

• April 16 Notes

10 . 20 . 30 . 40
255.255 . 0 . 0

Network Node

8 bits.8 bits.8 bits.8 bits
255 . 255 . 255 . 0

128+64+32+16+8+4+2+1 = 255
| | | | | | | |

CIDR: Classless Interdomain Routing
↓
10.20.30. 40/18 - 8+8+2=18

To determine network or node:
- Use subnet mask or CIDR

IPv6: partially based on MAC address

CIDR Value & CIDR Notation

IP Address: 192.168.0.1
Subnet Mask: 255.255.255.0

Binary Subnet Mask
11111111.11111111.11111111.00000000

24 bits 1s, Network Bits

CIDR Value = 24

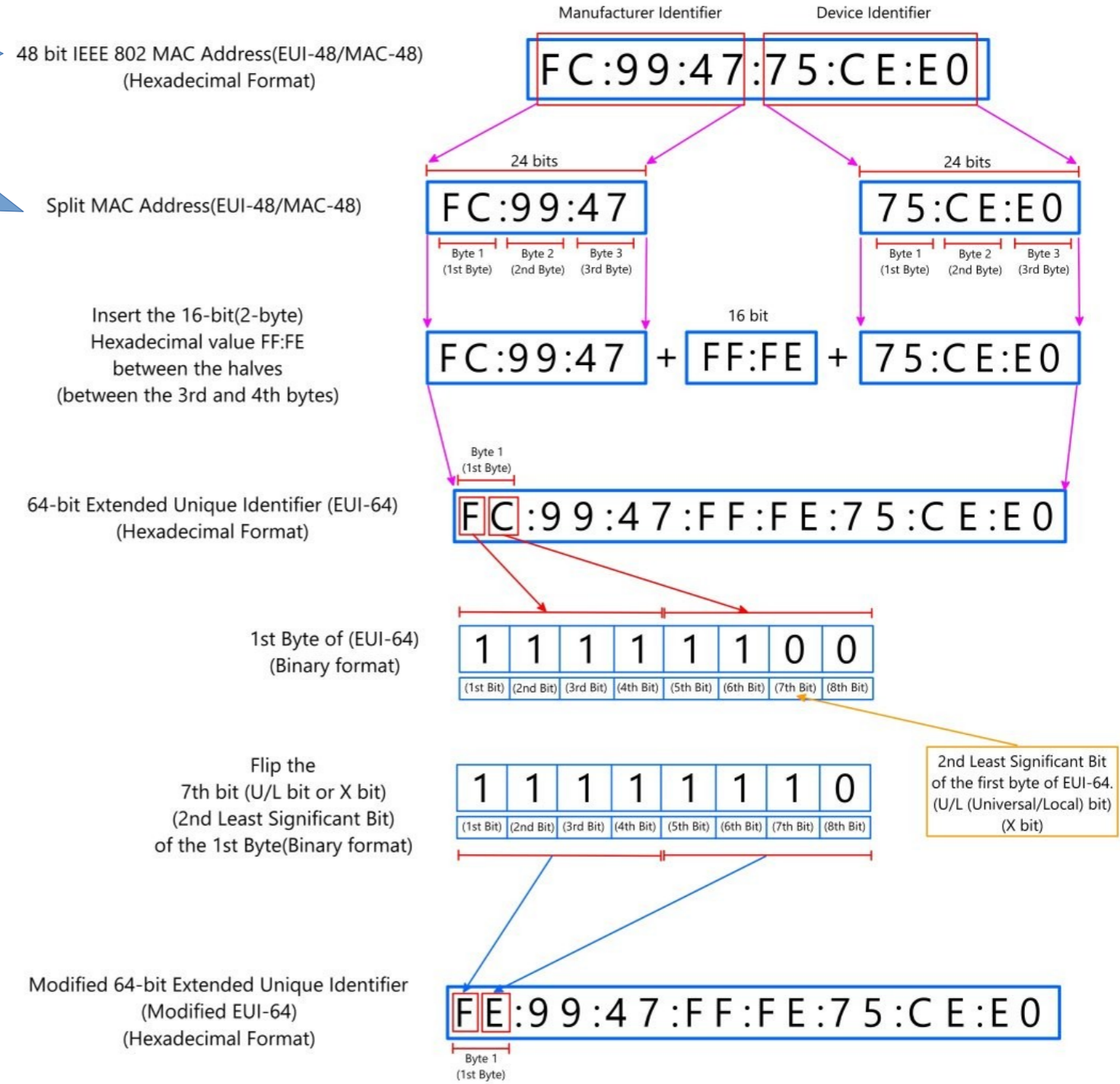
CIDR Notation = IP Address/CIDR Value

CIDR Notation = 192.168.0.1/24

• April 16 Notes

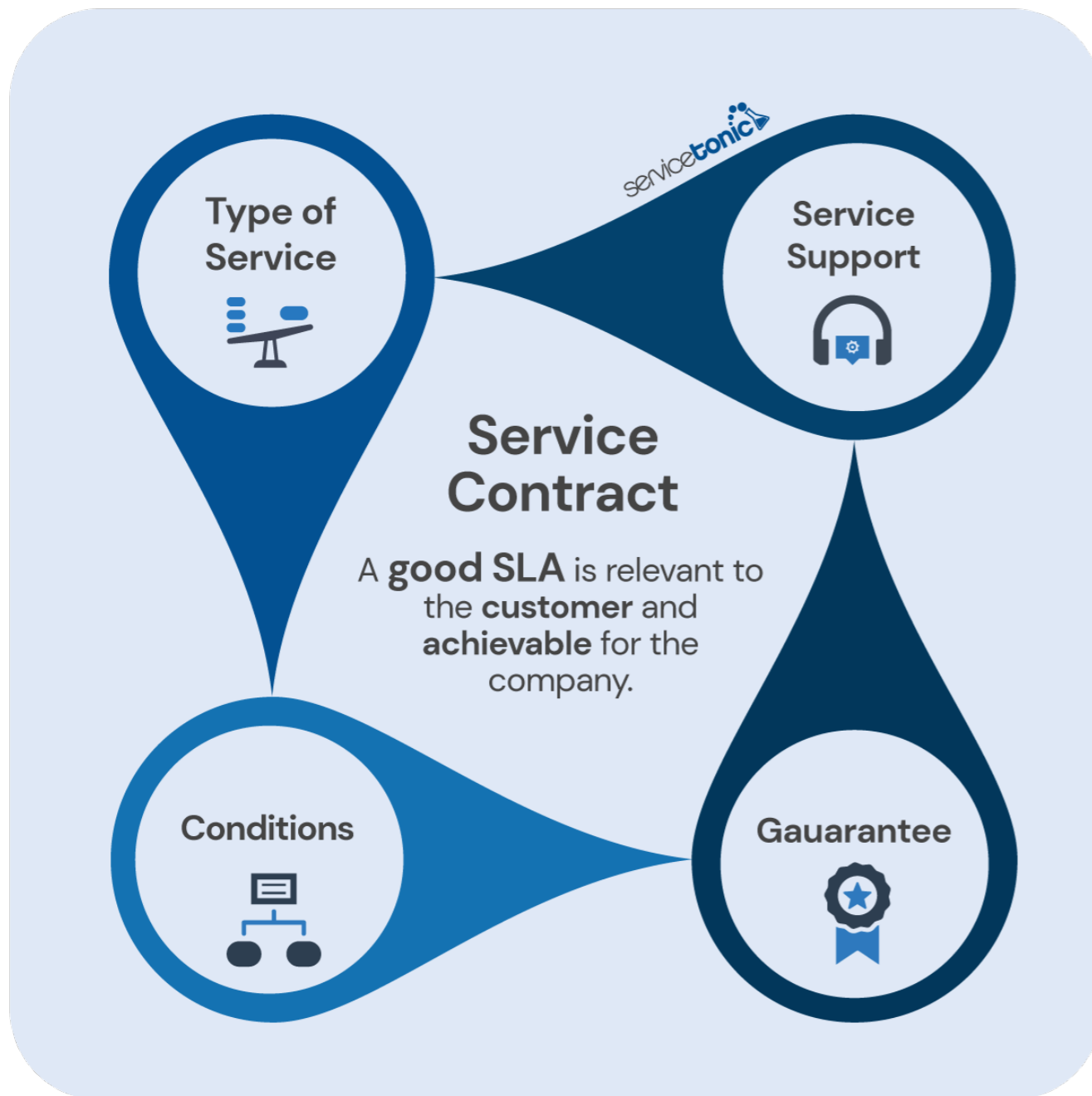
IPv6: partially based on MAC address

Creation process of Modified EUI-64 from MAC Address(EUI-48/MAC-48)



Rated speed: advertised what you are going to get
Throughput: what speed you actually get

- No Service Level Agreement [SLA] for residential!
- Business lines get SLA



ADVERTISED vs. ACTUAL FIBER OPTIC PERFORMANCE

ADVERTISED	VS.	ACTUAL
 Bandwidth Gigabit speeds		 Bandwitht Variable speeds
 Reliability 100% uptime		 Reliability Occasional outages
 Scalability Easily expandable		 Scalability Potential limitations

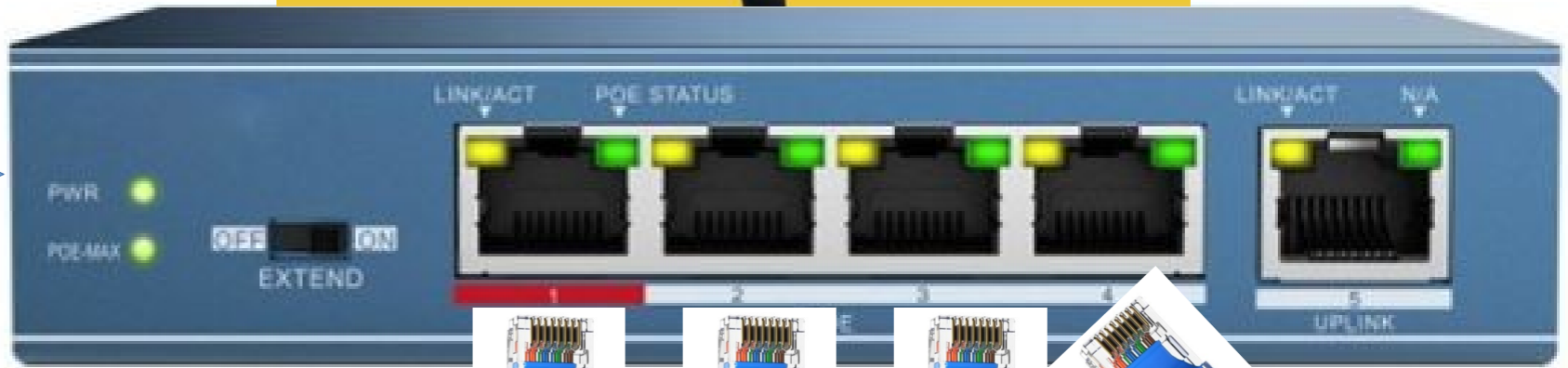
AccuTech Communication
www.accutechcom.com

Gigabit Switches: Shared Speed and Throughput

1 GBit FIOS Pipe



Gigabit Switch



Cat 6 cables



Cannot go over 1 Gbit each!



250 Mbit



250 Mbit



250 Mbit



250 Mbit

Pizza Pie

Contains 8 slices and cannot eat more

Pizza fractions

Whole



$1/1$

One half



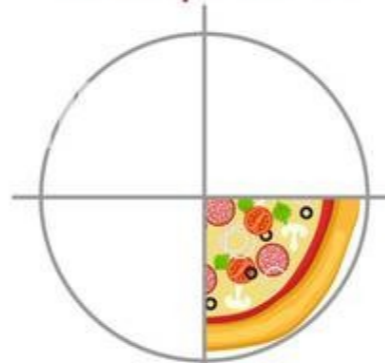
$1/2$

One third



$1/3$

One quarter



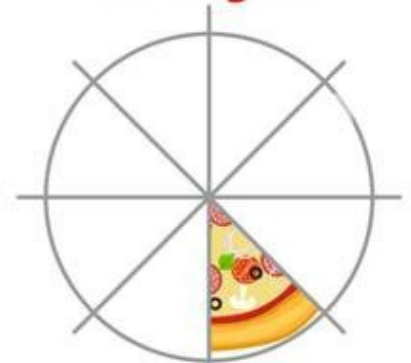
$1/4$

One sixth



$1/6$

One eighth

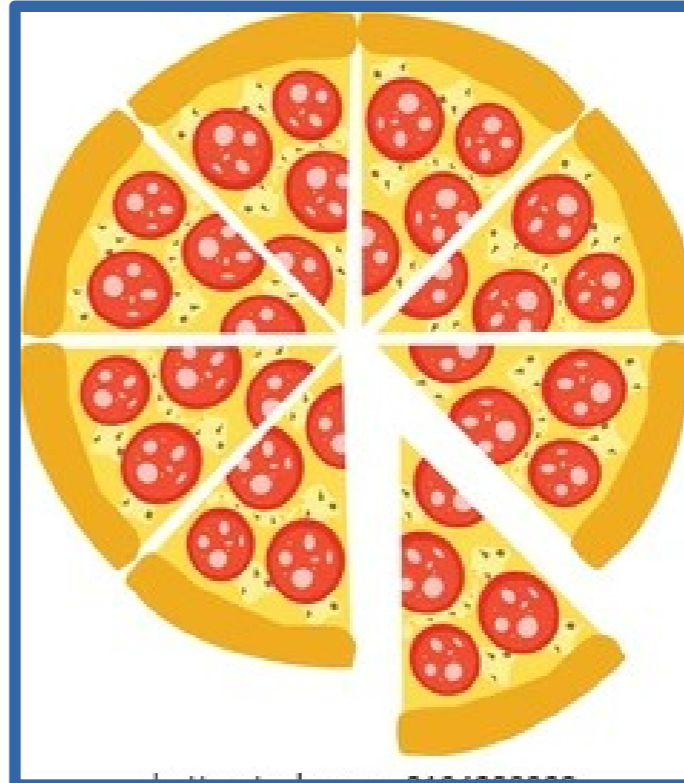


$1/8$

Pizza Fractions



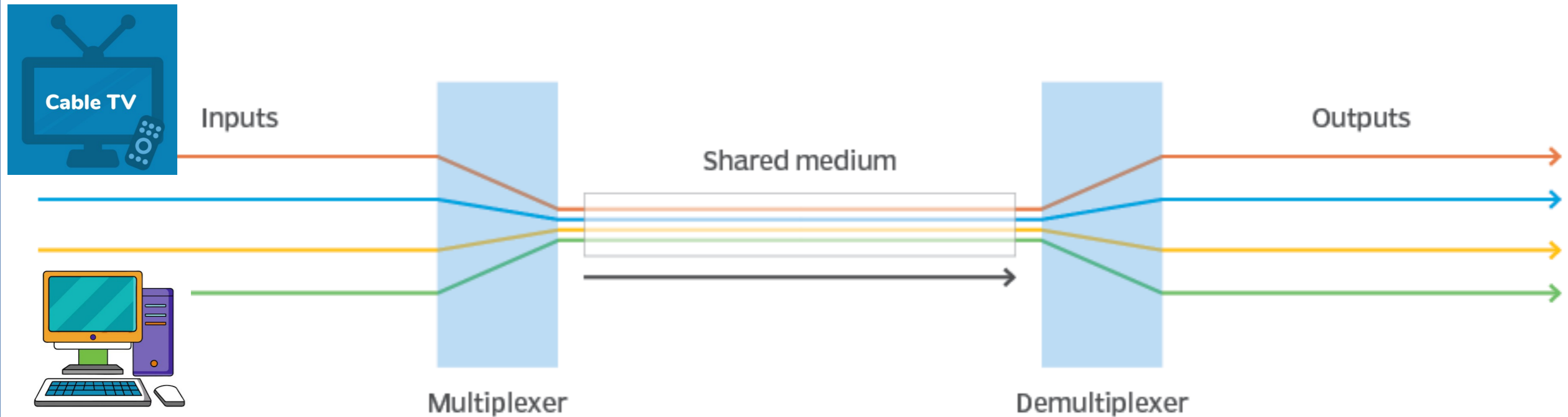
8 Eighths



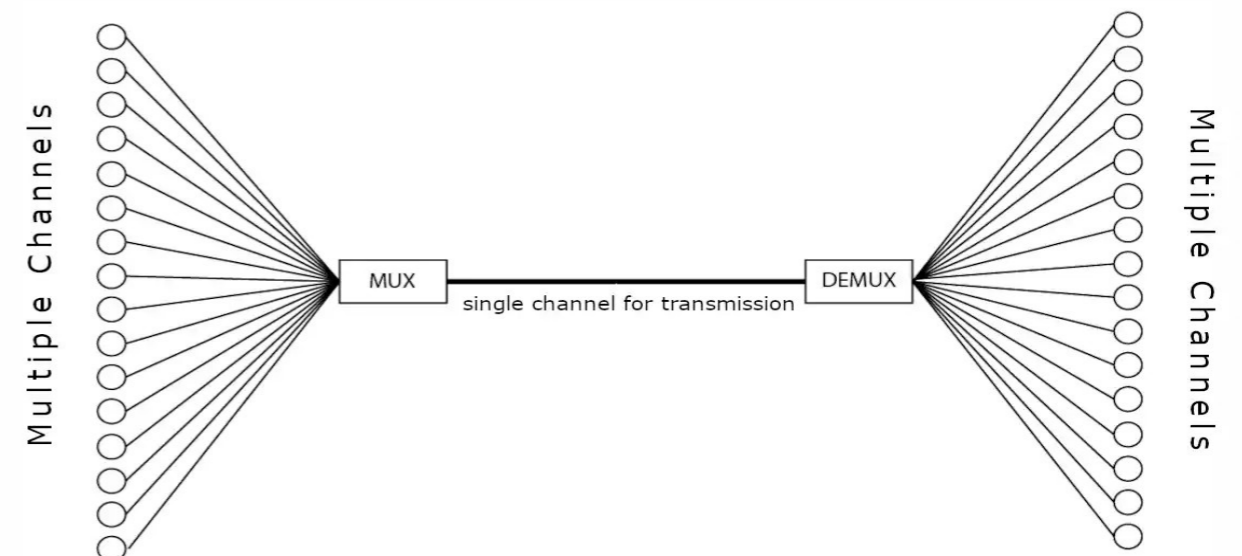
Multiplexing: allow for multiple users

- Shared link
- Send at same time
- Multiple messages at once

Multiplexing and demultiplexing

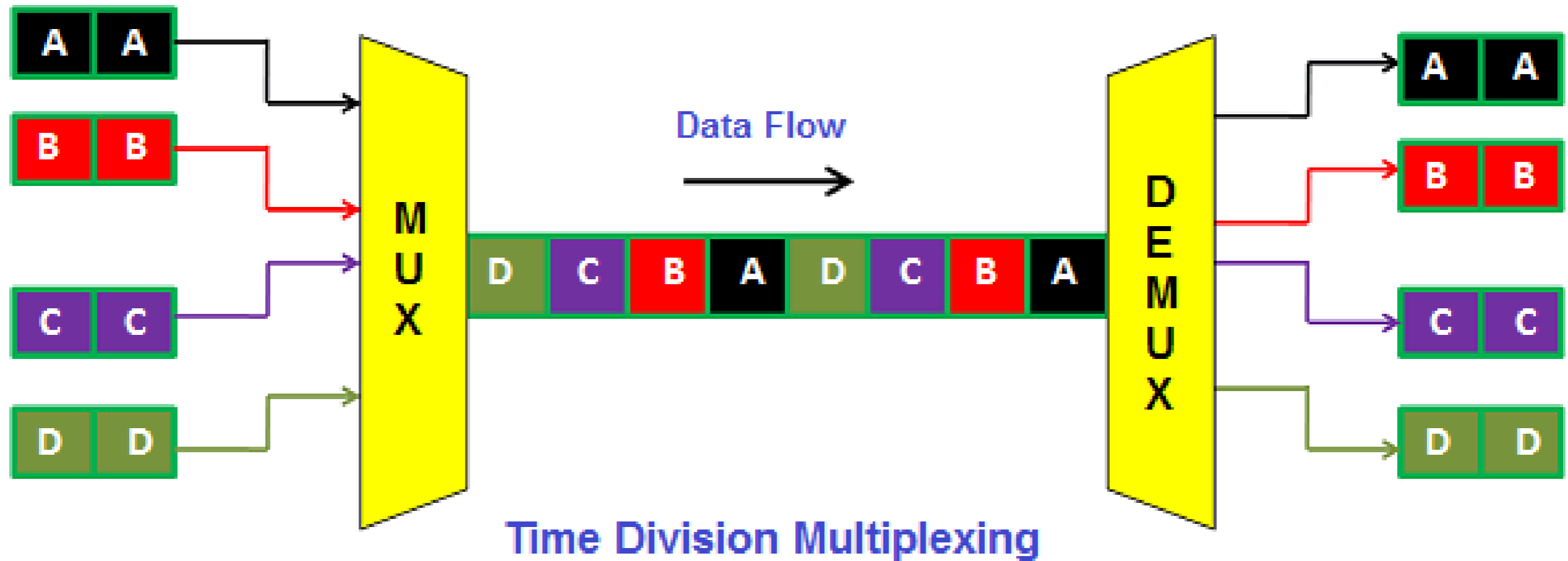


- Multiplexer consolidates signal
- Demultiplexer separates signal
- Signals will not interfere
- Signals can be voice/data

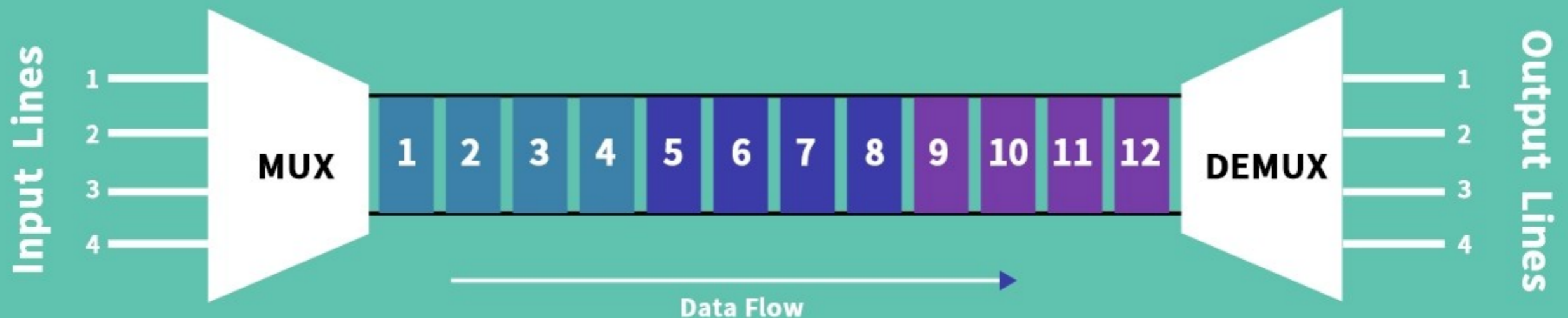


TDMS: Time Division Multiplexing

- Transmits signals by dividing time frame into several slots



Time Division Multiplexing (TDM)



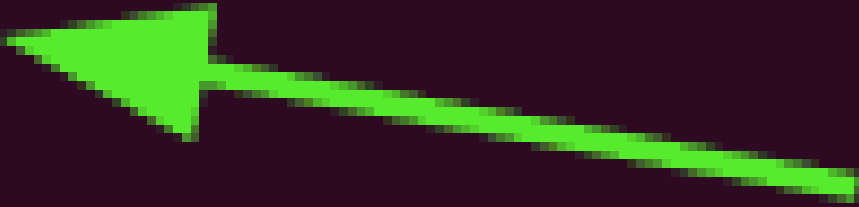
Quality of Service: how much time server is down per year

- 99%: 1 hour down per year; bad
- 99.999%: good uptime

```
Tasks: 190, 581 thr; 1 running
```

```
Load average: 0.41 0.40 0.38
```

```
Uptime: 01:24:08
```



```
OS: Ubuntu 18.04.5 LTS x86_64
```

```
Host: VirtualBox 1.2
```

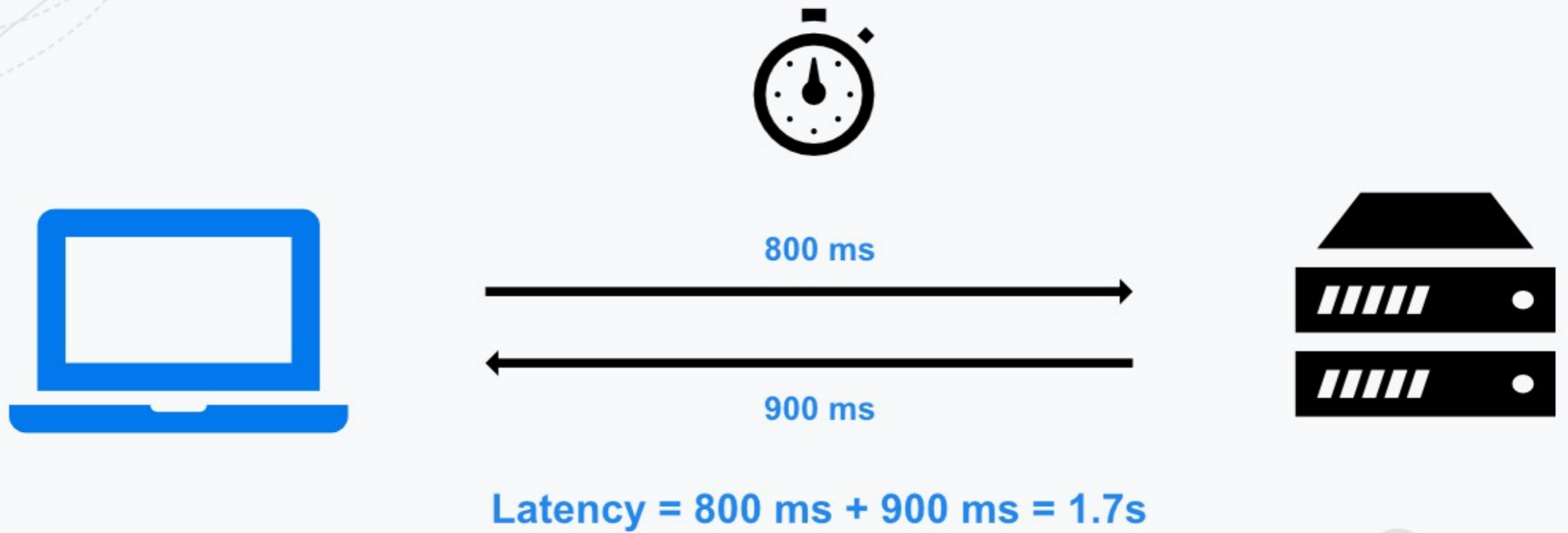
```
Kernel: 5.4.0-54-generic
```

```
Uptime: 1 hour, 20 mins
```

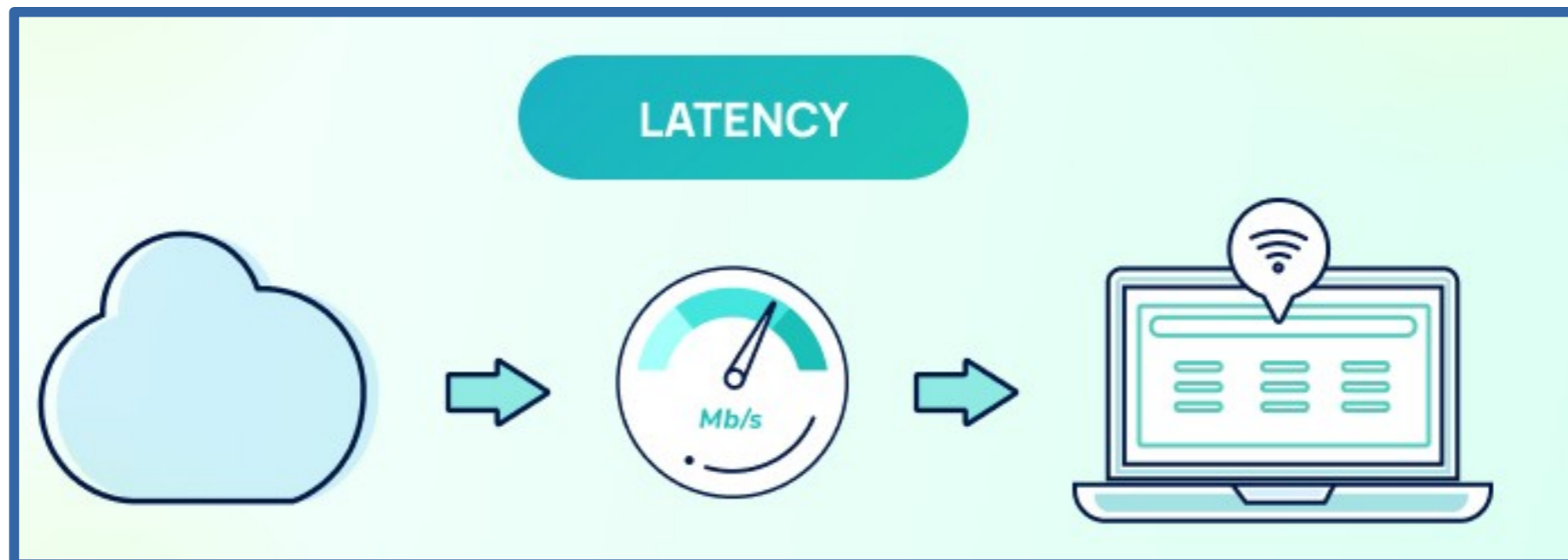


```
Package: 3307
```

Latency: Time delay in sending information



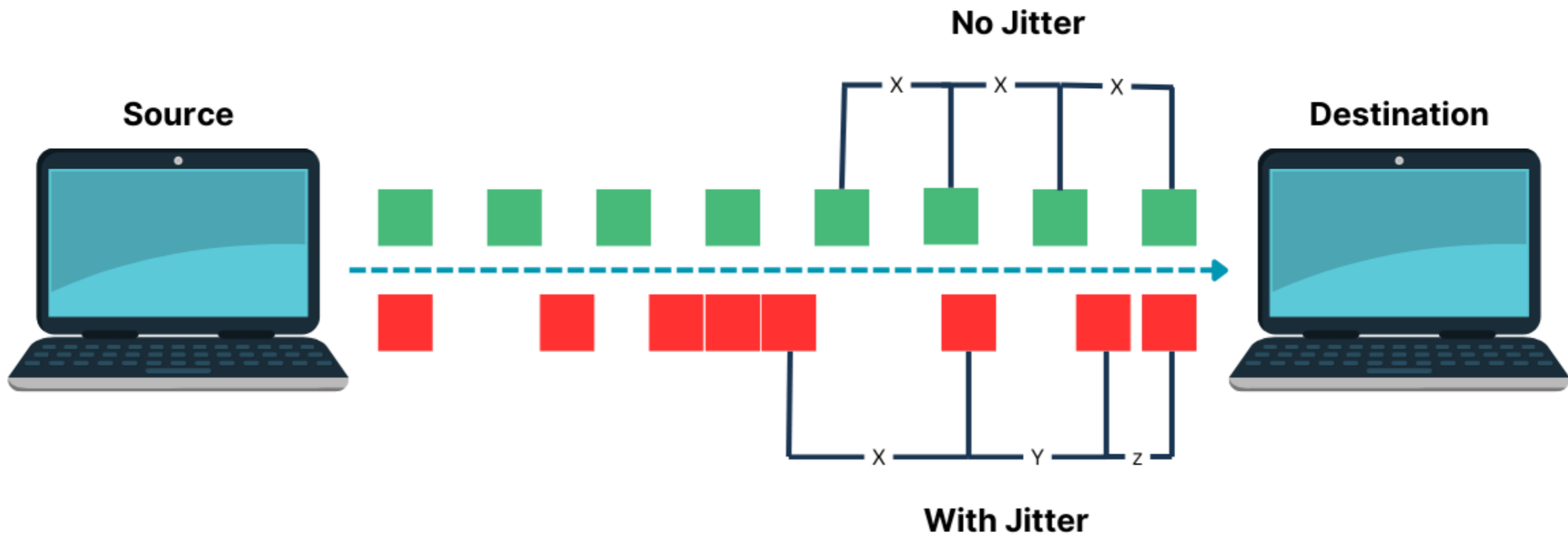
Network Latency



Jitter: random delay of latency
- High variability

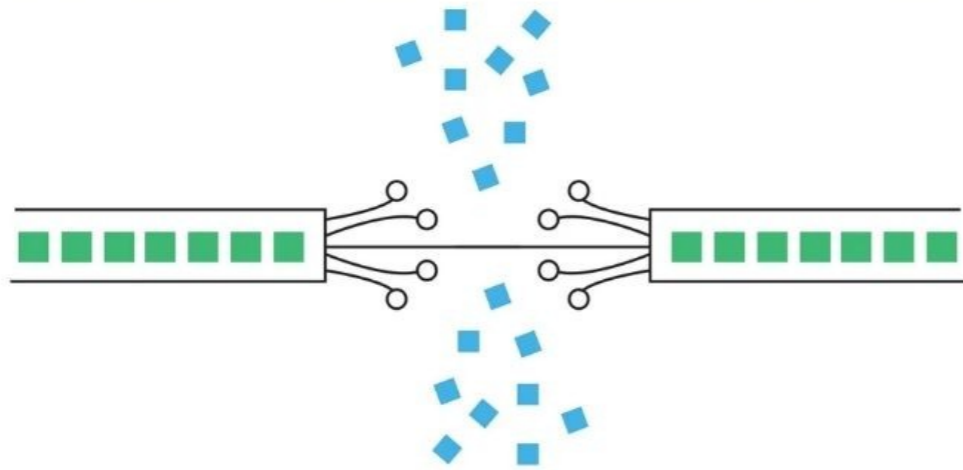
What is Jitter?

Jitter is a variation in the delay of the received packets.



Errors: % of incorrect packets

What is Acceptable vs. High Packet Loss?



Acceptable Packet Loss

Moderate Packet Loss

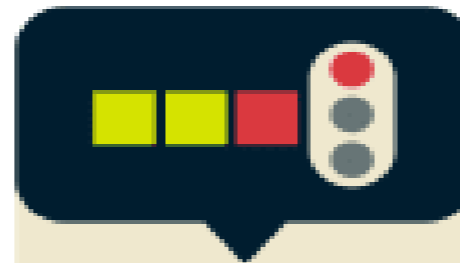
High Packet Loss

Less than 1% or 0.1%

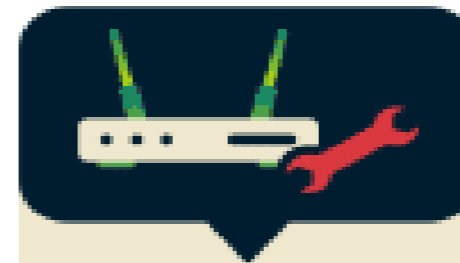
2% -5%

Above 5%

Common causes of packet loss



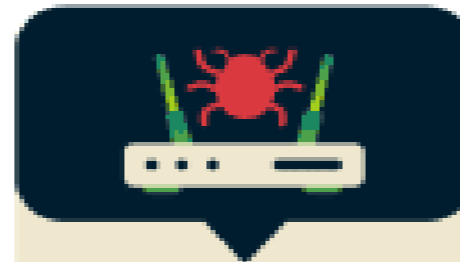
Network congestion



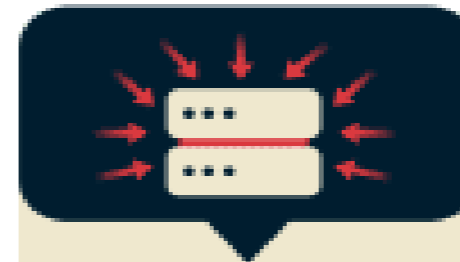
Hardware faults or misconfigurations



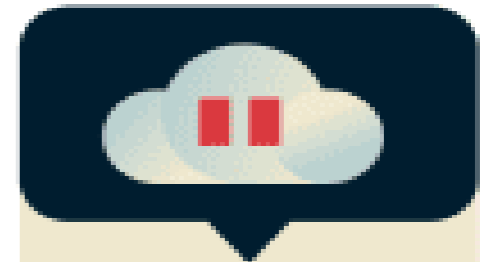
Wi-Fi interference or weak signal



Software or firmware bugs



Security attacks (DoS/DDoS)



ISP issues or traffic management

Availability:

- % of time resource is available, ie: server, Internet connection

The Nines of Availability

Availability percentages vs service downtime

Availability %	Downtime per year	Downtime per month	Downtime per week
90% (one nine)	36.5 days	72 hours	16.8 hours
99% (two nines)	3.65 days	7.20 hours	1.68 hours
99.5%	1.83 days	3.60 hours	50.4 minutes
99.9% (three nines)	8.76 hours	43.8 minutes	10.1 minutes
99.95%	4.38 hours	21.56 minutes	5.04 minutes
99.99% (four nines)	52.56 minutes	4.32 minutes	1.01 minutes
99.999% (five nines)	5.26 minutes	25.9 seconds	6.05 seconds
99.9999% (six nines)	31.5 seconds	2.59 seconds	0.605 seconds
99.99999% (seven nines)	3.15 seconds	0.259 seconds	0.0605 seconds

Availability

the percent of time a system spends in a functional state.



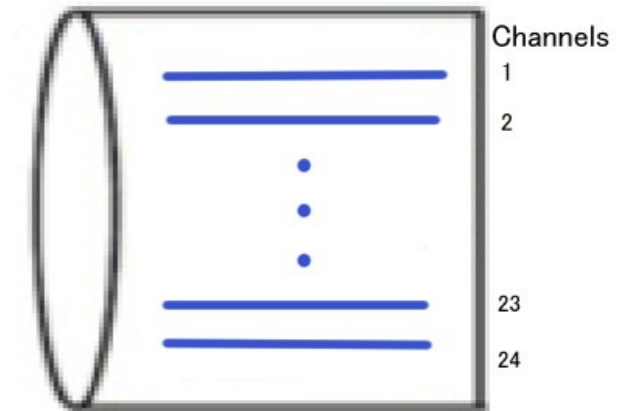
Dedicated Lines:

- T1: 1.5 Mbps
- Dedicated Link; point to point with SLA
- No one sharing line
- Demarcation

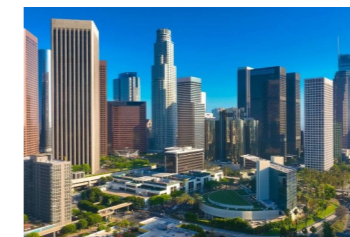
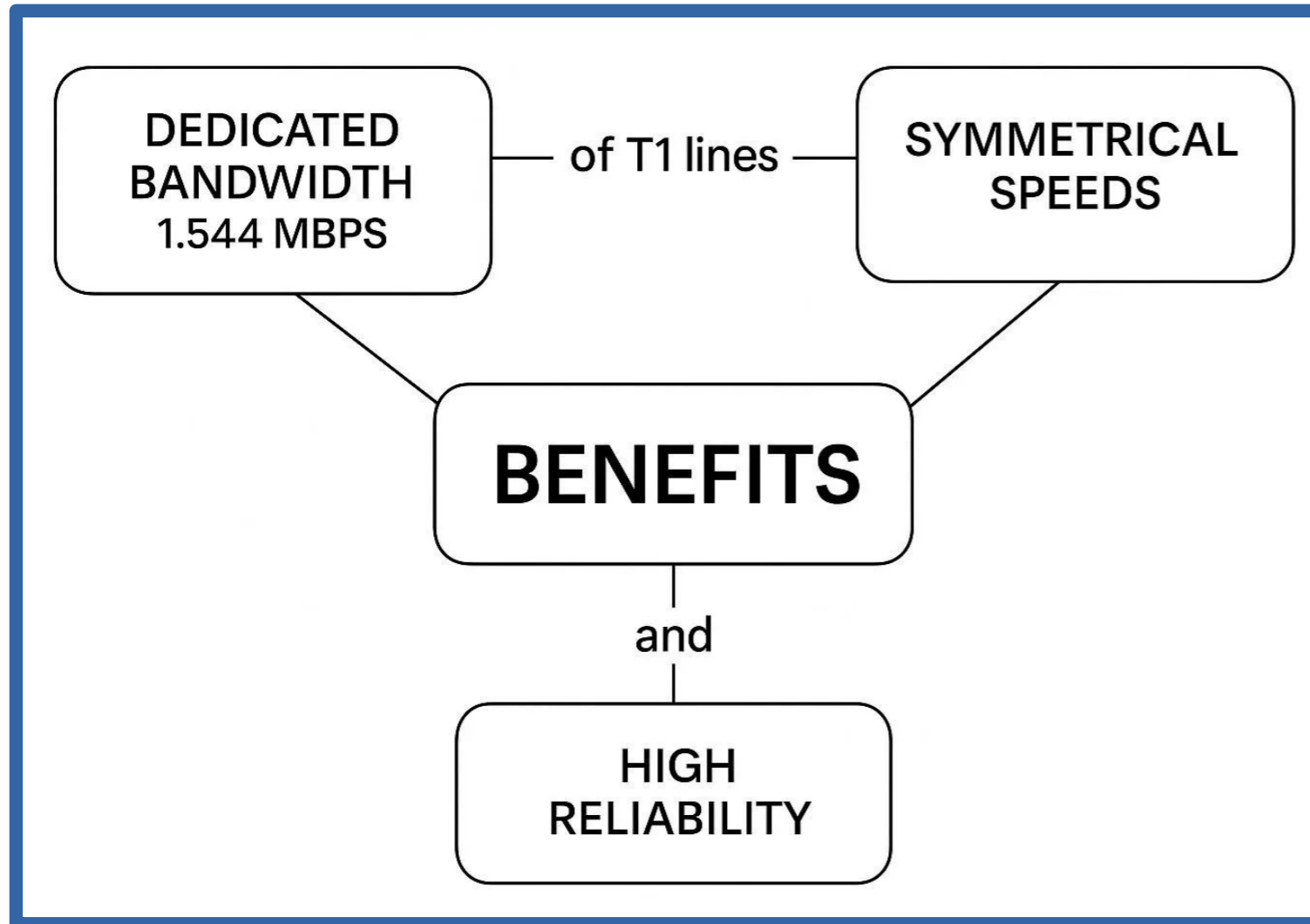
T1 Circuit (1.5 MB)

1 channel speed = 64 Kbps

64 Kbps/channel x 24 channel = 1536 Kbps



T1 Circuit has 24 Channels.



LA



NYC

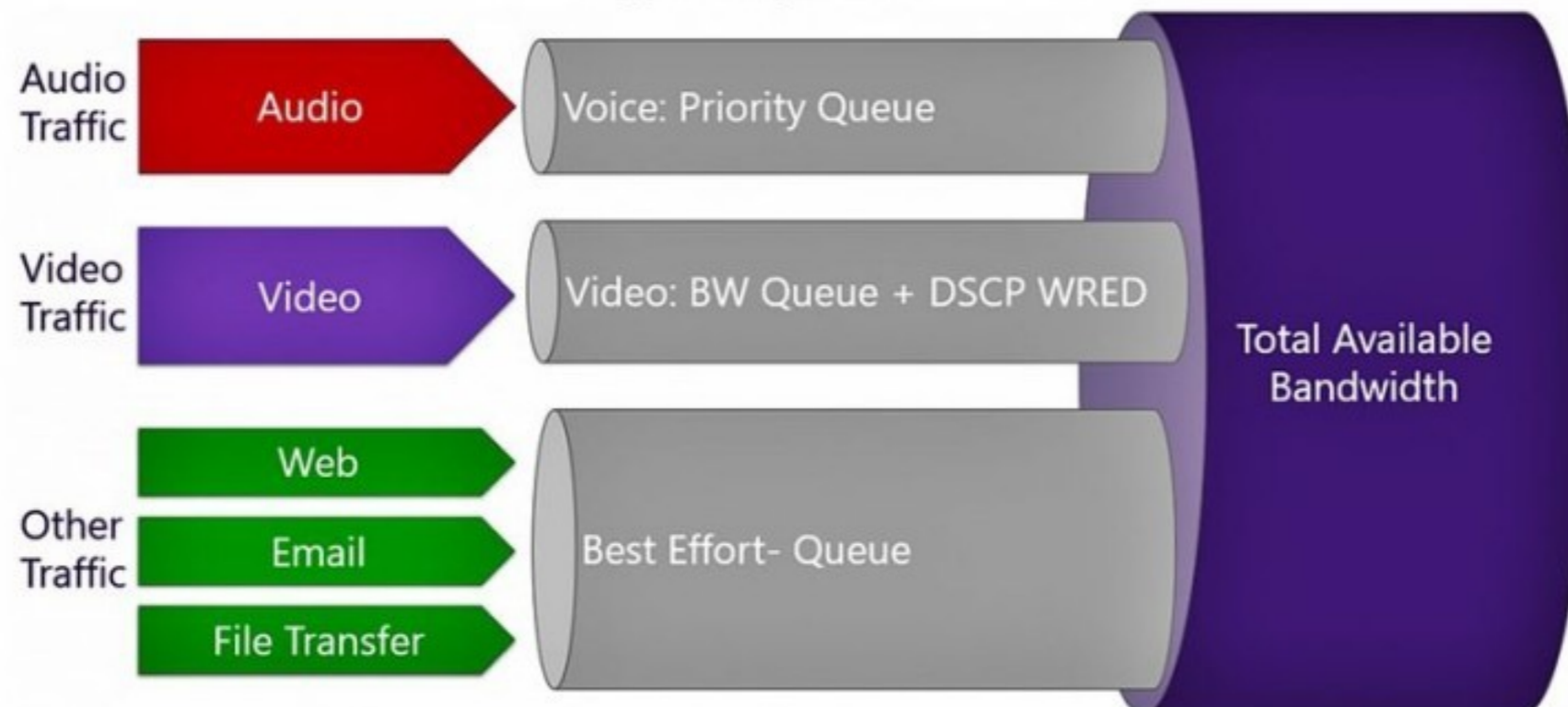
T1 Line

- Leased lines
- Do not go to web
- Can connect to office that routes to web

Quality of Service (QoS):

- Prioritize traffic
- Real time traffic (voice) gets priority
- Email is low priority

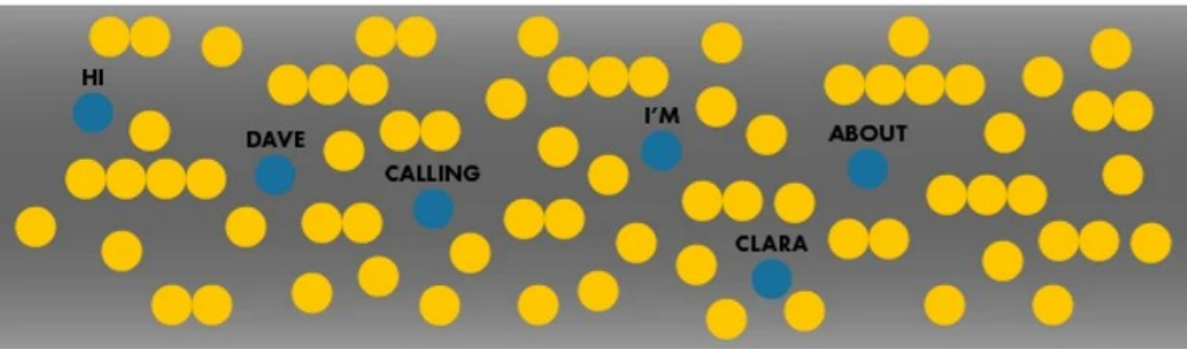
What is QoS?



Traffic Shaping:

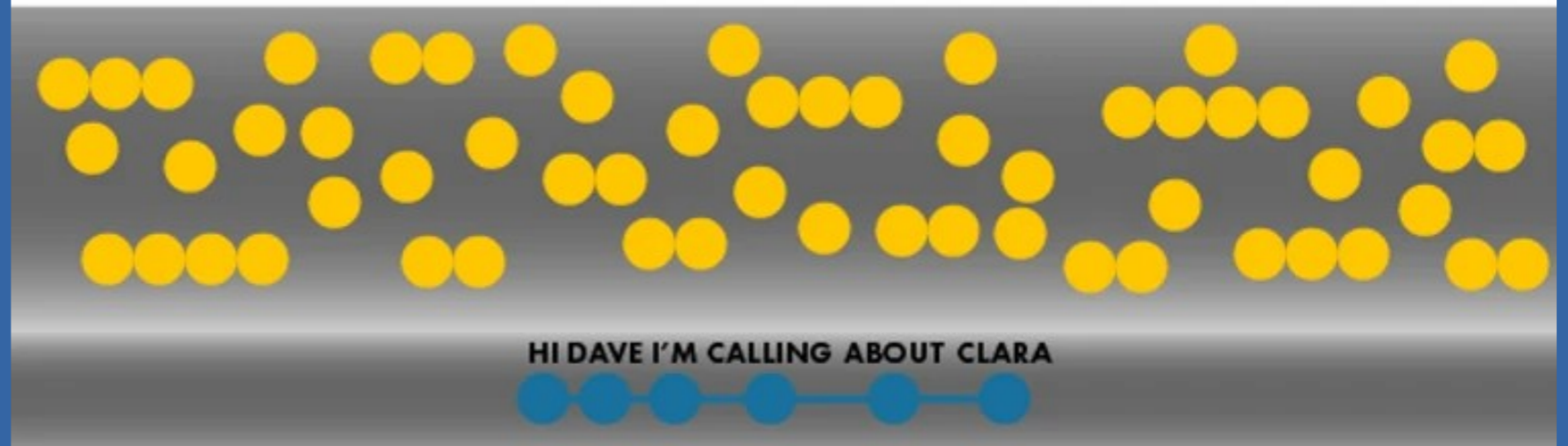
- Only approved applications, ie: email
- Not approved: Youtube, Facebook, etc

WITHOUT SHAPING



● VOICE
● ANY OTHER DATA

WITH SHAPING



● VOICE
● ANY OTHER DATA

Network Operations Center [NOC]:

- Runs datacenters
- Help to see problems from a higher level
- Can NYC communicate with other datacenters in USA?
- Global picture
- Monitor servers, websites, databases, routers
- Software helps to monitor system, ie: bad hard drive

