

Computer Networks

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Agenda

- Networks and Cloud
 - The physical and the virtual
- Connected Devices
- Network Types
 - *AN
- Network Protocols
 - Wired/Wireless
- Let's connect!!!



Networks

- Machines/Devices are effective/beautiful in isolation...
- Connecting a machine/ device to a computer network opens up amazing possibilities...
- Key point:
 - Computer networks are no longer only used to connect computers
 - Part of many aspects of everyday life



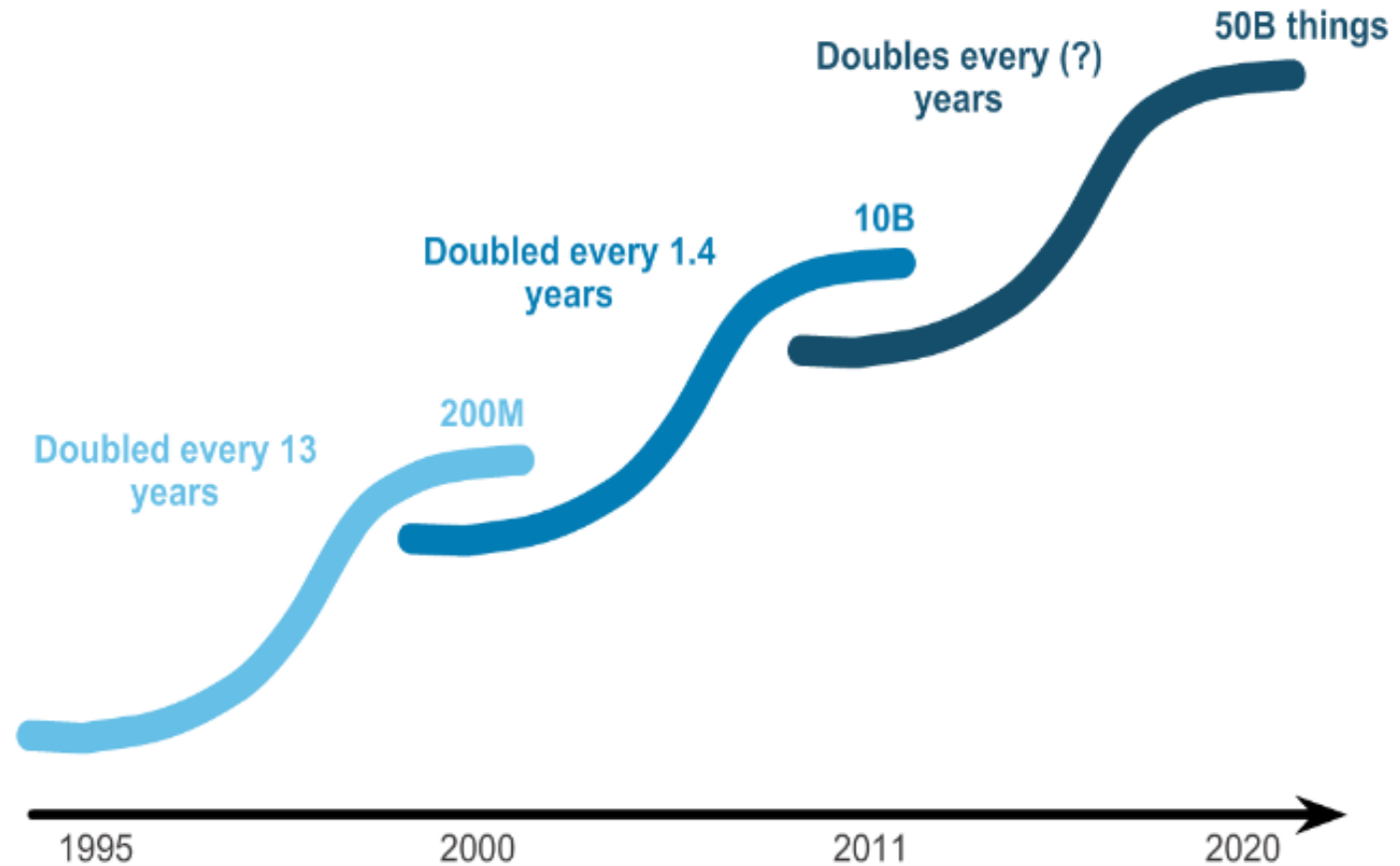
Computer Networks Evolution

"Fixed" Computing
(You go to the device)

Mobility/BYOD
(The device goes with you)

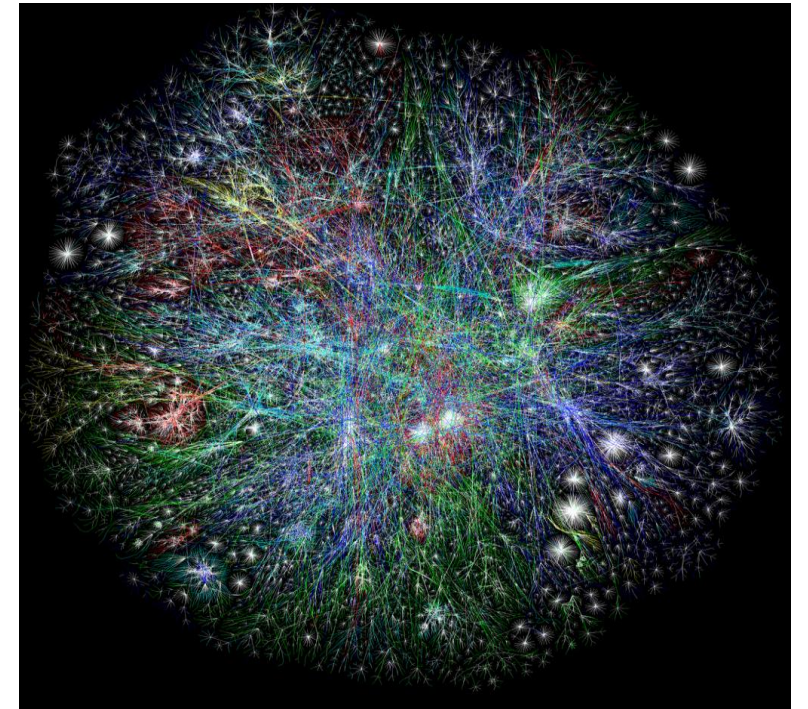
Internet of Things
(Age of Devices)

Internet of Everything
(People, Process, Data, Things)



Networks - Under the bonnet

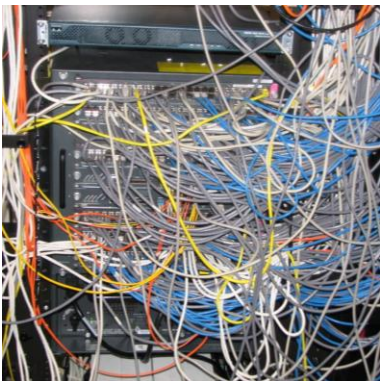
- Inherently Physical:
 - Devices need some form of physical channel to communicate
 - Devices need specific hardware to use that channel (eg. Antenna and associated electronics)



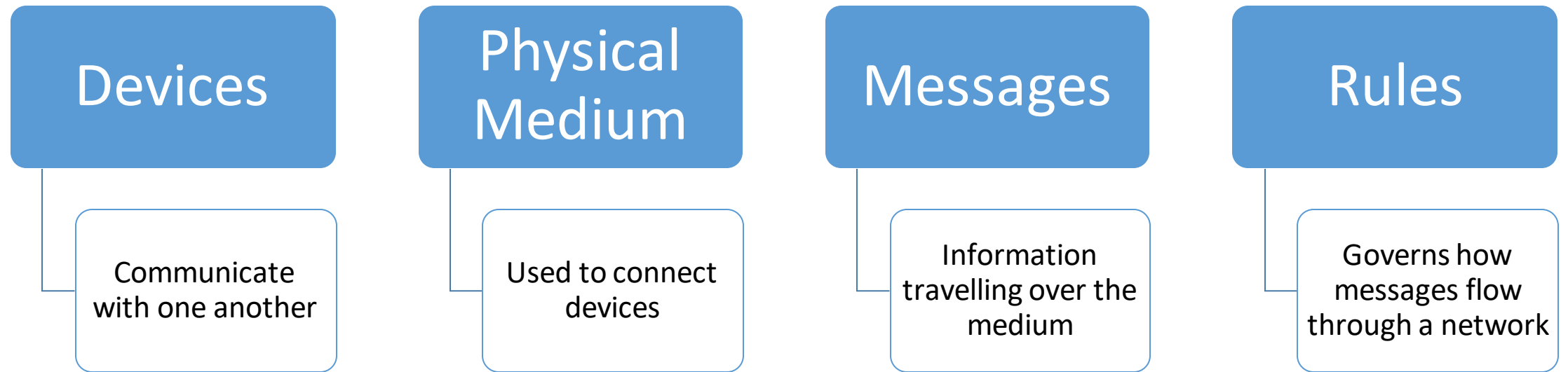


Networks – Under the bonnet

- Once connected, then it gets complicated!
- Sophisticated combination of protocols, software, hardware, algorithms, configurations, policies...
- Security, privacy, access, quality of service, wired/wireless...

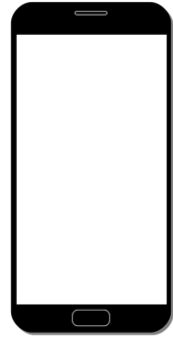


Elements of a Network



Devices

- End Devices

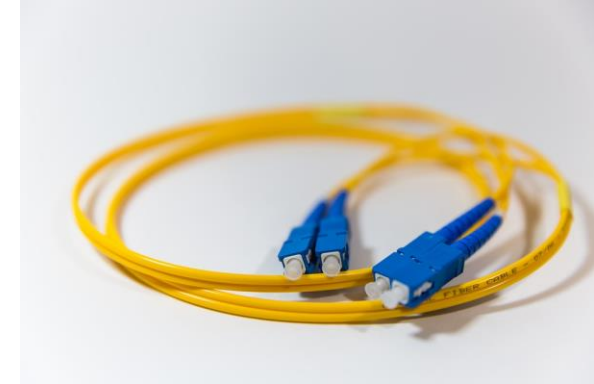
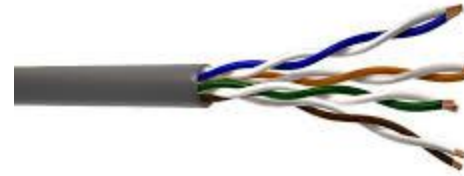


- Infrastructure Devices



Physical Medium

- Wired

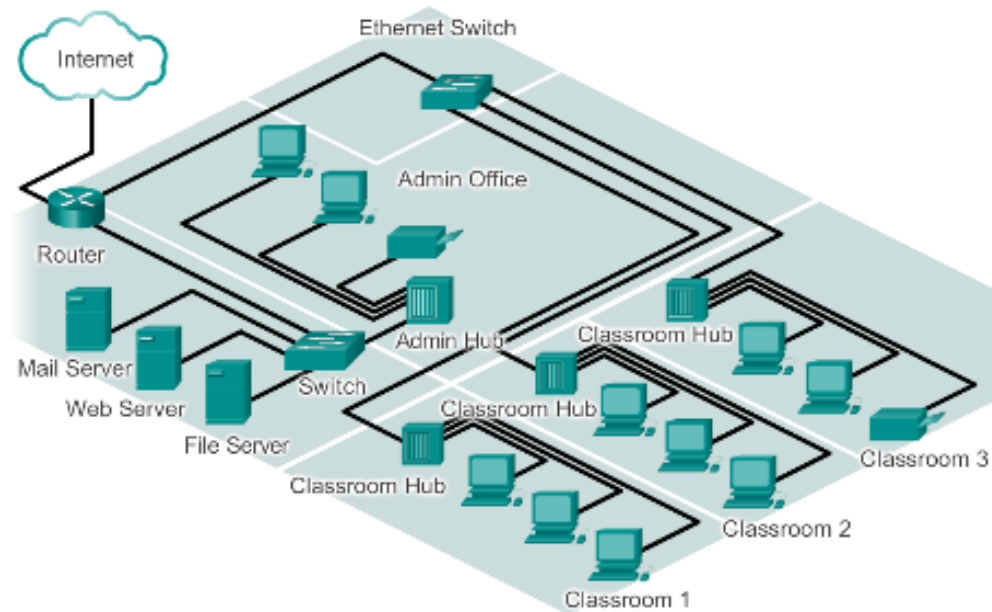


- Wireless

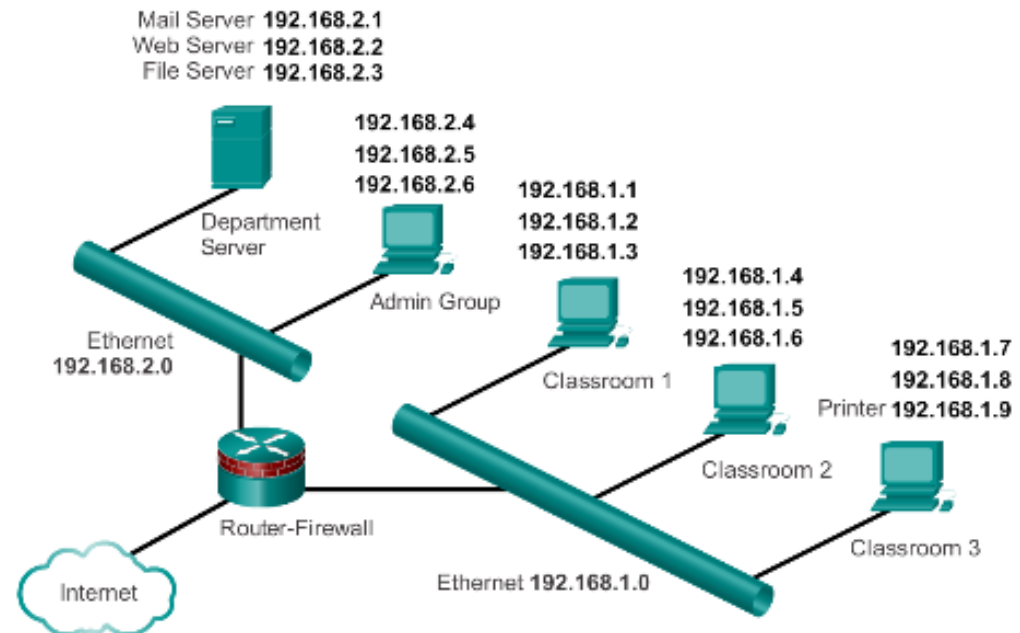


Network Topology

Physical Topology

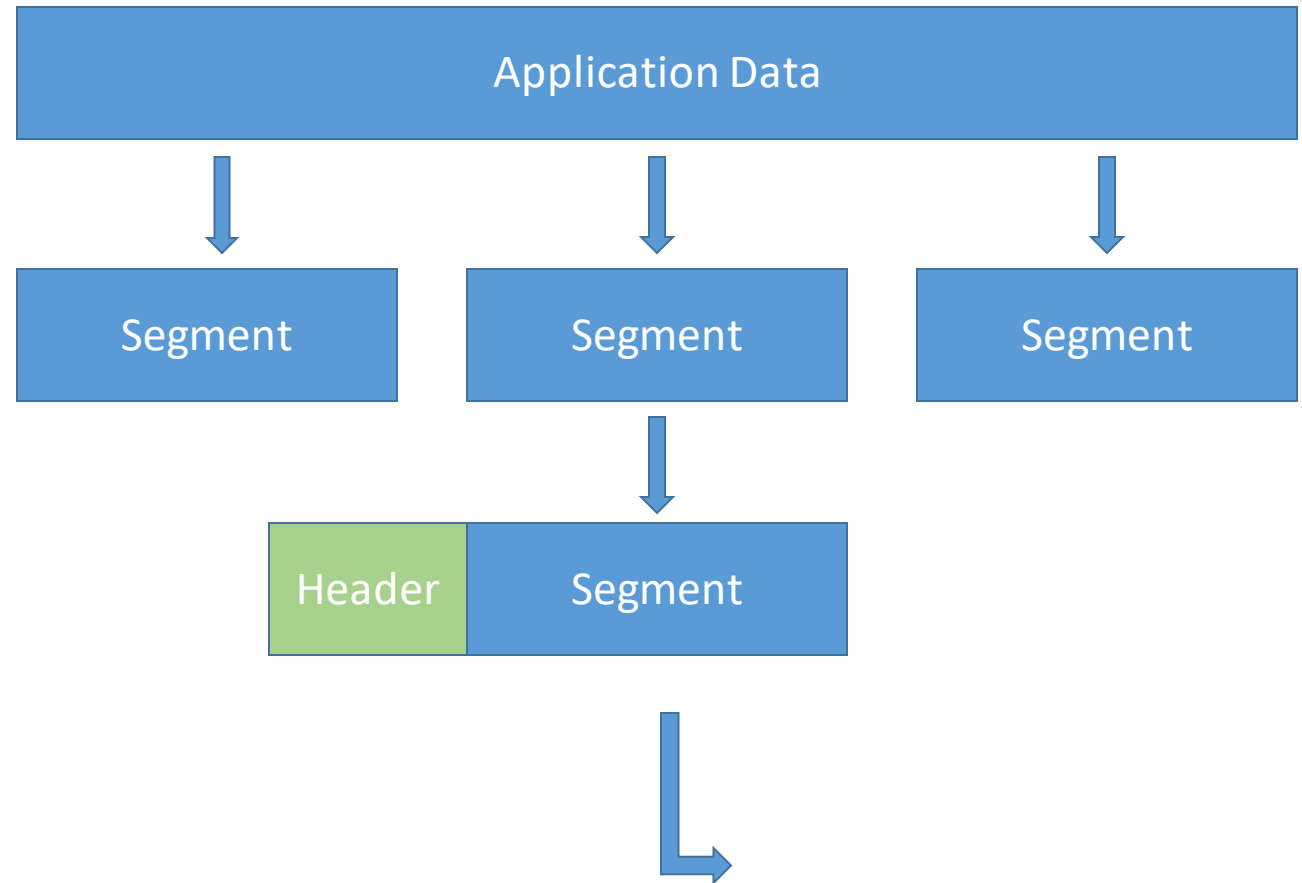


Logical Topology



Messages

- Data is divided into smaller parts during transmission
 - Segmentation
- The benefits of doing so:
 - Many different conversations can be interleaved on the network(multiplexing)
 - Increases reliability of network communications.
 - The separate pieces of each message need not travel the same pathway across the network from source to destination
- Adds complexity however:
 - Addressing, labeling, sending, receiving.
 - Reassembling
- NEED RULES FOR THIS...

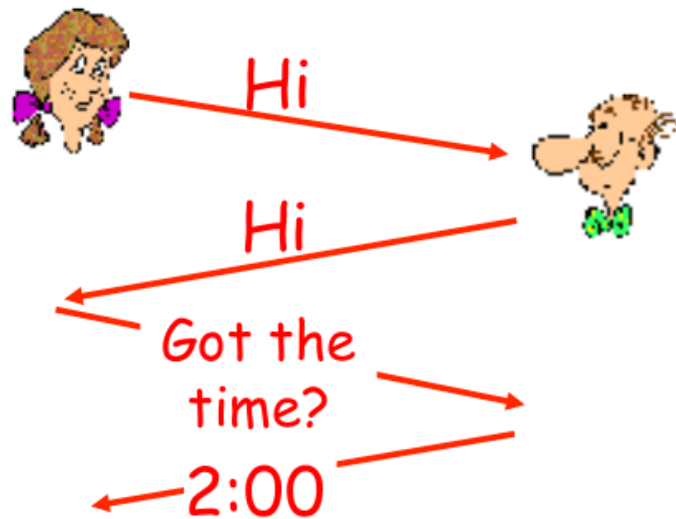


Rules

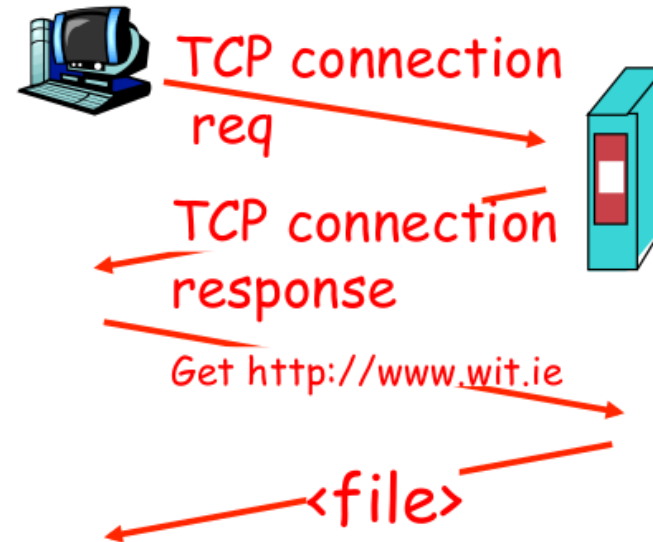
- Humans have generally accepted protocols for interaction:
 - Identified sender and receiver
 - Agreed upon method of communicating (face-to-face, telephone...)
 - Common language and grammar
 - Speed and timing of delivery
 - Confirmation or acknowledgement requirements
- All communication activity on the Internet is governed by protocols



Human Protocol



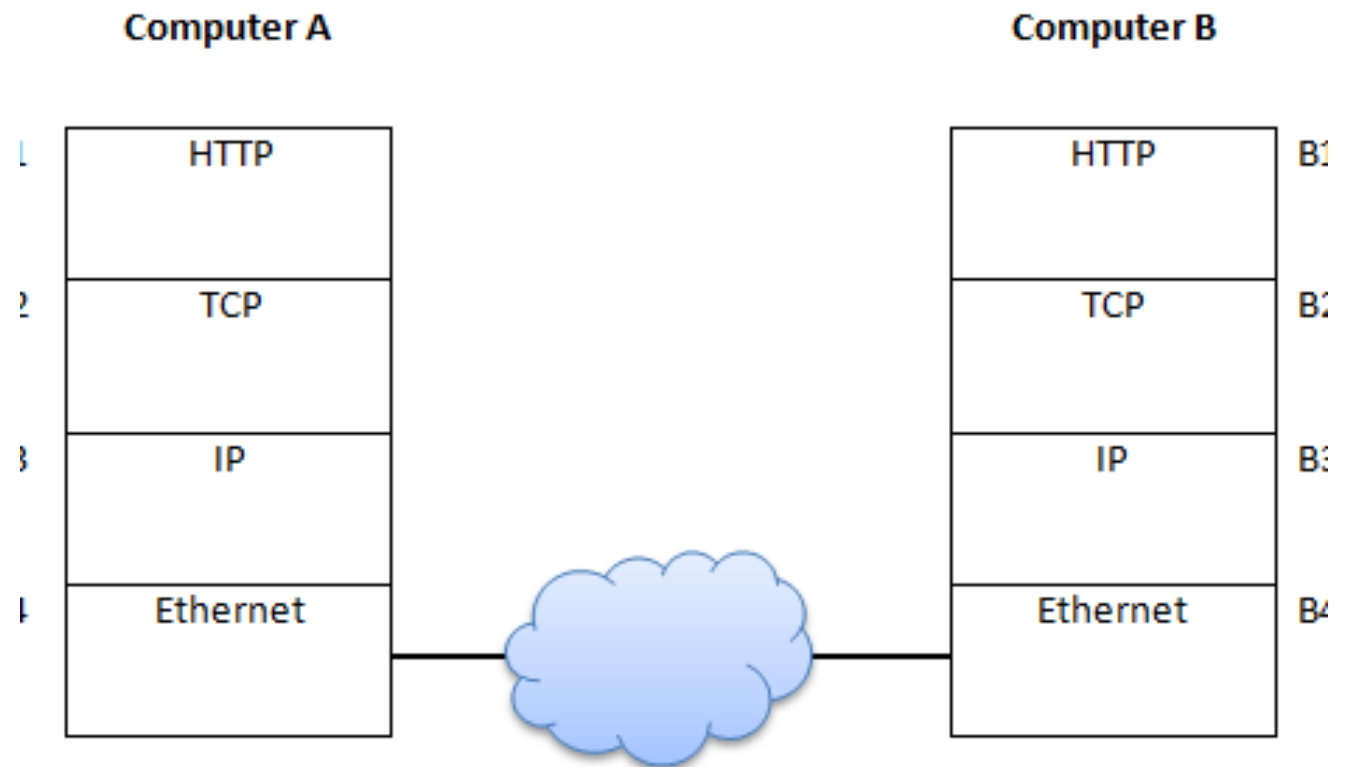
Network Protocol



time

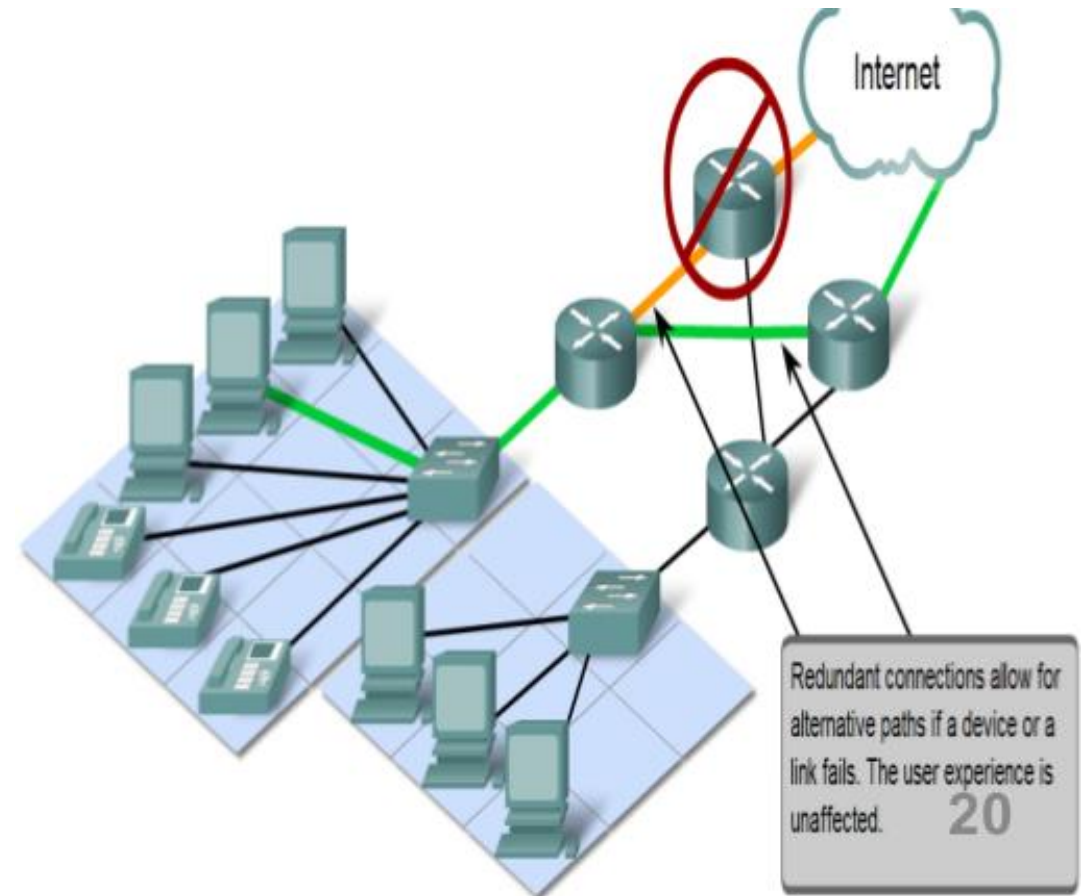
Network Protocols

- Machines rather than humans
- All communication activity in Internet governed by protocols
- Protocols define
 - Format, order of msgs sent and received among network entities
 - Actions taken on msg transmission, receipt



Network Characteristics

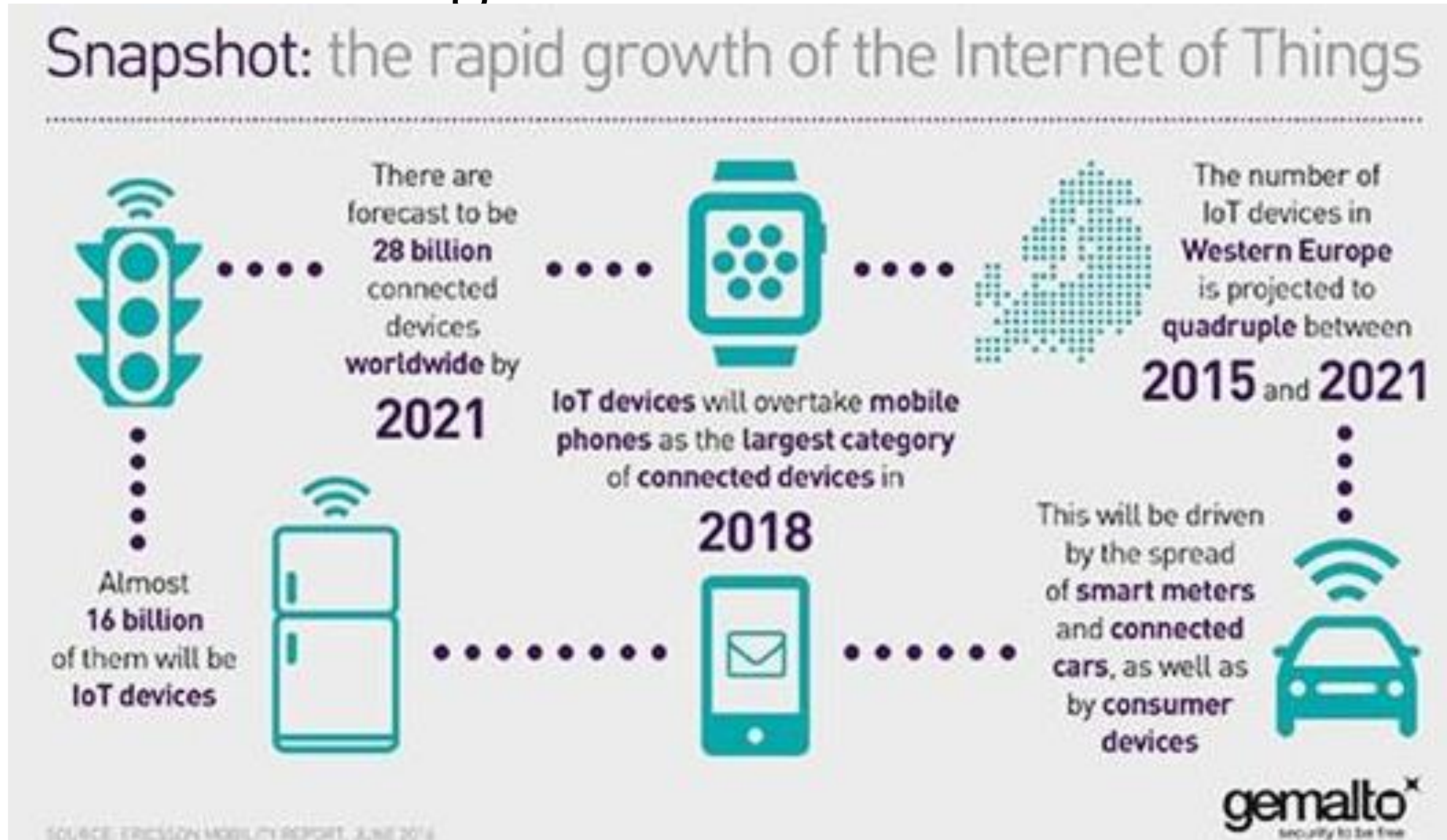
- Network architecture refers to:
 - the technologies that support the infrastructure
 - The programmed services and protocols that move the messages across that infrastructure
- 4 general characteristics to meet user expectations
 - Fault tolerance
 - Scalability
 - Quality of service (QoS)
 - Security



Key Points so far

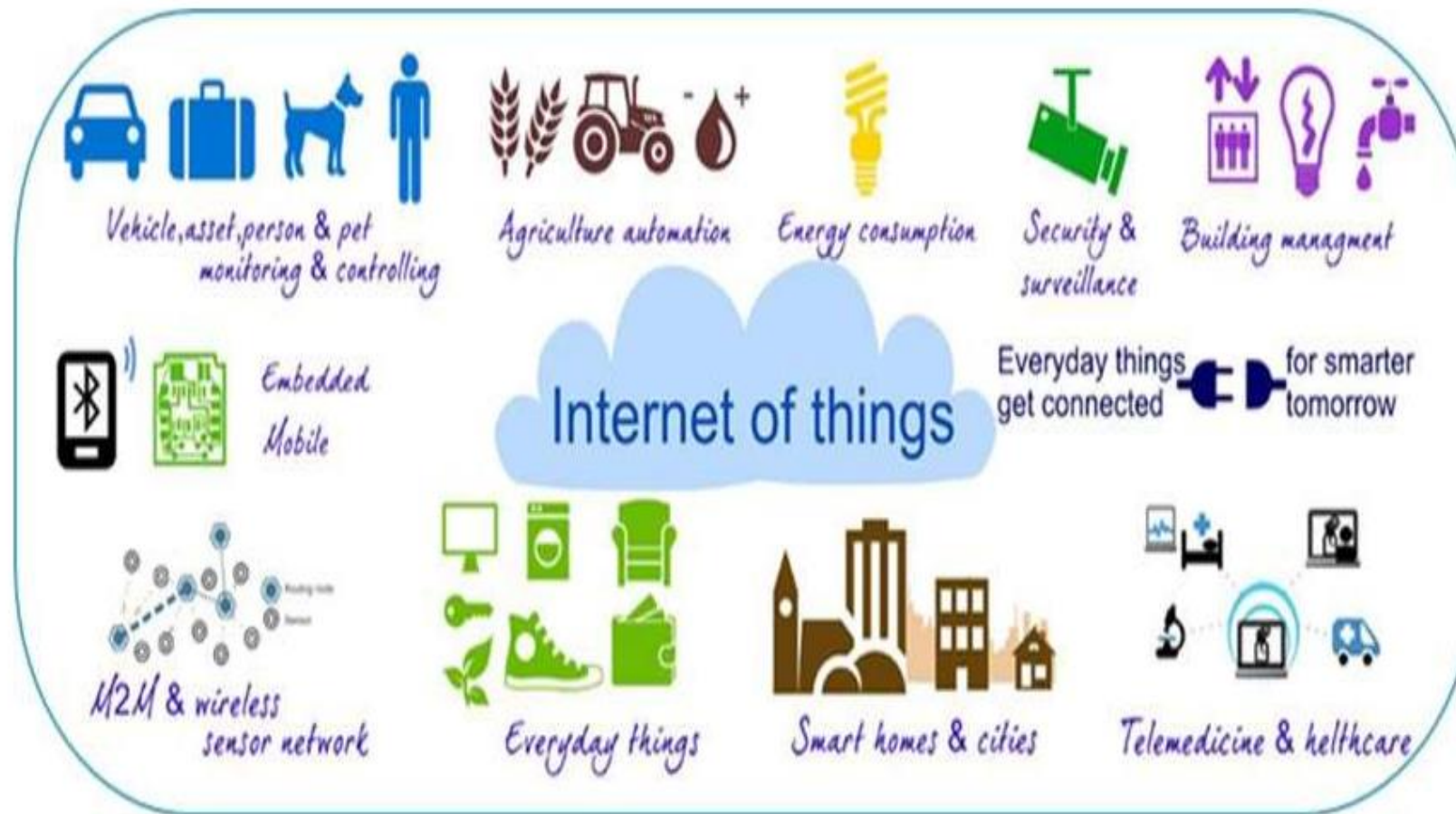
- Networks are everywhere
- 4 Components of every network
 - Devices
 - Medium
 - Protocols (Rules)
 - Messages (Data)
- Networks are connecting everything (not just for PCs/Laptops)
- Networks have a Topology
- Some key characteristics of a network

Internet of Things

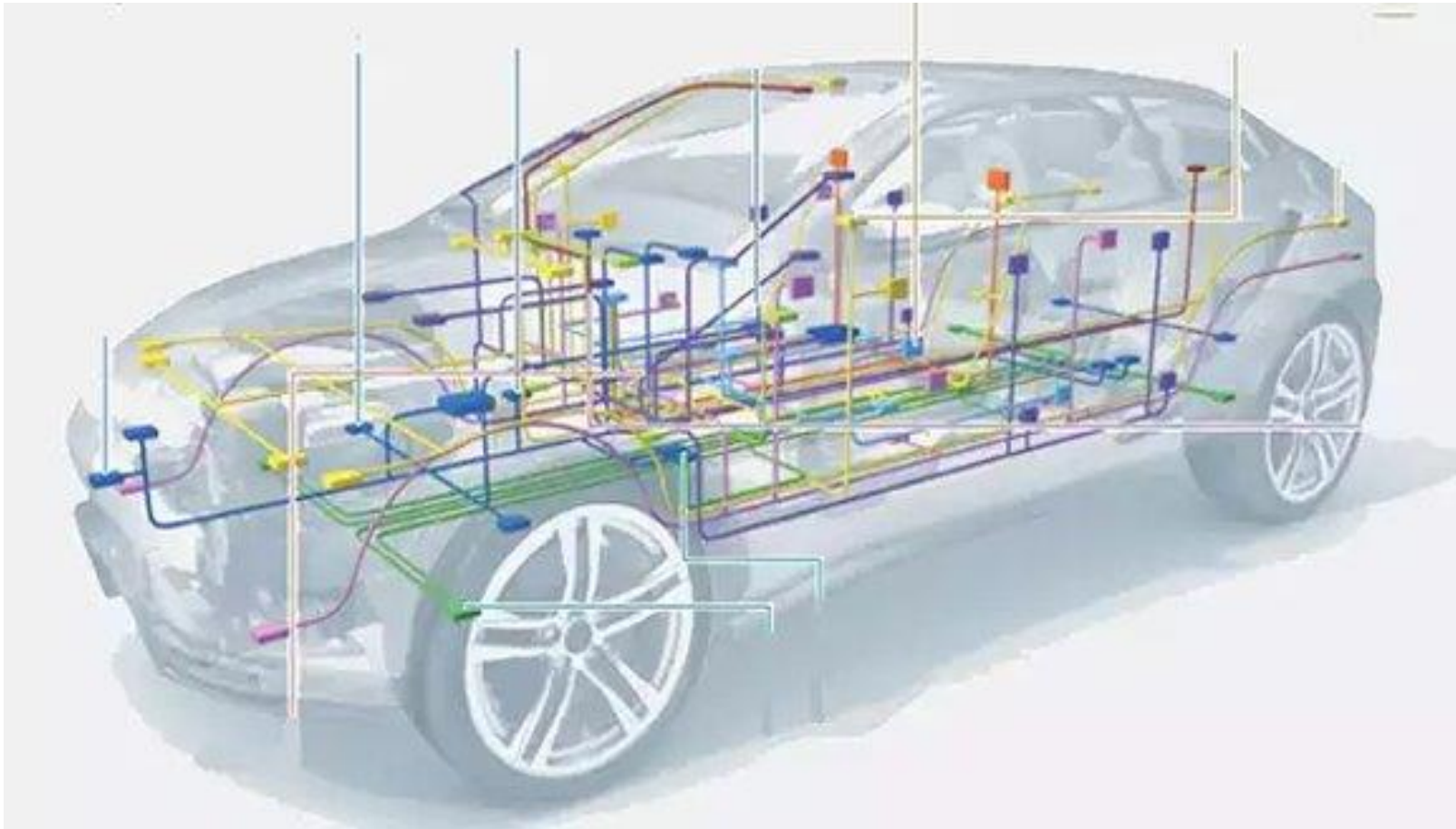


Source: Ericsson Mobility Report 2016

IoT Applications



Connected Car



Learning about Networks

- Can't create complex networks at home however you can create "virtual networks"
 - Virtualbox hypervisor
 - Vagrant
- Can use programmable, multi-channel, prototyping device to investigate different mediums, protocols etc.
 - Raspberry Pi has bluetooth, Wifi, Ethernet, SPI, I2C...

