

IT Infrastructure Architecture

Infrastructure Building Blocks
and Concepts

Networking

Presentation layer

Presentation layer

- This layer takes the data provided by the application layer and converts it into a standard format that the other layers can understand
- Many protocols are implemented in the presentation layer
 - SSL and TLS are the most important ones

SSL and TLS

- Allow applications to communicate securely over the internet using data encryption
- Secure Sockets Layer (SSL)
 - SSL is considered insecure and should not be used
- Transport Layer Security (TLS)
 - TLS is securing WWW traffic carried by HTTP to form HTTPS
 - Version 1.2 is considered secure
 - Version 1.3 is in a draft state
 - TLS relies on an application capable of handling the protocol (like a Web browser)

Application layer

Application layer

- This layer interacts with the operating system or application
- Examples:
 - HTTP
 - FTP
 - SMTP and POP3 (e-mail)
 - CIFS Windows file sharing

Application layer

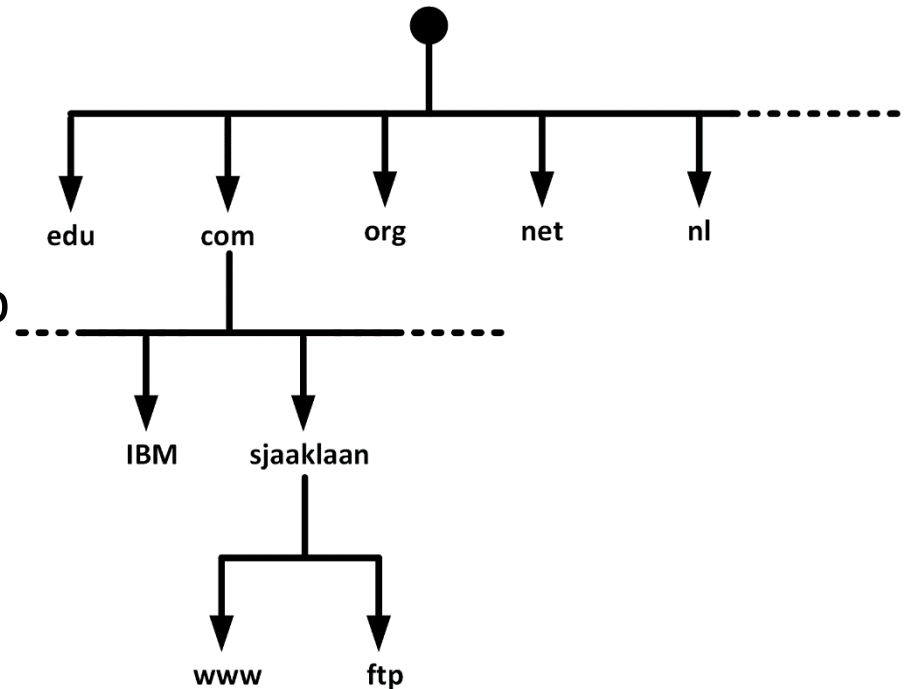
- This layer also contains the relatively simple infrastructure services
- Examples:
 - BOOTP
 - DHCP
 - DNS
 - NTP
- These infrastructure services are used by the infrastructure itself
 - Not necessarily used by upper layer applications
- If infrastructure services fail, usually the entire infrastructure fails!

BOOTP and DHCP

- BOOTP automatically assigns IP addresses to hosts
 - Uses a centralized BOOTP server
 - BOOTP requires manual configuration for each host in the network
- DHCP is an extension to BOOTP
 - It superseded BOOTP because it has more options
- DHCP dynamically assigns network related parameters to hosts:
 - IP addresses
 - Subnet masks
 - Default gateway to be used for routing
 - DNS server to be used
- A DHCP assigned IP address has a limited life span
 - Typically a few hours
 - This is called a lease

DNS

- DNS is a distributed database that links IP addresses with domain names
- Translates domain names, meaningful to humans, into IP addresses
- For example, *www.sjaaklaan.com* is translated to 217.149.139.184
- This IP address is used by the browser to connect to the web server
- DNS distributes the responsibility of mapping domain names to IP addresses by designating authoritative name servers for each domain



DNSSEC

- DNS has a number of security issues
 - DNS was not designed with security in mind
 - Updates to DNS records are done in non-encrypted clear text
 - Authorization is based on IP addresses only
- DNSSEC is a set of extensions to DNS
 - Provides origin authentication of DNS data
 - Provides data integrity
- DNSSEC is not in wide spread use today
 - All DNS servers must implement DNSSEC in order to make full use of all benefits

IPAM systems

- IP address management (IPAM) systems are appliances that can be used to plan, track, and manage IP addresses in a network
- IPAM systems integrate DNS, DHCP, and IP address administration in one high available redundant set of appliances

Network Time Protocol (NTP)

- NTP ensures all infrastructure components use the same time in their real-time clocks
- Particularly important for:
 - Log file analysis
 - Clustering software
 - Kerberos authentication
- NTP can maintain time:
 - To within 10 milliseconds over the internet
 - Accurate to 0.2 milliseconds or better in LANs
- When the time in an operating system is incorrect, the NTP client in the operating system changes the operating system clock

Network Time Protocol (NTP)

- NTP servers can be implemented as:
 - Software on operating systems, routers, and switches
 - Dedicated hardware appliances – often using some external signal like long wave radio clocks or GPS clocks
 - NTP time synchronization services on the internet
- NTP provides time in Coordinated Universal Time (UTC, previously known as GMT)
- The translation to the local time zone, including the switch to and from daylight saving time, is done at the operating system level, not in NTP clocks

Network Time Protocol (NTP)

- NTP operates within a hierarchy
- Each level in the hierarchy is assigned a number called the stratum
- The stratum defines its distance from the reference clock

