

Administration of Operating Systems

DO2003

<http://www.hh.se/do2003>

Networks



Network overview

- Main characteristics

- Facilitate communications

- Email, chat, ...

- Permit sharing of files, data, and other types of information

- Share network and computing resources

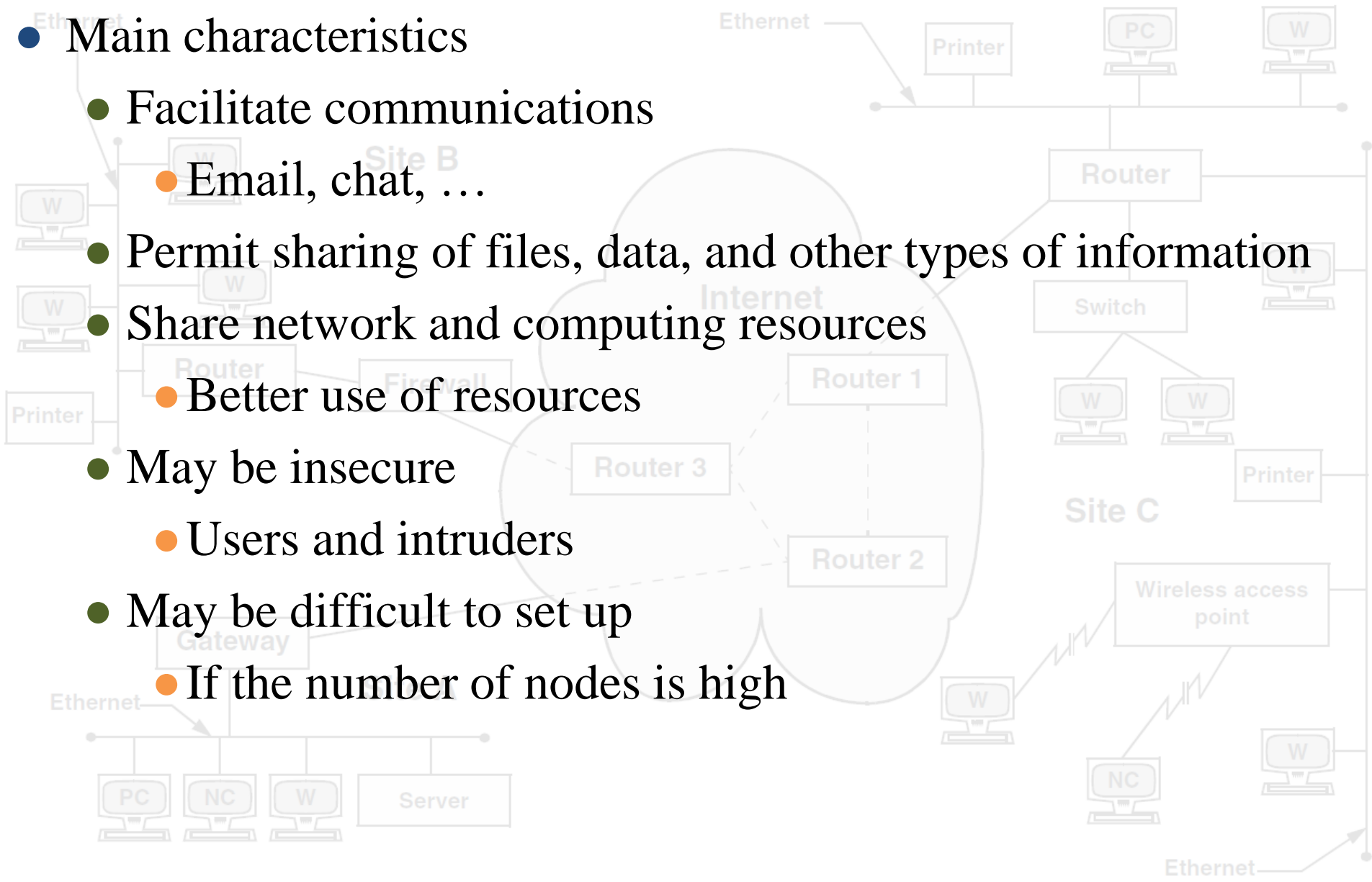
- Better use of resources

- May be insecure

- Users and intruders

- May be difficult to set up

- If the number of nodes is high



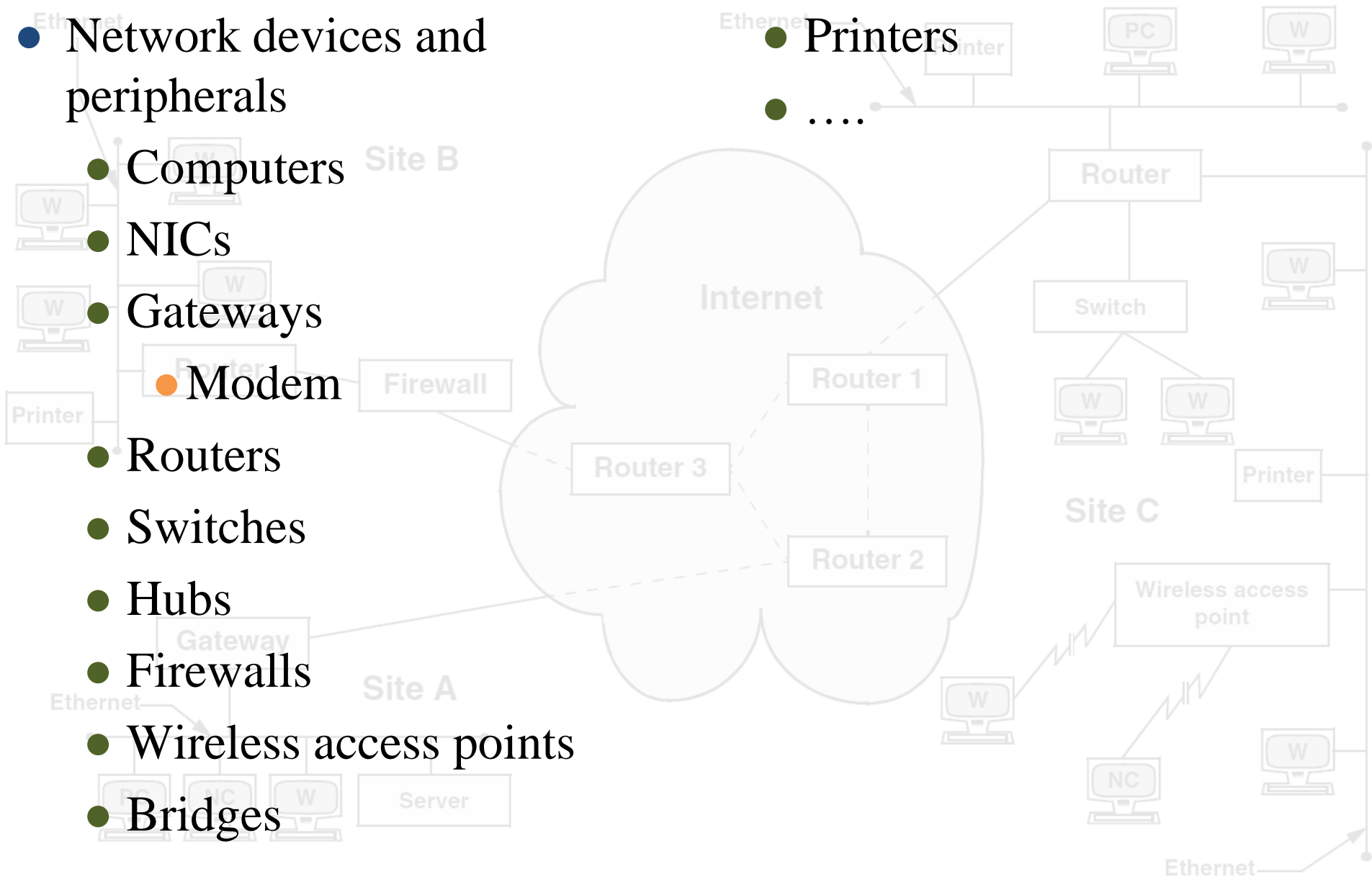
Network overview

- Network devices and peripherals

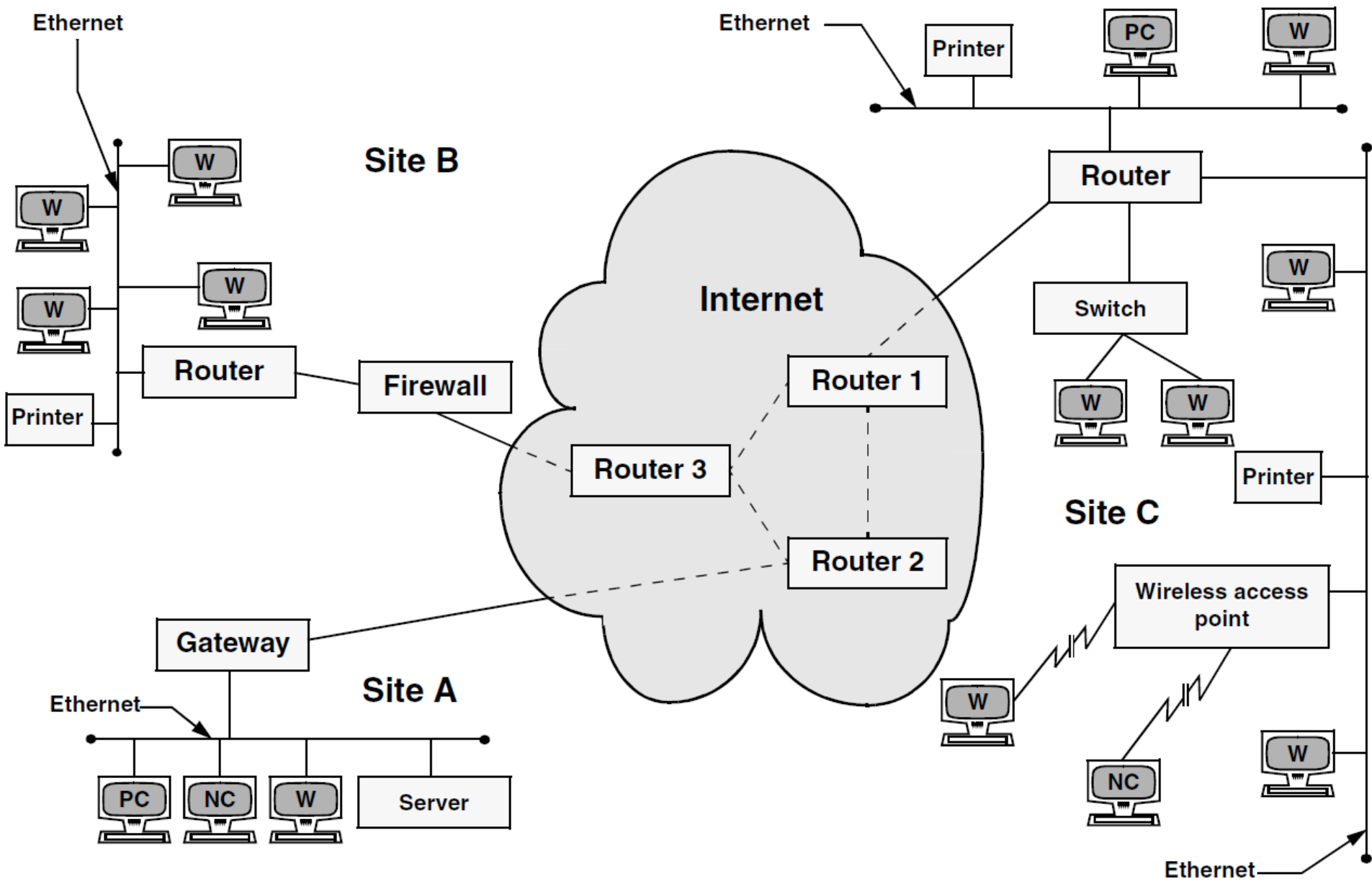
- Computers
- NICs
- Gateways
- Modem
- Routers
- Switches
- Hubs
- Firewalls
- Wireless access points
- Bridges

- Printers

-



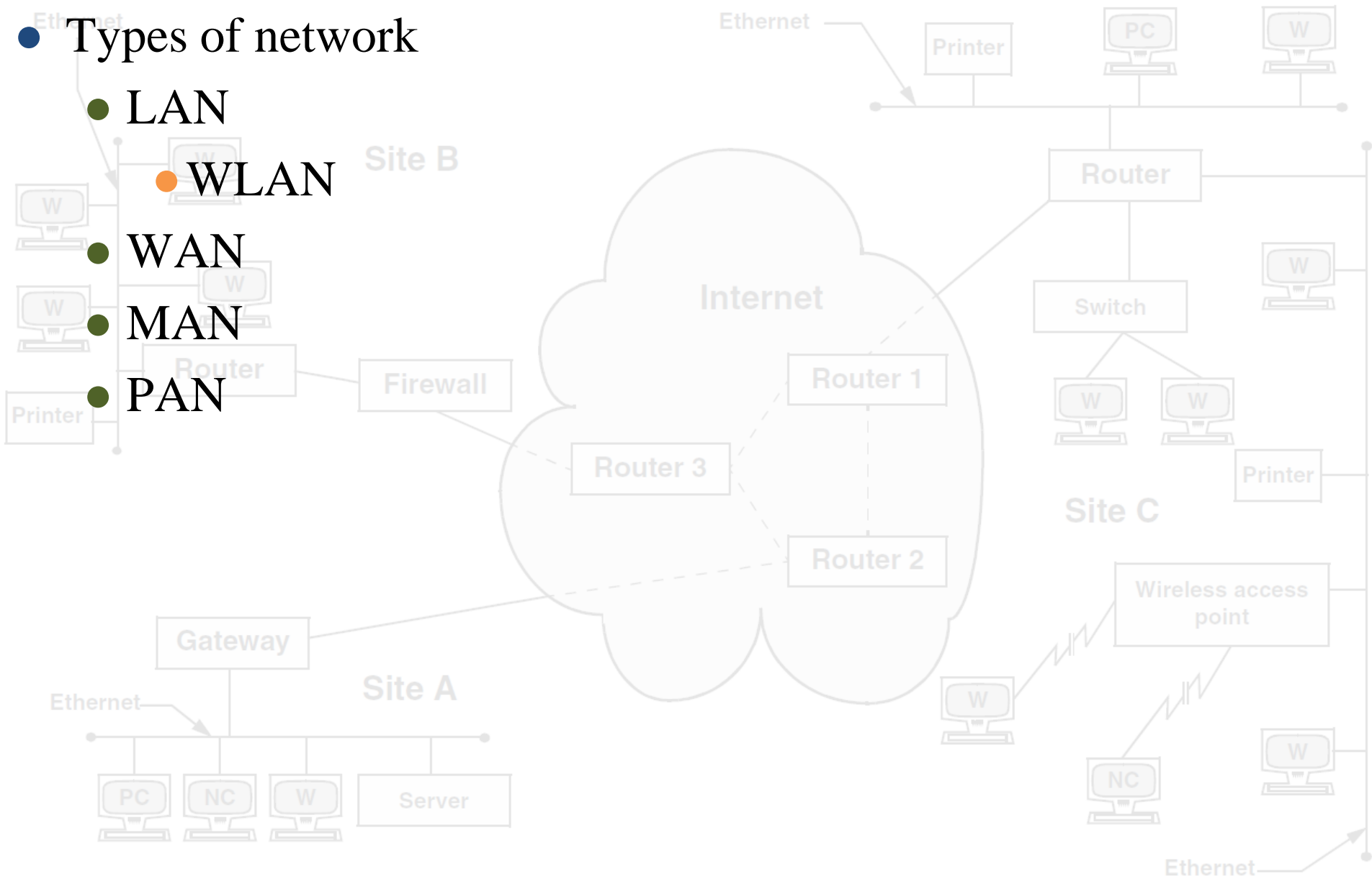
Network overview



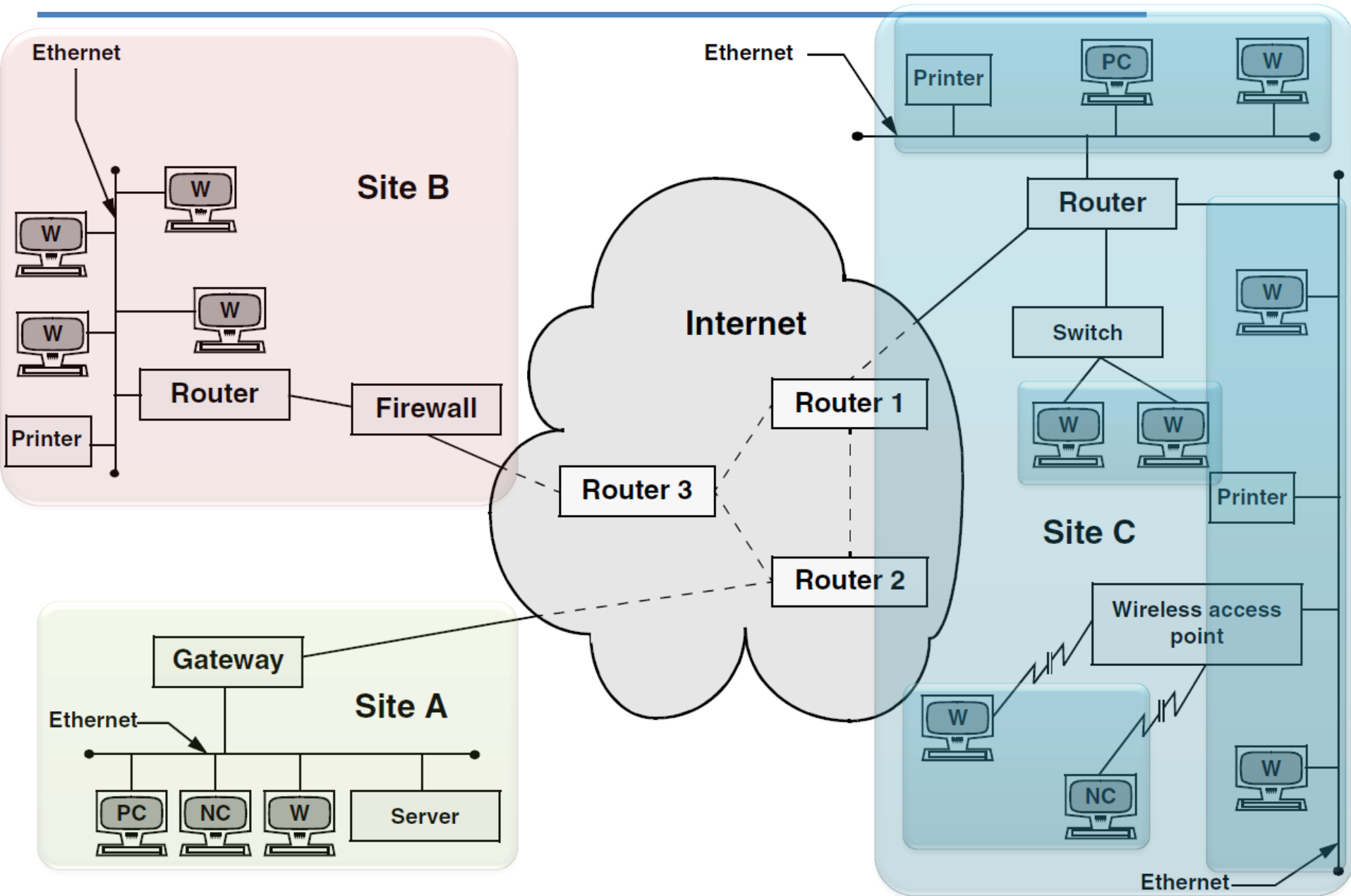
Network overview

- Types of network

- LAN
- WLAN
- WAN
- MAN
- PAN



Network overview



Network overview

- Communication model

- Broadcast

- Ethernet is an example

- Any device can transmit. Each system will process messages addressed to it, otherwise, discards

- Collision

- Contention and Low speed

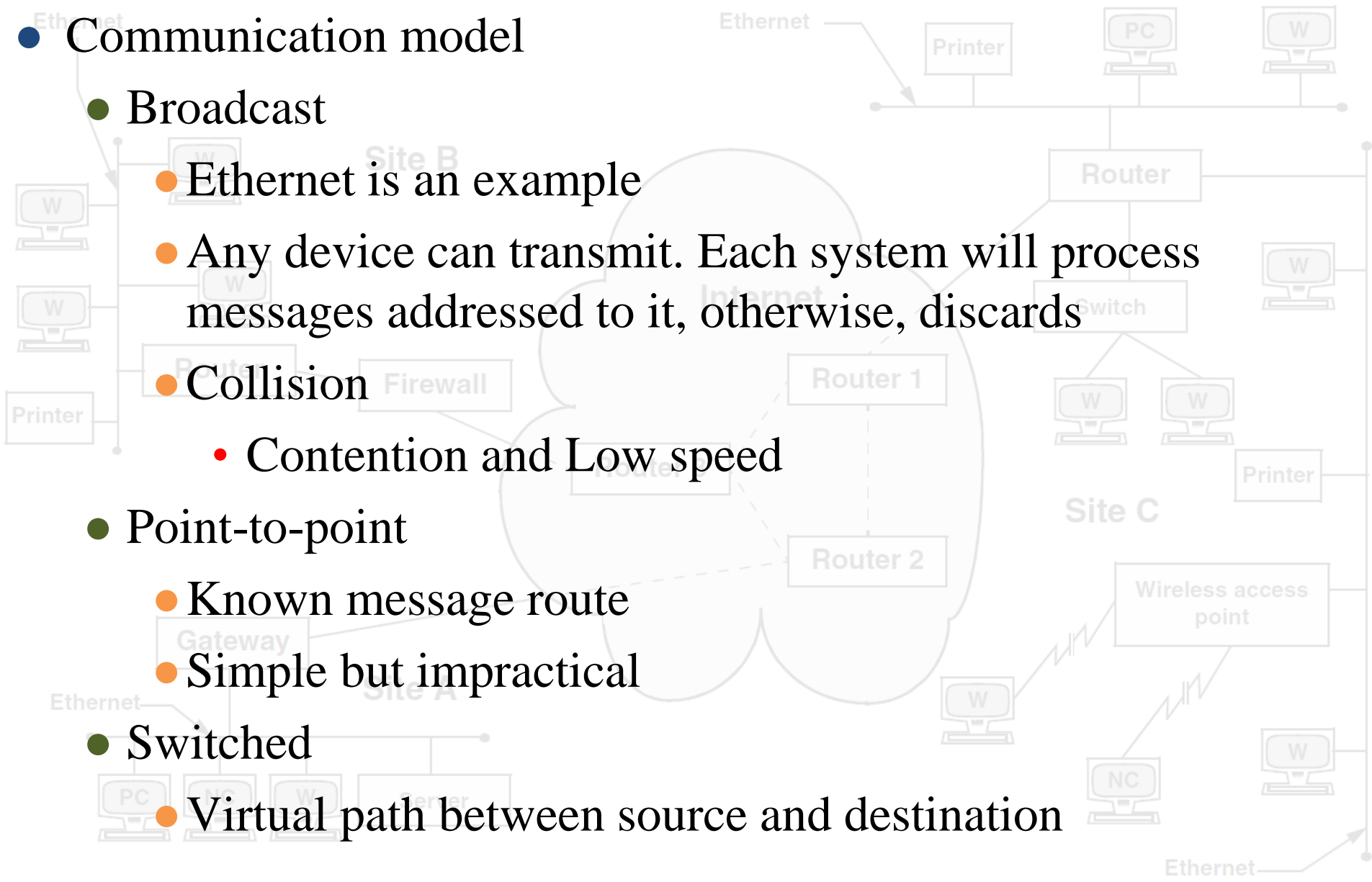
- Point-to-point

- Known message route

- Simple but impractical

- Switched

- Virtual path between source and destination



Network overview

- Internetworking

- Incompatibilities

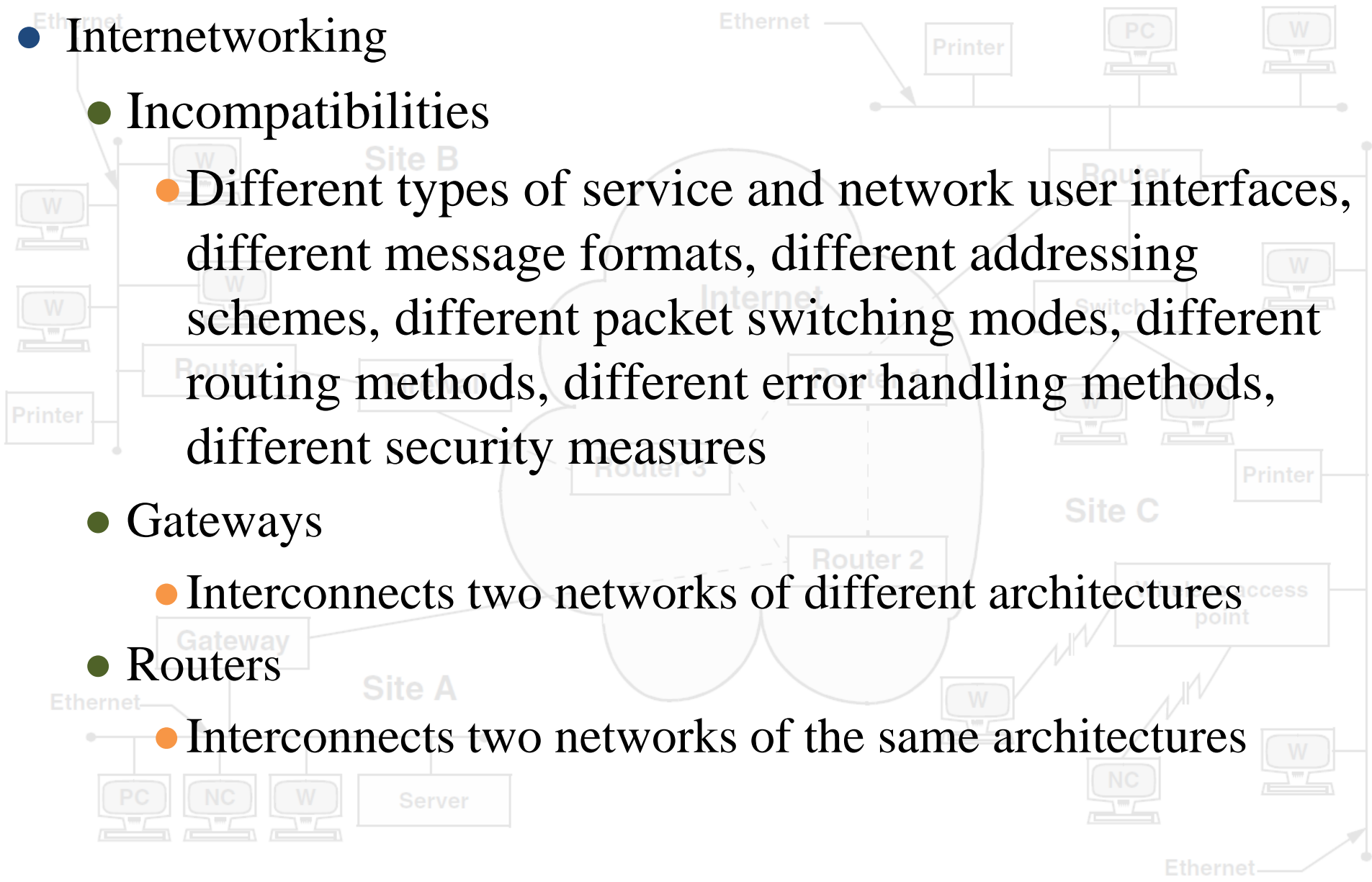
- Different types of service and network user interfaces, different message formats, different addressing schemes, different packet switching modes, different routing methods, different error handling methods, different security measures

- Gateways

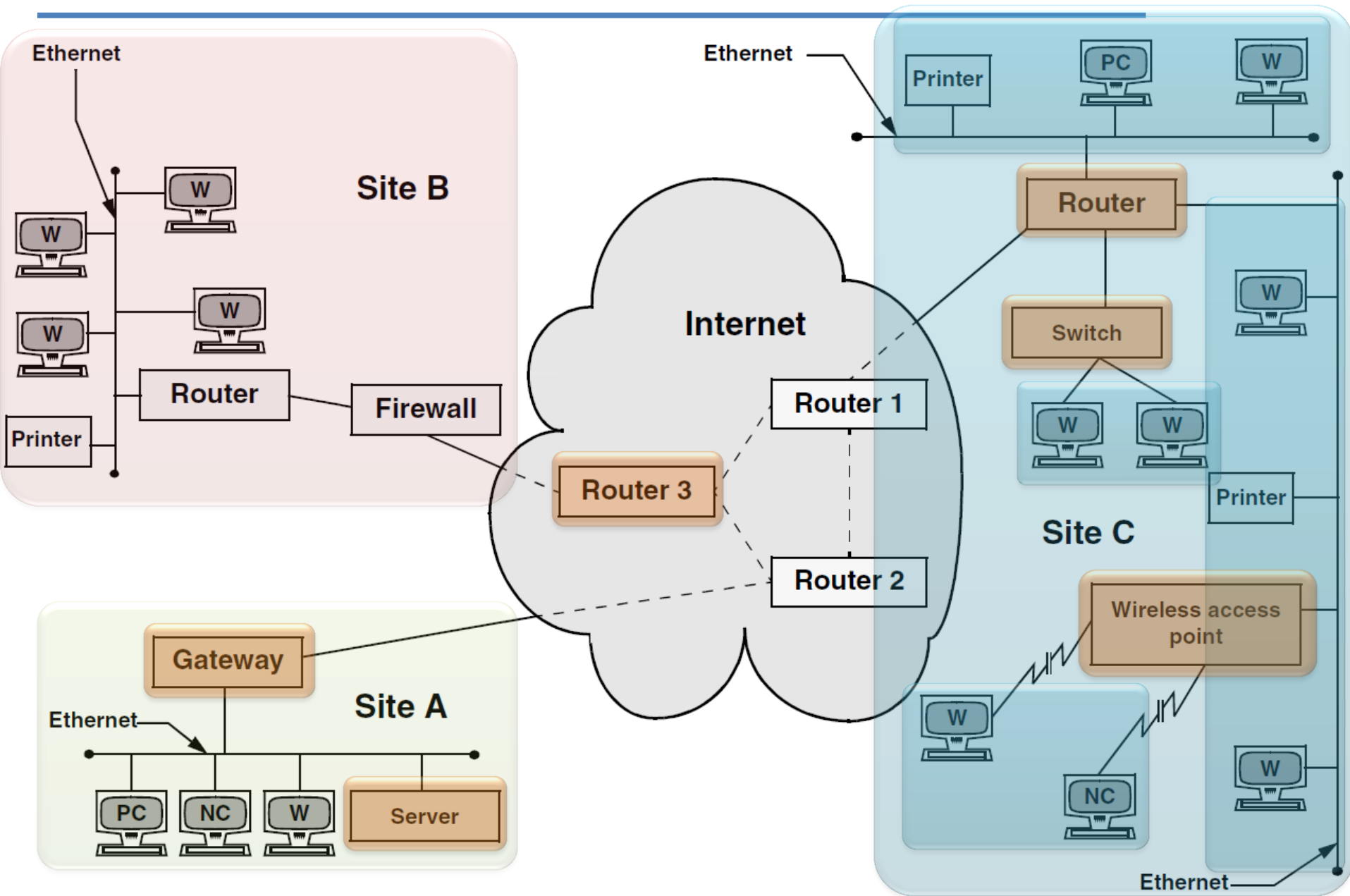
- Interconnects two networks of different architectures

- Routers

- Interconnects two networks of the same architectures

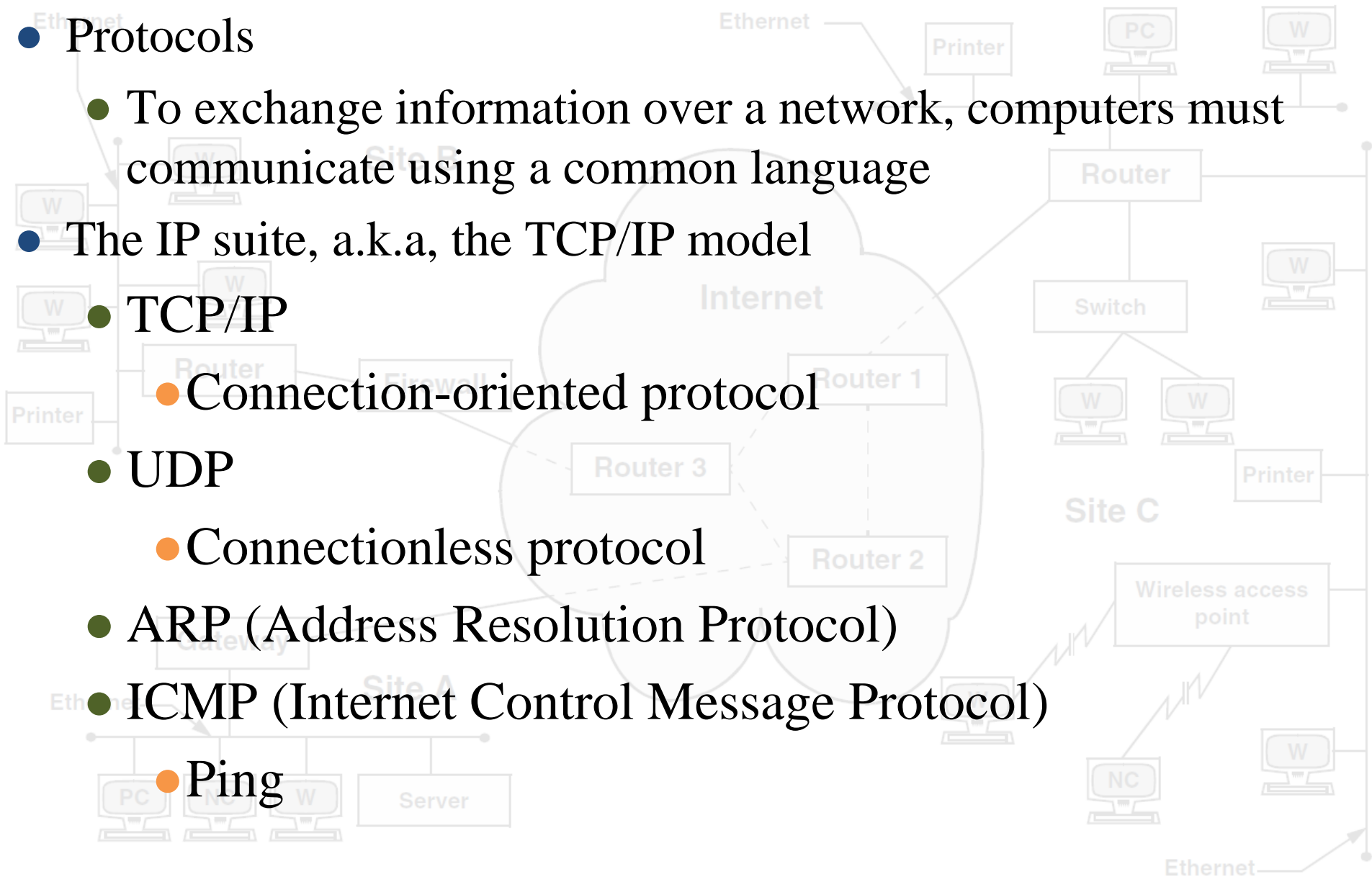


Network overview

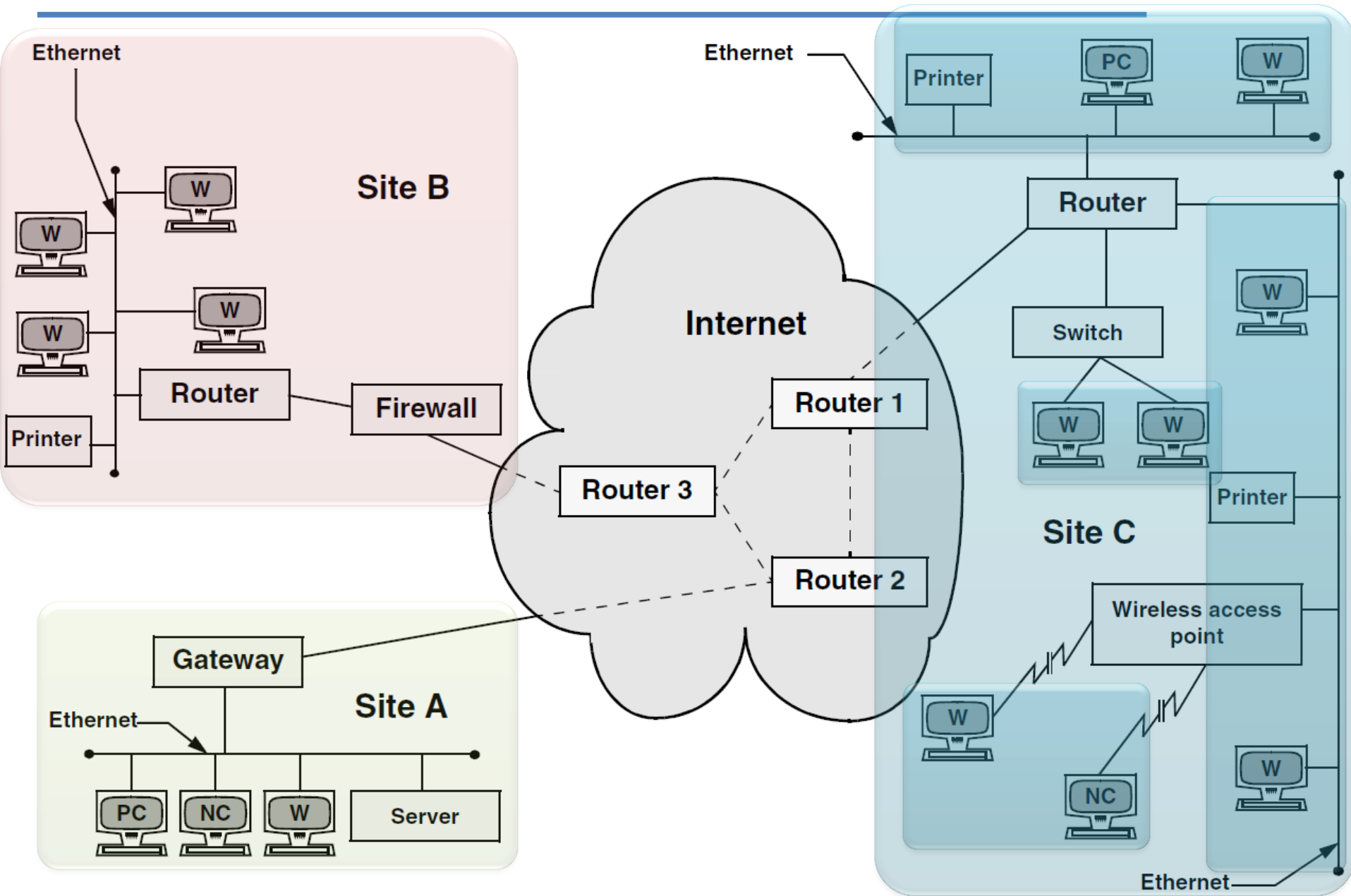


Network overview

- Protocols
 - To exchange information over a network, computers must communicate using a common language
- The IP suite, a.k.a, the TCP/IP model
 - TCP/IP
 - Connection-oriented protocol
 - UDP
 - Connectionless protocol
 - ARP (Address Resolution Protocol)
 - ICMP (Internet Control Message Protocol)
 - Ping



Network overview

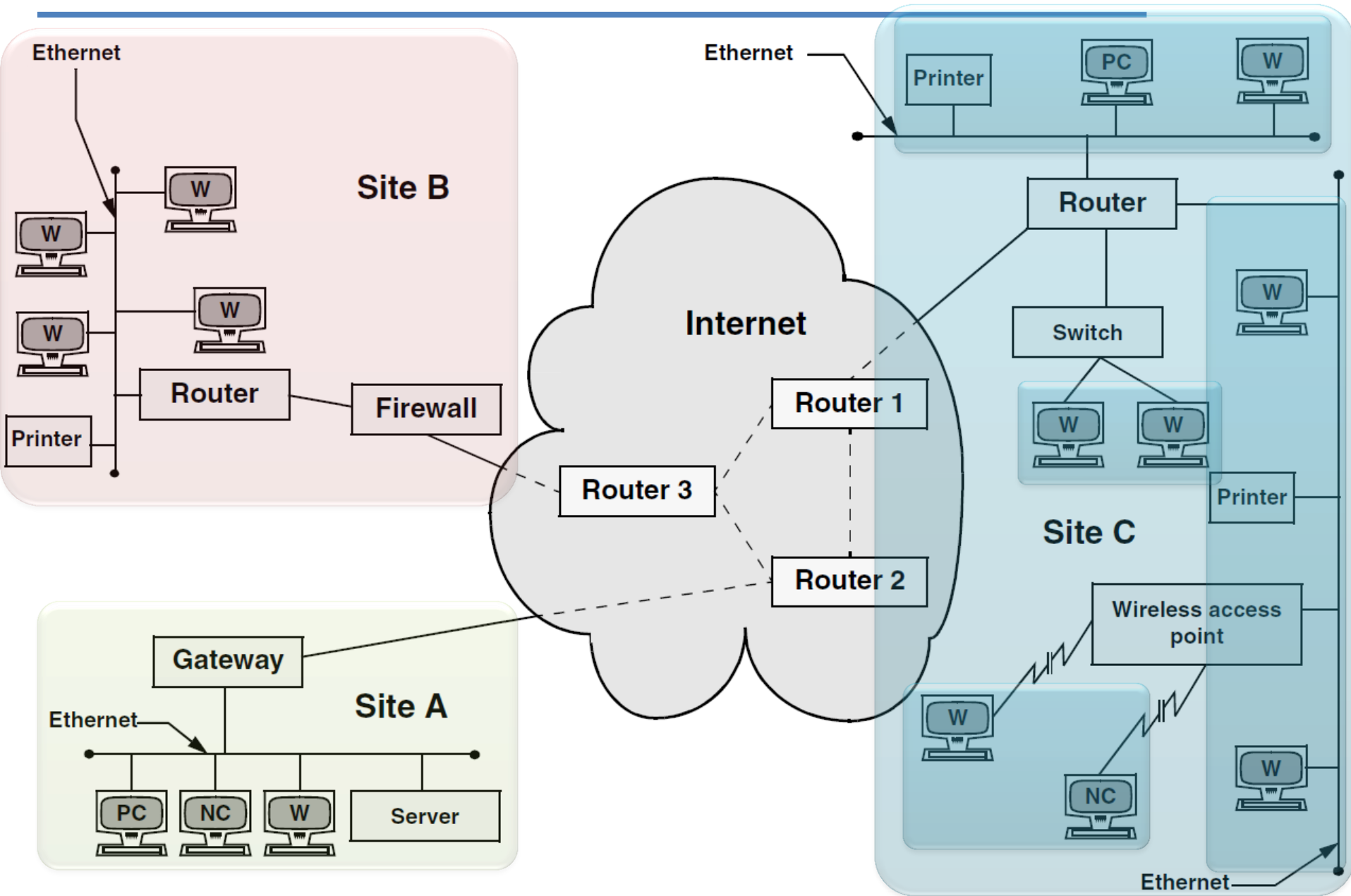


Network overview

● Addressing

- A logical connection allows to use telnet from a PC on site A and connect to a computer in site B
- Physical vs. logical addresses
- Static vs. Dynamic IP addresses
- IP Classes
 - Without classes and blocks, your host would have to know every network and sub network address on the Internet before it could send a message.
 - The subnet number and the subnet mask determine what range the IP address of the machine must be in.
 - Organizations use router and switch technology called VLANs (virtual local area networks) to group similar hosts into broadcast domains (subnets) based on function

Network overview



Network utilities

user@host

- Host identification

```
ide@ubuntu:~$ hostname  
ubuntu
```

- Connect to a remote computer

```
telnet user@host
```

- Transfer files from and to a remote computer

```
ftp user@host
```

- OpenSSH tools

- The ping, traceroute and other network utilities will help you to troubleshoot networking problems

Network utilities

- Test a network connection

- ping [options] destination

```
ide@ubuntu:~$ ping www.hh.se
```

```
PING octaplex.hh.se (194.47.12.29) 56(84) bytes of data.
```

```
64 bytes from octaplex.hh.se (194.47.12.29): icmp_seq=1 ttl=238 time=26.9 ms
```

```
...
```

```
CONTROL-C
```

```
--- octaplex.hh.se ping statistics ---
```

```
5 packets transmitted, 5 received, 0% packet loss, time 4003ms
```

```
rtt min/avg/max/mdev = 26.911/78.669/116.354/31.130 ms
```

- Trace the route that an IP packet follows to its destination

- traceroute

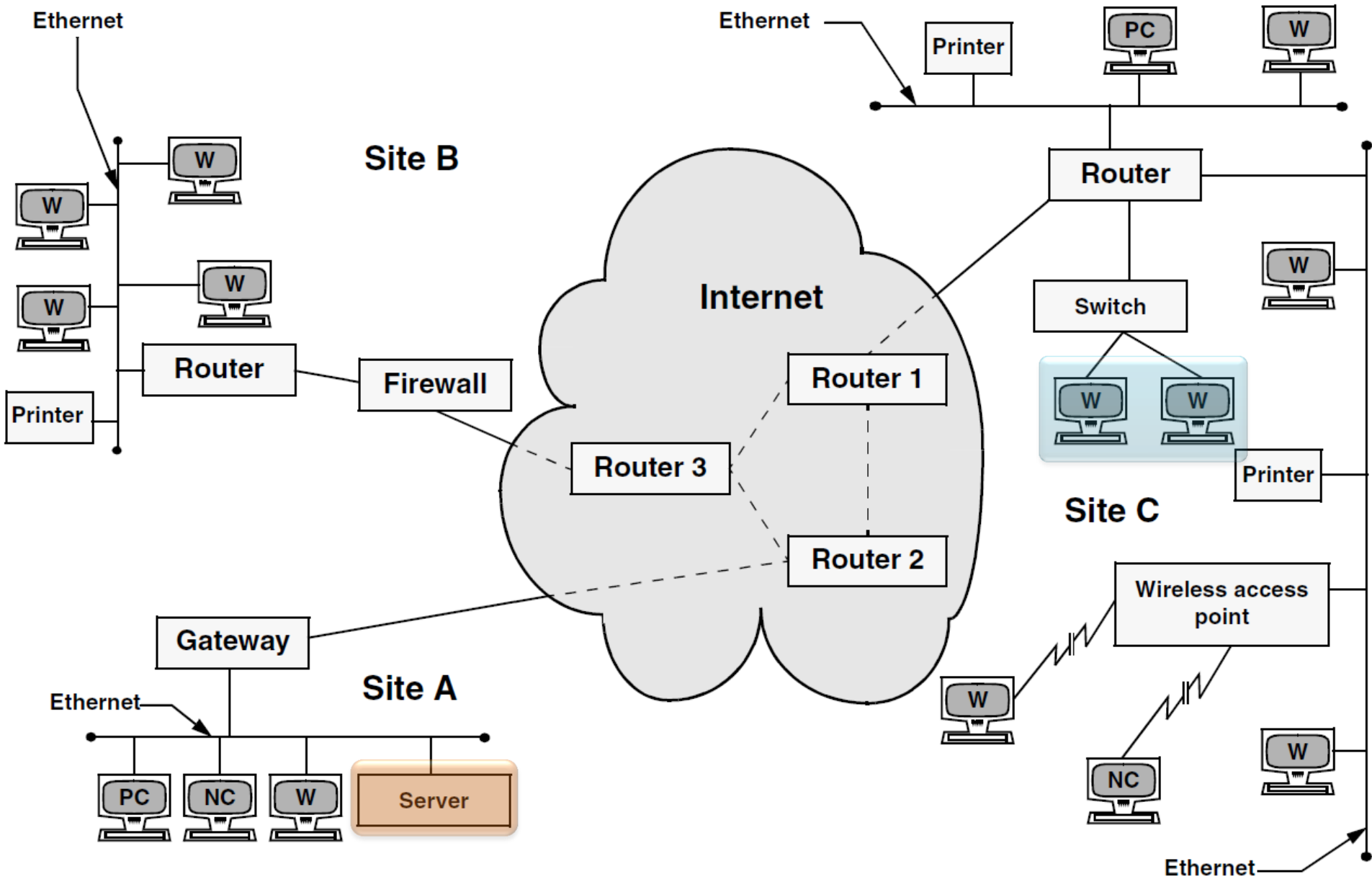
Network utilities

- Discover what path the packet follows, how far it gets, and what the delay is to reach its destination
 - Results a list of hosts that the packet traveled through to get to its destination
 - Helps to solve routing configuration problems and locate routing path failures
 - Displays asterisks when it does not receive a response
 - `tracert [options] destination`

Distributed Computing

- Client/server model (predominant)
 - A server machine runs server programs which share their resources with clients
 - A client requests a server's content or service function
 - DNS
 - Email
 - FTP
 - NFS
 - HTTP
- Peer-to-peer model
 - No central machine has all the resources

Distributed Computing



Distributed Computing

- **Domain Name Service (DNS)**

- A.K.A. Domain Name System or Domain Name Server
- Distributed system that stores and translates human-friendly computer hostnames into IP addresses
 - BIND (Berkeley Internet Name Domain) is the most used and standard DNS software on Linux

- **Network Filesystem**

- Protocol that allows computers to share filesystems with one another
- Transparent to the user. Remote files appear as if they were are stored on local disks.

Network services

- Services are provided by daemons that run continuously or by a daemon that is started automatically by the inetd (internet daemon) or xinetd (extended internet daemon)

```
ide@ubuntu:~$ cat /etc/services | less
```

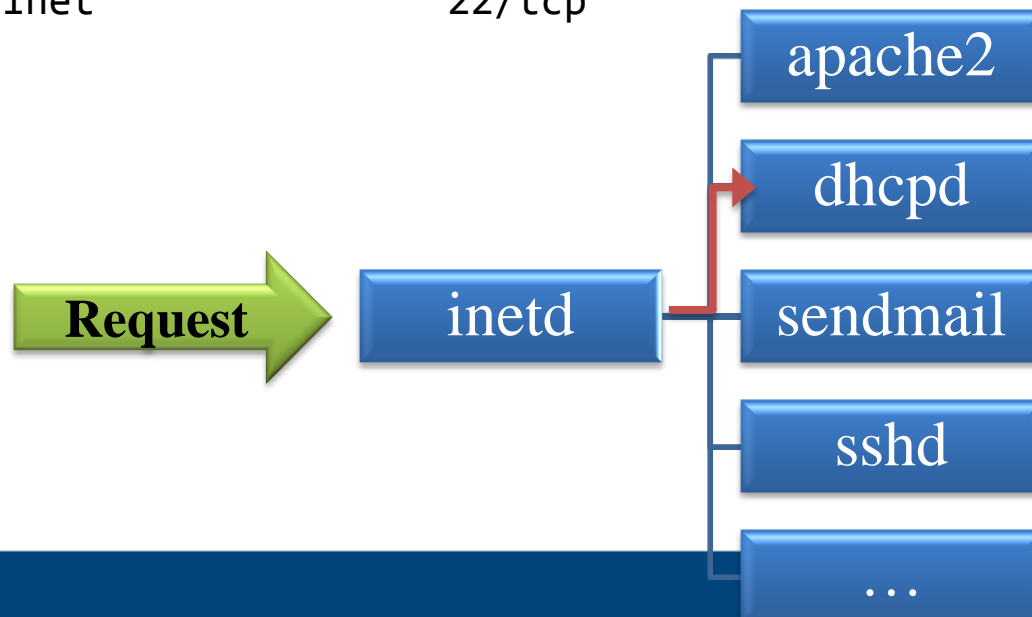
...

```
ssh          22/tcp      #SSH Remote Login Protocol
```

```
ssh          22/udp
```

```
telnet       22/tcp
```

...



A bit of history

- Usenet
 - One of the earliest and worldwide distributed Internet discussion system
 - 20 Year Usenet Timeline
 - http://www.google.com/googlegroups/archive_announce_20.html
- WWW
- URL
- Browsers
- Search engines

