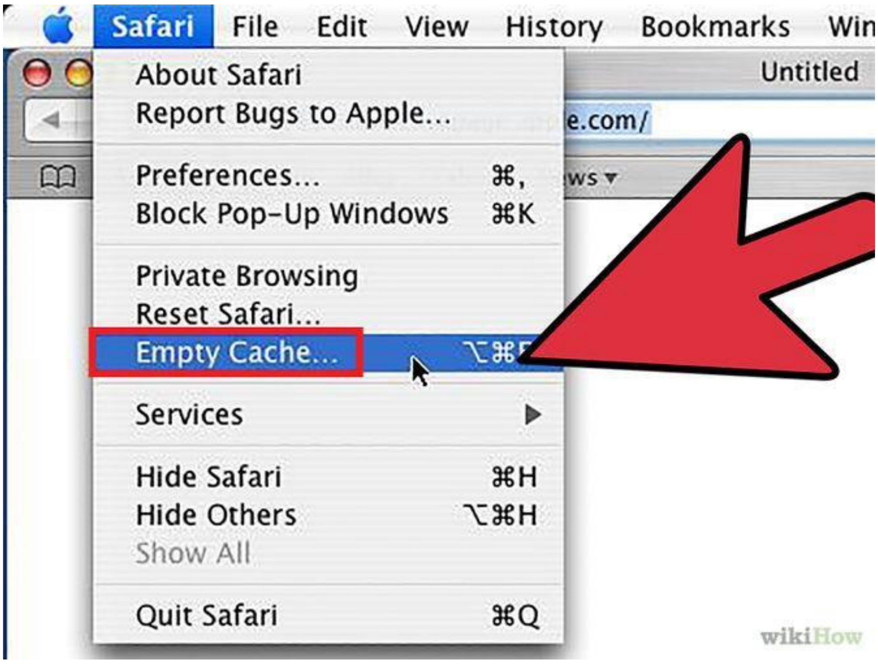


Step 2: Scroll down until you see "Safari." Click on it to bring up the option page.

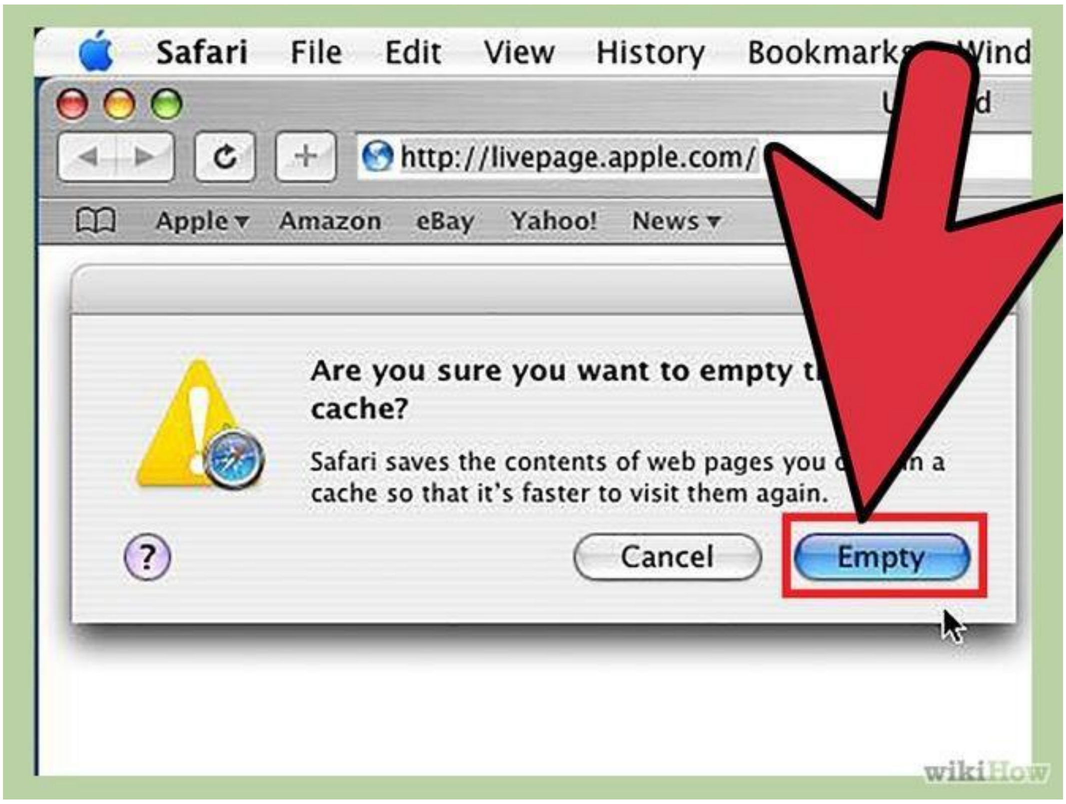

Carrier
11:04 AM
Settings
Safari
Fraudulent Website Warning
More about Safari and privacy...
Clear History
Clear Cookies and Data
READING LIST
Use Cellular Data
Use cellular network to save Reading List items from iCloud for offline rea
Advanced
wH
wikiHow

Step 3: Click **"Clear Cookies and Data**". A popup box will appear. Click "Clear Cookies and Data" again to confirm your choice.

9.3.4 Clearing cache for Safari for Mac OS x



Step 1: Once your browser is open, click the Safari menu and select Empty Cache.

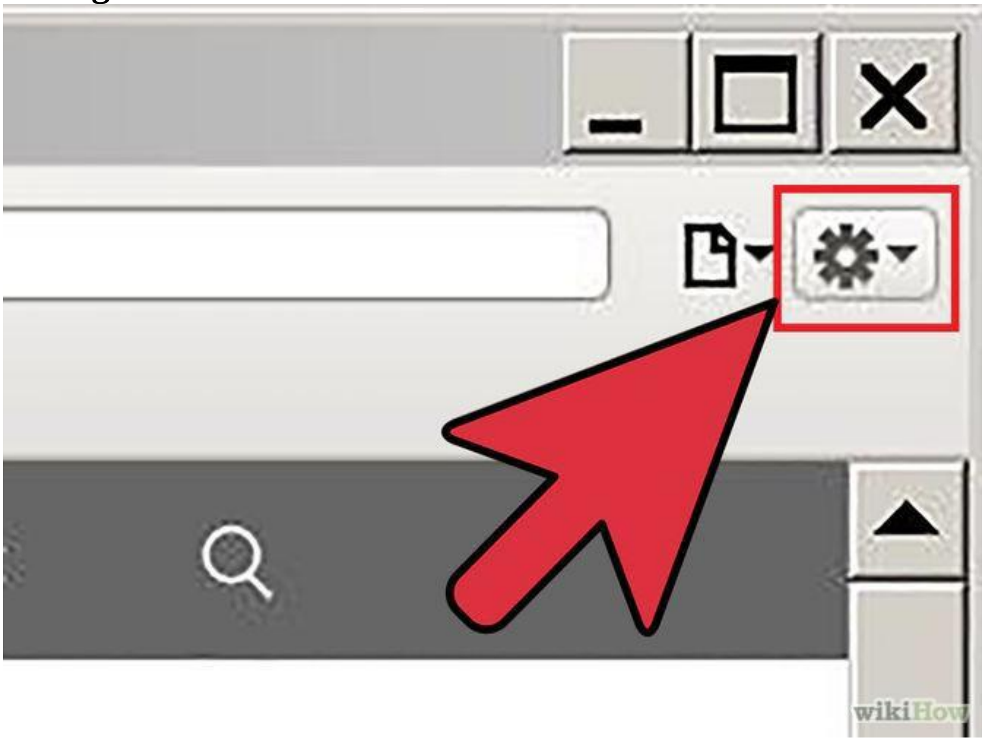


Are you sure you want to empty t
cache?

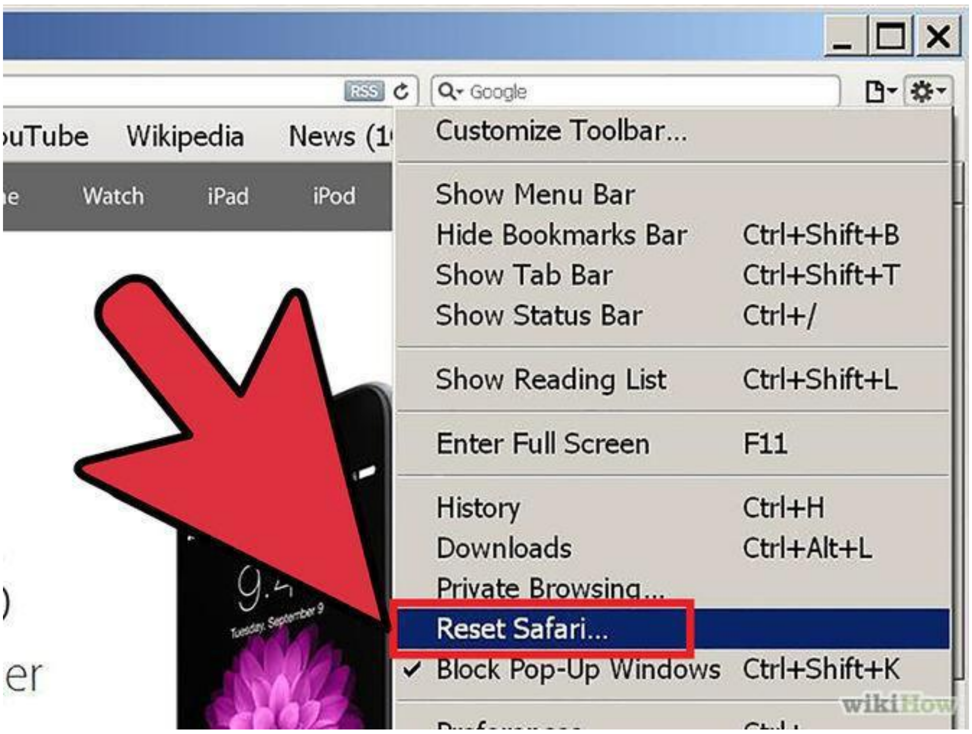
Safari saves the contents of web pages you o n a
cache so that it's faster to visit them again.

Step 2: Click Empty**.**

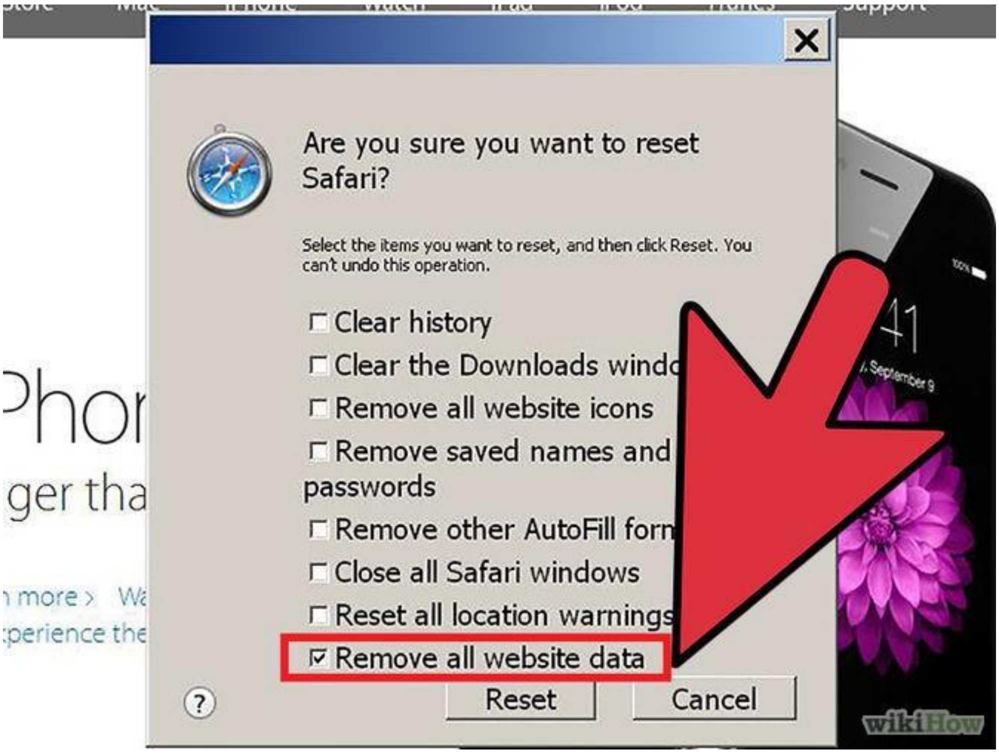
9.3.5 Clearing cache for Safari for windows



Step 1: Once your browser is open, click the gear icon on the top right.



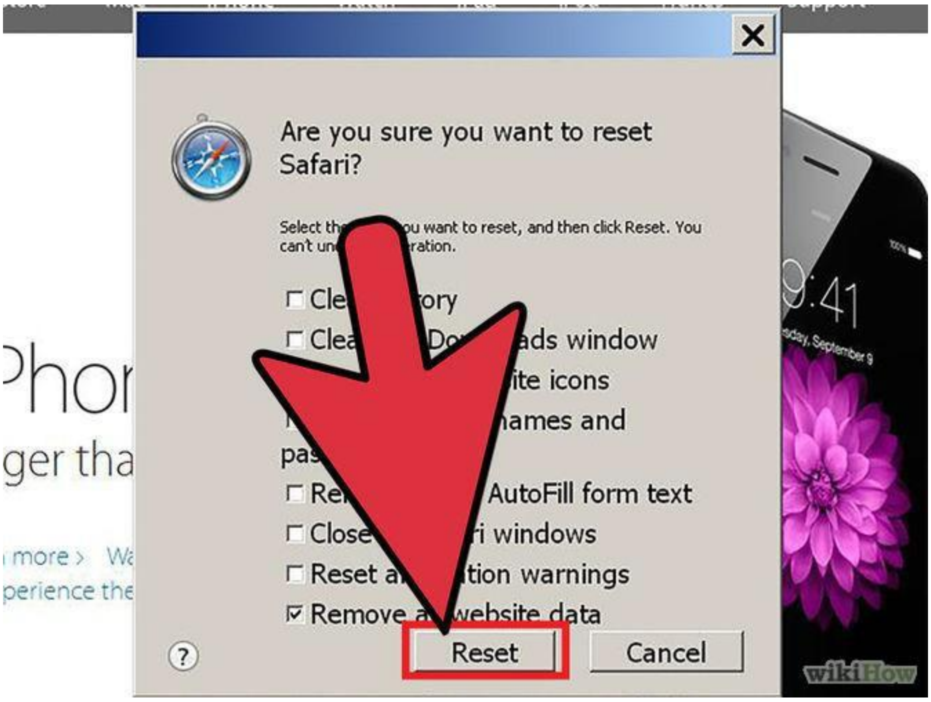
Step 2: Select "Reset Safari..." This will prompt a screen to open.


Are you sure you want to reset Safari?

Select the items you want to reset, and then click Reset. You can't undo this operation.

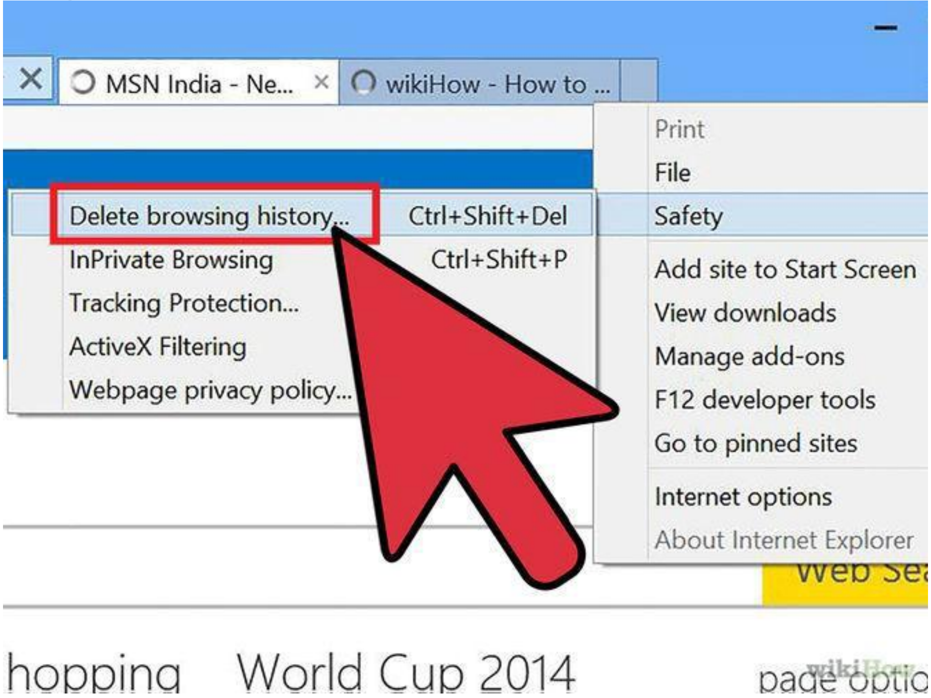
- □ Clear history
- □ Clear the Downloads windo
- □ Remove all website icons
- □ Remove saved names and passwords
- □ Remove other AutoFill forn
- □ Close all Safari windows
- □ Reset all location warnings
- ☑ Remove all website data

Step 3: Select **"Remove all website data"** at the very bottom of the prompt. Check or uncheck any other categories you want reset.

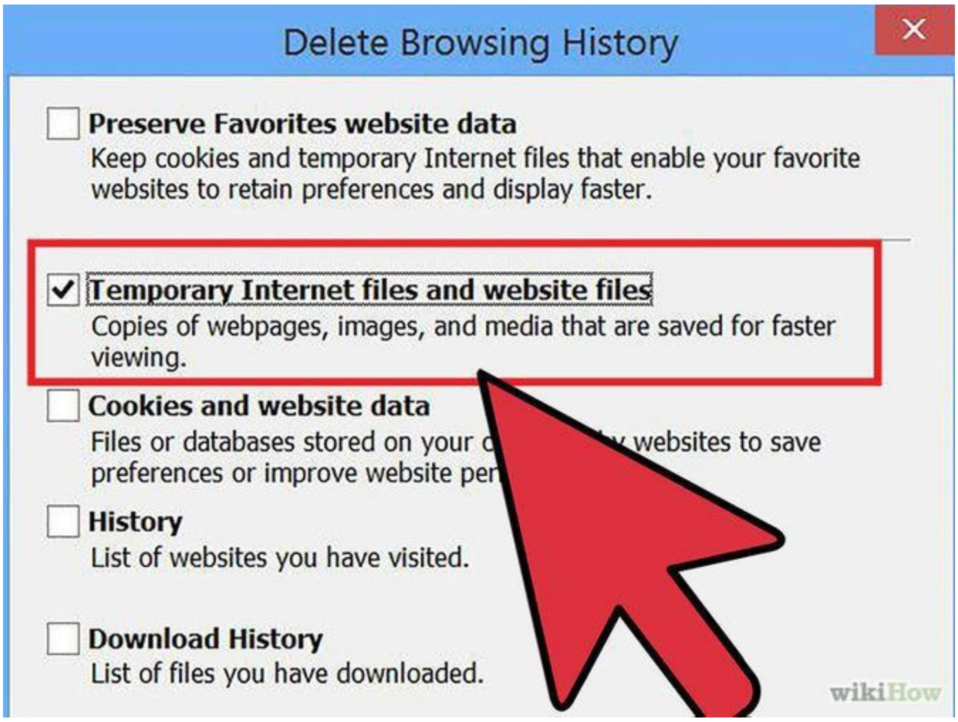

Are you sure you want to reset Safari?
Select th... ou want to reset, and then click Reset. You can't un... ration.
□ Cle... ory
□ Clea... Do... ads window
... ite icons
... ames and pa...
□ Re... AutoFill form text
□ Close... ri windows
□ Reset a... tion warnings
☑ Remove a... website data
Reset
Cancel
wikiHow

Step 4: Click “Reset”.

9.3.6 Clearing cache for Internet explorer 9, 10 and 11



Step 1: Once your browser is open, click the gear icon at the top right to open the **Settings** menu**.** Then, select **Safety** and **Delete Browsing History.**



□ **Preserve Favorites website data**
Keep cookies and temporary Internet files that enable your favorite websites to retain preferences and display faster.

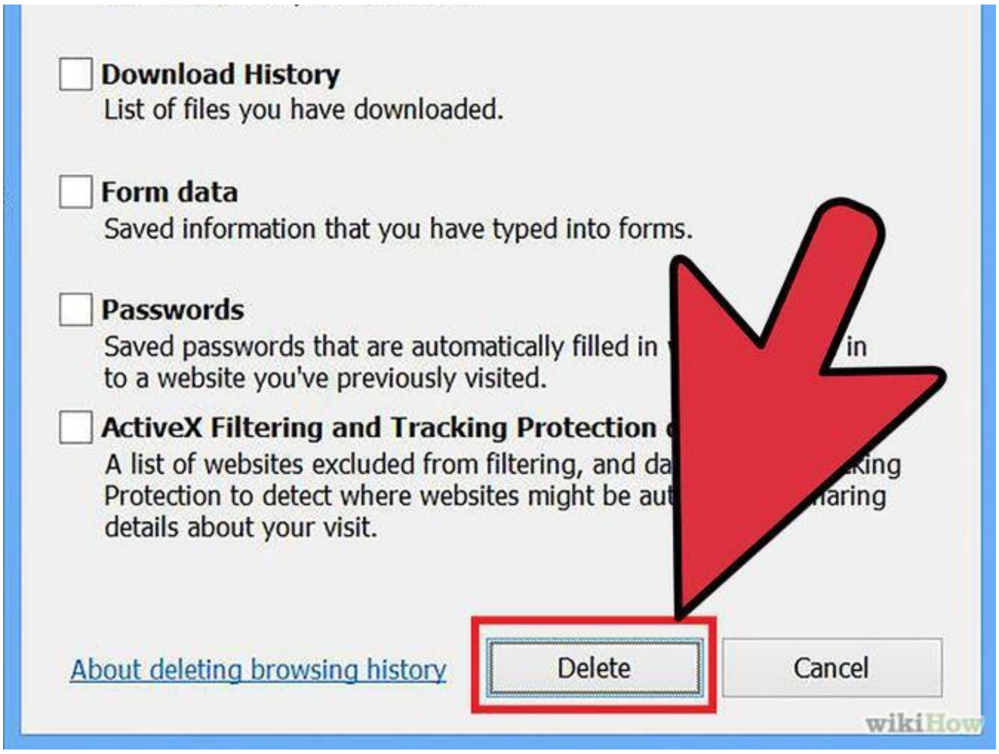
☑ **Temporary Internet files and website files**
Copies of webpages, images, and media that are saved for faster viewing.

□ **Cookies and website data**
Files or databases stored on your c y websites to save preferences or improve website per

□ **History**
List of websites you have visited.

□ **Download History**
List of files you have downloaded.

Step 2: Select Temporary Internet Files. You will also need to uncheck all of the other boxes, especially Preserve Favorites website data. This option makes the window also delete objects from websites in your Favorites folder, which is necessary to completely clear your cache.



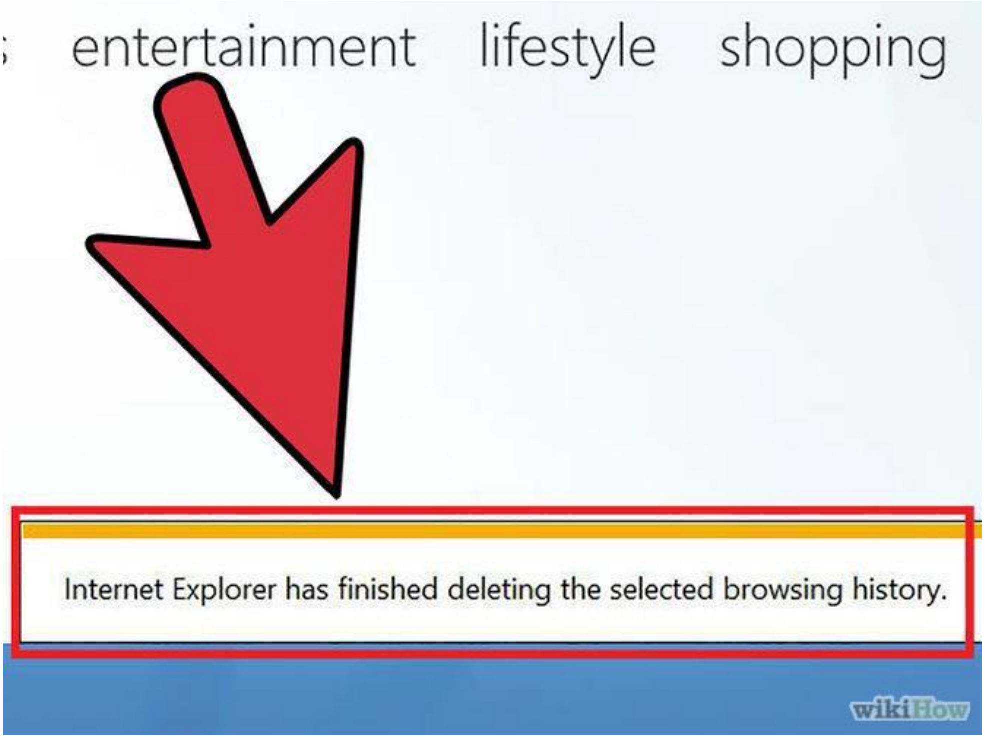
□ **Download History**
List of files you have downloaded.

□ **Form data**
Saved information that you have typed into forms.

□ **Passwords**
Saved passwords that are automatically filled in v in to a website you've previously visited.

□ **ActiveX Filtering and Tracking Protection d**
A list of websites excluded from filtering, and da king Protection to detect where websites might be aut aring details about your visit.

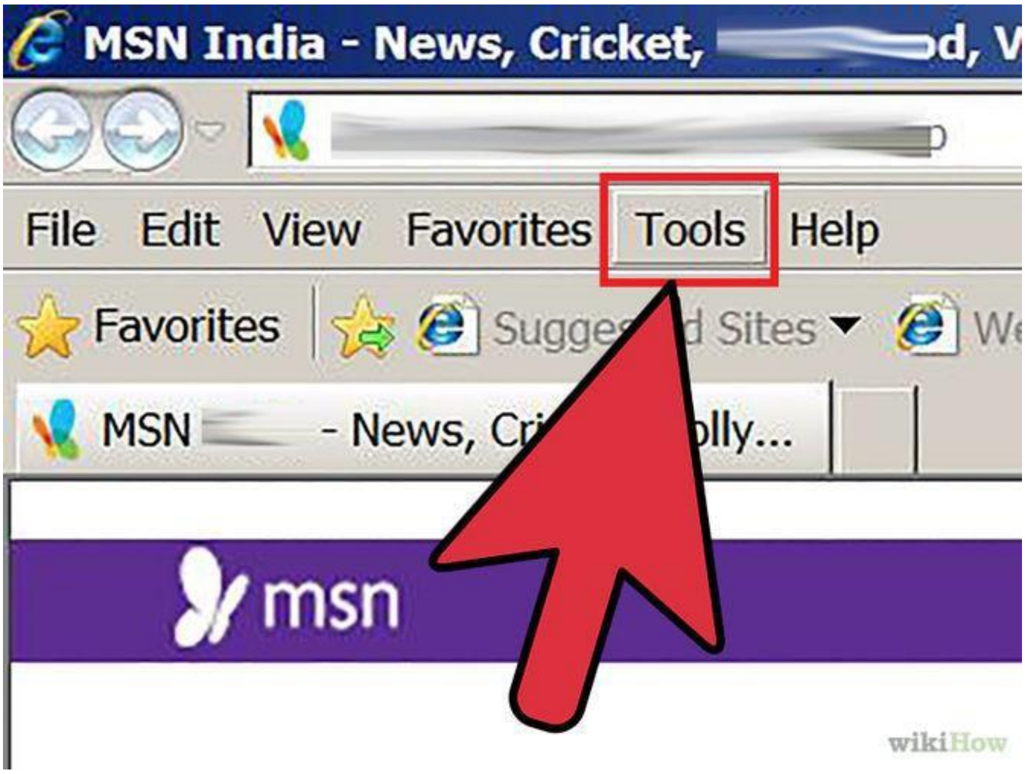
Step 3: Click the Delete button near the bottom of the window to perform the operations (i.e. clear your cache by deleting temporary files).



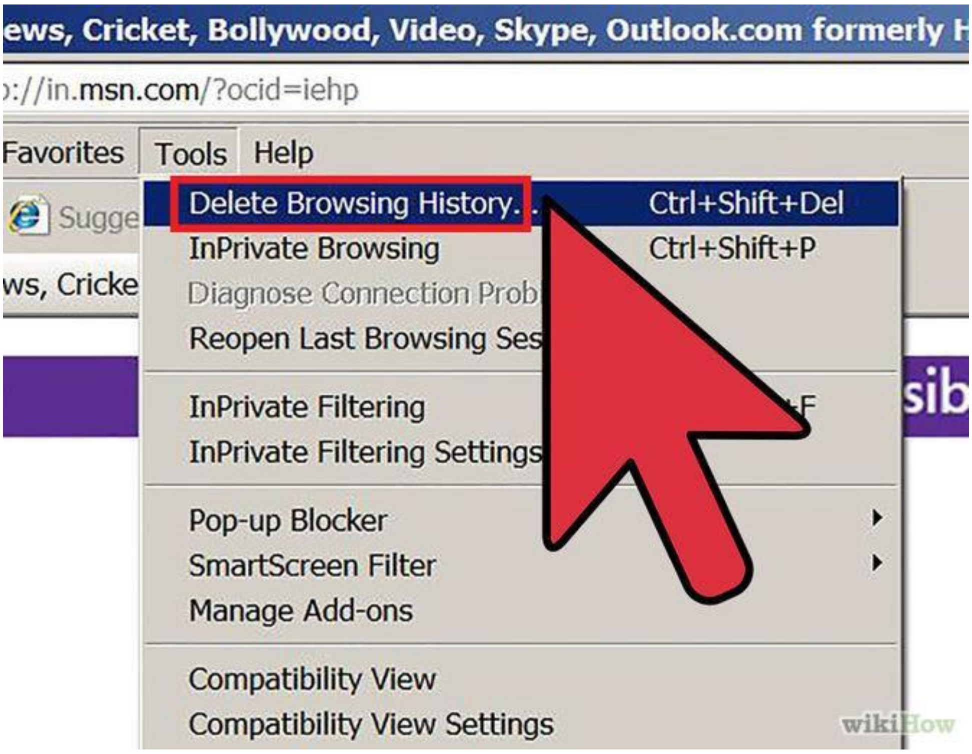
Internet Explorer has finished deleting the selected browsing history.

Step 4: Your computer will work for a moment, and then the process will be complete. You've successfully cleared Internet Explorer 9's Cache!

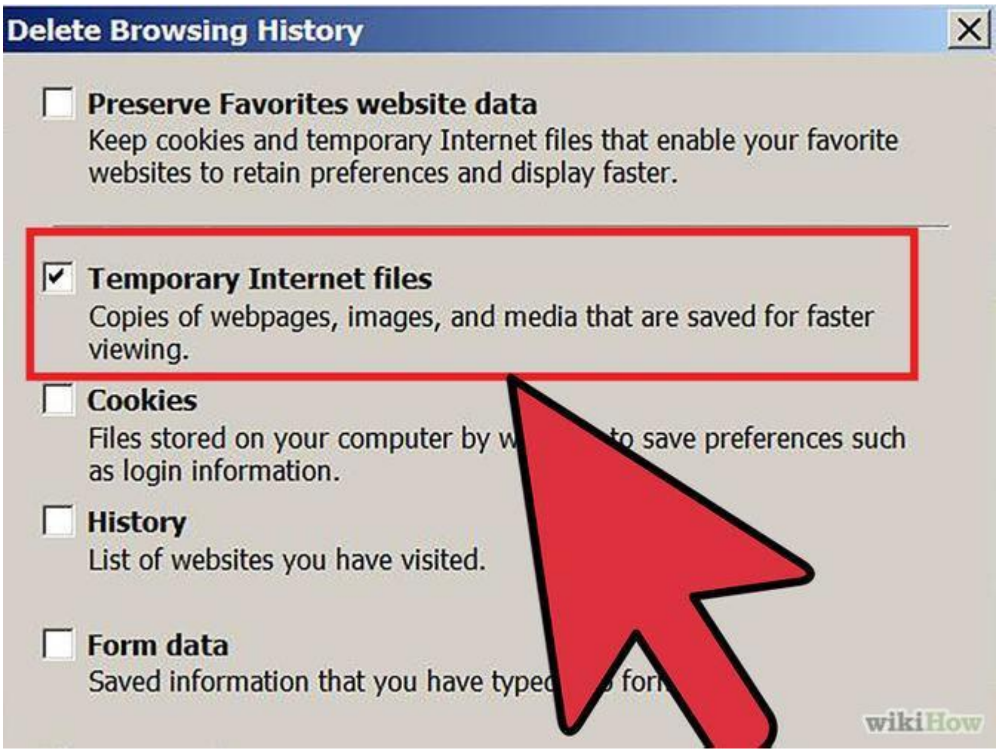
9.3.7 Clearing cache for Internet explorer 8



Step 1: Once your browser is open, click the **Tools** menu.



Step 2: Click on **Delete Browsing History.**



□ **Preserve Favorites website data**
Keep cookies and temporary Internet files that enable your favorite websites to retain preferences and display faster.

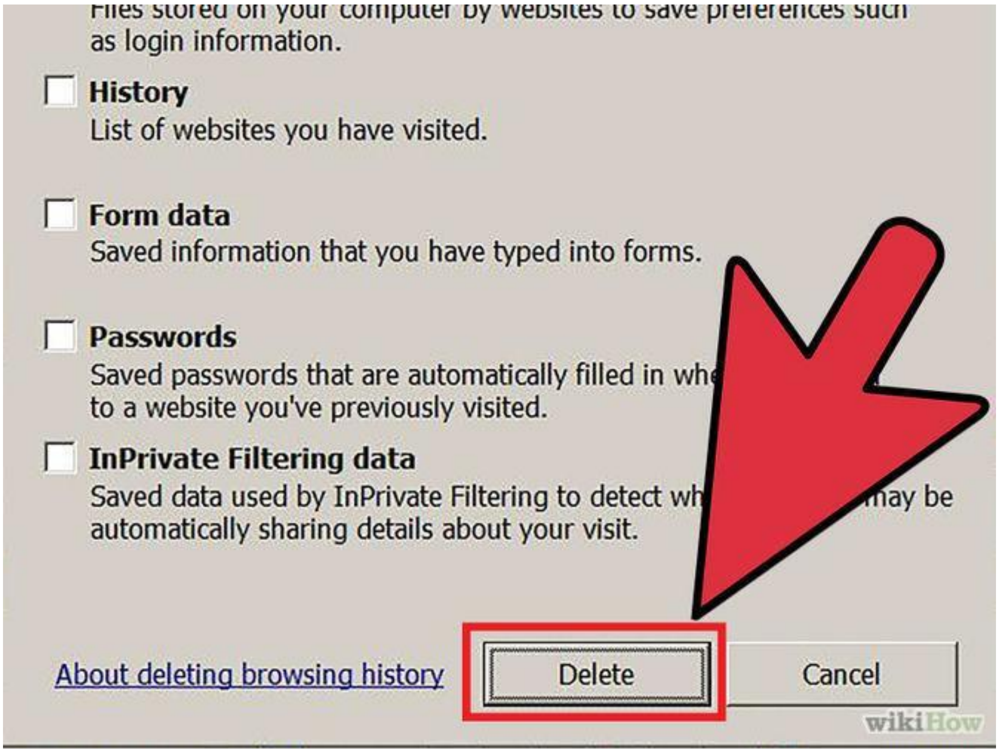
☑ **Temporary Internet files**
Copies of webpages, images, and media that are saved for faster viewing.

□ **Cookies**
Files stored on your computer by w to save preferences such as login information.

□ **History**
List of websites you have visited.

□ **Form data**
Saved information that you have typed for

Step 3: Select **Temporary Internet Files.**



Files stored on your computer by websites to save preferences such as login information.

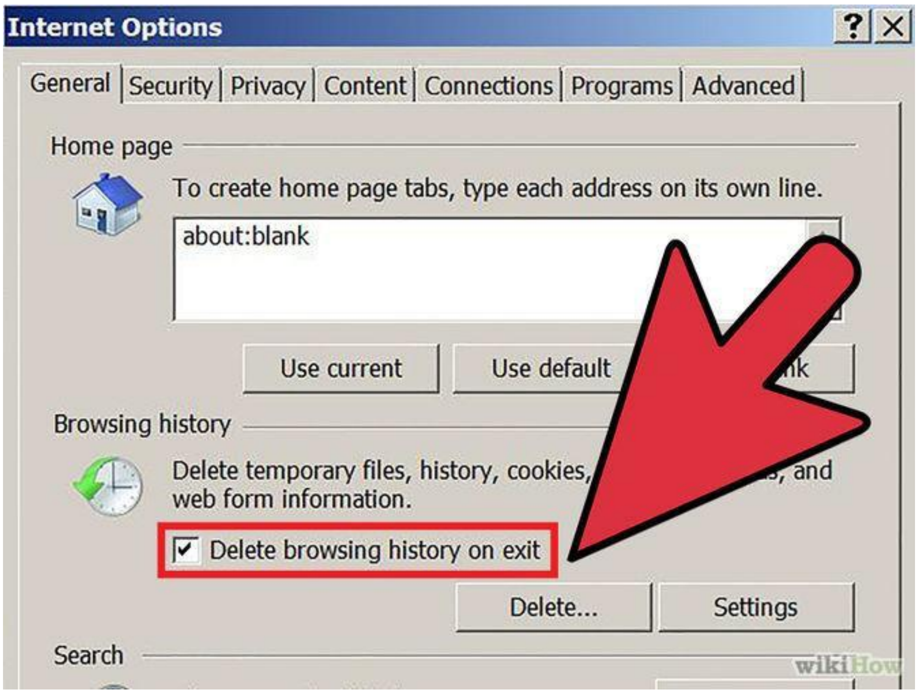
□ **History**
List of websites you have visited.

□ **Form data**
Saved information that you have typed into forms.

□ **Passwords**
Saved passwords that are automatically filled in whe
to a website you've previously visited.

□ **InPrivate Filtering data**
Saved data used by InPrivate Filtering to detect wh may be automatically sharing details about your visit.

Step 4: Click the **Delete** button near the bottom of the window to delete your temporary files (i.e. clear your cache).



To create home page tabs, type each address on its own line.

about:blank

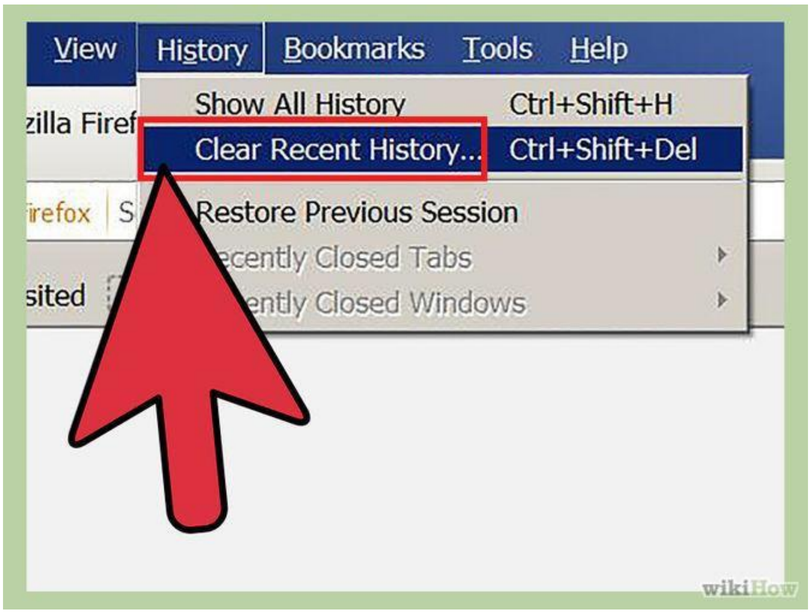
Delete temporary files, history, cookies, s, and web form information.

☑ Delete browsing history on exit

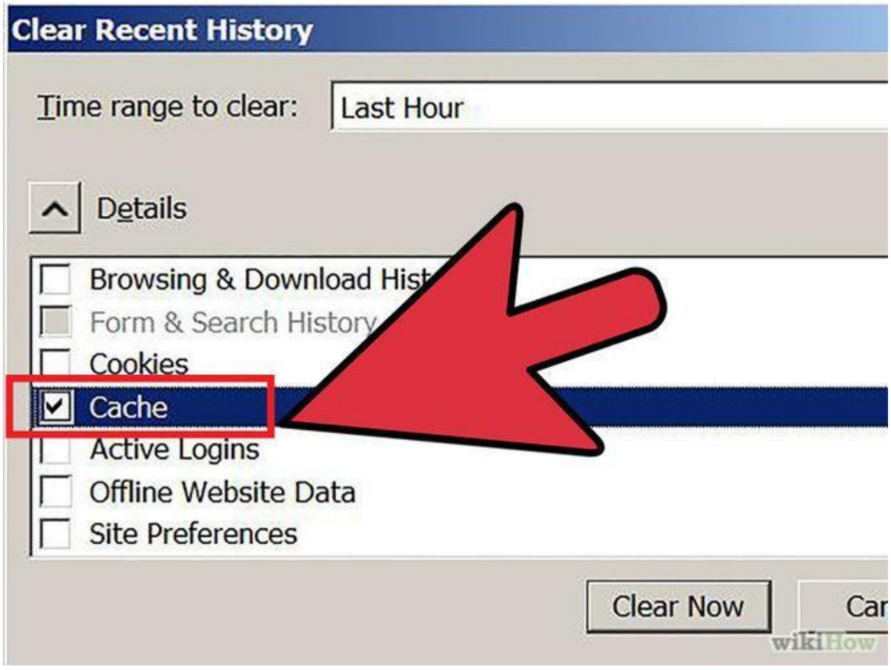
Step 5: Set your cache to delete every time you close Internet Explorer. If you want the browser to automatically clear the cache whenever you close it, close the 'Delete Browsing History' window, select **'Internet Options'** from the Tools menu, and check the **'Delete Browsing history on exit'** checkbox.

Note: IE8 has a "feature" which retains some cookies even after you clear your cache if you do not UNCHECK the "Preserve Favorites Website Data." If you truly need to clear your cache, you will want to uncheck this!

9.3.8 Clearing cache for Firefox



Step 1: On a PC, click the "Firefox" menu in the top left corner. Next, select the right arrow next to **"History >"**, and click **"Clear Recent History".**



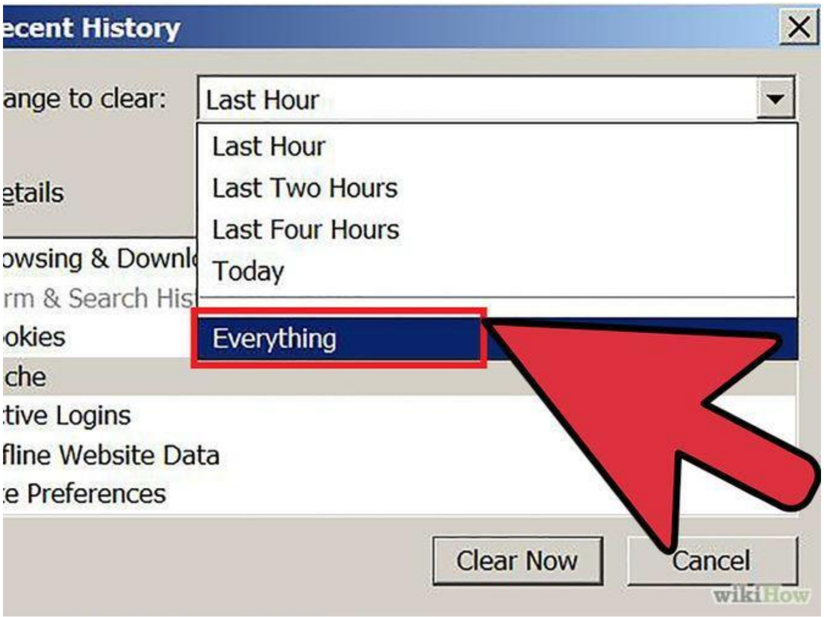
Clear Recent History

Time range to clear: Last Hour

Details

□ Browsing & Download Hist
□ Form & Search History
□ Cookies
☑ Cache
□ Active Logins
□ Offline Website Data
□ Site Preferences

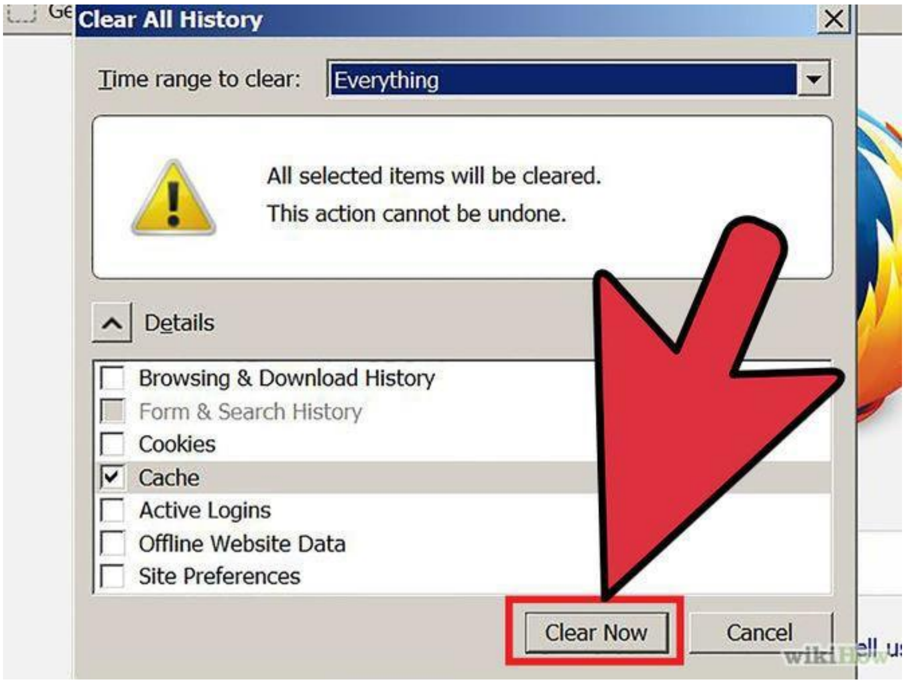
Step 2: Make **sure "Details"** is expanded, and then select **"Cache"** from the list. Uncheck everything else.



ecent History

ange to clear: Last Hour

Step 3: In the **"Time Range to Clear"** drop down, select **"Everything"**.



Clear All History

Time range to clear: Everything

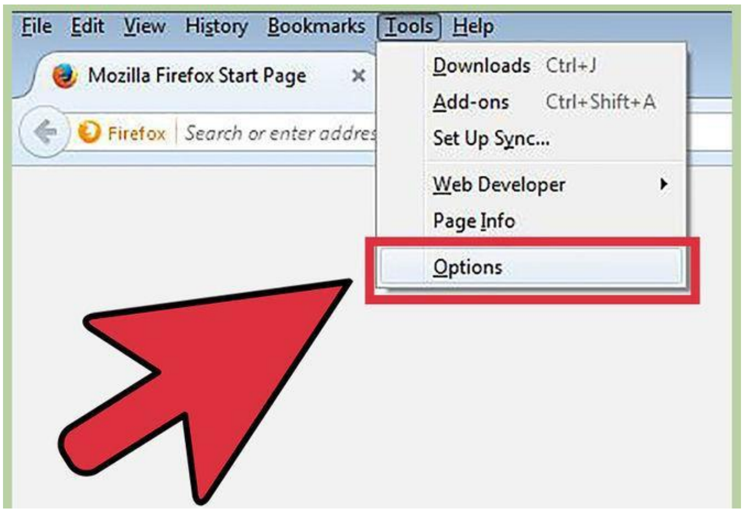
All selected items will be cleared.
This action cannot be undone.

Details

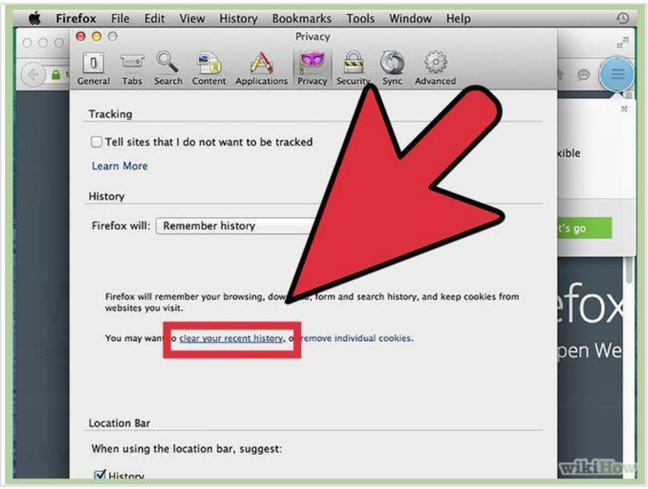
- □ Browsing & Download History
- □ Form & Search History
- □ Cookies
- ☑ Cache
- □ Active Logins
- □ Offline Website Data
- □ Site Preferences

Step 4: Select **"Clear Now"**. Your computer will work for a moment, and the process will be complete. You've successfully cleared Firefox's Cache!

9.3.9 Clearing cache for Firefox 33



Step 1: Click the Menu button ("hamburger button" - the one with three horizontal lines) and then choose Options.


Firefox File Edit View History Bookmarks Tools Window Help
Privacy
General Tabs Search Content Applications Privacy Security Sync Advanced
Learn More
wikiHow

Tracking

□ Tell sites that I do not want to be tracked

History

Firefox will: Remember history

Firefox will remember your browsing, dow... form and search history, and keep cookies from websites you visit.

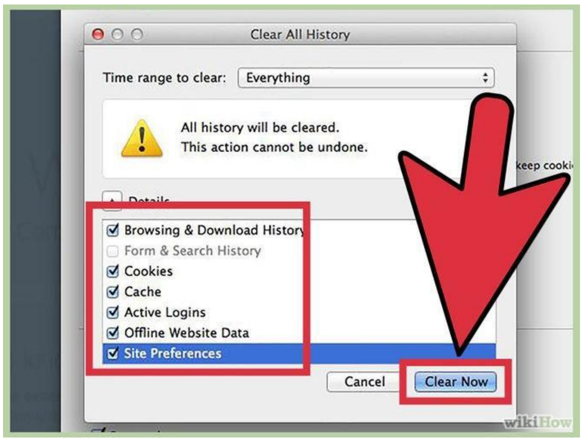
You may want to clear your recent history, or remove individual cookies.

Location Bar

When using the location bar, suggest:

☑ History

Step 2: Firefox for Mac: On a Mac, choose Preferences from the Firefox menu and then continue as instructed below. With the Options window now open, click the Privacy tab. In the History area, click the clear your recent history link.



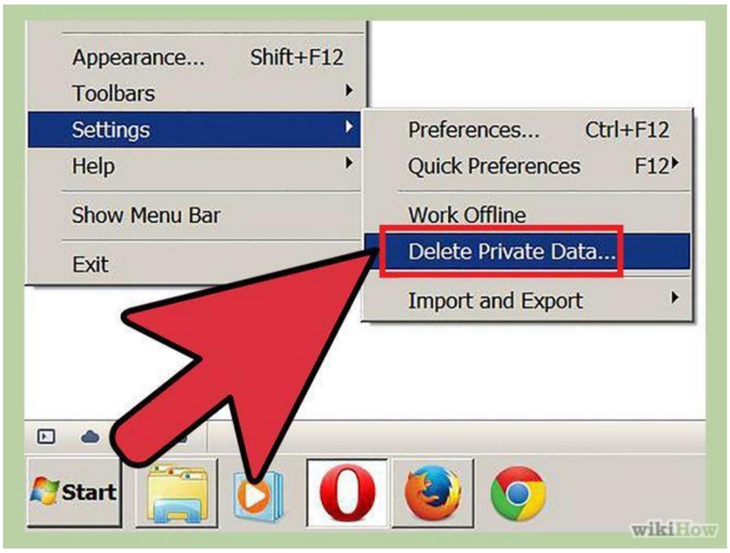
Time range to clear: Everything

All history will be cleared.
This action cannot be undone.

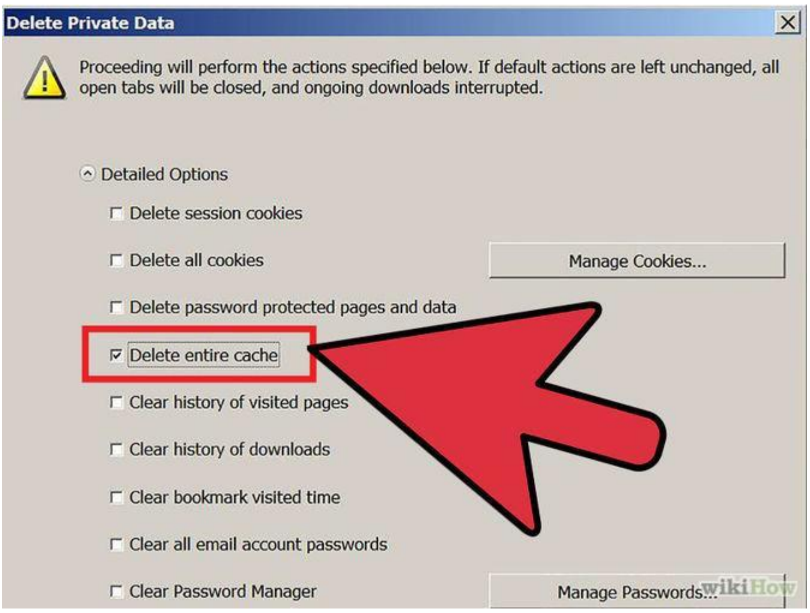
☑ Browsing & Download History
□ Form & Search History
☑ Cookies
☑ Cache
☑ Active Logins
☑ Offline Website Data
☑ Site Preferences

Step 3: If you wish to clear other kinds of stored data, feel free to check the appropriate boxes. They will be cleared with the cache in the next step.

9.3.10 Clearing cache for opera



Step 1: Once your browser is open, select the **"Settings"** menu and click **"Delete private data"**.



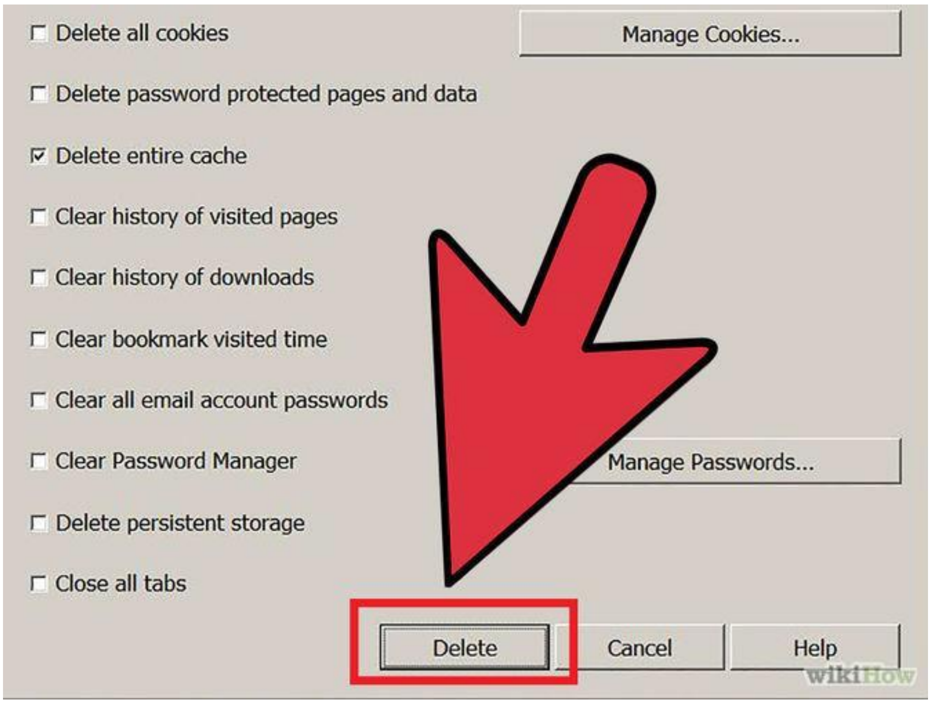
Delete Private Data

Proceeding will perform the actions specified below. If default actions are left unchanged, all open tabs will be closed, and ongoing downloads interrupted.

Detailed Options

- ☐ Delete session cookies
- ☐ Delete all cookies
- ☐ Delete password protected pages and data
- ☑ Delete entire cache
- ☐ Clear history of visited pages
- ☐ Clear history of downloads
- ☐ Clear bookmark visited time
- ☐ Clear all email account passwords
- ☐ Clear Password Manager

Step 2: Make sure the **"Delete entire cache"** box is checked. Make sure any unwanted categories are left **unchecked**.



☐ Delete all cookies

☐ Delete password protected pages and data

☑ Delete entire cache

☐ Clear history of visited pages

☐ Clear history of downloads

☐ Clear bookmark visited time

☐ Clear all email account passwords

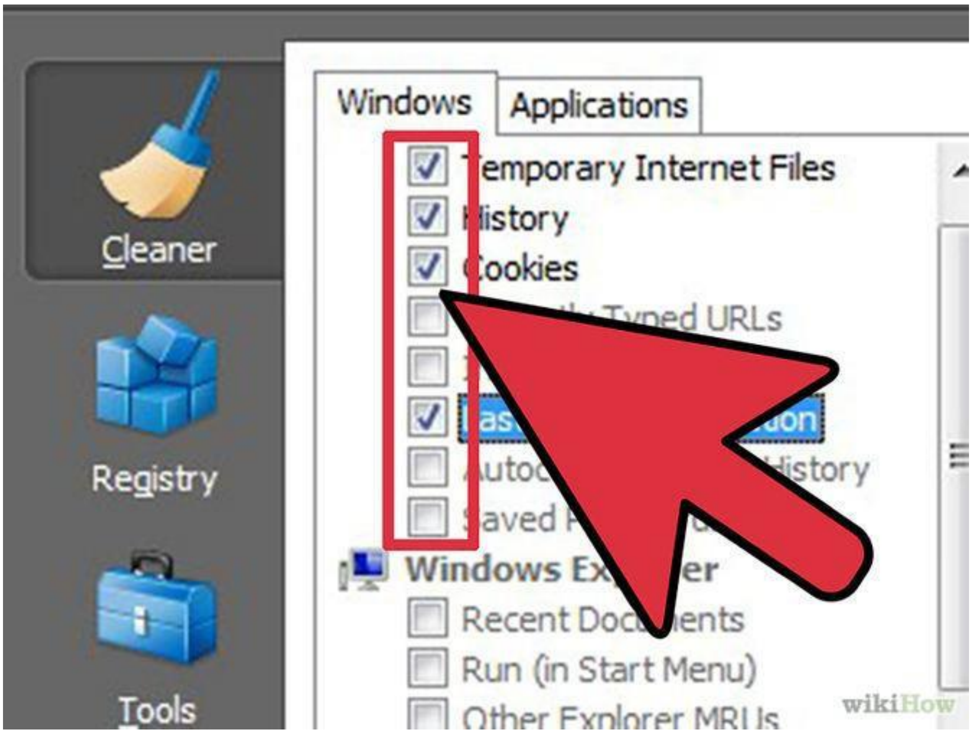
☐ Clear Password Manager

☐ Delete persistent storage

☐ Close all tabs

Step 3: Press **“Delete”**.

9.3.11 Clearing cache for Ccleaner



☑ Temporary Internet Files

☑ History

☑ Cookies

☐ ...tly Typed URLs

☐

☑ ...as... ...ion

☐ Auto... ...History

☐ Saved ...

Windows Ex... ...er

☐ Recent Doc... ...ents

☐ Run (in Start Menu)

☐ Other Explorer MRUs

Ccleaner- This is a computer maintenance tool that lets you scan and delete browser cache and cookies. Launch it, go to Cleaner tab and make sure to check the Temporary internet files for the browser you have.

ACTIVITY

a. Perform the cache clearing operation on your system browser.

b. Perform the cache clearing operation on the browser of your smartphone.

c. Install Ccleaner in your system and use it to perform cache clearing operation.

d. Find out whether the popular websites you visit daily are secure or not.

e. Can you find any banking site that does not use https://

f. Can you find some social networking site that does not use https://

g. Can you list down some important points that should be kept in mind before going for online shopping?

Unit 10: Wireless Security 10

Unit Structure

This chapter is about different kind of Best Practices that should be followed when using Wireless LAN.

10.1 WHAT IS WIRELESS LAN?

The Wireless LAN or WLAN is becoming a popular way to connect devices such as computers these days. In offices and homes, WLAN has become an alternative way of communication compared to wired LAN. The convenience to connect different devices is both cost effective and easily maintainable. The Wikipedia says: “Wireless LANs have become popular in the home due to ease of installation, and the increasing to offer wireless access to their customers; often for free.”

The other factors why WLANs are becoming more acceptable are:

1. No need to be connected physically with each other through any medium such as cables. You can roam around freely in office premises, home or around.
2. WLANs are cost effective. Cabling all the way in the offices, hotels etc are not needed. So it’s cheap and provides same quality of service.
3. Unreachable spots where a cable is hardly accessible, WLAN signals can reach out such as big installations like airports. Also surfing outdoors is also convenient. Just install the device called Access Points (AP) and you are done.
4. Less interruption and easy trouble shooting in case of failures as compared to cabled networks.
5. More secure as most of APs support best encryption methods which protect them from sniffing and other attacks.

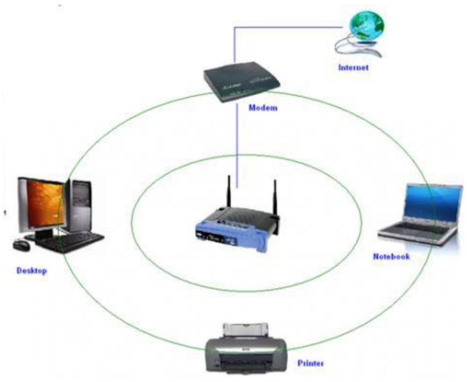


Figure 44: A typical Wireless network

10.2 MAJOR ISSUES WITH WLAN

Having said that, WLAN are also as prone to various attacks as their counterpart wired LNAs are. Actually WLANs are easier to hack as compared to wired LANs, if not properly configured, due to its easy accessibility around the installation. No need to be in contact of physical wires to hack can be done from anywhere. Its convenience can turn into serious risk to the organization if not configured properly. Major attacks include such as, Sniffing, Key cracking, DoS (Denial of Service), DE authentication attacks, War driving etc. This chapter is not focused on attacks, we shall mainly concentrate on best practices- how to install and use WLAN securely which can thwart a number of above mentioned attacks.

10.2.1 Secure WLAN

Wireless Security mainly depends on these 3 factors:

- How much is your wireless network secured in terms of encryption being used.
- Monitoring for suspicious and unusual activities.
- User awareness and education.

These are the combination of various approaches ranging from corporate to home networks. These are also for users how to remain safe while surfing.

10.2.2 Wi-Fi at home

Using a Wi-Fi at home is not a luxury anymore it has become a necessity. However, when the question of security comes into the scene, the first thought that would arise in my mind is how you can protect something which you cannot see, neither can you feel it? Protecting a home wireless network is altogether a different side of the coin as compared to wired networks. Most of wireless network device vendor‟s and Internet Service provider do not provide any security settings by default and leave the customer to fend for herself. So make sure, your network is secured from being maliciously used.

There is no silver bullet that will protect your wireless network infrastructure. These are, however, some countermeasures listed below that should be used in conjunction with each other to secure your wireless network to the highest level:

1. Use most secure possible encryption: The first and most necessary step- use industry standard encryptions. The old (however generally used) WEP-Wired Equivalent Privacy, has been known to be broken. Even you use complex passwords it can be broken and decrypted within minutes or hours. WEP uses 40 bit or 128 bits RC4 ciphers to encrypt the channel.

Instead use secure protocols such as WPA 2 – Wi-Fi Protected Access- 2, which uses strong 128 bits AES ciphers and is typically considered more robust encryption strategy available.

Attacks mitigated: WEP Key cracking, Sniffing, Capturing/Eavesdropping

2. Use Firewall: All the wireless routers come with built-in firewalls. Enable them with all the security features. You should block any anonymous ping requests and place restrictions on website browsing, if required. Define additional security policies and apply them.

Attacks mitigated: Fingerprinting, System compromise

3. Have a monitoring system in place: There‟s a saying- prevention is better than a cure. If you are able to detect some suspicious activities before it penetrates your network, you can block them or take precautionary measures. Deploy WIPS/WIDS for monitoring suspicious activities.

Attacks mitigated: Scanning, DoS

4. Don't use default credentials: Every wireless router comes with a set of default username/password. Sometimes, people don‟t change them and keep using them for long time. Username and passwords are used by computers or other devices to connect to wireless router. If any hacker is able to guess them, he can connect to your network easily. Studies show that majority of users use the same combination of username/passwords as set by manufacturers. Some default username combinations are: admin/admin, admin/password or admin/ " ".

Attacks mitigated: Unauthorized access, War driving

5. Disable Auto-connect feature: Some devices or the computers/laptops have „Let this tool manage your wireless networks‟ or „Connect automatically to available network‟. Such users having this auto-connect feature enabled are prone to Phishing attack or Rogue AP attack. Attackers keep their APs alive and kicking for such kind of unsuspecting users. They also use luring names as „HotSpot‟, „SecureConnect‟, ‟GovtNetworks‟ etc. The user will never suspect them and keep surfing the wireless network happily. Also if you have not changed the default password of your router, the attacker will try to use this feature on their machine and automatically connect using the easily guessable default passwords.

Attacks mitigated: Phishing, Sniffing, Rouge AP association

6. Don't use public Wi-Fi spots to surf sensitive websites: Free and open wireless networks available on airports, cafes, railway stations are not very secure by nature. They do not use any encryption to secure the channel between your laptop to the router. So any information which is not by default going on HTTPS from your laptop/smart phone is susceptible to sniffing and even more your session could be hijacked because the unencrypted channel may leak the active session ID used by your website. Recently to demonstrate these types of attacks one researcher developed a tool Firesheep [http://codebutler.github.com/firesheep/]. All the attacker needs to do is to just install this tool in Firefox and start sniffing the communications on a public unencrypted Wi-Fi. Some applications like Facebook encrypts the login page [HTTPS] but internal pages are served on unencrypted [HTTP] channel so your session ID can be leaked.

Attacks mitigated: Sniffing, Session Hijacking

7. Change the default SSID: Although this will not prevent hackers breaking into a network, using a default SSID acts as an indication that the user is careless. So he may be an obvious target to explore further to see if he still uses the default passwords as well?

Attacks mitigated: War driving

8. Restrict access by assigning static IP addresses and MAC filtering: Disable automatic IP assigning feature and use private static IPs to the legitimate devices you want to connect. This will help you in blocking unwanted devices from being connected to your network. Also, enable MAC filtering- router remembers MAC of each and every device connected to it and saves it as list. You can use this facility to restrict access. Only a set of trusted devices can be allowed to connect. However MAC spoofing is still possible but it raises an extra bar for your wireless network.

9. Turn off your router when not in use: Last but not least, a little obvious, but it will save your network from all the attacks for that time period.

1.7.2.3 Wi-Fi in a Corporate/Enterprise Network

Due to the nature of activity and criticality of information, it is very important that Corporate / Enterprise networks have a higher degree of security.

The following are good to have:

- Defining an adequate organization wide Information Security policy & procedures for wireless network

- SSID‟s should not be associated with the organization, AP vendor or any other related information which would be easy to guess or associate with the current organization
- Enable WPA2 Enterprise encryption with RADIUS authentication and use of EAP protocol like EAP-TTLS, TLS etc.
- Implementation of PKI infrastructure. CA signed certificates to authenticate the server to client and vice versa
- Filtering of clients based on unique identifier like MAC Address
- Isolated „Guest‟ wireless network with no interface / connection to the corporate network
- Limiting the radius of Wi-Fi network by reducing the power output of the AP
- Allocating IP Address to the employee and guest machines only after successful authentication
- Periodically changing the keys & passwords
- Use of VPN while accessing corporate information from Public Wi-Fi network
- Client side utilities like DecaffeintIDcan help in detecting changes in ARP table and serve as common man‟s IDS to protect against attacks like „hole196‟ and DoS.
- Implementation of Wireless IDS. Wireless IDS is a new concept. The key features of Wireless IDS are:
    - Prevention against Rogue AP‟s
    - Detection & prevention against DoS attacks
    - Assistance in locating the approximate physical location of the attacker
    - Assistance in enforcing the Organization‟s Information Security policy on wireless networks
    - Detection of use of scanning tools like Kismet & NetStumbler

ACTVITY

1. What are the precautions one should take using a Wi-Fi network at public place?
2. How to secure home network?
3. How to secure enterprise network?
4. Find more about the terms over internet:
    - IDS
    - DOS
    - Kismet
    - NetStumbler

Unit 11: Email and Social Media Security

11

Unit Structure

11.1 SAFE BROWSING GUIDELINES FOR SOCIAL NETWORKING SITES

Online communities have existed since the invention of the internet. First there were bulletin boards and email lists, which gave people around the world opportunities to connect, to communicate and to share information about particular subjects. Today, social networking websites have greatly expanded the range of possible interactions, allowing you to share messages, pictures, files and even up-to-the-minute information about what you are doing and where you are. These functions are not new or unique – any of these actions can also be performed via the internet without joining a social networking site.

Although these networks can be very useful, and promote social interaction both online and offline, when using them you may be making information available to people who want to abuse it. Think of a social networking site as being like a huge party. There are people there that you know, as well as some that you don't know at all. Imagine walking through the party with all your personal details, and up-to-the-minute accounts of what you are thinking, written on a big sign stuck on your back so that everyone can read it without you even knowing. Do you really want everyone to know all about you?

Remember that social networking sites are owned by private businesses, and that they make their money by collecting data about individuals and selling that data on, particularly to third party advertisers. When you enter a social networking site, you are leaving the freedoms of the internet behind and are entering a network that is governed and ruled by the owners of the site. Privacy settings are only meant to protect you from other members of the social network, but they do not shield your data from the owners of the service. Essentially you are giving all your data over to the owners and trusting them with it.

If you work with sensitive information and topics, and are interested in using social networking services, it is important to be very aware of the privacy and security issues that they raise. Human rights advocates are particularly vulnerable to the dangers of social networking sites and need to be extremely careful about the information they reveal about themselves AND about the people they work with.

[22] https://securityinabox.org/en/guide/social-networking

Before you use any social networking site it is important to understand how they make you vulnerable, and then take steps to protect yourself and the people you work with. This guide will help you understand the security implications of using social networking sites.

11.1.1 General Tips on using Social Networking platforms safely

Social media have become an evident part of our life. We share out updates with our friends, family and anyone who is concerned using social media. But the hackers can use this information to steal sensitive data and hack your account. Given below are some of the general tips on using social media.

- **Always ask the questions:**
  - ✓ Who can access the information I am putting online?
  - ✓ Who controls and owns the information I put into a social networking site?
  - ✓ What information about me are my contacts passing on to other people?
  - ✓ Will my contacts mind if I share information about them with other people?
  - ✓ Do I trust everyone with whom I'm connected?
- Always make sure you use **secure passwords** to access social networks. If anyone else does get into your account, they are gaining access to a lot of information about you and about anyone else you are connected to via that social network. Change your passwords regularly as a matter of routine.
- Make sure you understand the default **privacy settings** offered by the social networking site, and how to change them.
- Consider using **separate accounts/identities**, or maybe different pseudonyms, for different campaigns and activities. Remember that the key to using a network safely is being able to trust its members. Separate accounts may be a good way to ensure that such trust is possible.
- Be careful when accessing your social network account in public internet spaces. **Delete your password and browsing history** when using a browser on a public machine.
- **Access social networking sites using https://** to safeguard your username, password and other information you post. Using https:// rather than http:// adds another layer of security by encrypting the traffic from your browser to your social networking site.
- Be careful about putting too much information into **your status updates** – even if you trust the people in your networks. It is easy for someone to copy your information.

- Most social networks allow you to integrate information with other social networks. For example you can post an update on your Twitter account and have it automatically posted on your Facebook account as well. Be particularly **careful when integrating your social network accounts**! You may be anonymous on one site, but exposed when using another.
- Be cautious about how safe your content is on a social networking site. **Never rely on a social networking site as a primary host for your content** or information. It is very easy for governments to block access to a social networking site within their boundaries if they suddenly find its content objectionable. The administrators of a social networking site may also decide to remove objectionable content themselves, rather than face censorship within a particular country.

11.1.2 Posting Personal Details

Social networking sites ask you for a good deal of data about yourself to make it easier for other users to find and connect to you. Perhaps the biggest vulnerability this creates for users of these sites is the possibility of identity fraud, which is increasingly common. In addition, the more information about yourself you reveal online, the easier it becomes for the authorities to identify you and monitor your activities. The online activities of diaspora activists from some countries have led to the targeting of their family members by the authorities in their homelands.

Ask yourself: is it necessary to post the following information online?

- ✓ birth dates
- ✓ contact phone numbers
- ✓ addresses
- ✓ details of family members
- ✓ sexual orientation
- ✓ education and employment history

11.1.3 Friends, Followers and Contacts

The first thing you will do after filling in your personal details with any social networking application is establish connections to other people. Presumably these contacts are people you know and trust – but you may also be connecting to an online community of like-minded individuals that you have never met. The most important thing to understand is what information you are allowing this online community to have.

When using a social network account such as Facebook, where a lot of information about yourself is held, consider only connecting to people you know and trust not to misuse the information you post.

11.1.4 Status Updates

On Twitter and Facebook and similar networks, the status update answers the questions: What am I doing right now? What's happening? The most important thing to understand about the status update is who can actually see it. The default setting for the status update on most social networking applications is that anyone on the internet can see it. If you only want your contacts to see the updates, you need to tell the social networking application to keep your updates hidden from everyone else.

To do this in Twitter, look for “Protect Your Tweets”. In Facebook, change your settings to share your updates with “Friends Only”. Even if you switch to those settings, consider how easy it is for your information to be reposted by followers and friends. Agree with your network of friends on a common approach to passing on the information posted in your social networking accounts. You should also think about what you may be revealing about your friends that they may not want other people to know; it's important to be sensitive about this, and to ask others to be sensitive about what they reveal about you.

There have been many incidents in which information included in status updates has been used against people. Teachers in the US have been fired after posting updates about how they felt about their students; other employees have lost their jobs for posting about their employers. This is something that nearly everyone needs to be careful about.

11.1.5 Sharing Online Content

It's easy to share a link to a website and get your friend's attention. But who else will be paying attention, and what kind of reaction will they have? If you share (or "like") a site that opposes some position taken by your government, for example, agents of that government very might well take an interest and target you for additional surveillance or direct persecution.

If you want your contacts (and of course the administrators of the social networking platform you use) to be the only ones who can see the things you share or mark as interesting, be sure to check your privacy settings.

11.1.6 Revealing your Location

Most social networking sites will display your location if that data is available. This function is generally provided when you use a GPS-enabled phone to interact with a social network, but don't assume that it's not possible if you aren't connecting from a mobile. The network your computer is connected to may also provide location data. The way to be safest about it is to double-check your settings.

Be particularly mindful of location settings on photo and video sharing sites. Don't just assume that they're not sharing your location: double-check your settings to be sure.

11.1.7 Sharing Videos and Photos

Photos and videos can reveal people's identities very easily. It's important that you have the consent of the subject/s of any photo or video that you post. If you are posting an image of someone else, be aware of how you may be compromising their privacy. Never post a video or photo of anyone without getting their consent first.

Photos and videos can also reveal a lot of information unintentionally. Many cameras will embed hidden data (metadata tags), that reveal the date, time and location of the photo, camera type, etc. Photo and video sharing sites may publish this information when you upload content to their sites.

11.1.8 Instant Chats

Many social networking sites have tools that allow you to have discussions with your friends in real time. These operate like Instant Messaging and are one of the most insecure ways to communicate on the internet, both because they may reveal who you are communicating with, and what you are communicating about.

Connecting to the site via https is a minimum requirement for secure chatting, but even this is not always a guarantee that your chat is using a secure connection. For example, Facebook chat uses a different channel to HTTPS (and is more prone to exposure).

It is more secure to use a specific application for your chats, such as Pidgin with an Off-the-record plugin, which uses encryption. Read the 'Pidgin – secure instant messaging' hands-on guide.

11.1.9 Joining and Creating Groups, Events and Communities

What information are you giving to people if you join a group or community? What does it say about you? Alternatively, what are people announcing to the world if they join a group or community that you have created? How are you putting people at risk?

When you join a community or group online it is revealing something about you to others. On the whole, people may assume that you support or agree with what the group is saying or doing, which could make you vulnerable if you are seen to align yourself with particular political groups, for example. Also if you join a group with a large number of members that you don't know, then this can compromise any privacy or security settings that you have applied to your account, so think about what information you are giving away before joining. Are you using your photo and real name so strangers can identify you?

Alternatively, if you set up a group and people choose to join it, what are they announcing to the world by doing so? For example, perhaps it is a gay and lesbian support group that you have set up to help people, but by joining it people are openly identifying themselves as gay or gay-friendly, which could bring about dangers for them in the real world.

11.2 EMAIL SECURITY TIPS[23]

1. Don't open email attachments that you are not expecting, or which have come from someone you do not know. When you open such an email, make sure that your anti-virus software is up-to-date and pay close attention to any warnings from your browser or email program.
2. You can use anonymity software which can help you hide your chosen email service from anyone who might be monitoring your internet connection. A good, free software programme to do this is ***Tor*** (Find out more about Tor browser using Google). If you don't want to give away information about your identity through your email, do not register a username or 'Full Name' that is related to your personal or professional life.
3. You can avoid getting spam (unwanted or junk email) by guarding your email address and distributing it sparingly. Also, never open or reply to any emails you consider to be spam, because spammers will take this as a proof of the legitimacy of the address and will just send you more spam. Consider using a spam filter, but remember that it needs to be monitored as it may mistake a genuine email for spam.
4. You should try to avoid your emails being mistaken for spam by the recipients. Spam filters will block messages with certain words in the subject heading. It is worth scanning your spam folder for subject lines that are getting blocked.

[23] https://survival.tacticaltech.org/internet/email/tips

5. Beware of email scams. Many scam emails pretend to come from a bank, Ebay, Paypal, or other online shops. If you get an email telling you that your account is in danger of being shut down, or that you need to take immediate action by updating your account information, be very suspicious: these messages are usually scams. Another frequent scam has you receiving an email from someone you know which says that they have had an emergency and asks you to send them money. This person's email account is likely to have been compromised by a scammer.
6. Pay close attention if your browser suddenly gives you messages about invalid security certificates when you attempt to access a secure webmail account. It could mean that someone is tampering with the communication between your computer and the server in order to intercept your messages.

ACTIVITY

1. What are anonymous accounts? Find some browsers which supports anonymity.
2. After going through the above section, find out whether you were following the above safe practices while handling your social medial account? Find the gaps?
3. Based on the above recommendations, adjust your social media account settings.

Unit 12: Smartphone Security 12

Unit Structure

12.1 INTRODUCTION

Advances in technology now mean that mobile phones can provide services and features similar to desktop or laptop computers. These Smartphones offer many new ways to communicate and capture and disseminate media. To provide these new functionalities, the smartphones not only use the mobile network, but also connect to the internet either via a wi-fi connection (similar to a laptop at an internet cafe) or via data connections through the mobile network operator.

So while you can, of course, make phone calls with a smartphone, it is better to view smartphones as small computing devices. This means that the other material in this toolkit is relevant to your use of your smartphone as well as your computer.

Smartphones usually support a wide range of functionality – web browsing, email, voice and instant messaging over the internet, capturing, storing and transmitting audio, videos and photos, enabling social networking, multi-user games, banking and many other activities. However, many of these tools and features introduce new security issues, or increase existing risks. For instance, some smartphones have built-in geo-location (GPS) functionality, which means they can provide your precise location to your mobile network operator by default, and to many applications you use on your phone (such as social networking, mapping, browsing and other applications). As mentioned before, mobile phones already relay your location information to your mobile network operator (as part of the normal functions of the phone). However, the additional GPS functionality not only increases the precision of your location information, it also increases the amount of places where this information might be distributed.

It's worth reviewing all the risks associated with mobile phones discussed in our guide How to use mobile phones as securely as possible as all of them are also relevant to smartphone use. That guide also covers issues of eavesdropping, interception of SMS or phone calls, SIM card related issues, and best practices.

In this guide we'll take a look at the additional security challenges posed by smartphones.

[24] https://securityinabox.org/en/guide/smartphones

12.2 SMARTPHONE SECURITY GUIDELINES

12.2.1 Purses, Wallets, Smartphones

We have an intuitive understanding of the value of keeping our purse or wallet safe, because so much sensitive information is stored in them, and losing them will compromise our privacy and safety. People are less aware of the amount of personal information being carried in their smartphones, and consider losing a phone a nuisance rather than a risk. If you also think that a smartphone is a computing device which is always connected to a network and is continually carried around, it also highlights the important difference between a holder of discrete, passive information (like a wallet), and an active and interactive item like a smartphone.

A simple exercise can help illustrate this:

Empty the content of your wallet or purse, and take account of sensitive items. Typically you may find: - Pictures of loved ones (~5 pictures) - Identification cards (driver's license, membership cards, social security cards) - Insurance and health information (~2 cards) - Money (~5 bills) - Credit/Debit cards (~3 cards)

Now, examine the contents of your smartphone. A typical smartphone user may find some of the above in higher quantities and in some cases much more valuable items:

- Pictures of loved ones (~100 pictures)
- Email applications and their passwords
- Emails (~500 emails)
- Videos (~50 videos)
- Social networking applications and their passwords
- Banking applications (with access to the bank accounts)
- Sensitive documents
- Sensitive communication records
- A live connection to your sensitive information

The more you use smartphones, the more you need to become aware of the associated risks and take appropriate precautions. Smartphones are powerful amplifiers and distributors of your personal data. They are designed to provide as much connectivity as possible and to link to social networking services by default. This is because your personal data is valuable information that can be aggregated, searched and sold.

It can be disastrous if you lose your phone without having a backup of your most important data (such as your contacts) in a secure location. Besides backing up your data, make sure you also know how to restore the data. Keep a hard copy of the steps you need to take so you can do it quickly in an emergency.

In this chapter we'll start by introducing some smartphone basics – a description of various platforms and some basic setup procedures for securing your information and communication. The remaining parts of this chapter will cover specific precautions related to common uses of smartphones.

12.2.2 Platforms, Setup and Installation

12.2.2.1 Platforms and Operating Systems

At the time of writing, the most common smartphones in use are Apple's iPhone and Google's Android, followed by Blackberry and Windows phones. The key difference between Android and other operating systems is that Android is, mostly, an Open Source (*FOSS*) system, which allows the operating system to be audited independently to verify if it properly protects users' information and communication. It also facilitates development of security applications for this platform. Many security-aware programmers develop Android applications with user safety and security in mind. Some of these will be highlighted later in this chapter.

Regardless what type of smartphone you are using, there are issues that you should be aware of when you use a phone which connects to the internet and comes with features such as *GPS* or wireless networking capacities. In this chapter we focus on devices with the Android platform, because, as mentioned above, it's easier to secure data and communications. Nonetheless, basic setup guides and some applications for devices other than Android phones are provided, too. Blackberry phones have been presented as “secure” messaging and email devices. This is because messages and emails are securely channeled through Blackberry servers, out of the reach of potential eavesdroppers. Unfortunately, more and more governments are demanding access to these communications, citing need for guarding against potential terrorism and organized crime. India, United Arab Emirates, Saudi Arabia, Indonesia and Lebanon are examples of governments which have scrutinized the use of Blackberry devices and demanded access to user data in their countries.

12.2.2.2 Feature Phones

Another category of mobiles are often called 'feature phones'. Recently, feature phones have increased their functionalities to include those of some smartphones. But generally, feature phones' operating systems are less accessible; therefore there are limited opportunities for security applications or improvements. We do not specifically address feature phones, although many measures discussed here make sense for feature phones too.

12.2.2.3 Branded and locked smartphones

Smartphones are usually sold branded or locked. Locking smartphones means that the device can only be operated with one carrier, whose SIM card is the only one that will work in the device. Mobile network operators usually brand a phone by installing their own firmware or software. They may also disable some functionalities or add others. Branding is a means for companies to increase revenue by channeling your smartphone use, often also collecting data about how you are using the phone or by enabling remote access to your smartphone.

For these reasons, we recommend that you buy an unbranded smartphone if you can. A locked phone poses a higher risk since all your data is routed through one carrier, which centralizes your data streams and makes it impossible to change SIM cards to disseminate the data over different carriers. If your phone is locked, ask someone you trust about unlocking it.

12.2.2.4 General Setup

Smartphones have many settings which control the security of the device. It is important to pay attention to how your smartphone is set up. In the Hands-on Guides below we will alert you to certain smartphone security settings that are available but not active by default, as well as those which are active by default and make your phone vulnerable.

12.2.2.5 Installing and updating applications

The usual way to install new software on your smartphone is to use the iPhone Appstore or Google Play store, log in with your user credentials, and download and install a desired application. By logging-in you associate your usage of the online store with the logged-in user account. The owners of the application store keep records of this user's browsing history and application choices.

The applications which are offered in the official online store are, supposedly, verified by store owners (Google or Apple), but in reality this provides weak protection against what applications will do after being installed on your phone. For example, some applications may copy and send out your address book after you install them on your phone. On Android phones each application needs to request, during the installation process, what it will be permitted to do when it is in use. You should pay close attention to what permissions are requested, and if these permissions make sense for the function of the app you are installing. For example, if you are considering a "news reader" application and you find out that it requests the rights to send your contacts over a mobile data connection to a third party, you should look for alternative applications with appropriate access and rights.)ites. Some users may want to consider these alternative sites to minimize online contact with Google. One of the alternative store is **F-Droid** ('Free Droid'), which only provides *FOSS* applications. However please remember that you should trust the site before you download any apps from it. For inexperienced users we recommend that you use Google Play store.

If you don't want to (or are unable to) go online to access apps, you can transfer apps from someone else's phone by sending *.apk* files (short for 'android application package') via Bluetooth. Alternatively you could download the .apk file to your device's Micro SD card or use a usb cable to move it there from a PC. When you have received the file, simply long tap on the filename and you will be prompted to install it. (**Note**: be especially careful while using Bluetooth.

12.2.3 Communicating Securely (Through Voice and Messages) with a Smartphone

12.2.3.1 Secure Voice Communication

Basic telephony

In order to send or receive any calls or communications to your phone, the signal towers nearest you are alerted by your phone of its presence[25]. As a result of those alerts and communications the network service provider knows the precise geographic location of your mobile phone at any given time.

About Anonymity: If you are conducting sensitive phone conversations or sending sensitive SMS messages, beware of the above tracking 'feature' of all mobile phones. Consider adopting the steps below:

- Make calls from different locations each time, and choose locations that are not associated with you.
- Keep your phone turned off, with the battery disconnected, go to the chosen location, switch your phone on, communicate, switch the phone off and disconnect the battery. Doing this habitually, each time you have to make a call, will mean that the network cannot track your movements.
- Change phones and SIM cards often. Rotate them between friends or the second-hand market.

[25] https://securityinabox.org/en/guide/mobile-phones

- Use unregistered pre-paid SIM cards if this is possible in your area. Avoid paying for a phone or SIM cards using a credit card, which will also create a connection between these items and you.

About eavesdropping: Your phone can be set to record and transmit any sounds within the range of its microphone without your knowledge. Some phones can be switched on remotely and brought into action in this way, even when they look as though they are switched off.

- Never let people whom you don't trust get physical access to your phone; this is a common way of installing spying software on your phone.
- If you are conducting private and important meetings, switch your phone off and disconnect the battery. Or don't carry the phone with you if you can leave it where it will be absolutely safe.
- Make sure that any person with whom you communicate also employs the safeguards described here.
- In addition, don't forget that using a phone in public, or in places that you don't trust, makes you vulnerable to traditional eavesdropping techniques, or to having your phone stolen.

About interception of calls: Typically, encryptions of voice communications (and of text messages) that travel through the mobile phone network is relatively weak. There are inexpensive techniques which third parties can use to intercept your written communications, or to listen to your calls, if they are in proximity to the phone and can receive transmissions from it. And of course, mobile phone providers have access to all your voice and text communications. It is currently expensive and/or somewhat technically cumbersome to encrypt phone calls so that even the mobile phone provider can't eavesdrop – however, these tools are expected to become cheaper soon. To deploy the encryption you would first have to install an encryption application on your phone, as well as on the device of the person with whom you plan to communicate. Then you would use this application to send and receive encrypted calls and/or messages. Encryption software is currently only supported on a few models of so-called 'smart' phones.

Conversations between Skype and mobile phones are not encrypted either, since at some point, the signal will move to the mobile network, where encryption is NOT in place[26]. Using Internet through your Smartphone over mobile data connections or WiFi can provide more secure ways to communicate with people, namely by using *VoIP* and employing means to secure this channel of communication. Some smartphone tools can even extend some of this security beyond VoIP, to mobile phone calls as well (See **Redphone** below).

Here we list a few tools and their pros and cons:

Skype

The most popular commercial VoIP application, *Skype*, is available for all smartphone platforms and works well if your wireless connectivity is reliable. It is less reliable on mobile data connections.

Skype is a non Open-Source software what makes it very difficult to independently confirm its level of security. Additionally, Skype is owned by Microsoft, which has a commercial interest in knowing when you use Skype and from where. Skype also may allow law enforcement agencies retrospective access to all your communications history.

Other VoIP tools

Using VoIP is generally free (or significantly cheaper than mobile phone calls) and leaves few data traces. In fact, a secured VoIP call can be the most secure way to communicate.

RedPhone is a Free and Open-Source Software application that encrypts voice communication data sent between two devices that run this application. It is easy to install and very easy to use, since it integrates itself into your normal dialing and contact scheme. But people you want to talk to also need to install and use RedPhone. For ease of use, RedPhone uses your mobile number as a way to identify you to your contacts. Unfortunately, this makes it more difficult to use RedPhone without a functioning mobile service plan, even on devices capable of using WiFi to connect to the Internet. RedPhone also uses a central server, which puts the administrators of the service in a powerful position by allowing them to see much of the meta-data related to your encrypted VoIP calls.

CSipSimple is a powerful VoIP client for Android phones that is well maintained and comes with many easy set-up wizards for different VoIP services.

[26] https://securityinabox.org/en/guide/smartphones

Open Secure Telephony Network (OSTN) and the server provided by the Guardian project, **ostel.co**, currently offers one of the most secure means to communicate via voice. Knowing and trusting the entity that operates the server for your VoIP communication needs is an important consideration.

When using CSipSimple, you never directly communicate with your contact, instead all your data is routed through the Ostel server. This makes it much harder to trace your data and find out who you are talking to. Additionally, Ostel doesn't retain any of this data, except the account data that you need to log in. All your speech is securely encrypted and even your meta data, which is usually very hard to disguise, is blurred since traffic is proxied through the ostel.co server. If you download CSipSimple from ostel.co it also comes preconfigured for use with ostel, which makes it very easy to install and use.

Tool Guides for CSipSimple and Ostel.co are forthcoming. In the meantime, more information can be found by following the links above.

12.2.3.2 Sending Messages Securely

You should use precautions when sending SMS and using instant messaging or chatting on your smartphone.

SMS

SMS communication is insecure by default. Anyone with access to a mobile telecommunication network can intercept these messages easily and this is an everyday occurrence in many situations. Don't rely on sending unsecured SMS messages in critical situations. There is also no way of authenticating SMS messages, so it is impossible to know if the contents of a message was changed during delivery or if the sender of the message really is the person they claim to be.

Securing SMS

TextSecure is a *FOSS* tool for sending and receiving secure SMS on Android phones. It works both for encrypted and non-encrypted messages, so you can use it as your default SMS application. To exchange encrypted messages this tool has to be installed by both the sender and the recipient of a message, so you will need to get people you communicate with regularly to use it as well. TextSecure automatically detects when an encrypted message is received from another TextSecure user. It also allows you to send encrypted messages to more than one person. Messages are automatically signed making it nearly impossible to tamper with the contents of a message. In our TextSecure hands-on guide we explain in detail the features of this tool and how to use it.

Secure Chat

Instant messaging and chatting on your phone can produce a lot of information that is at risk of interception. These conversations might be used against you by adversaries at a later date. You should therefore be extremely wary about what you reveal when you are writing on your phone while instant messaging and chatting.

There are ways to chat and instant message securely. The best way is to use end-to-end encryption, as this will enable you to make sure the person on the other end is who you want.

We recommend ChatSecure as a secure text chat application for the Android phones. ChatSecure offers easy and strong encryption for your chats with *Off-the-Record* Messaging protocol. This encryption provides both authenticity (you can verify that you are chatting with the right person) and the independent security of each session so that even if the encryption of one chat session is compromised, other past and future sessions will remain secure.

ChatSecure has been designed to work together with Orbot, so your chat messages can be routed through the *Tor* anonymizing network. This makes it very hard to trace it or even find out that it happened.

For iPhones, the **ChatSecure** client provides the same features, although it is not easy to use it with the *Tor* network.

Whichever application you will use always consider which account you use to chat from. For example when you use Google Talk, your credentials and time of your chatting session are known to Google. Also agree with your conversation partners on not saving chat histories, especially if they aren't encrypted.

12.2.3.3 Storing Information on your Smartphone

Smartphones come with large data storage capacities. Unfortunately, the data stored on your device can be easily accessible by third parties, either remotely or with physical access to the phone. You can take steps to encrypt any sensitive information on your phone by using specific tools.

Date Encryption Tools

The **Android Privacy Guard (APG)** allows OpenGPG encryption for files and emails. It can be used to keep your files and documents safe on your phone, as well when emailing.

Recording Password Securely

You can keep all your needed passwords in one secure, encrypted file by using **Keepass**. You will only need to remember one master password to access all the others. With Keepass you can use very strong passwords for each account you have, as Keepass will remember them for you, and it also comes with a password generator to create new passwords. You can synchronise Keepass password databases between your phone and your computer. We recommend that you synchronise only those passwords that you will actually use on your mobile phone. You can create a separate smaller password database on the computer and syncronise this one instead of coping an entire database with all the passwords that you use to your smartphone. Also, since all the passwords are protected by your master password, it is vital to use very strong password for your Keepass database.

12.2.3.4 Sending Email from your Smartphone

In this section we will briefly discuss the use of email on smartphones. In the first instance, consider if you really need to use your smartphone to access your email. Securing a computer and its content is generally simpler than doing so for a mobile device such as a smartphone. A smartphone is more susceptible to theft, monitoring and intrusion.

If it is absolutely vital that you access your email on your smartphone, there are actions you can take to minimize the risks.

- Do not rely on smartphone as your primary means for accessing your email. Downloading (and removing) emails from an email server and storing them only on your smartphone is not advised. You can set up your email application to use only copies of emails.
- If you use email encryption with some of your contacts, consider installing it on your smartphone, too. The additional benefit is that encrypted emails will remain secret if the phone falls into wrong hands.

Storing your private encryption key on your mobile device may seem risky. But the benefit of being able to send and store emails securely encrypted on the mobile device might outweigh the risks. Consider creating a mobile-only encrytpion key-pair (using **APG**) for your use on your smartphone, so you do not copy your encryption private key from your computer to the mobile device. Note that this requires that you ask people you communicate with to also encrypt emails using your mobile-only encryption key.

12.2.3.5 Capturing Media with your Smartphone

Capturing pictures, video or audio with your Smartphone can be a powerful means to document and share important events. However, it is important to be careful and respectful of privacy and safety of those pictured, filmed or recorded. For example, if you take photos or record video or audio of an important event, it might be dangerous to you or to those who appear in the recordings, if your phone fell into the wrong hands. In this case, these suggestions may be helpful:

- Have a mechanism to securely upload recorded media files to protected online location and remove them from the phone instantly (or as soon as you can) after recording.
- Use tools to blur the faces of those appearing in the images or videos or distort the voices of audio or videos recordings and store only blurred and distorted copies of media files on your mobile device.
- Protect or remove meta information about time and place within the media files.

Guardian Project has created a *FOSS* app called **ObscuraCam** to detect faces on photos and blur them. You can choose the blurring mode and what to blur, of course. Obscuracam also deletes the original photos and if you have set up a server to upload the captured media, it provides easy functionality to upload it.

12.2.3.6 Accessing the Internet Securely from your Smartphone

As discussed in our guide **How to keep your Internet communication private** and our guide **How to remain anonymous and bypass censorship on the Internet**, access to content on the Internet, or publishing material online such as photos or videos, leaves many traces of who and where you are and what you are doing. This may put you at risk. Using your smartphone to communicate with the Internet magnifies this risk.

Through Wi-Fi or Mobile Data

Smartphones allow you to control how you access the Internet: via a wireless connection provided by an access point (such as an internet cafe), or via a mobile data connection, such as GPRS, EDGE, or UMTS provided by your mobile network operator.

Using a WiFi connection reduces the traces of data you may be leaving with your mobile phone service provider (by not having it connected with your mobile phone subscription). However, sometimes a mobile data connection is the only way to get online. Unfortunately mobile data connection protocols (like EDGE or UMTS) are not open standards. Independent developers and security engineers cannot examine these protocols to see how they are being implemented by mobile data carriers.

In some countries mobile access providers operate under different legislation than internet service providers, which can result in more direct surveillance by governments and carriers.

Regardless of which path you take for your digital communications with a smartphone, you can reduce your risks of data exposure through the use of anonymising and encryption tools.

Anonymity of your Smartphone

To access content online anonymously, you can use an Android app called **Orbot**. Orbot channels your internet communication through Tor's anonymity network.

Another app, Orweb, is a web browser that has privacy enhancing features like using proxies and not keeping a local browsing history. Orbot and Orweb together circumvent web filters and firewalls, and offer anonymous browsing.

Proxies

The mobile version of *Firefox* – **Firefox mobile** can be equipped with proxy add-ons, which direct your traffic to a proxy server. From there your traffic goes to the site you are requesting. This is helpful in cases of censorship, but still may reveal your requests unless the connection from your client to the proxy is encrypted. We recommend the **Proxy Mobile** add-on (also from **Guardian Project**, which makes proxying with Firefox easy. Is also the only way to channel Firefox mobile communications to Orbot and use the *Tor* network.

12.2.3.7 Advanced Smart Phone Security

Get Full Access to your Smartphone

Most Smartphones are capable of more than their installed operating system, manufacturers' software (firmware), or the mobile operators' programmes allow. Conversely, some functionalities are 'locked in' so the user is not capable of controlling or altering these functions, and they remain out of reach. In most cases those functionalities are unnecessary for smartphone users. There are however, some applications and functionalities that can enhance the security of data and communications on a smartphone. Also there are some other existing functionalities that can be removed to avoid security risks.

For this, and other reasons, some smartphone users choose to manipulate the various software and programs running the smartphone in order to gain appropriate privileges to allow them to install enhanced functionalities, or remove or reduce other ones.

The process of overcoming the limits imposed by mobile carriers, or manufacturers of operating systems on a smartphone is called rooting (in case of Android devices), or jailbreaking (in case of iOS devices, like iPhone or iPad). Typically, successful rooting or jailbreaking will result in your having all the privileges needed to install and use additional applications, make modifications to otherwise locked-down configurations, and total control over data storage and memory of the smartphone.

WARNING: Rooting or jailbreaking may not be a reversible process, and it requires experience with software installation and configuration. Consider the following:

- There is a risk of making your smartphone permanently inoperable, or 'bricking' it (i.e. turning it into a 'brick').
- The manufacturer or mobile carrier warranty may be voided.
- In some places, this process maybe illegal.

But if you are careful, a rooted device is a straightforward way to gain more control over your smartphone to make it much more secure.

Alternative Firmwares

Firmware refers to programmes that are closely related to the particular device. They are in cooperation with the device's operating system and are responsible for basic operations of the hardware of your smartphone, such as the speaker, microphone, cameras, touchscreen, memory, keys, antennas, etc.

If you have an Android device, you might consider installing a firmware alternative to further enhance your control of the phone. Note that in order to install alternative firmware, you need to root your phone.

An example of an alternative firmware for an Android phone is **Cyanogenmod** which, for example, allows you to uninstall applications from the system level of your phone (i.e. those installed by the phone's manufacturer or your mobile network operator). By doing so, you can reduce the number of ways in which your device can be monitored, such as data that is sent to your service provider without your knowledge.

In addition, Cyanogenmod ships by default with an OpenVPN application, which can be tedious to install otherwise. VPN (Virtual Private Network) is one of the ways to securely proxy your internet communication (see below).

Cyanogenmod also offers an Incognito browsing mode in which history of your communication is not recorded on your smartphone.

Full Device Encryption

If your phone is rooted you may consider encrypting it's entire data storage or creating a volume on the Smartphone to protect some information on the phone.

Luks Manager allows easy, on-the-fly strong encryption of volumes with an user-friendly interface. We highly recommend that you install this tool before you start storing important data on your Android device and use the Encrypted Volumes that the Luks Manager provides to store all your data.

Virtual Private Network(VPN) Security

A VPN provides an encrypted tunnel through the internet between your device and a VPN server. This is called a tunnel, because unlike other encrypted traffic, like https, it hides all services, protocols, and contents. A VPN connection is set up once, and only terminates when you decide.

Note that since all your traffic goes through the proxy or VPN server, an intermediary only needs to have access to the proxy to analyze your activities. Therefore it is important to carefully choose amongst proxy services and VPN services. It is also advisable to use different proxies and/or VPNs since distributing your data streams reduces the impact of a compromised service.

ACTIVITIES

1. Find out more about jailbreaking over internet.
2. Find and use the feature of “off-the –record” option in your chat application and observe what difference it makes.
3. Download and use Skype to make a video call to your friend.
4. Find out more about ***ObscuraCam*** over internet.

Unit 13: Ethical Hacking and Penetration Testing 13

Unit Structure

13.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- Understand the meaning of hacking.
- Know the benefits of Penetration Testing and Ethical Hacking.
- Identify various types of penetration testing.
- Classify various types of Hackers.
- Analyze various phases involved in Penetration Testing.
- Know various hacking tools and techniques.

13.2 INTRODUCTION

Computers have become mandatory to run a successful business. It is not enough to have isolated computers systems; they need to be networked to facilitate communication with external businesses. This exposes them to the outside world and cybercrime. Cybercrime is using computers to commit fraudulent acts such as fraud, privacy invasion, stealing corporate/personal data etc**. Cybercrimes cost many organizations millions of dollars every year**. Businesses need to protect themselves against such attacks.

Most people think hackers have extraordinary skill and knowledge that allow them to hack into computer systems and find valuable information. The term hacker conjures up images of a young computer whiz who types a few commands at a computer screen and poof! The computer spits out passwords, account numbers, or other confidential data. In reality, a good hacker, or security professional acting as an ethical hacker, just has to understand how a computer system works and know what tools to employ in order to find a security weakness. In this unit we book will discuss different types of hacking, some techniques and software tools that many hackers use to gather valuable data and attack computer systems.

13.3 ABOUT ETHICAL HACKING AND PENETRATION TESTING

There are many definitions of hacking. In this unit, we will define **hacking as the process of identifying weakness in computer systems and/or networks and exploiting the weaknesses to gain access**. An example of hacking is using by passing the login algorithm to gain access to a system. A **hacker** is a person who finds and exploits weakness in computer systems and/or networks to gain access. Hackers are usually skilled computer programmers with knowledge of computer security.

Vulnerability analysis and Penetration Testing, commonly known as Ethical

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hacking with permission from the system's owner. In the world of ethical hacking,
Hacking is a branch wherein, hackers engage in sanctioned hacking that is,
most tend to use the term pen tester, which is short for penetration tester. Pen

Testers penetrate systems like a hacker, but for "benign" purposes. As an ethical

hacker and future test candidate you must become familiar with the jargons of the trade. Here are some of the terms you will encounter in pen testing.

Glossary

1. **Hack Value:** This term describes a target that may attract an above- average level of attention to an attacker. Presumably because this target is attractive, it has more value to an attacker because of what it may contain.
2. **Target of Evaluation (TOE):** A TOE is a system or resource that is being evaluated for vulnerabilities. A TOE would be specified in a contract with the client.
3. **Attack:** This is the act of targeting and actively engaging aTOE.
4. **Exploit:** This is a clearly defined way to breach the security of a system.
5. **Zero Day:** This describes a threat or vulnerability that is unknown to developers and has not been addressed. It is considered a serious problem in many cases.
6. **Security:** This is described as a state of well-being in an environment where

only actions that are defined are allowed.

7. **Threat:** This is considered to be a potential violation of security.
8. **Vulnerability:** This is a weakness in a system that can be attacked and used as an entry point into an environment.
9. **Daisy Chaining:** This is the act of performing several hacking attacks in sequence with each building on or acting on the results of the previous action. As an ethical hacker, you will be expected to take on the role and use the mind-set and skills of an attacker to simulate a malicious attack. The idea is that ethical hackers understand both sides, the good and the bad, and use this knowledge to help their clients. By understanding both sides of the equation, you will be better prepared to defend yourself successfully.

Some things to remember about being an ethical hacker are:

- You must have explicit permission in writing from the company being tested prior to starting any activity. Legally, the person or persons that must approve this activity or changes to the plan must be the owner of the company or their authorized representative. If the scope changes, update the contracts to reflect those changes before performing the new tasks.
- You will use the same tactics and strategies as malicious attackers.
- You have every potential to cause harm that a malicious attack will have and should always consider the effects of every action you carry out.
- You must have knowledge of the target and the weaknesses it possesses.
- You must have clearly defined rules of engagement prior to beginning your assigned job.
- You must never reveal any information pertaining to a client to anyone but the client. If the client asks you to stop a test, do so immediately.
- You must provide a report of your results and, if asked, a brief on any deficiencies found during a test.
- You may be asked to work with the client to fix any problems that you find.
- As an ethical hacker you must agree to the following code of ethics:
- Keep private and confidential information gained in your professional work (in

particular as it pertains to client lists and client personal information). Do not collect, give, sell, or transfer any personal information (such as name, e-mail address, social security number, or other unique identifier) to a third party without prior client consent.

- Protect the intellectual property of others by relying on your own innovation and efforts, thus ensuring that all benefits vest with its originator.
- Disclose to appropriate persons or authorities potential dangers to any e-commerce clients, the Internet community, or the public, that you reasonably believe to be associated with a particular set or type of electronic transactions or related software or hardware.
- Provide service in your areas of competence; be honest and forthright about any limitations of your experience and education. Ensure that you are qualified for any project on which you work or propose to work by an appropriate combination of education, training, and experience.
- Never knowingly use software or a process that is obtained or retained either illegally or unethically.
- Do not engage in deceptive financial practices such as bribery, double billing, or other improper financial practices.
- Use the property of a client or employer only in ways properly authorized, and with the owner's knowledge and consent.
- Disclose to all concerned parties those conflicts of interest that cannot reasonably be avoided or escaped.
- Ensure good management for any project you lead, including effective procedures for promotion of quality and full disclosure of risk.
- Add to the knowledge of the e-commerce profession by constant study, share the lessons of your experience with fellow EC- Council members, and promote public awareness of the benefits of e-commerce.
- Conduct yourself in the most ethical and competent manner when soliciting professional service or seeking employment, thus meriting confidence in your knowledge and integrity.
- Ensure ethical conduct and professional care at all times on all professional assignments without prejudice.

- Do not associate with malicious hackers or engage in any malicious activities.
- Do not purposefully compromise or allow the client organization's systems to be compromised in the course of your professional dealings.
- Ensure all pen testing activities are authorized and within legal limits.
- Do not take part in any black hat activity or be associated with any black hat community that serves to endanger networks.
- Do not take part in any underground hacking community for purposes of preaching and expanding black hat activities.
- Do not make inappropriate references to the certification or misleading use of certificates, marks or logos in publications, catalogs, documents, or speeches.
- Do not violate any law of the land or have any previous conviction.
- Under the right circumstances and with proper planning and goals in mind, you can provide a wealth of valuable information to your target organization. Working with your client, you should analyze your results thoroughly and determine which areas need attention and which need none at all. Your client will determine the perfect balance of security versus convenience. If the problems you uncover necessitate action, the next challenge is to ensure that existing usability is not adversely affected if security controls are modified or if new ones are put in place. Security and convenience often conflict: the more secure a system becomes, the less convenient it tends to be.

A pen test is the next logical step beyond ethical hacking. Although ethical hacking sometimes occurs without a formal set of rules of engagement, pen testing does require rules to be agreed on in advance in every case.

13.4 TYPES OF PEN TESTING

When a pen test is performed it typically takes one of three forms: white box, gray box, or black box. The three forms of testing are important to differentiate your career, so let's take a moment to describe each:

between, as you may be asked to perform any one of them at some point during

Black Box

A type of testing in which the pen tester has little or no knowledge of the target is said to be Black Box testing. This situation is designed to closely emulate the situation an actual attacker would encounter as they would presumably have an extremely low level of knowledge of the target going in.

3.1.1 *Gray Box*

It is a form of testing where the knowledge given to the testing party is limited. In this type of test, the tester acquires knowledge such as IP addresses, operating systems, and the network environment, but that information is limited. This type of test would closely emulate the type of knowledge that someone on the inside might have; such a person would have some knowledge of a target, but not always all of it.

White Box

White Box is a form of testing in which the information given to the tester is complete. This means that the pen tester is given all information about the target system. This type of test is typically done internally or by teams that perform internal audits of systems.

CIA Triad

An ethical hacker is trying to preserve what is known as the CIA triad: confidentiality, integrity, and availability. The following list describes these core concepts and what they mean. Keep these concepts in mind when performing the tasks and responsibilities of a pen tester:

a) **Confidentiality:** The core principle that refers to the safeguarding of information and keeping it away from those not authorized to possess it. Examples of controls that preserve confidentiality are permissions and encryption.

b) **Integrity:** Deals with keeping information in a format that is true and correct to its original purposes, meaning that the data that the receiver accesses is the data the creator intended them to have.

c) **Availability:** The final and possibly one of the most important items that you can perform. Availability deals with keeping information and resources available to those who need to use it. Information or resources, no matter how safe and sound, are only useful if they are available when called upon.

CIA is possibly the most important set of goals to preserve when you are assessing and planning security for a system. An aggressor will attempt to break or disrupt these goals when targeting a system. As an ethical hacker your job is to find, assess, and remedy these issues whenever they are discovered to prevent an aggressor from doing harm. Another way of looking at this balance is to observe the other side of the triad and how the balance is lost. Any of the following break the CIA triad:

- **Disclosure** is the inadvertent, accidental, or malicious revealing or accessing of information or resources to an outside party. If you are not supposed to have access to an object, you should never have access to it.
- **Alteration** is the counter to integrity; it deals with the unauthorized or other forms of modifying information. This modification can be corruption, accidental access, or malicious in nature.
- **Disruption** (also known as loss) means that access to information or resources has been lost when it should not have. Information is useless if it is not there when it is needed. Although information or other resources can never be 100- percent available, some organizations spend the time and money to get 99.999- percent uptime, which averages about 6 minutes of downtime per year.

Think of these last three points as the anti-CIA triad or the inverse of the CIA triad. The CIA triad deals with preserving information and resources, whereas the anti-CIA triad deals with violating those points. You can also think of the anti-CIA as dealing more with the aggressor's perspective rather than the defender's.

An ethical hacker will be entrusted with ensuring that the CIA triad is preserved at all times and threats are dealt with in the most appropriate manner available (as required by the organization's own goals, legal requirements, and other needs). For example, consider what could happen if an investment firm or defense contractor suffered a disclosure incident at the hands of a malicious party. The results would be catastrophic.

In this unit you will encounter legal issues several times. You are responsible for checking the details of what laws apply to you, and you will need to get a lawyer to do that. You should be conscious of the law at all times and recognize when you may be crossing into a legal area that you need advice on. Both ethical hackers and hackers follow similar processes as the one outlined here though in less or stricter ways. Hackers are able to write their own rules and use the process however they want without concern or reasons except those that make sense to them. Ethical hackers follow the same type of process as seen here with little modification, but there is something that they have added that hackers do not have: Ethical hackers will not only have permission prior to starting the first phase, but they will also be generating a report that they will present at the end of the process. The ethical hacker will be expected to keep detailed notes about what is procured at each phase for later generation of that report.

When you decide to carry out this process, seek your cl ient's guidance and ask the following questions along with any others that you think are relative. During this phase, your goal is to clearly determine why a pen test and its associated tasks are necessary.

- Why did the client request a pen test?
- What is the function or mission of the organization to be tested?
- What will be the constraints or rules of engagement for the test?
- What data and services will be included as part of the test?
- Who is the data owner?
- What results are expected at the conclusion of the test?
- What will be done with the results when presented?
- What is the budget?
- What are the expected costs?
- What resources will be made available?

- What actions will be allowed as part of the test?
- When will the tests be performed?
- Will insiders be notified?
- Will the test be performed as black or white box?
- What conditions will determine the success of the test?
- Who will be the emergency contacts?
- Pen testing can take several forms. You must decide, along with your client, which tests are appropriate and will yield the desired results. Tests that can be part of a pen test include the following:
- An insider attack is intended to mimic the actions that may be undertaken by internal employees or parties who have authorized access to a system.
- An outsider attack is intended to mimic those actions and attacks that would be undertaken by an outside party.
- A stolen equipment attack is a type of attack where an aggressor steals a piece of equipment and uses it to gain access or extracts the information desired from the equipment itself.
- A social engineering attack is a form of attack where the pen tester targets the users of a system seeking to extract the needed information.

The attack exploits the trust inherent in human nature. Once you discuss each test, determine the suitability of each, and evaluate the potential advantages and side effects, you can finalize the planning and contracts and begin testing.

13.5 Vulnerability Research and Tools

An important part of your toolkit as an ethical hacker will be the information gathered from vulnerability research. This process involves searching for and uncovering vulnerabilities in a system and determining their nature. Additionally, the research seeks to classify each vulnerability as high, medium, or low. You or other security personnel can use this research to keep up to date on the latest weaknesses involving software, hardware, and environments. The benefit of having this information is that an administrator or other personnel could use this information to position defenses. Additionally, the information may show where to place new resources or be used to plan monitoring. Vulnerability research is not the same as ethical hacking in that it passively uncovers security issues whereas the process of ethical hacking actively looks for the vulnerabilities.

13.6 ETHICS AND THE LAW

As an ethical hacker, you need to be aware of the law and how it affects what you will do. Ignorance or lack of an understanding of the law is not only a bad idea, but it can quickly put you out of business or even in prison. In fact, under some situations the crime may be serious enough to get you prosecuted in several jurisdictions in different states, counties, or even countries due to the highly distributed nature of the Internet. Of course, prosecution of a crime can also be difficult considering the web of various legal systems in play. A mix of common, military and civil laws exists, requiring knowledge of a given legal system to be successful in any move toward prosecution.

Depending on when and where you're testing takes place, it is even possible for you to break religious laws. Although you may never encounter this problem, it is something that you should be aware of you never know what type of laws you may break.

Always ensure that you exercise the utmost care and concern to ensure that you observe proper safety and avoid legal issues. When your client has determined their goals along with your input, the contract must be put in place. Remember the following points when developing a contract and establishing guidelines:

Trust The client is placing trust in you to use the proper discretion when performing a test. If you break this trust, it can lead to the questioning of other details such as the results of the test. Legal Implications Breaking a limit placed on a test may be sufficient cause for your client to take legal action against you.

When we work in this area of specialization, it is paramount to know laws of various countries. Since most of the laws have their roots in US Laws, it is mandatory that we go through them.

13.7 HACKING

Hacking is any technical effort to manipulate the normal behavior of network connections and connected computers or systems. A hacker is any person engaged in hacking.

Culture of Hacking

To be accepted as hacker one should have the attitude, behave as though one have the attitude, and belief in that. Some of them can be listed as follows:

- Strong zeal to learn and obtain more knowledge
- Breaking law
- Anonymity
- Stealing confidential information.

Types of Hackers

Hackers can be classified in to the following types based on their depth of knowledge and activities.

a. **White Hats:** White hats are the good guys, the ethical hackers who use their hacking skills for defensive purposes. White-hat hackers are usually security professionals with knowledge of hacking and the hacker toolset and who use this knowledge to locate weaknesses and implement countermeasures.

b. **Black Hats:** Black hats are the bad guys: the malicious hackers or crackers who use their skills for illegal or malicious purposes. They break into or otherwise violate the system integrity of remote systems, with malicious intent. Having gained unauthorized access, black-hat hackers destroy vital data, deny legitimate users service, and just cause problems for their targets. Black-hat hackers and crackers can easily be differentiated from white-hat hackers because their actions are malicious. This is the traditional definition of a hacker and what most people consider a hacker to be.

c. **Gray Hats:** Gray hats are hackers who may work offensively or defensively, depending on the situation. This is the dividing line between hacker and cracker. Grayhat hackers may just be interested in hacking tools and technologies and are not malicious black hats. Gray hats are self-proclaimed ethical hackers, who are interested in hacker tools.

d. **Suicide Hackers:** Individuals who will aim to bring down the critical infrastructure whatever the consequence may be.

e. **Script Kiddies:** In hacker culture a script kiddie or skiddie are unskilled individuals who use scripts or programs developed by others to attack computer systems and networks and deface websites. It is generally assumed that script kiddies are juveniles who lack the ability to write sophisticated hacking programs or exploits on their own, and that their objective is to try to impress their friends or gain credit in computer-enthusiast communities. The term is typically intended as an insult.

f. **Hacktivist:** Detects and sometimes reports or exploits security vulnerabilities as a form of social activitism. A hacktivist is a hacker who utilizes technology to announce a social ideological, religious or political message. In general most hacktivism involve defacement or denial of service attacks. Hacktivits are also known as Neo hackers.

13.8 PHASES OF PENETRATION TESTING

As brought out earlier that a Pen-tester uses the same methodology as a hacker does, we will be using this terminology interchangeably

Foot printing

Now let's circle back around to the first step in the process of ethical hacking i.e. Foot printing. Foot printing, or reconnaissance, is a method of observing and collecting information about a potential target with the intention of finding a way to attack the target. Foot printing looks for information and later analyzes it, looking for weaknesses or potential vulnerabilities. The end result should be a profile of the target that is a rough picture but one that gives enough data to plan the next phase of scanning. When you conduct foot printing- as with all phases and processes described in this unit _you must be quite methodical. A careless or haphazard process of collecting information can waste time when moving forward or, in a worst-case scenario, cause the attack to fail. The smart or careful attacker spends a good amount of time in this phase gathering and confirming information. Foot printing generally entails the following steps to ensure proper information retrieval:

1 Collect information that is publicly available about a target (for example, host and network information).

2 Ascertain the operating system(s) in use in the environment, including web server and web application data where possible.

3 Issue queries such as whois, DNS, network, and organizational queries.

4 Locate existing or potential vulnerabilities or exploits that exist in the current infrastructure that may be conducive to launching later attacks.

Why Perform Foot printing?

Foot printing is about gathering information and formulating a hacking strategy. With proper care you, as the attacking party, may be able to uncover the path of least resistance into an organization. Passively gathering information is by far the easiest and most effective method. If done by a skilled, inventive, and curious party (you!), the amount of information that can be passively gathered is staggering. Expect to obtain information such as:

- Information about an organization's security posture and where potential loopholes may exist. This information will allow for adjustments to the hacking process that make it more productive.
- A database that paints a detailed picture with the maximum amount of information possible about the target.
- A network map using tools such as the Tracert utility to construct a picture of a target's Internet presence or Internet connectivity. Think of the network map as a roadmap leading you to a building; the map gets you there, but you still have to

determine the floor plan of the building.

Goals of the Foot Printing Process

Before you start doing foot printing and learn the techniques, you must set some expectations as to what you are looking for and what you should have in your hands at the end of the process. Keep in mind that the list of information here is not exhaustive, nor should you expect to be able to obtain all the items from every target. The idea is for you to get as much information in this phase as you possibly can, but take your time!

Here's what you should lookfor:

- Network information
- Operating system information
- Organization information, such as CEO and employee information, office information, and contact numbers and e-mail
- Network blocks
- Network services
- Application and web application data and configuration information
- System architecture
- Intrusion detection and prevention systems
- Employee names
- Work experience

Types of Reconnaissance

Process of Reconnaissance can be categorized as Passive and Active Reconnaissance.

Passive Reconnaissance

This involves gathering information about a potential target without the targeted individual‘s or company‘s knowledge. Passive reconnaissance canbe as simple as watching a building to identify what time employees enter the building and when they leave. However, most reconnaissance is done sitting in front of a computer.

When hackers are looking for information on a potential target, they commonly run an Internet search on an individual or company to gain information. This process when used to gather information regarding a TOE is generally called information gathering. Social engineering and dumpster diving are also considered passive information- gathering methods. These two methods will be discussed Sniffing the network is another means of passive reconnaissance and can yield useful information such as IP address ranges, naming conventions, hidden servers or networks, and other available services on the system or network. Sniffing tools are simple and easy to use and yield a great deal of valuable information. These tools are which literally let you see all the data that is transmitted on the network. Many times this includes usernames and passwords and other sensitive data. Examples: Domain name lookup, Whois, NSlookup, Sam Spade. Information that can be gathered during this phase includes:

- IP address ranges
- Namespaces
- Employee information
- Phone numbers
- Facility information
- Job information

Active reconnaissance

This involves probing the network to discover individual hosts, IP addresses, and services on the network. This process involves more risk of detection than passive reconnaissance and is sometimes called rattling the doorknobs. Active reconnaissance can give a hacker an indication of security measures in place (is the front door locked?), but the process also increases the chance of being caught or at least raising suspicion. Many software tools that perform active reconnaissance can be traced back to the computer that is running the tools, thus increasing the chance of detection for the hacker. Both passive and active reconnaissance can lead to the

For example, it‘s usually easy to find the type of web server and the operating discovery of useful information to use in an attack.

system (OS) version number that a company is using. This information may enable a hacker to find vulnerability in that OS version and exploit the vulnerability to gain more access. Foot printing takes advantage of the information that is carelessly exposed or disposed of inadvertently.

Scanning

It focuses on an active engagement of the target with the intention of obtaining more information. Scanning the target network will ultimately locate active hosts that can then be targeted in a later phase. Foot printing helps identify potential targets, but not all may be viable or active hosts. Once scanning determines which hosts are active and what the network looks like, a more refined process can take place.

Scanning involves taking the information discovered during reconnaissance and using it to examine the network.

Scanning is of two types.

i. **Network Scanning**: Network scanning is a procedure for identifying active hosts on a network. Hosts are identified by their individual IP addresses. Network- scanning tools attempt to identify all the live or responding hosts on the network and their corresponding IP addresses.

i. **Vulnerability Scanning:** Vulnerability scanning is the process of proactively identifying the vulnerabilities of computer systems on a network. Generally, a vulnerability scanner first identifies the operating system and version number, including service packs that may be installed. Then, the scanner identifies weaknesses or vulnerabilities in the operating system.

During this phase most commonly used tools are:

- Pings
- Ping sweeps
- Port scans
- Tracert

Hackers are seeking any information that can help them perpetrate an attack on a target, such as the following:

- IP addresses and open/closed ports on live hosts
- Information on the operating system(s) and the system architecture
- Services or processes running on hosts

Scanning is a set of procedures used to identify hosts, ports, and services on a target network. Scanning is considered part of the intelligence-gathering process an attacker uses to gain information about the targeted environment. Expect the information that is gathered during this phase to take a good amount of time to analyze, which will vary depending on how good you are at reading the resulting information. If you have performed your initial reconnaissance well, however, this process should not be complicated. Your knowledge will help you not only target your initial scans better, but also better determine how to decipher certain parts of the results. To successfully negotiate the scanning phase, you need a good understanding of networks, protocols, and operating systems.

Enumeration

The last phase before you attempt to gain access to a system is the enumeration phase. Enumeration is the systematic probing of a target with the goal of obtaining user lists, routing tables, and protocols from the system. This phase represents a significant shift in your process; it is the initial transition from being on the outside looking in to moving to the inside of the system to gather data. Information such as shares, users, groups, applications, protocols, and banners all proved useful in getting to know your target, and this information is now carried forward into the attack phase.

Enumeration occurs after scanning and is the process of gathering and compiling usernames, machine names, network resources, shares, and services. It also refers to actively querying or connecting to a target system to acquire this information. Hackers need to be methodical in their approach to hacking. The following steps are an example of those a hacker might perform in preparation for hacking a target system:

- Extract usernames using enumeration
- Group information
- Passwords
- Hidden shares
- Device
- information

Network layout

- Protocol information
- Server data
- Service information.
- Gather information about the host using null sessions.
- Perform Windows enumeration using the SuperScan tool.
- Acquire the user accounts using the tool GetAcct.
- Perform SNMP port scanning.

The objective of enumeration is to identify a user account or system account for potential use in hacking the target system. It isn‘t necessary to find a system administrator account, because most account privileges can be escalated to allow the account more access than was previously granted.

Gaining Access

Once you have completed the first three phases, you can move into the system-hacking phase. At this point, the process becomes much more complex: You can’t complete the system hacking phase in a single pass. It involves using a methodical approach that includes cracking passwords, escalating privileges, executing applications, hiding files, covering tracks, concealing evidence, and then pushing into a more involved attack. Phase 3 is when the real hacking takes place. Vulnerabilities exposed during the reconnaissance and scanning phase are now exploited to gain access to the target system. The hacking attack can be delivered to the target system via a local area network (LAN), either wired or wireless; local access to a PC; the Internet; or offline. Examples include stack based buffer overflows, denial of service, and session hijacking. Gaining access is known in the hacker world as owning the system because once a system has been hacked, the hacker has control and can use that system as they wish. In order to gain access

phase, you collected a wealth of information, including usernames. These usernames are important now because they give you something on which to focus your attack more closely. You use password cracking to obtain the credentials of a given account with the intention of using the account to gain authorized access to the system under the guise of an authentic user.

Password Cracking Techniques

Popular culture would have us believe that cracking a password is as simple as running some software and tapping a few buttons. The reality is that special techniques are used to recover passwords. For the most part, you can break these techniques into five categories, which you will explore in depth later in this chapter; but let's take a high-level look at them now:

i. **Dictionary Attacks**: An attack of this type takes the form of a password-cracking application that has a dictionary file loaded into it. The dictionary file is a text file that contains a list of known words up to and including the entire dictionary. The application uses this list to test different words in an attempt to recover the password. Systems that use passphrases typically are not vulnerable to this type of attack.

i. **Brute-force Attacks**: In this type of attack, every possible combination of characters is attempted until the correct one is uncovered. According to RSA “Exhaustive key search, or brute-force search, is the basic technique for trying every possible key in turn until the correct key is identified”.

i. **Hybrid Attack**: This form of password attack builds on the dictionary attack, but with additional steps as part of the process. In most cases, this means passwords that are tried during a dictionary attack are modified with the addition and substitution of special characters and numbers, such as P@ssw0rd instead of Password.

iv. **Syllable Attack:** This type of attack is a combination of a brute-force and a dictionary attack. It is useful when the password a user has chosen is not a standard word or phrase.

v. **Rule-based Attack:** This could be considered an advanced attack. It assumes that the user has created a password using information the attacker has some knowledge of ahead of time, such as phrases and digits the user may have a tendency to use. In addition to these techniques, there are four types of attacks. Each offers a different, effective way of obtaining a password from a target:

vi. **Passive Online Attacks:** Attacks in this category are carried out simply by sitting back and listening in this ca~~se~~, via technology, in the form of sniffing tools such as Wire shark, man-in-the-middle attacks, or replay attacks.

v**i**. **Active Online Attacks:** The attacks in this category are more aggressive than passive attacks because the process requires deeper engagement with the targets. Attackers using this approach are targeting a victim with the intention of breaking a password. In cases of weak or poor passwords, active attacks are very effective. Forms of this attack include password guessing, Trojan/spyware/key loggers, hash injection, and phishing.

v **i**. **Offline Attacks:** This type of attack is designed to prey on the weaknesses not of passwords, but of the way they are stored. Because passwords must be stored in some format, an attacker seeks to obtain them where they are stored by exploiting poor security or weaknesses inherent in a system. If these credentials happen to be stored in a plaintext or unencrypted format, the attacker will go after this file and gain the credentials. Forms of this attack include pre-computed hashes, distributed network attacks, and rainbow attacks.

ix. **Nontechnical Attacks**: Also known as non-electronic attacks, these move the process offline into the real world. A characteristic of this attack is that it does not require any technical knowledge and instead relies on theft, deception, and other means. Forms of this attack include shoulder surfing, social engineering, and dumpster diving.

Privilege Escalation

Escalating privileges basically means adding more rights or permissions to a user account. Simply said, escalating privileges makes a regular user account into an administrator account. Generally, administrator accounts have more stringent password requirements, and their passwords are more closely guarded. If it isn‘t possible to find a username and password of an account with administrator privileges, a hacker may choose to use an account with lower privileges. In this case, the hacker must then escalate that account‘s privileges. This is accomplished by first gaining access using a non-administrator user account — typically by gathering the username and password through one of the previously discussed methods —and then increasing the privileges on the account to the level of an administrator. When you obtain a password and gain access to an account, there is still more work to do: privilege escalation. The reality is that the account you’re compromising may end up being a lower -privileged and less defended one. If this is the case, you must perform privilege escalation prior to carrying out the next phase. The goal should be to gain a level where fewer restrictions exist on the account and you have greater access to the system.

Every operating system ships with a number of user accounts and groups already present. In Windows, preconfigured users include the administrator and guest accounts. Because it is easy for an attacker to find information about the accounts that are included with an operating system, you should take care to ensure that such accounts are secured properly, even if they will never be used. An attacker who knows that these accounts exist on a system is more than likely to try to obtain their passwords.

There are two defined types of privilege escalation, each of which approaches the problem of obtaining greater privileges from a different angle:

- **Horizontal Privilege Escalation**: An attacker attempts to take over the rights and privileges of another user who has the same privileges as the current account.
- **Vertical Privilege Escalation**: The attacker gains access to an account and then tries to elevate the privileges of the account. It is also possible to carry out

a vertical escalation by compromising an account and then trying to gain access to a higher-privileged account.

One way to escalate privileges is to identify an account that has the desired access and then change the password. Several tools that offer this ability, including the following:

- Active@ Password Changer
- Trinity Rescue Kit
- ERD Commander
- Windows Recovery Environment (WinRE)
- Password Resetter

Once you gain access to a system and obtain sufficient privileges, it's time to compromise the system and carry out the attack. Which applications are executed at this point is up to the attacker, but they can either be custom-built applications or off-the-shelf software. Once an attacker has gained access to a system and is executing applications on it, they are said to own the system. An attacker executes different applications on a system with specific goals in mind:

- **Backdoors:** Applications of this type are designed to compromise the system in such a way as to allow later access to take place. An attacker can use these backdoors later to attack the system. Backdoors can come in the form of rootkits, Trojans, and similar types. They can even include software in the form of remote access Trojans (RATs).
- **Crackers:** Any software that fits into this category is characterized by the ability to crack code or obtain passwords.
- **Keyloggers:** Keyloggers are hardware or software devices used to gain information entered via the keyboard.
- **Malware:** This is any type of software designed to capture information, alter, or compromise the system.

Pilfering

The objective is to gain access to trusted systems by information gathering. Once Administrator equivalent status has been obtained, attackers typically shift their attention to grabbing as much information as possible that can be leveraged for further system conquests.

Creating backdoors

The objective is to hide the fact of total ownership from the system administrators by erasing all tracks from logs. There are many ways to plant a backdoor on a system, but let's look at one provided via the PsTools suite. This suite includes a mixed bag of utilities designed to ease system administration. Among these tools is PsExec, which is designed to run commands interactively or non-interactively on a remote system. Initially, the tool may seem similar to Telnet or remote desktop, but it does not require installation on the local or remote system in order to work.To work, PsExec need only be copied to a folder on the local system and run with the appropriate switches. Let's take a look at some of the commands you can use with:

- The following command launches an interactive command prompt on a system named \\dbserver: psexec \\dbserver cmd.
- This command executes ipconfig on the remote system with the /all switch, and displays the resulting output locally:psexec \\ dbserver ipconfig /all.
- This command copies the program rootkit.exe to the remote system and executes it interactively: psexec \\dbserver -c rootkit.exe.
- This command copies the program rootkit.exeto the remote system and executes it interactively using the administrator account on the remote system: psexec \\dbserver -u administrator -c rootkit.exe.

As these commands illustrate, it is possible for an attacker to run an application on a remote system quite easily. The next step is for the attacker to decide what to do or what to run on the remote system. Some of the common choices are Trojans, rootkits, and backdoors. Other utilities that may prove helpful in attaching to a system remotely are the following:

- **PDQ Deploy:** This utility is designed to assist with the deployment of software to a single system or to multiple systems across a network. The utility is

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designed to integrate with Active Directory as well as other software packages.

RemoteExec: This utility is designed to work much like PsExec, but it also makes it easy to restart, reboot, and manipulate folders on the system.

- **DameWare:** This is a set of utilities used to remotely administer and control a system. Much like the other utilities on this list, it is readily available and may not be detected by antivirus utilities. DameWare also has the benefit of working across platforms such as Windows, OS X, and Linux

Covering Tracks

Once you have penetrated as system and installed software or run some scripts, then next step is cleaning up after yourself or covering your tracks. The purpose of this phase is to prevent your attack from being easily discovered by using various techniques to hide the red-flags and other signs. During this phase, you seek to eliminate error messages, log files, and other items that may have been altered during the attack process. The objective is to lay trap doors in various parts of the system so as to ensure easy privileged access. Last on the intruders checklist is the creation of future opportunities to return to the compromised system, hopefully disguised from the purview of system administrators.

Disabling Auditing

One of the best ways to prevent you from being discovered is to leave no tracks at all. And one of the best ways to do that is to prevent any tracks from being created or at least minimize the amount of evidence. When you're trying not to leave tracks, a good starting point is altering the way events are logged on the targeted system. Disabling auditing on a system prevents certain events from appearing and therefore slows detection efforts. Remember that auditing is designed to allow for the detection and tracking of selected events on a system. Once auditing is disabled, you have effectively deprived the defender of a great source of information and forced them to seek other methods of detection. In the Windows environment, you can disable auditing with the audit poll command included. Using the NULL session technique you saw during your enumeration activities, you can attach to a system remotely and run the command as follows:

auditpol \\<ip address of target> /clear

You can also perform what amounts to the surgical removal of entries in the Windows Security Log, using tools such as the following:

- Dumpel
- Elsave
- WinZapper
- CCleaner
- Wipe
- MRU-Blaster
- Tracks Eraser Pro
- Clear My History

Data Hiding

There are other ways to hide evidence of an attack, including hiding the files placed on the system such as EXE files, scripts, and other data. Operating systems such as Windows provide many methods you can use to hide files, including file attributes and alternate data streams. File attributes are a feature of operating systems that allow files to be marked as having certain properties, including read-only and hidden. Files can be flagged ashidden, which is a convenient way to hide data and prevent detection through simple means such as directory listings or browsing in Windows Explorer. Hiding files this way does not provide complete protection, however, because more advanced detective techniques can uncover files hidden in this manner.

Alternate Data Streams (ADS)

A very effective method of hiding data on a Windows system is also one of the lesser-known ones: Alternate Data Streams (ADS). This feature is part of the NTFS file system and has been since the 1990s, but since its introduction it has received little recognition; this makes it both useful for an attacker who is knowledgeable and dangerous for a defender who knows little about it. Originally, this feature was designed to ensure interoperability with the Macintosh Hierarchical File System (HFS), but it has since been used for other purposes. ADS provide the ability to fork or hide file data within existing files without altering the appearance or behavior of a file in any way. In fact, when you use ADS, you can hide a file from all traditional detection techniques as well as dir and Windows

Explorer. In practice, the use of ADS is a major security issue because it is nearly a perfect mechanism for hiding data. Once a piece of data is embedded and hidden using ADS, it can lie in wait until the attacker decides to run it later.

The process of creating ADS is simple:

triforce.exe > smoke.doc:triforce.exe

Executing this command hides the file triforce.exe behind the file smoke.doc. At this point, the file is streamed. The next step is to delete the original file that you just hid, triforce.exe. As an attacker, retrieving the file is as simple as this:

Start smoke.doc:triforce.exe

This command has the effect of opening the hidden file and executing it. As a defender, this sounds like bad news, because files hidden this way are impossible to detect using most means. But by using some advanced methods, they can be detected. Some of the tools that can be used to do this include the following:

- SFind—A forensic tool for finding streamed files
- LNS—Used for finding ADS streamed files
- Tripwire—Used to detect changes in files; by nature can detect ADS

An AD is available only on NTFS volumes, although the version of NTFS does not matter. This feature does not work on other file systems.

Denial of Service (DoS)

The objective is to use the readily available exploit code to disable a target. Essentially, a DoS attack disrupts or completely denies service to legitimate users, networks, systems or other resources. The intent of any such attack is usually malicious in nature and often takes little skill because of the requisite tools are readily available.

13.9 LET US SUM-UP

When becoming an ethical hacker, you must develop a rich and diverse skill

set and mind-set. Through a robust and effective combination of technological, administrative, and physical measures, organizations have learned to address their given situation and head off major problems through detection and testing. Technology such as virtual private networks (VPNs), cryptographic protocols, intrusion detection systems (IDSs), intrusion prevention systems (IPSs), access control lists (ACLs), biometrics, smart cards, and other devices have helped security become much stronger, but still have not eliminated the need for vigilance. Administrative countermeasures such as policies, procedures, and other rules have also been strengthened and implemented over the past decade. Physical measures include devices such as cable locks, device locks, alarm systems, and other similar devices. Your new role as an ethical hacker will deal with all of these items, plus many more. As an ethical hacker you must not only know the environment you will be working in, but also how to find weaknesses and address them as needed. You

involved, and you also must know the client's expectations. Understand the value

will also need to understand the laws and ethics of getting the proper contracts in place and not deviating from them. Hacking that is not performed under contract is considered illegal and is treated as such. By its very nature, hacking activities can easily cross state and national borders into multiple legal jurisdictions. Breaking outside the scope of a contract can expose you to legal harm and become a career-ending blunder.

13.10 FURTHER READINGS

1. Study Material "Post-Graduate Diploma in Cyber Security Information System (PGDCS-06), Certificate in e- Governance and Cyber Security", Uttrakhand Open University, Haldwani, made available under a Creative Commons

Attribution Share-Alike 4.0 Licence (International),

2. http://creativecommons.org/licenses/by-sa/4.0/
3. http://www.guru99.com/what-is-hacking-an-introduction.html

http://bedaone.blogspot.in/p/chapter-1-introduction-to-ethical.html

13.11 ASSIGNMENT

1. Explain the various components of CIA Triad. Explain each of them.
2. What are the various types of hackers? Explain each of them briefly?
3. Enumerate and explain various phases involved in penetration testing. Briefly explain each of them.

Unit 14: Computer Forensics 14

Unit Structure

14.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

Define Computer Forensic

Know the history and evolution of Computer forensics Describe

various types of cyber crimes

Understand benefits of computer forensics Know

about forensics readiness Implement forensics

readiness plan

14.2 INTRODUCTION

Computer forensics is the art of recovering and analyzing the contents found on Computer devices such as desktops, notebooks, tablets, smart phones, etc. It was little-known a few years ago. However, with the growing incidence of cyber-crime adoption of computer devices, this branch of forensics has gained momentum in the recent years, augmenting what was conventionally limited to the recovery and analysis of biological and chemical evidence during criminal investigations. This has been used an important technology used many investigating agencies for detection of cyber-criminal activities and evidences. In this unit we will discuss the evolution and of computer forensics technology, its benefits and applications.

14.3 DEFINITION OF COMPUTER FORENSICS

Computer forensics is the application of investigation and analysis techniques to gather and preserve evidence from a particular computing device in a way that is suitable for presentation in a court of law. The goal of computer forensics is to perform a structured investigation while maintaining a documented chain of evidence to find out exactly what happened on a computing device and who was responsible for it. It is the use of specialized techniques for recovery, authentication and analysis of electronic data when a case involves issues relating to reconstruction of computer usage, examination of residual data, and authentication of data by technical analysis or explanation of technical features of data and computer usage. Computer forensics requires specialized expertise that goes beyond normal data collection and preservation techniques available to end- users or system support personnel. Similar to all forms of forensic science, computer forensics is comprised of the application of the law to computer science. Computer forensics deals with the preservation, identification, extraction, and documentation of computer evidence. Like many other forensic sciences, computer forensics involves the use of sophisticated technological tools and procedures that must be followed to guarantee the accuracy of the preservation of evidence and the accuracy of results concerning computer evidence processing. So Computer Forensic is the use of specialized techniques for recovery, authentication, and analysis of computer data, typically of data which may have been deleted or destroyed.

14.4 CYBER CRIME

Computer crime or cybercrime is any crime that involves a computer and a network. The computer may have been used in the commission of a crime, or it may be the target. Dr.Debarati Halder and Dr. K. Jaishankar define Cybercrimes as: "Offences that are committed against individuals or groups of individuals with a criminal motive to intentionally harm the reputation of the victim or cause physical or mental harm, or loss, to the victim directly or indirectly, using modern telecommunication networks such as Internet (Chat rooms, emails, notice boards and groups) and mobile phones (SMS/MMS)". Such crimes may threaten a nation's security and financial health. Issues surrounding these types of crimes have become high-profile, particularly those surrounding hacking, copyright infringement, child pornography, and child grooming. There are also problems of privacy when confidential information is intercepted or disclosed, lawfully or otherwise.

Internationally, both governmental and non-state actors engage in cybercrimes, including espionage, financial theft, and other cross-border crimes. Activity crossing international borders and involving the interests of at least one nation state is sometimes referred to as cyber warfare.

Computer forensics is traditionally associated with criminal investigations and, as you would expect, most types of investigation center on some form of computer crime. This sort of crime can take two forms. (a) Computer based crime and (b) Computer facilitated crimes.

Computer Based Crime

This is criminal activity that is conducted purely on computers, for example cyber- bullying or spam. As well as crimes newly defined by the computing age it also includes traditional crime conducted purely on computers (for example, child pornography).

Computer Facilitated Crime

Crimes conducted in the "real world" but facilitated by the use of computers. A classic example of this sort of crime is fraud: computers are commonly used to communicate with other fraudsters, to record/plan activities or to create fraudulent documents.

Not all Computer forensics investigations focus on criminal behavior; sometimes the techniques are used in corporate (or private) settings to recover lost information or to rebuild the activities of employees.

14.5 EVOLUTION OF COMPUTER FORENSICS

It is difficult to pinpoint the first "computer forensic" examination or the beginning of the field for that matter. But most experts agree that the field of computer forensics began to evolve more than 30 years ago. The field began in the United States, in large part, when law enforcement and military investigators started seeing criminals get technical. Government personnel charged with protecting important, confidential, and certainly secret information conducted forensic examinations in response to potential security breaches to not only investigate the particular breach, but to learn how to prevent future potential breaches. Ultimately, the fields of information security, which focuses on protecting information and assets, and computer forensics, which focuses on the response to hi-tech offenses, started to intertwine.

Over the next decades, and up to today, the field is evolving. Both Government and private organizations and corporations have followed suit employing internal information security and computer forensic professionals or contracting such professionals or firms on an as- needed basis. Significantly, the private legal industry has more recently seen the need for computer forensic examinations in civil legal disputes, causing an explosion in the e- discovery field.

14.6 STAGES OF COMPUTER FORENSICS PROCESS

The overall computer forensics process is sometimes viewed as comprising four stages:

1. **Acquire**: Identifying and Preserving
2. **Analyze**: Technical Analysis
3. **Evaluate:** What the Lawyers Do
4. **Present:** Present Computer evidence in a manner that is legally acceptable in any legal proceedings.

14.7 BENEFITS OF COMPUTER FORENSICS

With the ever increasing rate of cyber-crimes, from phishing to hacking and stealing of personal information not only confined to a particular country but the globally at large, there is a need for forensic experts to be available in public and

private organizations. To be able to handle this, it's vital for network administrator and security staff of networked organizations to have this course in practice making sure that they have the laws pertaining to this on their fingertips. This would ensure that should need for the service avail itself, then they would come in and rescue the situation.

The survival and integrity of any given network infrastructure of any company or organization strongly depends on the application of computer forensics. They should be taken as the main element of computer and network security. It would be great aspects of this field should the company's network be under attack and the benefit for a company if it has knowledge of all the technical and legal intruder caught in the act, then an understanding about computer forensics will be of help in provision of evidence and prosecution of the case in the court of law.

New laws aimed at the protection of customer's data are continuously being developed. Should they lose data, then naturally the liability goes to the company. Such cases, if they occur will automatically result in the company or organization being brought to the court of law for failure to protect personal data, this can turn out to be very expensive. But through the application of forensic science, huge chunks of money can be saved by the firms concerned. A lot of money is lately being spent on network and computer security. Software for vulnerability assessment and intrusion detection has passed the billion dollar mark, this is according to experts. It simply means that there is a necessity in investment in either employing an expert in computer forensic in the firms, or having part of their staff trained into this venture so as to help in detection of such cases should they arise.

14.8 USES OF COMPUTER FORENSICS

There are few areas of crime or dispute where computer forensics cannot be applied. Law enforcement agencies have been among the earliest and heaviest users of computer forensics and consequently have often been at the forefront of developments in the field.

Computers may constitute a 'scene of a crime', for example with hacking or denial of service attacks or they may hold evidence in the form of emails, internet history, documents or other files relevant to crimes such as murder, kidnap, fraud and drug trafficking.

It is not just the content of emails, documents and other files which may be of interest to investigators but also the 'metadata' associated with those files. A computer forensic examination may reveal when a document first appeared on a computer, when it was last edited, when it was last saved or printed and which user carried out these actions.

More recently, commercial organizations have used computer forensics to their benefit in a variety of cases such as:

- Intellectual Property theft

  Industrial espionage

  Employment disputes Fraud

  investigations Forgeries
- Bankruptcy investigations
- Inappropriate email and internet use in the work place
- Regulatory compliance

14.9 OBJECTIVES OF COMPUTER FORENSICS

We all will agree to the fact that we are depending more on more on Information & Communication Technology (ICT) tools and internet for digital services to an extent that today we talk online using chat application, we depend on email to communicate with relatives and office, we stay in touch with our friends and update status using social engineering platforms like Facebook, etc., we work online by staying connected to our office/ client using internet, we shop online, we teach online, we learn online, we submit our bill online today. Our dependency on Computer and Internet have increased so much that we are online most of the time. Therefore, there is an increased need of protecting our information from being misused by following Information security guidelines. However, if the security of our computer is compromised, computer forensics comes handy for post- incident investigation.

The objectives of Computer forensics are to provide guidelines for:

- Following the first responder procedure and access the victim's computer after incident.

  Designing procedures at a suspected crime scene to ensure that the digital evidence obtained is not corrupted.

  Data acquisition and duplication.

  Recovering deleted files and deleted partitions from digital media to extract the evidence and validate them.

  Provide guidelines for analyzing digital media to preserve evidence, analyzing logs and deriving conclusions, investigate network traffics and logs to correlate events, investigate wireless and web attacks, tracking emails and investigate email crimes.

Producing computer forensic report which provides complete report on computer forensic investigation process.

- Preserving the evidence by following the chain of custody.
- Employing the rigorous procedures necessary to have forensic results stand up to scrutiny in a court of law.
- Presenting Computer forensics results in a court of law as an expert witness.

14.10 ROLE OF FORENSICS INVESTIGATOR

- Following are some of the important duties of a forensic investigator:
- Confirms or dispels whether a resource/network is compromised.
- Determine extent of damage due to intrusion.
- Answer the questions: Who, What, When, Where, How and Why.
- Gathering data in a forensically sound manner.
- Handle and analyze evidence.
- Prepare the report.

Present admissible evidence in court.

14.11 FORENSICS READINESS

There are several reasons for this field's growth; the most significant being that computers are everywhere. You would be hard pressed to find a household today without at least one computer. And it is not just computers that computer forensic examiners get involved with. Computer forensic examiners analyze all types of technical devices. Look around you while you walk down the street people are on their cell phones, using iPods, PDAs, and text messaging. Computer forensic examiners analyze all of these electronic devices! Cyber forensics is a rapidly changing field. There are new technologies coming out daily that are becoming smaller, but storing more and more data. This leads to why cyber forensics is import. In computer related crimes, such identity fraud, it is becoming easier to hide data. With the proper analysis of digital evidence, better security can be made to protect computer users, but also catch those who are committing the crimes. Organizations have now realized the importance of being prepared to combat cyber criminals with their forensic readiness plan ready.

Forensics Readiness

Forensic readiness is the ability of an organization to maximize its potential to use digital evidence whilst minimizing the costs of an investigation. In a business context there is the opportunity to actively collect potential evidence in the form of log files, emails, back-up disks, portable computers, network traffic records, and telephone records, amongst others. This evidence may be collected in advance of a crime or dispute, and may be used to the benefit of the collecting organization if it becomes involved in a formal dispute or legal process.

Goals of Forensic Readiness

Some of the important goals of forensics readiness are:

- To gather admissible evidence legally and without interfering with business processes;
- To gather evidence targeting the potential crimes and disputes that may adversely impact an organization;
- To allow an investigation to proceed at a cost in proportion to the incident; To minimize interruption to the business from any investigation; and
- To ensure that evidence makes a positive impact on the outcome of any legal action.

Benefits of Forensic Readiness

Forensic readiness can offer an organization the following benefits:

- Evidence can be gathered to act in an organization's defense if subject to a lawsuit;
- Comprehensive evidence gathering can be used as a deterrent to the insider threat (throwing away potential evidence is simply helping to cover the tracks of a cyber- criminal);
- In the event of a major incident, an efficient and rapid investigation can be conducted and actions taken with minimal disruption to the business;
- A systematic approach to evidence storage can significantly reduce the costs and time of an internal investigation;
- A structured approach to evidence storage can reduce the costs of any court-ordered disclosure or regulatory or legal need to disclose data (e.g. in response to a request under data protection legislation);
- Forensic readiness can extend the scope of information security to the wider threat from cyber-crime, such as intellectual property protection, fraud, extortion etc.;
- It demonstrates due diligence and good corporate governance of the company's information assets;
- It can demonstrate that regulatory requirements have been met;
- It can improve and facilitate the interface to law enforcement if involved;
- It can improve the prospects for a successful legal action; It can provide evidence

to resolve a commercial dispute;

- It can support employee sanctions based on digital evidence

Steps for Forensic Readiness Planning

The following ten steps describe the key activities in forensic readiness planning:

1. Define the business scenarios that require digital evidence;
2. Identify available sources and different types of potential evidence;
3. Determine the evidence collection requirement;
4. Establish a capability for securely gathering legally admissible evidence to meet the requirement;
5. Establish a policy for secure storage and handling of potential evidence;
6. Ensure monitoring is targeted to detect and deter major incidents;
7. Specify circumstances when escalation to a full formal investigation (which may use the digital evidence) should be launched;
8. Train staff in incident awareness, so that all those involved understand their role in the digital evidence process and the legal sensitivities of evidence;
9. Document an evidence-based case describing the incident and its impact.
10. Ensure legal review to facilitate action in response to the incident. Let us now discuss in brief each of the ten steps.

1. **Define the business scenarios that require digital evidence:** The first step in forensic readiness is to define the purpose of an evidence collection capability. The rationale is to look at the risk and potential impact on the business from the various types of crimes and disputes. What is the threat to the business and what parts are vulnerable? This is, in effect, a risk assessment, and is performed at the business level.

The aim is to understand the business scenarios where digital evidence may be required and may benefit the organization the event that it is required. In general the areas where digital evidence can be applied include:

- Reducing the impact from computer-related crime;
- Dealing effectively with court orders to release data;
- Demonstrating compliance with regulatory or legal constraints;
- Producing evidence to support company disciplinary issues;
- Supporting contractual and commercial agreements; and
- Proving the impact of a crime or dispute.

In assessing these scenarios, this step provides an indication of the likely benefits of being able to use digital evidence. If the identified risks, and the potential benefits of forensic readiness, suggest a good return on investment is achievable, then an organization needs to consider what evidence to gather for the various risk scenarios.

2. **Identify available sources and different types of potential evidence:** The second step in forensic readiness is for an organization to know what sources of potential evidence are present on, or could be generated by, their systems and to determine what currently happens to the potential evidence data. Computer logs can originate from many sources. The purpose of this step is to scope what evidence may be available from across the range of systems and applications in use. Some basic questions need to be asked about possible evidence sources to include.

- Where is data generated?
- What format is it in?
- How long is it stored for?
- How is it currently controlled, secured and managed?
- Who has access to the data?
- How much is produced?
- Is it archived? If so where and for how long?
- How much is reviewed?
- What additional evidence sources could be enabled?
- Who is responsible for this data?
- Who is the formal owner of the data?
- How could it be made available to an investigation?
- What business processes does it relate to?
- Does it contain personal information?

Email is an obvious example of a potential rich source of evidence that needs careful consideration in terms of storage, archiving & auditing and retrieval. But this is not the only means of communication used over the internet, there is also instant messaging, web-based email that bypasses corporate email servers, chat- rooms and newsgroups, even voice over the internet. Each of these may need preserving and archiving. The range of possible evidence sources includes:

- Equipment such as routers, firewalls, servers, clients, portables, embedded devices etc.
- Application software such as accounting packages etc for evidence of fraud, ERP packages for employee records and activities (e.g. in case of identity theft), system and management files etc;
- Monitoring software such as intrusion detection software, packet sniffers,

keyboard loggers, content checkers, etc.;

- General logs such as access logs, printer logs, web traffic, internal network logs, internet traffic, database transactions, commercial transactions etc;
- Other sources such as: CCTV, door access records, phone logs, pabx data etc;
- Back-ups and archives.

3. **Determine the Evidence Collection Requirement:** It is now possible to decide which of the possible evidence sources identified in step 2 can help deal with the crimes and disputes identified in step 1 and whether further ways to gather evidence are required. This is the evidence collection requirement. The purpose of this step is to produce an evidence requirement statement so that those responsible for managing the business risk can communicate with those running and monitoring information systems through an agreed requirement for evidence. One of the key benefits of this step is the bringing together of IT with the needs of corporate security. IT audit logs have been traditionally configured by systems administrators independently of corporate policy and where such a policy exists there is often a significant gap between organizational security objectives and actually the bottom-up auditing implemented.

The evidence collection requirement is moderated by a cost benefit analysis of how much the required evidence will cost to collect and what benefit it provides (see above). The critical question for successful forensic readiness is what can be performed cost effectively. By considering these issues in advance and choosing storage options, auditing tools, investigation tools, and appropriate procedures it is possible for an organization to reduce the costs of future forensic investigations.

4. ***Establish a capability for securely gathering legally admissible evidence*** **to meet the requirement**

At this point the organization knows the totality of evidence available and has decided which of it can be collected to address the company risks and within a planned budget. With the evidence requirement understood, the next step is to ensure that it is collected from the relevant sources and that it is preserved as an authentic record. At this stage legal advice is required to ensure that the evidence can be gathered legally and the evidence requirement can be met in the manner planned. For example, does it

monitoring personal emails, the use of personal data, or 'fishing trips1' on

involve employee activities? In some countries, some or all of these activities may be illegal. Relevant laws, in the areas of data protection, privacy and human rights, will inevitably constrain what can actually be gathered. Some of the guidelines are:

- Monitoring should be targeted at specific problems.

- It should only be gathered for defined purposes and nothing more;
- Staff should be told what monitoring is happening except in exceptional circumstances.

Physical security of data such as back-up files or on central log servers is important from the data protection point of view, and also for secure evidence storage. As well as preventative measures such as secure rooms and swipe card access it is also prudent to have records of who has access to the general location and who has access to the actual machines containing evidence. Any evidence or paperwork associated with a specific investigation should be given added security by, for example, storing in a safe. Additional security of logs can also be achieved through the use of WORM storage media.

5. Establish a policy for secure storage and handling of potential evidence: The objective of this step is to secure the evidence for the longer term once it has been collected and to facilitate its retrieval if required. It concerns the long-term or off-line storage of information that might be required for evidence at a later date. A policy for secure storage and handling of potential evidence comprises security measures to ensure the authenticity of the data and also procedures to demonstrate that the evidence integrity is preserved whenever it is used, moved or combined with new evidence. In the parlance of investigators this is known as continuity of evidence (in the UK) and chain of custody (in the US). The continuity of evidence also includes records of who held, and who had access to, the evidence (for example from swipe control door logs). A significant contribution to the legal collection of evidence is given by the code of practice on the legal admissibility and weight of information stored electronically, published by the British Standards Institution. This document originated from a perceived need for evidence collection in the paperless office. The problem it addressed is if all paper documents are scanned, can the paper sources be thrown away without loss of evidential usability? The current edition broadens the scope to all information management systems, Ad hoc opportunistic searches, without justification, for potentially incriminating activities or communication such as those where information is transmitted over networks such as email systems for example. It points out that methods of storage, hardware reliability, operation and access control, and even the programs and source code, may be investigated in order to determine admissibility. A closely related international standard is being developed as ISO 15801. The required output of this step is a secure evidence policy. It should document the security measures, the legal advice and the procedural measures used to ensure the evidence requirement is met. Upon this document rests the likely admissibility and weight of any evidence gathered.

6. Ensure monitoring and auditing is targeted to detect and deter major incidents: In addition to gathering evidence for later use in court, evidence sources can be monitored to detect threatened incidents in a timely manner. This is directly analogous to Intrusion Detection Systems (IDS), extended beyond network attack to a wide range of behaviors that may have implications for the organization. It is all very well collecting the evidence.

This step is about making sure it can be used in the process of detection. By monitoring sources of evidence we can look for the triggers that mean something suspicious may be happening. The critical question in this step is when should an organization be suspicious? A suspicious event has to be related to business risk and not couched in technical terms.

Thus the onus is on managers to explain to those monitoring the data what they want to prevent and thus the sort of behavior that IDS might be used to detect for example. This should be captured in what triggers should provoke suspicion, who to report the suspicion to, whether heightened monitoring is required, and whether any additional security measures should be taken as a precaution. Each type of monitoring should produce a proportion of false positives. The sensitivity of triggers can be varied as long as the overall false positive rate does not become so high that suspicious events cannot be properly reviewed. Varying triggers also guards against the risk from someone who knows what the threshold on a particular event is and makes sure any events or transactions he wishes to hide are beneath it.

7. Specify circumstances when escalation to a full formal investigation (which may use digital evidence) is required: Some suspicious events can be system generated, such as by the rule-base of an IDS, or the keywords of a content checker, and some will be triggered by human watchfulness. Each suspicious event found in step 6 needs to be reviewed. Either an event will require escalation if it is clearly serious enough, or it will require enhanced monitoring or other precautionary measures, or it is a false positive. The purpose of this step is to decide how to react to the suspicious event. The decision as to whether to escalate the situation to management will depend on any indications that a major business impact is likely or that a full investigation may be required where digital evidence may be needed. The decision criteria should be captured in an escalation policy that makes it clear when a suspicious event becomes a confirmed incident. At this point an investigation should be launched and policy should indicate who the points of contact are (potentially available on a 24x7 basis) and who else needs to be involved. As with steps 3 and 6, the network and IT security managers and the non-position. What level of certainty or level of risk is appropriate for an escalation? What strength of case is required to proceed? A preliminary business impact assessment should be made based on whether any of the following are present:

- Evidence of a reportable crime
- Evidence of internal fraud, theft, other loss

- Estimate of possible damages (a threshold may induce an escalation trigger) Potential
- for embarrassment, reputation loss
- Any immediate impact on customers, partners or profitability
- Recovery plans have been enacted or are required; and
- The incident is reportable under a compliance regime.

8. ***Train staff, so that all those involved understand their role in the digital*** **evidence process and the legal sensitivities of evidence**

A wide range of staff may become involved in a computer security incident. The aim of this step is to ensure that appropriate training is developed to prepare staff for the various roles they may play before, during and after an incident. It is also necessary to ensure that staff is competent to perform any roles related to the handling and preservation of evidence. There will be some issues relevant to all staff if they become involved in an incident. The following groups will require more specialized awareness training for example:

- The investigating team;
- Corporate HR department;
- Corporate PR department (to manage any public information about the incident);
- Owners' of business processes or data;
- Line management, profit center managers;
- Corporate security;
- System administrators;
- IT management;
- Legal advisers; and
- Senior management (potentially up to board level).

At all times those involved should act according to ‘need to know’ principles. They should be particularly aware whether any staff, such as ‘whistle blowers’ and investigators, need to be protected from possible retaliation by keeping their names and their involvement confidential. Training may also be required to understand the relationships and necessary communications with external organizations that may become involved.

9. Present an evidence-based case describing the incident and its impact: The aim of an investigation is not just to find a culprit or repair any damage. An investigation has to provide answers to questions and demonstrate why those answers are credible. The questions go along the lines of who, what, why, when, where and how. Credibility is provided by evidence and a logical argument. The purpose of this step is to produce a policy that describes how an evidence-based case should be assembled. A case file may be required for a number of reasons:

- To provide a basis for interaction with legal advisers and law enforcement;
- To support a report to a regulatory body;
- To support an insurance claim;
- To justify disciplinary action;
- To provide feedback on how such an incident can be avoided in future;
- To provide a record in case of a similar event in the future (supports the corporate memory so that even if there are changes in personnel it will still be possible to understand what has happened);
- To provide further evidence if required in the future, for example if no action is deemed necessary at this point but further developments occur.

10. Ensure legal review to facilitate action in response to the incident: At certain points during the collating of the cyber-crime case file it will be necessary to review the case from a legal standpoint and get legal advice on any follow-up actions. Legal advisers should be able to advice on the strength of the case and suggest whether additional measures should be taken; for example, if the evidence is weak is it necessary to catch an internal suspect red handed by monitoring their activity and seizing their PC? Any progression to a formal action will need to be justified, cost- effective and assessed as likely to end in the though companie's favour the actual decision of how to proceed will clearly be post-incident, considerable legal preparation is required in readiness. Legal advisors should be trained and experienced in the appropriate cyber laws and evidence admissibility issues. They need to be prepared to act on an incident, pursuant to the digital evidence that has been gathered and the case presented in step 9. Legal advice should also recognize that the legal issues may span legal jurisdictions e.g. states in the US, member states in the EU. Advice from legal advisers will include:

- Any liabilities from the incident and how they can be managed;
- Finding and prosecuting/punishing (internal versus external culprits);
- Legal and regulatory constraints on what action can be taken;
- Reputation protection and PR issues;
- When/if to advice partners, customers and investors;
- How to deal with employees;
- Resolving commercial disputes; and
- Any additional measures required.

14.12 ISSUES FACING COMPUTER FORENSICS

The issues facing computer forensics examiners can be broken down into three broad categories: technical, legal and administrative

Technical Issues

a. **Encryption** Encrypted data can be impossible to view without the correct key or password. Examiners should consider that the key or password may be stored elsewhere on the computer or on another computer which the suspect has had access to. It could also reside in the volatile memory of a computer (known as RAM) which is usually lost on computer shut-down; another reason to consider using live acquisition techniques, as outlined above.

b. **Increasing storage space** Storage media hold ever greater amounts of data, which for the examiner means that their analysis computers need to have sufficient processing power and available storage capacity to efficiently deal with searching and analyzing large amounts of data.

c. **New technologies** Computing is a continually evolving field, with new hardware, software and operating systems emerging constantly. No single computer forensic examiner can be an expert on all areas, though they may frequently be expected to analyze something which they haven't previously encounter. In order to deal with this situation, the examiner should be prepared and able to test and experiment with the behavior of new technologies. Networking and sharing knowledge with other computer forensic examiners is very useful in this respect as it's likely someone has already come across the same issue.

d. **Anti-forensics** Anti-forensics is the practice of attempting to thwart computer forensic analysis. This may include encryption, the over- writing of data to make it unrecoverable, the modification of files' metadata and file obfuscation (disguising files). As with encryption, the evidence that such methods have been used may be stored elsewhere on the computer or on another computer which the suspect has had access to. In our experience, it is very rare to see anti-forensics tools used correctly and frequently enough to totally obscure either their presence or the presence of the evidence that they were used to hide.

Legal Issues

Legal issues may confuse or distract from a computer examiner's findings. An Example herr would be the 'Trojan Defence'. A Trojan is a piece of computer code disguised as something benign but which carries a hidden and malicious purpose. A lawyer may be able to argue that actions on a computer were not carried out by a user but were automated by a Trojan without the user's knowledge; such a Trojan Defense has been successfully used even when no trace of a Trojan or other malicious code was found on the suspect's computer. In such cases, competent opposing lawyer, supplied with evidence from a competent computer forensic analyst, should be able to dismiss such an argument. A good examiner will have identified and addressed possible arguments from the "opposition" while carrying out the analysis and in writing their report.

Administrative Issues

a. **Accepted standards** There–are a plethora of standards and guidelines in computer forensics, few of which appear to be universally accepted. The reasons for this include: standard-setting bodies being tied to particular legislations; standards being aimed either at law enforcement or commercial forensics but not at both; the authors of such standards not being accepted by their peers; or high joining fees for professional bodies dissuading practitioners from participating.

b. **Fit to practice** In–many jurisdictions there is no qualifying body to check the competence and integrity of computer forensics professionals. In such cases anyone may present themselves as a computer forensic expert, which may result in computer forensic examinations of questionable quality and a negative view of the profession as a whole.

14.13 LET US SUM-UP

Computer forensics is the practice of collecting, analyzing and reporting on Computer data in a way that is legally admissible. Computer forensics requires specialized expertise that goes beyond normal data collection and preservation techniques available to end-users or system support personnel. Computer crime, or cybercrime, is any crime that involves a computer and a network. Activity crossing international borders and involving the interests of at least one nation state is sometimes referred to as cyber warfare.

The survival and integrity of any given network infrastructure of any company or organization strongly depends on the application of computer forensics. Forensic readiness is the ability of an organization to maximize its potential to use digital evidence whilst minimizing the costs of an investigation.

Monitoring should be targeted at specific problems. Physical security of data such as back-up files or on central log servers is important from the data protection point of view, and also for secure evidence storage.

A policy for secure storage and handling of potential evidence comprises security measures to ensure the authenticity of the data and also proceduresto demonstrate that the evidence integrity is preserved whenever it is used, moved or combined with new evidence. The aim of an forensic investigation is not just to find a culprit or repair any damage. An investigation has to provide answers to questions and demonstrate why those answers are credible. At certain points during the collating of the cyber- crime case file it will be necessary to review the case from a legal standpoint and get legal advice on any follow-up actions.

14.14 FURTHER READINGS

1. Digital Forensics, (PGDCS-07), Study Materials of Uttarakhand Open University, Haldwani, for Post-Graduate Diploma in Cyber Security,
2. Robert Rowlingson Ph.D , qinetiq Ltd., A Ten Step Process for Forensic Readiness, International Journal of Digital Evidence, Winter 2004, Volume 2, Issue 3.
3. ICT and Education, Fundamental of ICT in education, By Dr. T. Manichander.
4. http://einvestigations.com/computer-forensics/expert-witness/
5. http://searchsecurity.techtarget.com/definition/computer-forensics
6. https://www.linkedin.com/pulse/computer-forensic-egharevba-etinosa- aca- acfe-amscce-clrmp-ifrs-cert.
7. https://forensiccontrol.com/resources/beginners-guide-computer- forensics.

14.15 ASSIGNMENT

1. Name the four stages of computer forensic process.
2. Outline the uses of computer forensics.
3. Mention the objectives of computer forensics?
4. Write the role of a forensics investigator?
5. What are the benefits of forensic readiness?
6. Explain various steps involved in forensic readiness planning.