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INFORMATION TECHNOLOGY

CIW
Foundations

Version 3.0.0

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Abstract:

This study guide will help you prepare for Prosoft exam 1D0-410, CIW Foundations exam. Exam topics include basic knowledge of Internet Technologies, Web authoring using HTML, and Network infrastructure.

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Contents:

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Internet Fundamentals

Overview and History of the Internet

The Internet is a gigantic, decentralized network of computer networks, connecting millions of people in the world electronically.

ARPANET

- Advanced Research Project Agency Network
- Created in 1968 by the Department of Defense (DOD)
- ARPANET's design had multiple hosts with multiple connections (no hub)
- Decentralized control meant the network could operate even if a number of hosts were lost
- Created to reduce the chances of a total network failure during the cold war.
- Originally designed to operate on a UNIX platform.

NSFNet

- In the 1980s, the DOD assigned the ARPA project to the National Science Foundation (NSF)
- NSF added more supercomputers and more access to networks
- Expanded the range of sites: businesses, universities, government, military institutions and more.

WWW

- World Wide Web
- Created in March 1989 by Tim Berners-Lee, at *Conseil Européen pour la Recherche Nucléaire* (CERN), European Laboratory for Particle Physics. His hypertext system was proposed to better share information between scientists.
- W3C (World Wide Web Consortium, founded in 1994) defines common standards, specifications, and interoperability for the web.
- Information is presented in many formats: sound, graphics, video, etc.
- Provides a visual layout for hypertext links, browser software, code structure, etc.
- Web pages are written in HTML (HyperText Markup Language), with interactive objects using Java, JavaScript, VBScript, applets, etc.
- A hypertext communication system.

How the Internet Works

TCP/IP

- Transmission Control Protocol/Internet Protocol
- "Low-level" software that transmits information from one computer to the destination computer.
- Information being transmitted is broken into packets, and each packet is then sent separately. A packet is data that has been processed by the protocol so it can be sent across a network. If a packet is lost in the process of transmission, only the missing packet needs to be retransmitted, not the entire transmission.
- The Internet is decentralized, so if one connection on the route is lost, the information can simply be re-routed elsewhere. IP recognizes the damaged route, and goes around it. This flexibility assures an accurate and steady flow of information regardless of any particular connection.

See also sections under Networking Fundamentals on

TCP/IP as a Network Protocol
TCP/IP Architecture
TCP/IP Configuration

IP Addresses

- Internet Protocol Addresses
- The Internet's data transmission standard, whereby every computer on the Internet has its own IP address, which allows data packets to be delivered to a specific computer (like a mailman delivering mail to your door).
- A flexible, expandable 32-bit (at present, 128-bit in future) addressing system that allows for billions of current and future users.
- Also called "dotted quad" or the "dot address"(the numeric IP address consists of four sets of numbers (0-255) separated by a dot. e.g. 172.10.199.20.
- With the expansion of the Internet with e-commerce, there is currently a shortage of IP addresses. To offset the demand for IP addresses, subnetting and supernetting are often used.

See also: Internet Addresses under Networking Fundamentals

Clients and Servers on the Internet

Client/Server systems are distributed computing system where tasks are divided between the server and the client. Programs run on many desktops at a time and interact with the server as the common, central computer. Businesses transmitting large amounts of data across the Internet limit available bandwidth (the amount of information or traffic that can a network can carry at a time).

Email Clients and Servers

- Internet email operates within an email client program.
- Users only need to be connected to the email server to send and receive email, not while reading or writing emails.
- The server does not have to perform complex error checking because messages are formatted in the email standard (in the client program).

Connecting to the Internet

To support an Internet client, you need:
- Computing device – PC, laptop, WebTV, Internet phone, handheld device
- Operating System - Windows 9x/NT/2000, Linux, UNIX
- TCP/IP – Internet Protocol
- Client software – Internet browser, email, news group programs (most with a GUI)
- Internet connection – dial-up (modem, ISDN) or direct (cable, DSL) connection to an Internet Service Provider (ISP)
- Internet addresses – web addresses, email addresses, server addresses

Dial-up Connection

- Most dial-up connections use a phone line and a modem (modulate/demodulate)
- Use either Serial Line Internet Protocol (SLIP) or Point-to-Point (PPP) connections. PPP is the more robust choice.
- WebTV usually uses an analog modem and phone line to connect to the Internet.
- ISDN - Integrated Services Digital Network (also called a "terminal adapter") - requires a digital phone line.

Common Dial-up Connection Speeds

128 Kbps	Two 64 Kbps ISDN channels (using Multilink PPP) are combined to create faster connection speeds
64 Kbps	Single ISDN channel, digital phone line required
56 Kbps	Fastest dial-up speed using analog modem
33.6 Kbps	Moderately fast
28.8 Kbps	Standard speed until the mid- to late 1990s
14.4 Kbps	Slow, may not support some multimedia features (like streaming video)

Note: Kbps not KBps: kilobits per second, not kilobytes per second.

Direct Connection

- Internet connection is always on
- LAN connection, Cable TV, DSL (Digital Subscriber Line – replacing ISDN)
- Requires a Network Interface Card (NIC) with correct connectors (RJ-45, BNC)

- More expensive than dial-up connections
- Cable modems share the cable network in their neighborhood (speed determined by number of users at that time)
- DSL speed depends on distance between the DSL line and the phone company's main distribution frame.
- Both cable and DSL modems commonly drop below 512 Kbps.

Common Direct Connections

T3	44.736 Mbps. North American ISPs most often use to connect to the infrastructure of the Internet.
E3	34.368 Mbps. European T3 equivalent.
T1	1.544 Mbps. North American corporate LANs commonly use to connect to ISPs.
E1	2.048 Mbps. European T1 equivalent.
Cable Modem	512 Kbps – 52 Mbps (usually limited to 10 Mbps, depending on the NIC card)
DSL	512 Kbps – 10 Mbps

* **Note:** Mbps not MBps: megabits per second, not megabytes per second.

Internet Protocols

Protocols are the rules that define how clients and servers communicate across a network.
- File Transfer Protocol (FTP) – transfers files between computers
- Electronic mail (email) – transfers messages between computers
- Telnet
- News and Gopher
- WWW
- Hypertext Transfer Protocol (HTTP) – transfers HTML documents across the Internet

Compare with Networking Protocols and Routing Protocols

Also check out:
        An Introduction to Internet Protocols for Newbies

FTP

- Developed to enable researchers to access programs and large data files
- Transfers files between two computers or one computer and one server
- Can be protected with user ID and passwords, or not (Anonymous FTP sites)
- Sites that don't require an account are called Anonymous FTP sites (with "guest" or "anonymous") – often universities.

- Two kinds of resources available: binary files (machine language, often executable programs) and large text files. To download files, the FTP client program uses the *get* command or clicking on the file. To download multiple files, FTP client uses the *mget* command.

FTP Server File Types

Extensions	File Type
.zip	WinZip or PKZIP compressed file.
.txt	Text file
.asc	ASCII text file (ASCII is a universally accepted standard text file)
.exe	Executable file
.tar	UNIX Tar Z file compressed by UNIX systems
.z	UNIX Tar Z file, also used by Solaris
.sea	Macintosh Stuffit self-extracting compressed file
.sit	Macintosh Stuffit compressed file
.hqx	Encoded UNIX binhex file (standard UNIX file type)
.uue	Encoded UNIX file
.pdf	Adobe Acrobat Portable Document File.

Uploading files to an FTP site requires an FTP client program, correct URL destination, and permission. To upload files, the FTP client program uses the *put* command.

Email – SMTP, POP, IMAP

Two mail servers: incoming and outgoing
- Outgoing uses SMTP (Simple Mail Transfer Protocol)
- Incoming uses POP3 (Post Office Protocol version 3) or IMAP4 (Internet Messaging Access Protocol version 4)
- POP is a protocol that resides on the incoming email server, and sorts mail into the correct "mailboxes"
- IMAP is similar to POP, but also allows mailbox sharing and multiple mail server access.

Telnet

- Also called a remote host connection, Telnet is a pre-GUI protocol used most often on UNIX-based servers.
- Remote terminal connection service (used widely by universities in the past). That is, it allows users to log on and run server applications remotely.
- Used with dial-up shell (text only) accounts, and requires a login id and password on the host computer (which may have a general login or public access id).

Newsgroups - NNTP

- Usenet (USEr NETwork), developed in 1979, was a public-access network of newsgroups and group mailing lists, which was later absorbed by the Internet.
- Network News Transfer Protocol (NNTP), developed in 1985, allows Internet sites to exchange Usenet articles.
- Requires access to a News server to read and post news and information about any topic.
- Newsgroups use the "tree" structure, where each branch holds more specific information for the user.

10 Top-Level Internet-wide Newsgroup Categories

biz	Commercial topics
comp	Computers
news	Usenet news topics
rec	Recreation
sci	Science
soc	Social discussions
talk	Controversial topics
humanities	Humanities' topics
misc	Other topics not mentioned above
alt	Topic not assigned a category (including controversial and adult-oriented topics)

Gopher

- An older UNIX-based menu system used to find text-based resources quickly (like library catalogues and phone books). Similar to the Web today.
- Gopher searches and retrieves documents using a Gopher viewer or browser (browsing with Gopher is also called tunneling).
- Keyword searches using search engines like Veronica (Very Easy Rodent-Oriented Net-wide Index to Computer Archives)
- Gopher home is: gopher://gopher.tc.umn.edu

HTTP

- Transfers Web pages from a Web server to a Web client (browser)
- HTTP is a "request-response" type of protocol, in that it tells the server to send in a specific format when a client opens connection to a server makes a request. When the server responds, the connection is closed.
- From W3C: "The Hypertext Transfer Protocol (HTTP) is an application-level protocol with the lightness and speed necessary for distributed, collaborative, hypermedia information systems. It is a generic, stateless, object-oriented protocol, which can be used for many tasks, such as name servers and

distributed object management systems, through extension of its request methods (commands). A feature of HTTP is the typing and negotiation of data representation, allowing systems to be built independently of the data being transferred.

For more on HTTP:
W3C HTTP Protocols
HTTP 1.0 (RFC 1945)
HTTP 1.1 (RFC 2068)
Proposed Extension to HTML (RFC 2069)

Domain Name System (DNS)

- A system that maps unique, hierarchical names to specific IP addresses.
- Translates the numeric IP address into server names.
- A Domain Name is made up of three parts: www.brainbuzz.com
- www – server/host name (specific)
- BrainBuzz – registered company domain name
- com – domain category, country code or top level domain (general)
- Some companies further divide their DNS by department, workstation, location…
- Top Level Domain (TLDs) names:
  - com – commercial/company
  - edu – educational institutions (universities)
  - gov - government (US)
  - mil – military (US)
  - org – organizations, clubs, associations, non-profit…
  - net – network sites, including ISPs
  - int – international organizations
  - Two-letter country codes (ca, uk, au, ch, jp…)

Registering Domain Names

- Each country has its own Domain Name registration process. To register a domain, your ISP (on your behalf) and your host (you/employer acting as a service provider) make formal request to a domain name registrar (like ICANN or InterNIC)
- Domain Name registrars activate domain names on a first-come first-serve basis.
- Registrars provide the following services:
  - Search for registered domain names, host IP addresses, and last/first name queries with WHOIS (to determine registered host on a system).
  - Domain name registration
  - Registration service forms for domain name transfers, modifications, etc.
  - Resources links (for payments, policies…)

Virtual Domains

- Allows a company to host its domain name on a third-party ISP server
- Provides a private web address, no matter where the web site is hosted.
- Shortens web addresses

Uniform Resource Locator (URL)

When you use a web browser, you identify Internet resources with a URL. A URL specifies both the location (Domain name) and the protocol to access it (FTP, HTTP, HTTPS).

Prefixes

- http:// - Web page URL
- ftp:// - FTP site URL
- gopher:// - Gopher URL
- mailto: - email URL
- news: - newsgroup URL

Intranets and Extranets

Intranets and Extranets are subsets of the Internet, as they use the same protocols and technologies as the Internet, but are used by one organization or company and keep the general Internet traffic out.

Intranet

An Intranet is an internal web site for employees within a company to access files or documents in their web browser. Security features (such as firewalls) keep the regular Internet traffic from accessing the Intranet. As an Intranet uses TCP/IP, it is cross-platform: machines with dissimilar operating systems can access the resources.

Extranet

An extranet is a web site set up for existing customers of a company that is not available to the Internet public (customer support). Customers log onto the Web server with usernames and passwords.

Browsing the World Wide Web

Web browsers support Internet functions (email, FTP, newsgroups, HTTP), enable users to view graphics, video, etc. and accommodate different types of users (visually impaired, for example). The two most commonly used and well-known browsers are Netscape Navigator and Microsoft Internet Explorer. They have many features in common (like underlining hyperlinks, for example). Many companies still

use older versions of the web browsers (legacy applications), which may not support some web features (frames, active content).

I suggest you download the Netscape Navigator and Internet Explorer and become familiar with both applications: how they are similar and how they are different (e.g. toolbars). Know what capabilities and limitations each has.

<u>Email</u>

Email addresses, also known as email accounts, contain the @ symbol separating the user's name (mailbox, person, account) and the domain (e.g. cherinas@brainbuzz.com).

To send email, configure your browser with:
- Your email address and the destination address
- The outgoing mail server (SMTP) address

To receive email, configure your browser with:
- Your email account name (POP account name, POP ID) and password
- The incoming mail server (POP, IMAP) address

Common email applications are Netscape Messenger, Microsoft Outlook and Outlook Express, and Qualcomm Eudora Light (a stand-alone email client application).

Netiquette

This is the term for etiquette of the Internet – including email, newsgroups, discussion boards, and all Internet communication.
- Use business language for any communication that is work-related
- No email is private – it can be printed or forwarded.
- Proofread and check spelling before sending.
- DO NOT TYPE IN CAPITAL LETTERS – IT DENOTES SHOUTING AND ANGER.
- Remember that your reader will not have the benefit of your tone of voice and body language to understand your meaning: be conscious of what you are saying and how you are saying it.
- Think clearly about what you are writing, and answer messages only when you have ascertained all the information that is needed to reply.
- Respond to emails immediately, whenever possible.
- Choose an appropriate and helpful subject line.

Email Privacy

Your employer has the right to read email you send using company equipment and Internet connections. Some companies have written email policies for employees. Email may be archived and read by supervisors, administrators, and can also be

forwarded to anyone within a company – our outside the company. Email is a written record.

Also, know Email Attachments, Signatures and Mailing Lists.

Browser Customization

You should know how to customize the following in both Internet Explorer and Netscape Navigator:
- Fonts
- Home Page
- History/Favorites Folder
- Browser Cache
- Bookmarks and Favorites
- Disabling Image loading and Active Content

Email Security

Security is always a big issue on the Internet. You should be able to configure the security and safety levels in both IE and Netscape.

Security features to keep in mind are:
- Cookies
- Security Information/Alert
- Secure Sites
- Authentication
- Digital Certificates
- Encryption
- Virus Detection
- Proxy Servers
- Firewalls

See also Network Security and Enterprise Network Security

Cookies

Cookies are small text files left on a client's computer by a web server to gain marketing information or to customize web user experience.

Security Information/Alert

Both browsers warn users of potential security risks with a Security Information or Security Alert popup window.

Secure Sites

Another security warning popup window will appearwhenever a user enters a secure site. A secure site uses data encryption and will have a small lock in the corner of the browser.

Authentication

Authentication is when a web site requires users to login, with a username and password, before accessing certain resources. The user's identity must be verified (authorized). Types of authentication are:
- Anonymous Access: no restrictions
- Basic Authentication: user name and password required, with plain text transmission
- Secure Authentication: user name and password required, with data encryption
- Digital Certificates: certificate required

Digital Certificates

Digital Certificates are basically a digital ID card, issued by a certificate authority to authenticate Internet data transfers. Certificates, when validated, provide a high level of protection against fraud and misrepresentation of your personal and company information.

Encryption

Encryption is the scrambling of data using specific algorithms in the software encoding, as specified by a string of numbers called the *key.* You need the key in order to read the data. Encryption levels use 40-, 128- or 256-bit keys.

Virus Detection

A virus is a malicious software program (usually an .exe file, but can also have a .bat, .vbs, or .com extension) designed to replicate itself on a system unnoticed and somehow harm/disable the computer. These programs have become very costly in recent years. Antivirus programs, software to detect and clean up viruses, are readily available and should be used and regularly updated for new viruses on all computers connecting to the Internet.
- http://www.antivirus.com
- http://www.mcafee.com

Proxy Servers

A proxy server is used mainly to increase security (and speed) between your LAN and the Internet. Proxy servers often provide caching functions for frequently used/downloaded documents and safe passage through firewalls for corporate users.

They also hide the network IP address from the rest of the Internet with a "contingent IP address".

Firewalls

A firewall is anything that protects the LAN (private data) from external sources, especially the Internet: any barrier, such as hardware, software, policies, etc.   A firewall restricts unauthorized access and export of proprietary information, as well as accidental exposure and malicious actions.

<u>Search Engines</u>

Internet search utilities are called Search Engines: a software application that searches (queries) an Internet catalog (database) for user-specified information. For example, Yahoo! Lycos, AltaVista, MSN, Excite, Infoseek, WebCrawler, Northern Light, Google...

- Search engines are made up of large databases, which contain information about web pages that have registered with them specifically.
- Using keywords, words that appear on a web page and are used by a search engine to identify relevant URLs, you should be able to find just about anything.
- Some search engines use a "spider" or "robot" program that automatically searches the web and indexes to web sites.
- When an engine performs a search, a database searches for keywords or word combinations called "search strings".
- Search engines rank hits by "relevancy" to help you determine how closely matched the results are to the search.
- Some search engines allow the user to sort results.

Yahoo!

- One of the oldest and most basic search engine, Yahoo! was created in 1994
- More of an index of links (sorted by a hierarchical subject guide)
- Not case sensitive
- The "Yahoo! interface" offers hyperlinks, alphabetical category and subcategory listings, to narrow your search.

Infoseek

- http://infoseek.go.com
- Two search options: general and advanced
- Can also search again within the results found.

AltaVista

- http://www.altavista.com
- Created in 1995, it contains one of the largest online web databases (originally designed to index the whole Internet).
- Uses a spider program to search the web and Usenet postings.

Lycos

- http://www.lycos.com
- One of the largest and most complex databases on the Internet.
- Can search newsgroups by topic

WebCrawler

- http://www.webcrawler.com
- Started in 1994, WebCrawler is a much smaller database, though fast and simple.
- Good for searching broad, general topics.

Excite

- http://www.excite.com
- Excite's database also contains cross-referencing fields for conceptual searches (words with more than one meaning, for example).

People Searches

Some search engines are made specifically for people searches, like WhoWhere? by Lycos and Yahoo! People Search. They build their databases by:
- Finding people who are online
- A registration process (an individual submits his/her data)
- Traditional phone books and public directories, etc.

Mailing List Searches

A mailing list is a community that discusses a certain subject by e-mail. A mailing list directory allows users to search mailing lists according to areas of interest.
- www.liszt.com
- www.neosoft.com/cgi-bin/paml_search Publicly Accessible Mailing Lists

Searching FTP Servers with Archie

- Archie searches anonymous FTP sites, by filename
- Can connect with a Telnet client or Archie client
- Powerful, but awkward (need to know what you're looking for to use it)

Veronica

- Very Easy Rodent-Oriented Net-wide Index to Computer Archives
- An index and retrieval system to locate information on Gopher servers.
- Connect to the server that is physically located closest to you.

Advanced Search Techniques

A standard Internet search will use keywords and Boolean operators (a word or symbol used to narrow your Internet search results, or to include/exclude words or phrases: AND, OR, NOT, NEAR, +/-, "" are all Boolean operators.) But most search engines also offer Advanced Search options such as:
- Static index or site map
- Keyword index
- Full-text index
- Sorting results options

You should also know how to promote you own site with a search engine:
- "Adding Your Site"
- `<META>` tag

<u>Business Resources</u>

Market Intelligence

Market intelligence is gathering information and obtaining knowledge of a whole industry sector or niche market (also called secondary market research) from a number of companies and sources, such as:
- Market research and review companies
- Industry association home pages
- Newsgroups and search engines
- Sites that link to market intelligence data.
- Online database services
- "Push" technology services

While the web simplifies market intelligence and research, not all the information you require will be online, free, or detailed enough for your research (it may not even be accurate). Fee-based services pre-date the web

To narrow or target your market research, check for:
- Relevance
- Volume

Find targeted, in-depth sites and databases that provide you details you require to make strategic decisions about your market. Then, find Industry Overview data and build a market profile (What is the market size? How much competition? Etc.)

- www.imarket.inc.com
- www.zapdata.com

Company Directories

Certain sites on the web are dedicated to listing companies; these are Company Directories.
- www.thomasregister.com
- www.hoovers.com

Industry Regulations Information

- http://www.access.gpo.gov
- www.doc.gov

Commercial Internet Resources

- Online Newspapers
- Financial Markets
- Libraries
- Encyclopedias
- Yellow Pages
- Government Resources
- Copyright, Patent and Trademark Offices

Push and Pull Technology

- **Pull technology**: a pull client requests information from a computer or program. (Most traffic on the Web is pull technology)
- **Push technology**: an Internet client/server technology with customized information flow within and to organizations and desktops for presentation in a browser (multimedia applications to deliver their message). The server decides when to send new information to users (like TV). Also called netcasting. E.g. www.pointcast.com

Visitor Tracking

Tracking visitors to your site may provide new business opportunities

E-commerce Basics

E-commerce can be defined as the electronic exchange of goods and services, but it also includes particular issues regarding:
- Data management: exchange of information, languages used
- Security: privacy and integrity of information, authentication
- Communication: transfer of info from buyer to seller

B2B

The Business-to-business model has e-commerce conducted between two businesses, and usually means high volume, lower price margins.

B2C

The Business-to-consumer model has e-commerce conducted between a business and its consumers, and usually means lower volume, higher price margins.

EDI

Electronic Data Exchange (EDI) is the standardized method for transferring information between two computers (data interchange).
- Handles large volumes of like transactions
- Operates in a time-sensitive tight-margin business

SET

Secure Electronic Transactions (SET) is a standard protocol used to secure online credit card purchases. SET
- Provides definite identification by all parties (user, merchant, bank)
- Encryption (Merchant never sees credit card number)
- Designed for financial transactions (first proposed by MasterCard, later adopted by Visa) with payment gateways

E-commerce Issues

- Intellectual Property (Copyright, Trademark, Licensing)
- Confidentiality and Privacy
- Taxation
- Customs
- Regulations and the Law
- Fraud and Trust
- Security
- Availability

Elements of a Successful Web Storefront

- Demand generation: traffic, lookers become buyers...
- Ordering: consistency, easy process, substitutes, immediacy...
- Fulfillment: timely, shipment, undamaged goods...
- Payment processing: cash, check, credit, *Smartcard*...
- Customer service and support: relationship development, FAQ, contact info...
- Security: Secure Sockets Layer (SSL), privacy...
- Community: loyalty, trust...
- Physical requirements: hardware, software, staff…

Project Management

A project is a temporary endeavor to create/develop a unique product. It is defined by a start and an end date, budget, clearly defined objectives and scope.

Main elements:

- Schedule
- Costs
- Risks

Stages of Project Cycle:

- Business process design (functionality)
- Technology design (architecture)
- Implementation (development)
- Pilot (parallel)
- Live (cutover)

Read more:
> Project Management Institute
> International Organization for Standardization (ISO) 9000
> Smart Business Supersite

HTML Fundamentals

Introduction to HTML

HTML, Hypertext Markup Language, is the standard format for documents on the Internet. It was invented by Tim Berners-Lee. Ted Nelson conceived hypertext in 1965. The W3C (World Wide Web Consortium) is the organization that determines the standards for the evolution of HTML (and XML, CSS, and DOM).

HTML 3.2 is the current standard; HTML 4.0 Recommendation has the latest specifications: Transitional, Strict, Frameset. (Read the HTML 4.0 Fact Sheet)

HTML 4.01 is the foundation for XHTML (a mix between HTML and XML).

HTML is a cross-platform markup language that has both contextual and formatting elements to position content on the page. HTML files are plain text files, and thus are relatively fast and easy to transmit across distances.

HTML Files

An HTML document has the extension .html or .htm.

Default HTML Documents:

Listed in order of preference:
- index.htm
- index.html
- default.htm
- default.html
- welcome.htm
- welcome.html
- home.htm
- home.html

Markup Tags

HTML consists of markup tags, portions of text enclosed in angle brackets, which indicate to programs receiving the documents (browsers) how to display and process the text. "Code" is basically the combination of tags and text.

Two Types of Tags:

- Container tags: come in pairs, with an opening and a closing tag
  <EXAMPLE>like this</EXAMPLE>
- Empty tags: stand alone <EXAMPLE>
- Some tags can be both, like paragraph breaks <P>

Three Parts of Tags:

- Element: the main instruction of the tag
- Attribute: quality or certain aspect of the element
- Value: value to the element and attribute (enclosed in quotation marks)

```
<ELEMENT ATTRIB="VALUE">example</ELEMENT>
```
An HTML document begins with a Document Type Declaration (DTD) statement before the HTML. HTML documents are then broken into two sections with document structure tags:
- <HTML> : identifies the document as HTML
- <HEAD> : identifies and encloses the head section
- <BODY> : identifies and encloses the body of the document

Structure of Basic HTML code:
```
<HTML>
<HEAD>
```

```
<TITLE>Title</TITLE>
</HEAD>
<BODY>
```

Content
```
</BODY>
</HTML>
```

Document Type Declaration:

The DTD tag is not HTML (it is actually SGML), and precedes all HTML. It describes the primary language and version of your code. The DTD tag helps browsers interpret the HTML code (better use of advanced browser features, for example).

DTD Syntax:
```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Strict//EN">
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Frameset//EN">
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 3.2 Final//EN">
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 2.0//EN">
```

META tags

The <META> tag in the HEAD section describes an HTML document's contents. Search engines and spider programs look for the keywords specified here. The meta tag can specify keywords, a description of the page, the author, and can refresh the page automatically.

Syntax:
```
<META NAME="Keywords" CONTENT="ciw, foundations, html, brainbuzz,
cramsession, exam, certification">
<META NAME="Description" CONTENT="Cramsession for the CIW Foundations
Exam.">
<META NAME="Author" CONTENT="Cherina Sparks">
<META HTTP-EQUIV="Refresh" Content="4;
URL=http://cramsession.brainbuzz.com">
```

Two Levels of Elements:

- Block-level elements: affect entire paragraph
- Text-level elements: affect single characters or words
- Font style elements
- Phrase elements

Block-Level Elements:

P	Paragraph
BR	Break
H1...H6	Heading Level 1-6
PRE	Preformatted text tag: fixed width font
DIV	To align content
BLOCKQUOTE	Indent and align text
CENTER	Centers text

Text-level Elements:

Element	Font / Phrase	Function
B	Font	Bold
I	Font	Italic
U	Font	Underline
EM	Phrase	Italic
STRONG	Phrase	Bold
BIG	Font	Larger text
CITE	Phrase	Citation (italic)
CODE	Phrase	Program Code (fixed width)
DFN	Phrase	Definition (italic in IE)
KBD	Phrase	Text to be typed (fixed width)
SAMP	Phrase	Sample program output (fixed width)
SMALL	Font	Smaller text
SUB	Font	Subscript
SUP	Font	Superscript
TT	Font	Teletype (fixed width)
STRIKE	Font	Strike through text
VAR	Phrase	Variable text in program code (italic)

List tags

OL	Ordered List (Numeric)
UL	Unordered List (Bulleted)
LI	List element
DL	Definition List
DT	Defined Term
DD	Definition Data

Lines and Attributes

HR	Horizontal Rule
ALIGN	Attribute to align left, right, center
SIZE	Height of the line (in pixels or percentage of window)
WIDTH	Length of the line (in pixels)
NOSHADE	No 3D shading effect

```
<!--Comment text follows this syntax-->
```

<u>Images</u>

Standard image syntax:

```
<IMG SRC="filename.gif">
```

File formats:

- GIF: Graphical Interchange Format (Transparency, Interlacing, Animation)
- JPEG/JPG: Joint Photographic Experts Group
- BMP: Bitmap (IE only)
- PNG: Portable Network Graphics

Image Attributes

- BOTTOM: (default) bottom of image aligned with baseline of text
- MIDDLE: center of image aligned with baseline of text
- TOP: top of image aligned with baseline of text
- LEFT: top of image aligned with the left and top of text
- RIGHT: top of image aligned with the right and top of text
- ALT: alternate text to appear while image is loading
- HEIGHT: specify height of image (resize)
- WIDTH: specify width of image (resize)

Image Maps

Image maps can be client-side or server-side (require CGI script).

Example Image Map Code:

```
<MAP NAME="ImageMapName">
      <AREA SHAPE="rect" COORDS="x1, x2, y1, y2" HREF="URL">
      <AREA SHAPE="circle" COORDS="x1, y1, radius" HREF="URL">
      <AREA SHAPE="polygon" COORDS="x1, y1, x2, y2...xn, yn"
HREF="URL">

</MAP>
```

```
<IMG SRC="imagemap.gif" USEMAP=#ImageMapName">
```

Colors

You want your colors to display the same in different browsers and on different operating systems. If your code asks for an unsupported color, the result is called dithering – an approximation of the color by combining RGB values. The "web-safe" color palette (Netscape-safe or browser-safe) consists of 216 colors that should render inline images consistently.

Basic Color Codes:

Color	Hexadecimal	RGB Value
Black	#000000	R0 G0 B0
White	#FFFFFF	R255 G255 B255
Green	#008000	R0 G255 B0
Yellow	#FFFF00	R255 G255 B0
Red	#FF0000	R255 G0 B0
Blue	#0000FF	R0 G0 B255
Purple	#800080	R128 G0 B128
Orange	#FF8000	R255 G128 B0

Non-Keyboard Characters

Special Characters on the keyboard require either an ANSI value or an ASCII code.

Character	Description	HTML Code
<	Less than	<
>	Greater than	>
©	Copyright	© or ©
®	Registered trademark	® or ®
é	Acute accented e	é
To insert more than one space		

More Character codes:
http://www.w3.org/MarkUp/html-spec/html-spec_13.html

Backgrounds

Background colors are either
- Hexadecimal values: 00-FF
- RGB (Red-Green-Blue) values: 0-255
- Color names: blue, green, etc.

```
<BODY BGCOLOR="color">
```

Attributes:

BGCOLOR	Background color of the page
TEXT	Color of non-link text
VLINK	Color of visited links
ALINK	Color of active links
LINK	Color of non-visited, non-active links
BACKGROUND	Indicates image for background

Font Tags

The <FONT> tag can have three attributes: SIZE, COLOR, and FACE (HTML 4.0 Recommendation for CSS).

SIZE	1-7 (or +1, +2, -1, -2 for resizing)
COLOR	Hexadecimal, RGB or color names
FACE	Typeface

Creating Hyperlinks

Hyperlinks are created with Anchor tags: <A>. They can reference links within or outside a document, can reference an HTML document (URL), an image, or another file type (.pdf, .doc, .asp, etc).

Syntax Examples:
```
<A HEF="URL, document">Text displayed</a>
<A HEF="URL, document"><IMG SRC="image displayed"></a>
<A NAME="Bookmark">Text displayed</a>
```

HTML Tables

Tables were introduced in HTML 2.0.

Table Tags

<TABLE>	Indicates table
Attributes	BORDER: thickness of outside line CELLPADDING: spaces between cell border and text CELLSPACING: distance between cells WIDTH: width in pixels, percent
<CAPTION>	Table title/caption
<TR>	Table Row

Attributes	ALIGN: horizontal alignment within cell VALIGN: vertical alignment within cell
\<TH\>	Table Header
\<TD\>	Table Data
\<DIV ALIGN= \>	Aligns entire table
Other Attributes:	COLSPAN: indicates columns for a cell to span ROWSPAN: indicates rows for a cell to span BGCOLOR: background color BORDERCOLORLIGHT BORDERCOLORDARK RULES

To differentiate between parts of a table, you can also use the following cross-column-spanning tags:
- \<THEAD\>
- \<TBODY\>
- \<TFOOT\>

Or cross-row-spanning tags:
- \<COLGROUP\>
- \<COL\>

Example Table Syntax:

```
<DIV ALIGN="center">
<TABLE BORDER="3" CELLPADDING="3" CELLSPACING="1">
<CAPTION>Title of the Table</CAPTION>
<TR>Table row
<TH>Table header
</TR>
<TD ALIGN="center">Table Data</TD>
</TR>
</TABLE>
</DIV>
```

Forms

Forms are used to obtain user input. Information entered in a form is submitted to a server and processed and/or stored. A form is either server-side script or client-side script and requires a CGI (Common Gateway Interface).

\<FORM\> container tag begins and ends an HTML input form document, and can have these attributes:
- \<METHOD\>

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- <ACTION>
- <ENCTYPE>

Other Form tags and their attributes to know are:
- <INPUT>
  - NAME, TYPE, VALUE, CHECKED, SIZE, MAXLENGTH
- <SELECT>
  - NAME, MULTIPLE, SIZE
- <OPTION>
  - SELECTED
- <TEXTAREA>
  - NAME, COLS, ROWS

Method

- GET: form data is appended to the URL to be used in a query string
- POST: form data is posted to the URL as specified by the ACTION attribute (often an email address, for example)
- ACTION: specifies name and location of the CGI script. Types of actions include:
- INPUT TYPE: text box, radio button, check box, select list, etc.
- SELECT TYPE: selected
- TEXTAREA: defines text window

Form Fields

Field	Description	Syntax
Text box	User enters text	`<INPUT TYPE="text">`
Check box	Square box: either/or	`<INPUT TYPE="checkbox" NAME= VALUE= >`
Radio button	Round option buttons	`<INPUT TYPE="radio" NAME= VALUE= >`
Select list	Drop-down list	`<SELECT NAME= >` `<OPTION>...`
Multiple-select list	Exposed list, scrollable, multiple selections	`<SELECT NAME= MULTIPLE SIZE= >` `<OPTION>...`
Password field	Masks text entered	`<INPUT TYPE="password" NAME= SIZE= >`
Text Area	Scrolling text field for multiple lines of text	`<TEXTAREA NAME= COLS= ROWS= WRAP= >`

| Reset button | Clears data entered in the form (default values) | `INPUT TYPE="reset"` |
| Submit button | Processes form ACTION statement | `INPUT TYPE="submit"` |

Example Form Fields:

Name: [   ]

⊙ Male   ○ Female

☐ I understand Forms

[List Element 1 ▾]

| List Element 1 |
| List Element 2 |
| List Element 3 |
| List Element 4 |

Password: [   ]

Comments:

[   ]

[Reset] [Submit]

NAME and VALUE Attributes

Form Example Code:

```
<FORM METHOD="POST"
     ACTION="http://URL/cgi-bin/scriptfilename">
Name: <INPUT TYPE="text" NAME="Name" SIZE="40"><P>
Email: <INPUT TYPE="text" NAME="Email" SIZE="40"><P>
I understand Forms:<BR>
<INPUT TYPE="radio" NAME="Yes" VALUE="yes" CHECKED>Yes
<INPUT TYPE="radio" NAME="No" VALUE="no">No

<INPUT TYPE="submit"> <INPUT TYPE="reset">
</FORM>
```

More on HTML Forms:
> Server-side Scripting under Networking Fundamentals
> Intro to CGI scripts and HTML

Page Accessibility

- User-friendly front end (interface)
- Performance, easy to download across a network

Front-end Issues

- Incorporates images and graphical elements, but sparingly
- Tables and forms constructed carefully
- Hyperlinks not broken
- Easy navigation (no dead ends, alternative paths)

Back-end Issues

- Bandwidth and download time: watch page size and keep it under 100 KB, as not everyone has high-speed connections. It takes approximately 14 seconds to download a 100KB file on a 56Kbps modem)
- Server load

Branding

- Target markets
- Marketing messages
- Media and technologies used
- Sales strategies
- Colors

Cascading Style Sheets

CSS are used to override or customize the existing properties of certain HTML tags in a document and provide consistency across a web site. They are not case sensitive, but may not display properly between browsers.

- Selector: any HTML element you want to include
- Declaration: the Property and Value assigned to the Selector
- Property: the customization of the Selector
- Value: defining the Property (color, size, font)

Example:
```
BODY {color: black; font: red}
```

CSS are used mostly for inheritance: the parent elements passing on to other elements (large textual changes done quickly)

CSS1

- Declare an inline style: SPAN or STYLE container tags add attributes within HTML tags in the HEAD
- Create embedded style sheet:
- Link to external style sheet: in the HEAD, a LINK tag to external .css file that defines the style sheet
- Use an imported style sheet: a link to an external .css file at the top of the document. i.e. `@import url(filename.css);`

Common CSS Attributes

- color
- background
- font
- font-family
- font-size
- font-weight
- font-style

- line-height
- text-decoration
- text-indent
- text-align
- margin-left
- margin-top
- ; (used to separate multiple attributes)

Dynamic HTML

DHTML allows animations, dynamic updating and interactions with web pages. Web pages react to user interaction without contacting the server (consuming more bandwidth). With DHTML, you can control exactly how you want an image to perform:

- Automatic text size and color adjustments (using an event handler for a mouse over, for example)
- Absolute positioning: text that moves with user input
- New document content without refreshing the page.
- Sequencing of events: animations, audio, video.

Document Object Model

DOM is used to describe objects (elements) within a document rendered in a web browser, like the dreaded pop-up windows. DOM requires a scripting language like Visual Basic or JavaScript.

For more, visit the W3C DOM page
For more on the JavaScript Object Hierarchy.

XML and XHTML

Extensible Markup Language (XML) allows you to describe the function and context of the content within a document. XML and HTML were recently combined with specifications for XHTML: HTML 4.01 and XML 1.0 specifications.

XML allows you to create your own customized markup language (a meta-language), but it must be well-formed and valid.

Read more at W3C:
     XML
     XHTML

Well-formed XML

- DTD
- Root element: a container tag that surrounds all others
- Properly declared container tags (there are no empty tags in XML)
- Think ahead and define every element (rules, syntax, structure, vocabulary, etc)
- Tree structure

Valid XML

- Must contain the DTD
- DTD defines the validity of all other tags

XML and Style Sheets

- CSS
- XSL (Extensible Style sheet Language): can transform XML into an HTML page

Read more on XSL

Frames

Frames are an extension of the HTML 3.2 standard, submitted by the IETF and W3C. A frame is a scrollable separate pane in which pages are displayed within a frameset. A frameset is the set of frames in which the pages are displayed. Each frame has its own URL.

Frames are best utilized when you have static and dynamic content combined. (Some web designers and developers avoid using frames altogether, in part because older browsers cannot support them.)

<FRAMESET> tag follows the </HEAD> tag, and is a container tag that defines how the frames are displayed in the browser: the regions of the browser window defined for each frame URL (file). Requires at least one of the two following attributes:
- COLS: defines the number and size (in pixels or percent) of columns in a browser
- ROWS: defines the number and size (in pixels or percent) of rows in a browser.
- *: indicates a wildcard value for various browsers and screens.

<FRAME> tag defines the content in each frame. Requires the SRC attribute to specify which file appears in the frame.

Example Frame HTML Code.

```
<HTML>
<FRAMESET ROWS="25%,75%">
   <FRAME SRC="Frame2.htm">
<FRAMESET COLS="30%,70%">
   <FRAME SRC="Frame1.htm">
   <FRAME SCR="Frame3.htm">
<NOFRAMES>
<BODY>If you can read this, you do not have frames enabled.
</BODY>
</NOFRAMES>
</FRAMESET>
</FRAMESET>
</HTML>
```
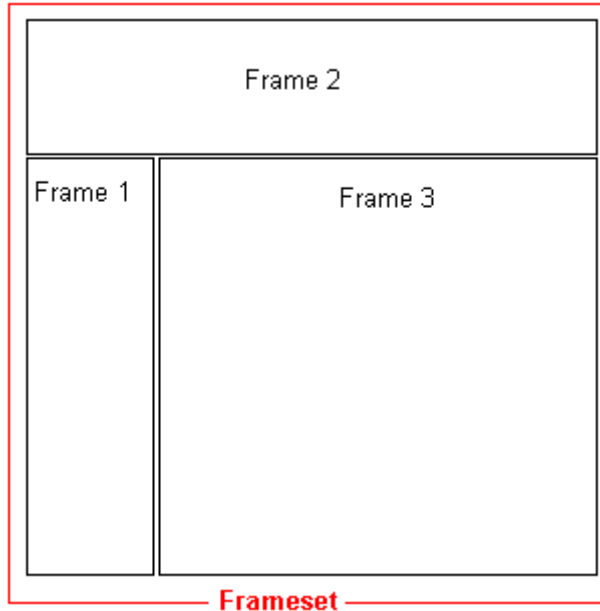
Frame Relationships

Frames can be targeted by name or by relationship. Examples:
- <FRAME SRC="URL" NAME="Frame2.htm">
- <FRAME SCR="URL" TARGET="top">

Targeting Frames

Hyperlinks <A> need to be targeted to open in the correct frame:
- TARGET="main"
- TARGET="toc"
- TARGET="top"
- TARGET="_parent"
- TARGET="_top"
- TARGET="rightbottom"
- TARGET="_blank" (new browser window)

To target all links within a frame to a particular frame, use the <BASE> tag. For example:

```
<BASE HREF="URL" Target="main">
```

Other Frame Attributes

Tag	Attributes
<FRAMESET>	COLS
	ROWS
	FRAMEBORDER
	FRAMESPACING
<FRAME>	NAME
	SRC
	MARGINHEIGHT
	MARGINWIDTH
	NORESIZE
	SCROLLING
<IFRAME>	WIDTH
	HEIGHT
*not available in Netscape	SRC
<NOFRAMES>	

Floating Frames

<IFRAME> tag denotes a floating frame. Floating frames are scrollable areas that cannot be resized.

HTML 3.2 and HTML 4.0

HTML 4.0 Recommendation, which was accepted by W3C in 1997, adds elements to better define and organize web content, like CSS, active content, and frames.

New Elements in HTML 4.0:

- <ABBR>
- <ACRONYM>
- TITLE
- <BUTTON>
- <DEL> and <INS>
- <CITE>: reason for deletion/insertion
- <DATETIME>: when change was made
- <FIELDSET>
- <LEGEND>: labels the fields (e.g. Required Fields)
- <INPUT TYPE="check box, etc">
- <LABEL> (a form field)
- <FOR>
- <INPUT TYPE="text">
- <OPTGROUP> (Options)
- <SELECT NAME="Name">

- VALUE
- LABEL
- <Q> (Quotation)
- <LANG>: specifies language (FR, DE, IT, JA, etc)
- <DIR>: direction of the language (e.g. RTL is "right to left")
- Example: `<Q LANGUAGE="FR" DIR="RTL">quotation</Q>`
- <SPAN> (Inline element)

New Attributes in HTML 4.0
Element Attributes

- ID
- DIR

- LANG
- STYLE
- TITLE

Event Attributes

- ONKEYPRESS
- ONMOUSEDOWN
- ONMOUSEOVER
- ONRESET
- ONSUBMIT
- ONCLICK
- ONLOAD
- ONMOUSEOUT

Table Attributes

- ACCESSKEY
- DISABLED
- READONLY
- SUMMARY
- TABINDEX

Deprecated Elements

- APPLET
- BASEFONT
- CENTER
- DIR
- FONT
- ISINDEX
- MENU
- S

- STRIKE
- U

Deprecated Attributes

HTML 4.0 recommends the use of CSS instead of these attributes.
- ALIGN (expect with tables)
- ALINK
- BACKGROUND
- BGCOLOR
- BORDER
- COLOR
- FACE
- LINK
- TEXT
- TYPE
- VLINK
- HEIGHT/WIDTH (with tables and APPLET)

Obsolete Elements

- LISTING
- PLAINTEXT
- XMP

Scripting Languages

Scripting languages increase interactivity in Web pages. Each Scripting language is a subset of a larger language, with less functionality, but easier to learn and implement. JavaScript (a subset of Java) was developed by Netscape; VBScript (a subset of Visual Basic) was developed by Microsoft (Microsoft has it's own version of JavaScript called JScript). Both JavaScript and VBScript are *object-based* languages that follow the basic syntax and program flows of programming language out of which each was developed.

See also section on Server-side Scripting

Basic Scripting tags and structure

```
<HTML>
<HEAD>
<SCRIPT LANGUAGE="JavaScript or VBScript">
<!--   (*comment tag is used to hide the script from browsers not script-enabled)
```

```
        Your Script

-->
</SCRIPT>

<BODY>
<SCRIPT>
<!--



        Your Script

-->
</SCRIPT>
</BODY>
</HTML>
```

JavaScript vs. VBScript

The Internet is *event-driven*. For example, a user action within the browser signals a response or action to take place. Scripting languages are designed to react to these events that occur.

	JavaScript	VBScript

script identifying tags	`<SCRIPT LANGUAGE="JavaScript">`
	`<!--`
	
	`...`
	
	`-->`
	`</SCRIPT>`
		`<SCRIPT LANGUAGE="VBScript">`
		`<!--`
		
		`...`
		
		`-->`
		`</SCRIPT>`

inserting a message box	`Alert("Text")`	`Msgbox "Text"`

adding a button	`<FORM>`
	
	`<INPUT TYPE="button"`
	`  language="JavaScript"`
	`  onclick='alert("text")`
	
	`</FORM>`
		`<FORM>`
		
		`<INPUT TYPE="button"`
		`  language="VBScript"`
		`  onclick='msgbox("text")`
		
		`</FORM>`
		
		`* you can customize and use`
		`multiple buttons on a message box`

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		using VBScript.
hyperlink buttons	`<FORM>` `<INPUT TYPE="button"` `  language="JavaScript"` `  value="text"` `  onClick='top.location.href="URL">` `</FORM>`	`<FORM>` `<INPUT TYPE="button"` `  language="VBScript"` `  value="text"` `  onClick='top.location.href="URL">` `</FORM>`

See also:
> [CIW JavaScript Cramsession](#)

Other Languages

C++ and Java are examples of Object-Oriented Programming ([OOP](#)) languages. Java is based on C++, but is less complex. OOP Languages can create stand-alone applications; scripting languages cannot.

Active Content

Active content is used on web pages to enhance user experience: animations, multimedia, added functionality and interactivity. An Object is an element of a web page (a unit of code) that contains data and procedures for how an item on the page responds. Active content also creates security issues (For example, for both Java applets and ActiveX to run, they download information to your system).

To enable active content in your browser:

Netscape Navigator: Options → Network Preferences → Languages →
> Enable Java
> Enable JavaScript

Internet Explorer: View → Options → Security →
> Active Content →
> Allow downloading of active content
> Enable ActiveX controls and plug-ins
> Run ActiveX scripts
> Enable Java programs
> Safety Level (none, medium, high)

ActiveX

ActiveX is a cross-platform technology developed by Microsoft that enables components to interact with each other on the Internet, regardless of language. Uses the <OBJECT> tag.

Sample Code:

```
<OBJECT ID="name" WIDTH=1 HEIGHT=1
     CLASSID="number">
     <PARAM NAME="variable a" VALUE="0">
     <PARAM NAME="variable b" VALUE="10">
</OBJECT>
```

For more, check out:
Microsoft's ActiveX Controls

Java Applets

A Java applet is a small program created in Java designed to reside in HTML pages and run in web browsers. Uses the <APPLET> tag.

Sample Code:

```
<APPLET CODE="title"
     ALIGN=left
     WIDTH=400
     HEIGHT=200
     DELAY=2>
     <PARAM NAME="text" VALUE="insert your text here">
     <PARAM NAME="tfontname" VALUE="Arial, etc">
     <PARAM NAME="fontsytle" VALUE="BOLD, etc">
     <PARAM NAME="backgroundcolor" VALUE="blue">
</APPLET>
```

Sound files

Sound files can be inserted using the <EMBED> tag (supported by both browsers).

Sample Code:

```
<EMBED SRC="filename"
     AUTOSTART="true or false"
     LOOP="true or false"
     WIDTH="100"
     HEIGHT="100">
```

Filename Extensions

jpg jpeg	Joint Photographic Experts Group
gif	Graphics Interchange Format
tiff	Tag Image File Format
bmp pcx	Bitmap
wpg	WordPerfect Graphic
mov qt	QuickTime
avi	Audio Video Interleave
mpg mpeg	Moving Pictures Experts Group
awa awm fli	Animation
wav au snd aif hcom	sound
iff mod nst	Amiga sound file
voc	Soundblaster
rtf	Rich Text Format

Plug-ins

A plug-in is a program that is installed and extends the functionality of the browser by enabling different file formats to be viewed in HTML documents. (For example, Flash, Shockwave, QuickTime, RealPlayer). Most plug-ins are for enhanced multimedia integration directly into the browser (For example, streaming video, which uses *disk cache* to enable the continuous flow of data).

Viewers

A viewer is a scaled-down version of an application, designed to view and print files, but not edit them. (For example, Microsoft PowerPoint Viewer and Adobe Acrobat Reader.)

Networking Fundamentals

Introduction to Networking

A network is two or more computers connected that share data. Networking on the Internet is called internetworking.

Originally, networks were centralized (mainframes) and limited to large institutions. By the late 1980s, many businesses adopted the client/server network model: a more modular model better suited for small- to medium-sized businesses. The Internet created even more decentralized (and more affordable) networking.

Mainframes

- Centralized computing, the first network solution, with remote terminals
- "Back end" (server) information processing
- To retrieve information, a terminal makes a request, the mainframe processes the query, structures and returns the data, and then returns it to the terminal.
- Disadvantage: mainframe must handle all processing work and network congestion (as every request and response occupies the network bandwidth).

Client/Server Model

- Distributed computing
- Reduces network traffic by dividing tasks between the server (back end) and the client (front end). The server/back end stores and presents information, and is often a more powerful computer than the front-end workstations.
- Two types of databases: single database servers (storage on one machine) and distributed databases (storage across several machines, while still allowing searches and transactions as if on one machine). Distributed databases divide tasks among several computers and connections, which can prevent network bottlenecks.
- Databases need to translate human-readable language into machine-readable code (most efficiently with SQL).
- Advantages: modular, scalable, multi-platform, flexible, less expensive, distributed tasks
- Three-tier computing: client (first, user interface), server/network (second, intermediary processing), sever and database (third, query)

Client/Server Configuration

Based on:
- Types of applications used
- User requirements
- Network architecture

Web-based Networking

- Three-tier computing (VPNs, extranets)
- Advantages: combines the power of mainframes and scalability of client/server model

Networks are made up of three basic components:
- Protocols – rules of communication
- Transmission Media – methods for interconnecting network elements
- Network Services – shared resources
Networks are either peer-to-peer or server-based.

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Peer-to-peer:

- Doesn't require dedicated resources, as any host can share its resources with any other host on the network.
- Less expensive, easier to work/maintain, less secure, fewer users (less than 10)
- File system management problems
- Novell NetWare Lite, Windows 95/98, Artisoft LANtastic
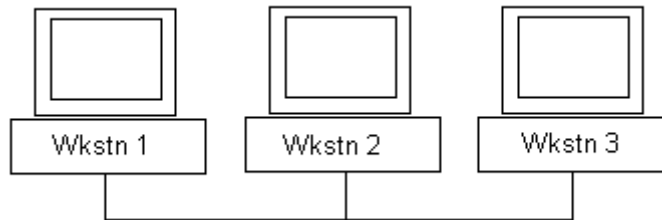
Server-based:

- Configuration of nodes. A dedicated node that shares out its resources to hosts is a server (resources like printers, files, and applications)
- More security, more expensive
- Print servers, file servers, mail servers, web servers
- Novell NetWare, UNIX, Microsoft NT, Apple AppleTalk

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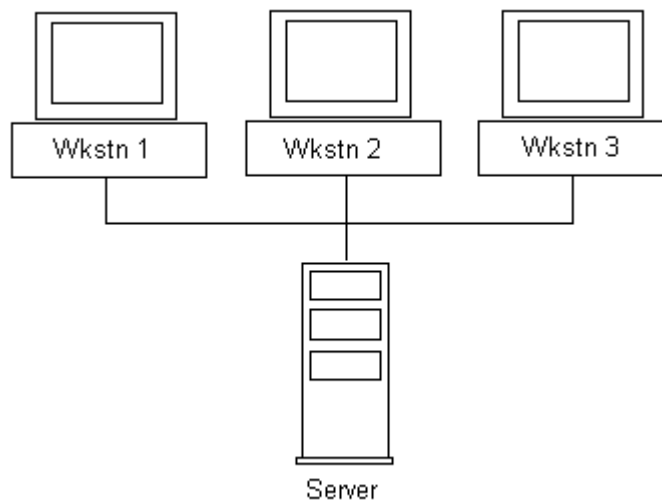
Enterprise Network:

- Connect all nodes in an organization (LAN, WAN)
- Run mission-critical applications
- Include both P2P and Server-based networks
- Multi-protocol systems and across multiple architectures (gateways)
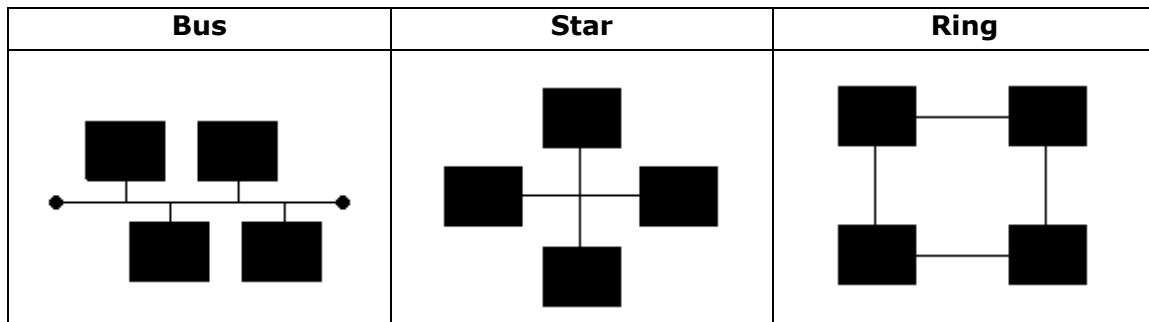
Physical Topologies:

Bus	Star	Ring

Mesh: every computer is connected to every other computer
Hybrid: any of these in combination

Do not confuse Physical Topologies with Logical Topologies.
Logical Topology: the actual path of a signal over a network (bus, ring)
Physical topologies: how the network devices are actually connected.

Network Operating Systems:

- Novell NetWare 5
- Microsoft NT, 2000
- UNIX

Networking Protocols

A protocol is a rule of communication, a standard agreed-upon way to communicate that enables data flow from one computer (NIC card) to another.

See also section on Internet Protocols

OSI/RM

Open Systems Interconnect reference model, as defined by the ISO in 1983:
- A universal concept to help develop protocols and standardize network technologies

- A common framework to connect heterogeneous/dissimilar systems (NOS interoperability)
- Describes the process of packet creation and how information is sent over a network.

7	**Application**	User-end interface that supports file transfers, network management and services
6	**Presentation**	Data transformations (like ASCII to binary, for example), translation and conversion
5	**Session**	Establishes, manages, and ends connections between application. Traffic flow information is found here.
4	**Transport**	Reliable transparent transport between source and destination hosts (end points). End-to-end error recovery and flow control supported here.
3	**Network**	Organizes data into packets (or datagrams), then forwards and routes them to their destinations.
2	**Data Link** *- LLC* *- MAC*	Reliable data transfer across the physical link. Frames are synchronized, checked for errors and flow control, and transmitted. Data is prepared to be sent across the transmission medium. IEEE 802.2 of LAN standards divides the Data Link layer into two sub-layers: Logical Link Control (LLC) layer and the Media Access Control (MAC) Layer. LLC – error and flow control. MAC – places data on the transmission media.
1	**Physical**	Responsible for the mechanical, electrical, and procedural characteristics of the transmission (of the unstructured bit stream) over a physical link, to establish, maintain, and deactivate the physical link.

***Note:** Each layer only talks to the layers directly above and below it (except the Physical layer).
***Note:** Know this thoroughly – you will always need to know and understand this model.

More on the OSI/RM:
James Bond Guide to the OSI Model
The ISO/OSI Model

Packets

"Packet" is a generic term for any piece of information that passes through a network (also called "datagram" at the Network layer or "frame" at the Data Link layer). Packets are made up of three parts:

- Header (7 layers)
- Data
- Trailer

The packet creation process begins at layer 7 (Application) and each layer adds its own information to the header. When a packet is received, the reverse occurs: beginning at layer 1 and each layer removing its corresponding part of the package until only the data remains.

Application, Transport and Network Protocols

OSI/RM	Protocols
Application	Application
Presentation	
Session	
Transport	Transport
Network	Network
Data Link	
Physical	

Application-layer Protocols

These protocols, aka Upper-layer protocols, allow applications to talk to each other across networks:
- SMTP: Simple Mail Transfer Protocol
- BOOTP: Bootstrap Protocol
- FTP: File Transfer Protocol
- HTTP: Hypertext Transfer Protocol
- AFP: Apple Filing Protocol
- SNMP: Simple Network Management Protocol
- SMB: Server Message Block Protocol
- X.500 (Directory architecture)
- NCP: NetWare Core Protocol
- NFS: Network File System

Transport-layer Protocols

These protocols provide reliable data delivery:
- TCP: Transmission Control Protocol
- UDP: User Datagram Protocol (does not provide reliable data delivery, however; used for broadcasting)
- SPX: Sequenced Packet Exchange Protocol
- NWLink: NetWare Link

- ATP: AppleTalk Transaction Protocol
- NetBEUI

Network-layer Protocols

These protocols provide addresses used on and rules for a network:
- IP: Internet Protocol
- IPX: Internetwork Packet Exchange
- NWLink: NetWare Link
- NetBEUI: Network BIOS Extended User Interface
- X.25
- Ethernet

Stateful and Stateless Protocols

Some network protocols require a connection (or session) be established before information is transferred. A session is called a state, so connection-oriented protocols are also called stateful, and connectionless protocols are called stateless. For example, TCP is stateful, while IP is stateless.

Routable and Nonroutable Protocols

Nonroutable protocols use static, predefined, unchangeable routes, whereas routable protocols can pass through routers and across LANs and WANs. For example, NetBEUI, NetBIOS, SNA and DLC are nonroutable protocols, while TCP/IP and IPX/SPX are routable.

Major networking protocols to know:
- TCP/IP
- IPX/SPX
- NetBEUI
- AppleTalk
- DLC: Data Link Control
- SNA: Systems Network Architecture

TCP/IP

In January 1983, the networks of the Internet adopted TCP/IP suite as the official protocol. TCP/IP is an open standard (not vendor specific) and is a collection of protocols including:

- TCP: Transmission Control Protocol
    - Ensures reliable connection
    - Fragments and reassembles messages in the correct order
- IP: Internet Protocol (currently Ipv4)
    - Connectionless

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- o Provides 32-bit IP addresses (see section on Internet Addressing)
- o (IPv6 will use 128-bit IP addresses in the future)
- UDP: User Datagram Protocol
- ICMP: Internet Control Message Protocol
- ARP: Address Resolution Protocol

See also these other TCP/IP sections:

> TCP/IP under Internet Fundamentals
> TCP/IP Architecture
> TCP/IP Configuration

IPX/SPX

IPX/SPX is a LAN/WAN protocol suite developed by Novell (Microsoft calls it NWLink), therefore not vendor-neutral and not supported on the Internet:

- SPX: Sequenced Packet Exchange
  - o Connection-oriented, transport-layer protocol
  - o Provides reliable data delivery and session management
- IPX: Internetwork Packet Exchange
  - o Connectionless
  - o Network addressing and packet forwarding (routing)

NetBEUI

IBM developed NetBEUI, Network BIOS (Basic Input/Output System) Extended User Interface. It is nonroutable.

NetBIOS

NetBIOS, Network Basic Input/Output System, designed to be used with NetBEUI, but is mainly used as an application programming interface now. It is a session-layer protocol, and can operate with NetBEUI, TCP/IP and IPX/SPX.

AppleTalk

AppleTalk is used in Apple networks and divides computers into zones.

DLC

DLC, Data Link Control, is used to link clients to mainframes (and HP laser printers to LANs via JetDirect).

SNA

IBM introduced SNA, Systems Network Architecture, as a network architecture that includes topology and protocols. The SNA model is similar to OSI/RM, but it is generally used with mainframes.

Binding Protocols

You must *bind* your protocols to your NIC (Network Interface Card). If you are using multiple protocols on a network, you need to determine the binding order of your protocols (In Window 95/98, this order is predetermined; in NT/2000 you can change the order of the hierarchy).

LANs and WANs

Local Area Networks (LANs) are a group of computers located in one geographical area that share files and services. Wide Area Networks (WANs) are a group of computers located in multiple or expansive geographical area that share files and services.

NAP (Network Access Point): a junction between two or more high-speed networks called *Internet backbones.* These backbones supply essential connectivity for the rest of the Internet as smaller networks connect to them.

Network Components

- NIC (Network Interface Card), also called an adapter card: interface between a single computer and the network
- Repeater: an amplifier that prevents signal degradation over distance
- Hub: a focal point of a network – connects computers in a physical star topology
- Bridges: device for filtering frames and connecting segments of a network, uses MAC addresses
- Routers: direct data packets between networks using IP addresses
- Brouters: combination bridge and router
- Switches: directs information flow on a network from one node to another.
- Gateway: converts protocols
- CSU/DSU (Channel Service Unit/Data Service Unit): terminates physical connections
- Modem (Modulate/Demodulate): a device to connect computers over analog telephone lines.
- Patch panel: a group of sockets that switch data manually between inbound and outbound transmissions

Networking devices to use depends on the demands on the network. Higher traffic will require components and/or bandwidth to handle it.

Cables: Fiber Optic or Twisted pair
- Fiber Optic cables are the fastest, most expensive, and most difficult to implement
  - o Single-mode: specific wavelength

o Multi-mode: many wavelengths (frequencies, or modes)
- Twisted Pair cannot exceed 100 m
  o STP: shielded twisted pair
  o UTP: unshielded twisted pair

Category	Description
1	Voice (UTP only)
2	4 twisted pairs, data transmission up to 4 Mbps (UTP only), token ring
3	4 twisted pairs, data transmission up to 10 Mbps, Ethernet
4	4 twisted pairs, data transmission up to 16 Mbps, token ring
5	4 twisted pair, data transmission up to 100 Mbps, Ethernet and fast Ethernet
6	4 twisted pair, data transmission up to 155 Mbps, fast Ethernet
7	4 twisted pair, data transmission up to 1000 Mbps, gigabit Ethernet

Connectors:
- RJ-45 (like phone jack)
- Coaxial (Thicknet, Thinnet)
- BNC Connector (like cable TV)

Transmission Types

- **Synchronous**: transmissions are synchronized between the access devices and the network device (message-framed data), and the message is received in the order it was transmitted.
- **Asynchronous**: transmissions are asynchronized between the access device and the network device, but each character is synchronized by information in the header and trailer bits.
- Data transmission flow: circuits are:
- **Simplex**: one direction
- **Half duplex**: two directions, only one at a time
- **Full duplex**: two directions simultaneously.
- **Baseband**: entire media bandwidth for a single channel using TDM (Time Division Multiplexing)
- **Broadband**: divides media bandwidth into multiple channels, each with a separate signal using FDM (Frequency Division Multiplexing)

IEEE LAN Standards

IEEE (The Institute of Electrical and Electronics Engineers) creates standards for network computers and communication access methods.

- **802.2**: divides the OSI/RM Data Link Layer into Logical Link Control (LLC) and Media Access Control (MAC)
- **802.3**: Ethernet, uses CSMA/CD
  - o **802.3u**: fast Ethernet
  - o **802.3z** and **802.3ab**: gigabit Ethernet
- **802.5**: Token ring, uses token passing (with a MAU)
- **802.12**: 100VG-AnyLAN, uses demand priority
- **Apple LocalTalk**: uses CSMA/CA
- **FDDI** (Fiber Distributed Data Interface): token-based (for MAN)

WAN Standards

- **X.25**: original ARPANET packet service, but still used in bank machines, error-free data delivery, 56 Kbps or slower.
- **Frame Relay**: fast packet switching relay technology, using fiber optic and digital cabling, PVCs (Permanent Virtual Circuits) and variable-length packets, 64 Kbps-1.544 Mbps.
- **ATM** (Asynchronous Transfer Mode): mostly used in Internet backbone. cell relay technology, using fixed-length cells, 155 Mbps – 622 Mbps.

TCP/IP Architecture

Internet architecture is divided into four layers, each layer responsible for specific communication tasks.

OSI/RM	Internet Architecture
Application	Application
Presentation	
Session	Transport
Transport	
Network	Internet
Data Link	Network Access
Physical	

See also sections on

TCP/IP under Internet Fundamentals
TCP/IP Configuration
TCP/IP as a Network Protocol under Networking Fundamentals

Application Layer

- Corresponds to the Presentation and Application layers of the OSI model.
- Interacts with the transport-layer protocols to send and receive data.
- Protocols include:
    - HTTP ([RFC 1945](#), [RFC 2616](#))
    - FTP ([RFC 959, STD 9](#))
    - Telnet ([RFC 854](#), [RFC 855, STD 8](#))
    - NNTP ([RFC 977](#))
    - Gopher ([RFC 1436](#))
    - SMTP ([RFC 821, STD 10](#))
    - SNTP ([RFC 1157, STD 15](#))
    - DNS ([RFC 1034](#), [RFC 1035, STD 13](#))
    - BOOTP ([RFC 951](#), [RFC 1497](#), [RFC 2132](#))
    - DHCP ([RFC 2131](#))
- Port Numbers:

    - FTP: port 21
    - SMTP: port 25
    - DNS: port 53
    - HTTP: port 80

Transport Layer

- Corresponds to the Transport and Session layers of the OSI model.
- Accepts application-layer data, divides data into packets, and provides the flow of information between two hosts.
- Protocols include:
    - TCP ([RFC 793, STD 7](#))
    - UDP ([RFC 768, STD 6](#))

Internet Layer

- Corresponds to the Network layer of the OSI model.
- Addressing and routing of packets on TCP/IP networks (either locally or through a gateway)
- Protocols include:
    - IP ([RFC 791, STD 5](#))
    - ICMP ([RFC 792, STD 5](#))
    - IGMP ([RFC 1112, STD 5](#))
    - ARP ([RFC 826, STD 37](#))
   - RARP ([RFC 903, STD 38](#))

Network Access Layer

- Corresponds to the Data Link and Physical layers of the OSI model.
- Accepts higher-layer datagrams (or Ethernet frames) and transmits them over the network.
- Handles interfacing with network media.
- Physical connections, NIC, OS device driver.

Demultiplexing

To process an incoming packet the destination computer uses demultiplexing. TCP has to keep track of which connection datagram is a part of. This task is referred to as "demultiplexing." The information needed to do keep track is contained in a series of protocol headers. There are several levels of demultiplexing going on in TCP/IP.
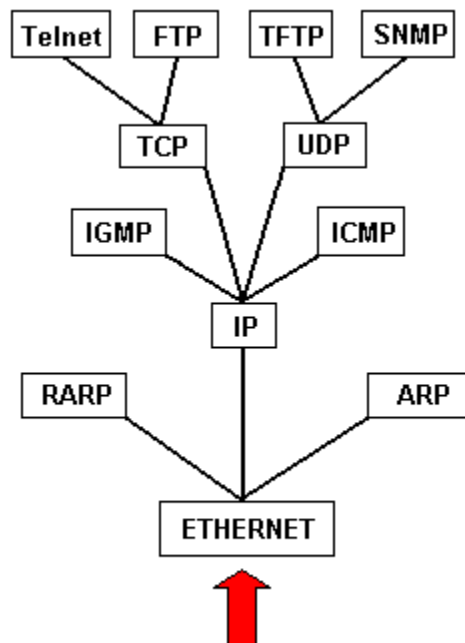
For more, check out:
Multiplexing and Demultiplexing Applications

CramSession
Prepare for Success!

Routing

The Internet layer performs routing. Routing, a very important IP function, is the process that determines the path of packets from source to destination. Routing is most often performed by a router, which forwards packets from one network to another to reach a destination. The destination (IP address) is determined by the router's *routing information table*. The default gateway determines which router will route the packet to the destination network (IP address of the local network). The distance between source and destination is measured in hops.

Direct routing

Direct routing occurs when a router is not needed and packets are being sent across the same physical network.

Indirect routing

Indirect routing occurs when a router is needed and packets are being sent across different physical networks.

Static routing

Static routing requires manually maintained routing information tables.

Dynamic routing

Dynamic routing calculates and updates routes automatically (using RIP and OSPF).

Routing Protocols

Routing Protocols are either **Interior** or **Exterior**. RIP and OSPF are interior routing protocols; EGP and BGP are exterior routing protocols.

Routing Information Protocol (RIP)

RIP keeps one route to a destination, specifically the one with the fewest hops between the source and the destination. Old route information is replaced when a new, better route is found. This works well for small-medium LANs. There are two versions of this protocol: RIPv1 (RFC 1058) and RIPv2 (RFC 2453)

Open Shortest Path First (OSPF)

OSPF takes into consideration not only the hop count, but also bandwidth, multiple connections, and security. Its latest version is now an Internet standard (RFC 2328). OSPF also offers routing table updates, multiple routes for a single destination, load balancing, network partitioning, authentication, and definition of host- and network-specific routes.

Internet Addressing

The International Corporation of Assigned Names and Numbers (ICANN) organization dispenses all IP addresses.

See also IP Addresses under Internet Fundamentals

IP addresses are made up of two parts: the network portion and the host portion. Each is displayed as four numbers, or octets, separated by a period (e.g. 126.10.192.254). This translates into binary as four bytes or 32 bits.

Binary bit value:

1	1	1	1	1	1	1	1
128	64	32	16	8	4	2	1

E.g.
01111110.00001010.11000000.11111110 = 126.10.192.254

01111110	00001010	11000000	11111110
0+64+32+16+8+4+2+0	0+0+0+0+8+0+2+0	128+64+0+0+0+0+0+0	128+64+32+16+8+4+2+0
126.	10.	192.	254

A valid Internet IP address cannot be all zeros (0) or all ones (255).
Classes:

Class	Starting Binary Value	IP Address Range
A	0	0.0.0.0 => 127.255.255.255
B	10	128.0.0.0 => 191.255.255.255
C	110	192.0.0.0 => 223.255.255.255
D	1110	224.0.0.0 => 239.255.255.255
E	11110	240.0.0.0 => 247.255.255.255

Class	Network Portion	Host Portion
A	1 byte	3 bytes
B	2 bytes	2 bytes
C	3 bytes	1 byte
D	4 bytes (multicasting)	
E	Experimental/future use	

Class	Networks	Hosts
A	126	16,777,214
B	16,384	65,534
C	2,097,152	254

Loopback Address – 127

The loopback address allows client and server to communicate on the same host. So, 127.0.0.1 cannot be used as an Internet address (similar to a PING for troubleshooting).

Broadcast Address – 255

'255' is used to send messages to all network hosts. Four types are Limited (255.255.255.255), net-directed (netid.255.255.255), subnet-directed (within a subnet), all-subnets-directed broadcasts (not used anymore).

Reserved IP Addressing

Reserved IP addresses are used for private networks (RFC 1918)

Class	Reserved Block
A	10.0.0.0 => 10.255.255.255
B	172.160.0 => 172.31.255.255
C	192.168.0.0 => 192.168.255.255

Subnetworks and Subnet masks

Subnets divide hosts into logical groups within a network. Thus, one network is divided into several subnetworks. Subnets require subnet routing, in which the host portion of the IP address is divided into two parts: subnetwork and host. Subnet IP addresses require a subnet mask to know how to interpret the subnetwork and host portions of the IP address (whether the IP address is local or remote, for example).

Class	Default Subnet Mask
A	255.0.0.0 (/8)
B	255.255.0.0 (/16)
C	255.255.255.0 (/24)

For excellent articles on Subnetting,
> Learn to Subnet Part I
> Learn to Subnet Part II
> Quick and Dirty Subnetting

TCP/IP Configurations

Basics:
- IP address
- Subnet mask
- Default gateway
- DHCP client

Name resolution:
- Host name
- Domain name
- DNS server
- NetBIOS name
- WINS server

(Often you can configure the order used to resolve a name from these methods.)

Troubleshooting IP Addresses

Commands and tools:
- PING
- TRACERT
- NETSTAT
- IPCONFIG
- WINIPCONFIG
- ARP
- Network analyzers (that monitor traffic/trends, send alert messages, test connections)

Internetworking Servers

A server is a powerful network computer that provides a service. Servers are generally named after the types of services they provide, including:

File and Print Servers

File servers store data files and programs. Print servers enable multiple users to share printing services through a queue

Application Servers

Application server runs programs and processes data

HTTP (web) Servers

The web server binds TCP to port 80, and listens for requests made in HTML. Applications used are called CGI applications (Common Gateway Interface) or scripts. The web server stores web documents including images, multimedia and web pages.

Proxy Servers

A Proxy server acts as a intermediary between the network host and other hosts outside the network. It manages TCP/IP address, provides caching for frequently used documents, and provides more security (firewall access, filtering, transaction logging)

Caching Servers

A caching server speeds up access to data by caching frequently accessed data. (Often, this is done by a proxy server)

DNS Servers

Domain Names System servers translate host computer names, FQDN (Fully Qualified Domain Name), into IP addresses (aka name servers) – of the web server most often. DNS servers use an application that provides name-to-address translations. DNS is hierarchical and distributed (and decentralized) with three levels of domains: root level, top level, and second level.

See also DNS under Internet Fundamentals

FTP Servers

FTP servers allow the transfer of large documents faster than with email and HTTP. They also log all traffic (usually anonymous)

Mail Servers

Mail servers store and forward email messages. MIME (Multipurpose Internet Mail Extensions) is often used to transmit files with email (also Uuencoding and BinHex).

Mailing list Servers

A mailing list server (aka SMTP server, "reflector" or "autoresponder") just sends emails. MLM (Mailing List Manager) is used to configure a mailing list.

Media:

Media servers use UDP and buffers to achieve the effect of real-time connection for streaming video and net conferences.

News Servers

News servers use NNTP (Network News Transfer Protocol). Newsgroup names are written in a hierarchical index, and require a newsreader.

Certificate Servers

Certificate servers certify/validate keys and generate/manage digital certificates with cryptography, as either encryption or digital signatures.

Directory Servers

Directory servers identify all the resources on a network and make them available to authenticated users (including user, administrator and server tasks). Protocols include X.500, DAP (Directory Access Protocol) and LDAP (Lightweight Directory Access Protocol)

Catalogue Servers

Catalogue servers provide a single access point for searchable information across a distributed network (index, catalogue, search services)

Transaction Servers

A replacement for the mainframe CICS server, transaction servers enable high-volume, inexpensive bridging to mainframe servers.

Mirrored Servers

Mirrored servers provide redundancy to protect data in a RAID (Redundant Array of Inexpensive Disks).

Internet Daemon

The Internet Daemon (inetd) is a UNIX service or program that starts other Internet server processes. It begins at startup and runs in the background until needed. It can be used to launch any UNIX server process.)

Choosing a Server

- Determine the company's needs
- Determine which types of servers are required
- Determine and find solutions: best – better (a few alternatives)
- Weigh benefits, costs, advantages, disadvantages...

Server-side Scripting

Active Content is often embedded in HTML documents as server-side include, code that activates programs on a server (includes are designed to create dynamic pages and lower server overhead) and provide for code re-use.

When a request is made to the HTTP (web) server that requires data from another server (e.g. from a database), HTTP Gateways are used. HTTP Gateways, a script or small application that allows this transfer of data, enable the two servers to act together without the user noticing (e.g. CGI, SAPI, ISAPI).

See also Active Content and Forms under HTML Fundamentals

CGI

CGI scripts are files with executable permissions located in a directory called CGI-BIN. CGI scripts are often written in PERL, but are an open standard, not platform-specific. Every time a script requests a CGI application, another instance of that application opens, making it quite system-resource intensive as more and more applications run.

CGI alternatives include
- JSP: JavaServer Pages (including Java servlets)
- PHP: Personal Home Page
- ASP: Active Server Page
- SSJS: Server-Side JavaScript

SAPI

Server Application Programming Interface (SAPI) is a proprietary vendor-specific technology, similar to CGI.

ISAPI

Internet Server Application Programming Interface (ISAPI) is a proprietary HTTP server extension supported only by Microsoft Web servers (like IIS 4.0). ISAPI applications open "threads" (sub-processes). It can support more user requests without draining system resources, because ISAPI uses DLL files that can handle every request without being reloaded into memory. ISAPI favors VBScript.

NSAPI

The Netscape Server Application Programming Interface (ISAPI) is Netscape's proprietary version of ISAPI.   NSAPI supports different languages, and favors JavaScript.

Databases

A database is a searchable file or group of files used to organize data and information. Databases store, access, organize and manipulate data using database software. There are three types of databases:

- Non-relational: uses DBMS (Database Management System) software, which has either hierarchical (one user at a time) or network (many users) databases.
- Relational: uses RDBMS (Relational Database Management System), which uses indexed tables
- Object-oriented: uses ODBMS (Open Database Management System)

Database Connectivity

Gateway programs and scripts access the OS registry. Two standards enable users to program the OS registry to interpret databases with CGI, JSP, PHP, ASP, SSJS, Java servlets, and other gateway applications:

- ODBC Open Database Connectivity is a Microsoft standard API for SQL to access relational databases. (Microsoft's ODBC page)
- JDBC: Java Database Connectivity (developed by Sun Microsystems JavaSoft) allows Java to process SQL statements within Java programs.

A number of programs simplify DBC: LiveWire, ColdFusion, Save As HTML, and ADO, as well as JSP, PHP, ASP, SSJS and Java servlets. (You also should know a little about each of these applications.)

Network Security Essentials

Defense and protection of assets is a simple definition for security. This includes the physical safety and safeguarding of assets. The ISO defines security as a "means to reduce, to the greatest extent possible, the vulnerability of data and resources."

See also sections on Email Security and Enterprise Network Security

Securing a Server:

- Change system defaults
- Permissions for users, groups
- Certificates, encryption, passwords
- Automated logging
- Establish a baseline of activity (traffic trends, irregularities)
- Combine OS and Internet server policies

- Change system topology (firewall)
- Written policies and guidelines
- Locked rack and room (physical security)
- Kerberos (an authentication system)
- OTP (one time passwords)

You should be able to define each of the following.

Network Assets:

- Local resources
- Network resources
- Server resources
- Database/information resources

Security Threats:

- Accidental threats
- Intentional threats
- Casual hacker
- Determined hacker

Types of Attacks:

- Spoofing (masquerade) attack
- Man-in-the-middle (hijacking) attack
- Denial of Service (DOS) attack
- Brute-force attack
- Insider attack
- Trapdoor attack
- Replay attack
- Trojan horse attack
- Social-engineering attack

Combat and defeat attacks with *authentication, access control, data integrity and confidentiality, non-repudiation*.

See also:
> SANS GIAC Security Essentials Cramsession
> CIW Security Cramsession

Types of Viruses:

- Macros
- Executables
- Boot sector

- Stealth
- Polymorphic

The Hacker Process

1. Discovery
   - WHOIS, PING
   - Computer type and OS configuration
   - Network elements like services, ports, topology
2. Penetration
   - System defaults
   - System bugs
   - Network access
3. Control
   - Destroy evidence
   - Obtaining additional accounts

The only way to know a network's ability to withstand the hacker process is a thorough *auditing process*.
- Status quo analysis (Physical security, Service discovery)
- Risk analysis
- Threat Analysis

Security Organizations

- CERT
- CSRC at NIST
- CIAC

Enterprise Network Security

Authentication

Three methods of authentication are:
- What you know (login, password)
- What you have (key, smart card)
- Who you are (unique physical attributes, like fingerprints, voice analysis, and retinal scans)

Encryption

Encryption is the primary means for privacy across an enterprise network. There are three models, which can be used alone or in combination to achieve PGP (Pretty Good Privacy):
- Symmetric key: uses a single key, 40 to 128 bits (e.g. a password).

- Asymmetric key: uses a pair of keys, one encrypts, one decrypts
- One way: uses a hash table (a table of hexadecimal number to calculate the encryption) (e.g. SSL connections)

Across long distance, Virtual Private Networks (VPNs) are used for secure communication using tunneling protocols (like IPSec and PPTP: Point-to-Point Tunneling Protocol)

Encryption standards can be country-specific.

Secure Sockets Layer (SSL)

SSL protocol enables applications to exchange data over public networks privately, providing an extra layer of protection above TCP/IP (between Transport and Session layers of the OSI/RM). SSL allows two hosts to communicate after authenticating with a digital certificate. SSL 3.0 is the current standard. S-HTTP – Secure HTTP is the protocol used.

Certificate Types:
- CA (Certificate Authority) certificates
- Server certificates
- Personal certificates
- Software publisher certificates

Firewalls

A firewall is a secure computer system that is positioned between a trusted network (LAN) and a distrusted one (Internet). Generally, firewalls are placed between what is public and what is private, as a protective barrier and the primary means of enforcing security policies.

Functions include:
- Packet filtering (source IP, destination IP, ports)
- Application-level gateway (like a proxy between in and out, on a program basis)
- Circuit-level gateway (like a proxy between inside and outside, at the Transport layer)
- Better authentication (password, Kerberos)
- Encrypted access (VPN)
- Logging, reporting
- Detecting intrusions
- Evasive actions
- Choke point (screened subnet, bastion host, DMZ)

See also how security compares between Email, Network and Enterprise Networking.

Special Thanks to Cherina Sparks MA, A+
for contributing this Cramsession.
Visit her site at
http://debaucherina.stormloader.com/