Hardware components

Router

A router connects multiple networks with different protocols and architectures. A router is usually positioned in the outer boundaries of a network in order to connect it with the Internet or another, network. A router uses a routing table to decide which way to send each Data packet. It’s a dynamic behaviour which handles down times and blockages without administrators intervention. The tasks of the router consist of:

* Investigating the available routes
* Chosing the passing route considering certain criteria
* Creation of a physical connection to other networks
* Adapting data packets to the transmission technology (Fragmenting)

A router usually has two connections. One for the LAN sie and one for the WAN side. LAN is the local network with private IP- addresses, while WAN side is the public internet.

Hub

Hus is used in Ethernet networks. Computers connect with a HUB UTP cable. Hub is a box with a lot of UTP plugs for connecting computers in a local network and allowing them to communicate. Hub is a central point for connecting a group of computers in a network in a star shape. Hub forwards all the data that are received on one port to all other connected ports. A typical hub has 8 ports but there are hubs with 32 ports as well. Hub accepts data through a port and transmits them through other ports.

Hub enhances the transmited signal, transmits signal through the network, doesn’t require filtering and represents the central point of the network. Hub does not recognize the type of information in the signals, it doesn’t recognize the addresses or data.

Flaws of hub systems are: inefficiency( for example, you want to send the data from a computer connected on port 1 to a computer connected to a port 5. Hub doesn’t know that and he sends the data to all the computers. Computer connected on port 5 will know that data is intended for it and it will accept it, white the others will reject them), two computers cannot send data at the same time because it leads to a collision. Multiple hubs can be connected together to increase the size of the network but by doing that the number of colisions will increase and the network performance will drop.

Switch

Instead of using a HUB we can use devices which analyse traffic through a node called SWITCH. Switch is one of the fundamental elements of a network. Switch has a number of ports usually between 18-32. They are more intelligent than hubs. A switch has a built in microprocessor which analyses the data so it knows the transfer them from one port to the other. When we turn on the switch it scans the network and remembers on which port is which computer connected. That is possible because each network card has a MAC address. That is why this network is more efficient and it does not lead to collisions and there is also no speed limit as there is by HUBs.

Switch enables sending of information through a network to a large number of users at the same time without slowing down the transmission.

Software components

Browser client

The primary function of a web browser is to correctly display the contents of an internet site. Internet sites don’t consist of only texts and images. In many cases the websites have dynamic elements built in, which enable interaction with the user. Since every piece of software is built differently, it’s possible that some website will display differently on different browsers, still it’s the duty of the developer to make sure that their content display properly on all browsers.

The safety factor is also important. Considering that there are many opportunities for an attack through viruses and malware on the internet, the web browser is the first line of defence. Modern web browsers are able to judge a websites trustworthiness through certificates.

Websites are closely connected with the web search engines such as Google, Bing etc… Users can use the search engine to systematically search the World Wide Web for text data that is specified as a search parameter.

Email client

An email client es a program which can be used to receive, read, write and send emails.

To display an email, an email client can open an email directly from a mail server(IMAP or IMAPS) or it can be downloaded from a mail server(through POP3 or POP3S) and then opened locally, usually after they are stored in a user defined directory.

To send an email, the e-mail client uses simple mail transfer protocol (SMTP) to a SMTP-relay server(smarthost), which sends them to the email server of the receiver. The flaw of this is that if the relay server is offline, it is impossible to send an email.

Aleternatively Mail Transfer Agents(MTA) can be used. It is a process in which allow a creation of a local que for sending out E-mails.

FTP Client

FTP client is necessary for the transfer of data. In many modern browsers is FTP client already integrated. The client creates a TCP – connection to a Control-port of a server. Through this connection data can be exchanged between the client and the server, using FTP-commands.

A free open source software option for transmitting data is FileZilla.

Explain the following protocols

TCP/IP including IPv6

Transmission Control Protocol consists of multiple layers

**The application layer** allows the user to interact with the application.

Visiting a website with a browser, the browser sends a HTTP-get request. The HTTP request contains information about the HTTP version being used and which website is being requested from the server. The server answers with a Header-information. The header consists of data about the server and the transfered content. And finally the information itself is transfered, in this case the HTML website.

**Transport layer**

TCP is in charge of creating a connection between a computer and a Web Server. As soon as both sides agree to a connection, from the perspective of the protocol there is no difference between them. At this point, the browser and the server can exchange information. Both sides keep the ability to end the connection. In order for them to be able to create a connection they need an IP address.

**Network layer**

The network layer is specifified in the TCP/IP reference model but it is only used as a placeholder. Multiple different protocols can be used here, in home usage Ethernet (WLAN) is used. These protocols are used for the communication between the router and the PC.

**Data Link Layer**

While the physical layer deals with a stream of raw bits, the data in the data link layer is tranformed into Frames. A frame contains hundreds or thousands Bytes. After a Frame is sent it's receival is confirmed ( Acknowledgement Frame), which confirms that the Data Frame is correctly received. It may happen, that the receiver is overwhelmed by data from a Sender (or multiple Senders) which makes him unable to properly receive and confirm the data Packets. This problem, also known as the Flow Control is dealt with in the Data Link Layer

**The physical layer** solves the problem of transmitting Data bits through physical media. This layer uses mechanical, elektrical and functional tools to create a physical connection and transmit Bits. It defines the bit size and transmission speeds. Hardware components of this layer include:

cable connections like fiber optic cables, lan cables, electrical cables, Repeaters and hubs, W-Lan Antennas...

**Internet protocol**

It is because of the IP addresss that the data packets arrive to their correct target. The data transmitted is the IP-Packet, which consists of Header and use data. The header data contains all the important information about the target, the source, and the possible ways that data can be segmented into multiple data blocks. The use data contains the actaul information.

IPv4 is is a networking address scheme. Every device connected to the network has a unique IP address which is used to keep track of the devices connected to the network

IPv4 addresses are divided using dots into 4 parts, each part being a number between 0 and 255, this means that in total there are 4.3 billion possible address combination. As the popularity of cell phones increase, and the fact that each need an IP address on their cellular data network, IPv4 limitation is increasingly becoming a problem.

IPv6 uses a 128 bit address, while IPv4 uses 32 bit address. Which means that there are 2^128 possible address combinations. IPv6 is increasing in popularity as IPv4 is becoming obsolete.

HTTP

HTTP is the communications protocol in the World Wide Web. The most important functions are data request from the server and loading them in the browser. The browser deals with the rendering of text and images and playing of audio and video data. The communication happens on the Client-Server principle. The HTTP client (Browser) sends a request (HTTP-Request) to the HTTP-Server (Webserver). The server processes the request and sends an answer (HTTP-Response). After the servers answer is the connection closed. Typically multiple HTTP connection happen at the same time.

The communication between the client and server is based on text format reports. The reports are usually send to the server by TCP through Port 80. The reports are called Request and Response and consist of a Header and the data. The header contains location information. The data is the data that the server sends to the client or the data that the client sends to the server for processing. The server can only process the data with additional programs or scripts.

SMTP

The simple mail transfer protocol is a protocol that is use for the exchange of email in a computer network. It is used to store and send emails. For message receival we use other, more specialized protocols such as POP3 or IMAP. SMTP servers usually use port 25.

SMTP is a communication protocol for the transmission of e-mails. The communication happens between an e-mail-client and an SMTP server or between two SMTP-servers.

For the exchange of E-Mails we use Mail Transfer Agents (MTA). MTAs communicate with SMTP-Protocol.

When an SMTP-Server receives an E-Mail from an E-Mail-Client(SMTP-Client), it transmits the e-mail to the designated SMTP-Server. DNS plays a central role here. DNS has special data for electronic mail called Mail Exchange Records. Using this data SMTP-Server identifies the target SMTP-Server of the Domain that is specifived in the E-Mail\_address of the receiver.

The process of E-Mail-Routing happens like this: The SMTP-Server queries a DNS Server and receives a list of Mail Servers, the E-Mails for the targeted SMTP- server

4 types of functionality

Purpose

It is important to be aware of the purpose of a website. A website should be built from the ground up with the purpose in mind. A purpose of the website could be to advertise a business, or it could be a personal website like a blog. A website could be more marketing oriented and be designed to sell products to users.

-Navigation

A simple and easy to follow navigation should be implemented on a website. Poor navigation would frustrate the visitors and cause them to cancel their work on the website.

A popular form of navigation is a navigation bar that is present on all pages of the website. This navigation bar would contain the essential links that the user can use to find the important parts of the website.

Keeping users engaged

As a service providers we want our users to stay engaged with our website for extended periods of time. To achieve this we have to investigate and deal with the sources of users frustration with the website. Some possible problems might be:

* Speed of the website. It is important that the website is fast as users dislike long loadingtimes and poor responsiveness of a awebsite.
* Intuitive design is also important as users cannot be bothered figuring out how new websites work
* Keep users coming back with by keeping the website up to date and relevant to the users changing demand

Talking their language

Writing is an important aspect of a website. It is important to research which population group is accessing your website the most and research their behaviour and habits. By doing that we may be able to write the website in a way that resonates with our targeted audience the most.

* Mobile friendly

Users are increasingly moving from desktop PCs to mobile devices such as smartphones, tablets etc… The design should reflect this by being able to adapt to a different display sizes. We can build websites by defining elements using width percentage or we can implement breakpoints at certain display width which would trigger a whole new website design.

-FAQ

Website visitors will often have questions about the site. By identifying the most frequently asked questions it is possible to make a Frequently Asked Questions section on the website. Such a section would reduce the amount of support queries made by the visitors and would improve user satisfaction.

-Hosting

It is important that a website is online 24/7 and that it can handle spikes in visitor numbers. To achieve this it is important to have a good hosting service. A website host can also manage the SSL certificate automatically.

Markup languages

A mark up language is a language that annotates text so that ta the computer can understand the text. Most markup languages are also human readable because they are written in a way that they are easily distinguished from text.

HTML

HTML is a markup language. HTML uses tags to define structure of the text. Elements and tags are defined by the < and > characters. The newest version of HTML is HTML5 this added more features

Hypertext Markup Lnaguage(HTML) is a text based markup language for structuring electronical documents such as text with Hyperlinks, images and other content. HTML documents are the foundation of the world wide web and are used by web browsers. Other then the data displayed by the browser, HTML files can contain additional data in the form of Meta-data, for example about the language used in the text, the author or brief description of the contents.

XML

The Extendable Markup Language, is a mark up language used for creation of hiearchicaly structured data in the format of Text Data, which can be read by huamns and machines.

XML is designed to be used for exchange of data between computer systems in a way that is not dependant on the platform or implementation details, especially over the internet and it was published in 1998 by W3C.

The most important structure unit of an XML document is the element. Elements can contain text and other types of content. Elements build nodes of the structure tree of an XML document. Tags are used to create elements. A start of an element: <ElementName>, an end of the element</elementName>

Different types of xml documetns are used for different purposes:

XHTML(web), SVG(vector graphics), OpenStreetMap(Geodata), Mpeg-7(multimedia)…

web runtime environments

During the production of a web application we may need to set up a local version of the application. On the local version we are able to instantly see the changes that are being made. In that local version we may need to simulate the same environment as it would be in alive application which may include: creating several user accounts, making test payments and simulating usage. When the local application works as we expect, we may push the changes to a live version of the application.

web application programming languages

Javascript is a light weight, interpreted programming language. Javascript is most known as a scripting language for websites but it is also used in environments outside of the web browser for example: Node.js, Apache and Adobe Acrobat. Javascript can function as both a procedural and an object oriented language.

* databases including SQL

A lot of web applications need a permanent storage location. It would be impossible to keep record of our users and their activities without a permanent storage in the form of a database. A database is a collection of information that is organized so that it can be easily accessed, managed and updated. In a relational database, digital information is organized into rwos, columns and tables which are indexed. in contrast, a graph database uses nodes and edges to define relationships between data entries and require a special semantic search syntax.

Relational model ( RM) for database management is an approach to managing data using a structure consistent with first order predicate logic, where all data is represented in terms of tuples, grouped into relations. A database organized in terms of the relational model is a relational database.

SQL is a standard language for accessing and manipulating databases. Sql is used by database administrators and developers. We use SQL commands to add, update, delete rows of data and retrieve subsets of information from a database.

php

PHP is a general purpose scripting language that is especially suited for web development and can be embedded into HTML. PHP is used for a creation of dynamic websites i.e. websites that interact with user. PHP code is executed on the server, and the result is returned to the browser as plain HTML. PHP can be used to interact with files on a server, collect data, send and receive cookies, interact with the database, control user access, encrypt data.

identify one typical stack combination

LAMP stack

LAMP is composed for four open-source components:

Linux: an open source operating system

Apache: Web server software

Mysql: Open source database

PHP: server-side open source scripting language.

Many popular websites use LAMP such as Facebook.