Networking

It’s complicated

Networking

Networking and Communication Trends

- Convergence
- Speed
- Stability
- Embeddedness
- Ubiquitousness

Networking

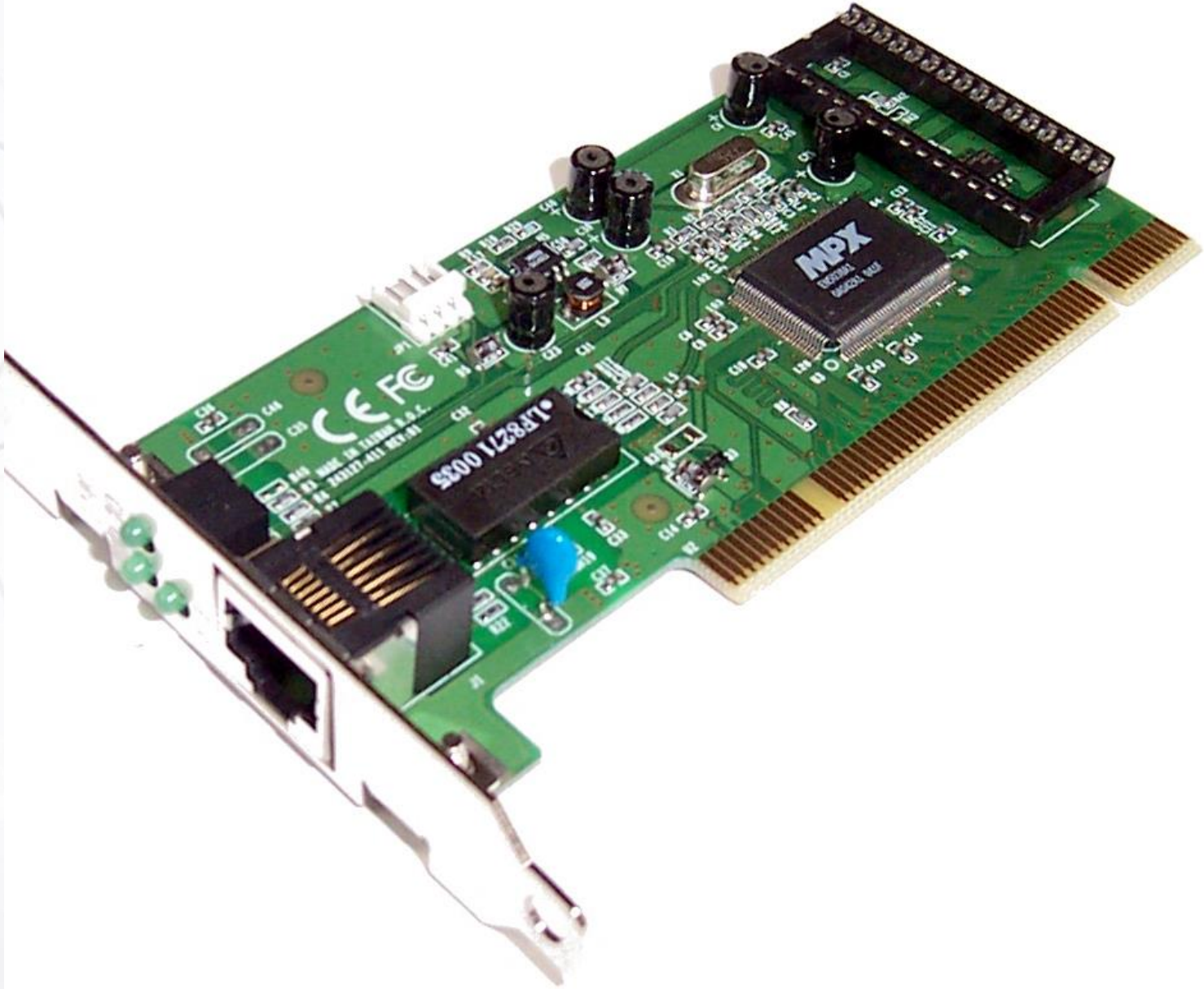
- The definition has evolved over the years, and continues to do so
  - General definition
    - In the beginning
    - Now
  - Some other terms
    - Client / server v. Centralized
    - Grid computing
    - Cloud computing
      - Why

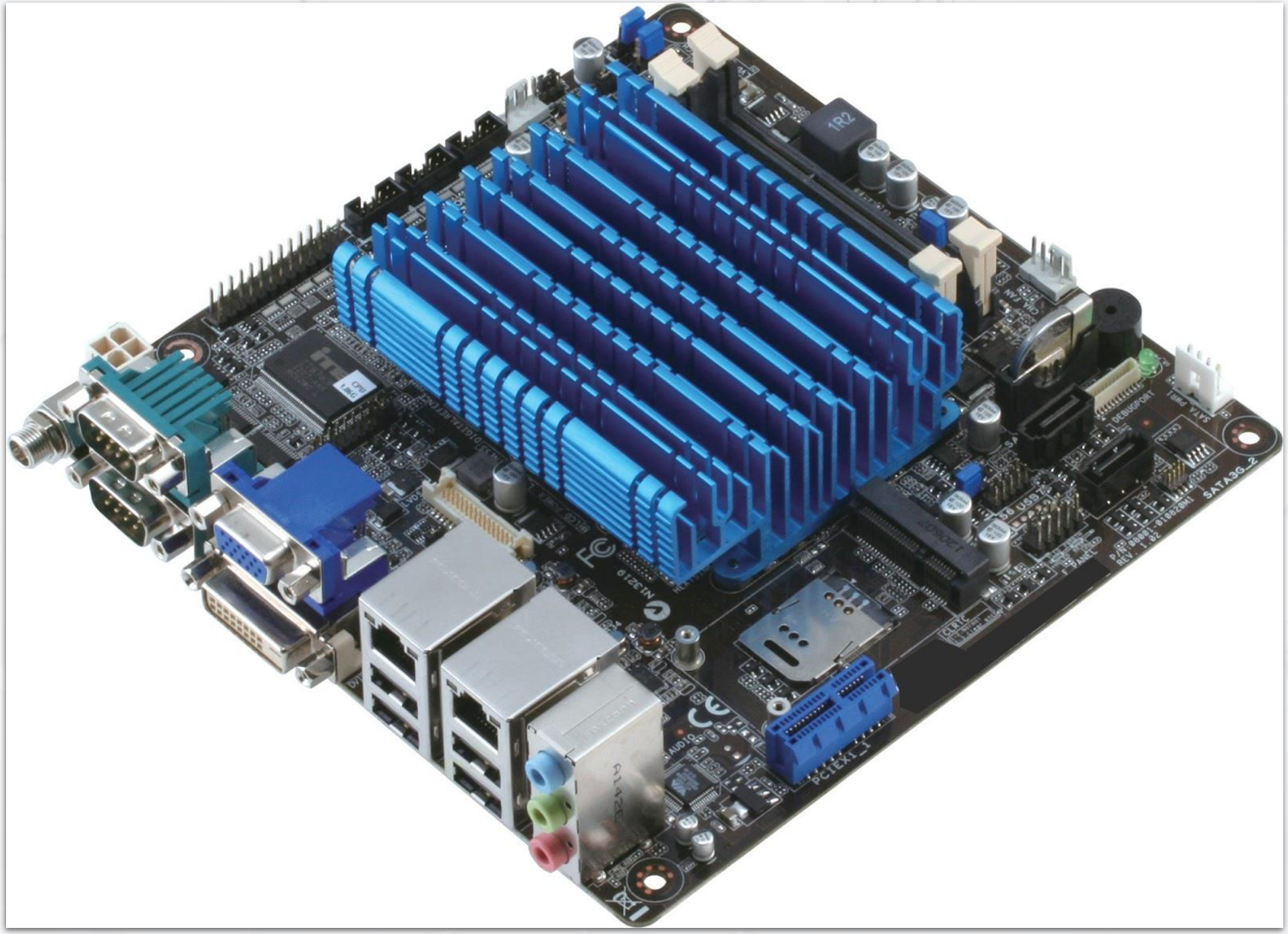
Networking

- The definition has evolved over the years, and continues to do so
  - Related hardware
    - This discussion has also evolved over the years, if not outright changed
    - NIC
    - NOS

Network Interface Card

- Still use these
- Are embedded
- Can use other methods as well




1R2
SATA3G_2
PCIEX1_1

Networking

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    - NIC
    - Hub
    - NOS

NETWORK EVERYWHERE ™
Fast Ethernet
10/100 5-Port Network Hub
Network Everywhere the Basic Solution Line From Linksys
Model NH1005
LINKSYS
Link/Act
100
Power
1 2 3 4 5
1 2 3 4 5 Uplink

Networking

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    - NIC
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    - Switch
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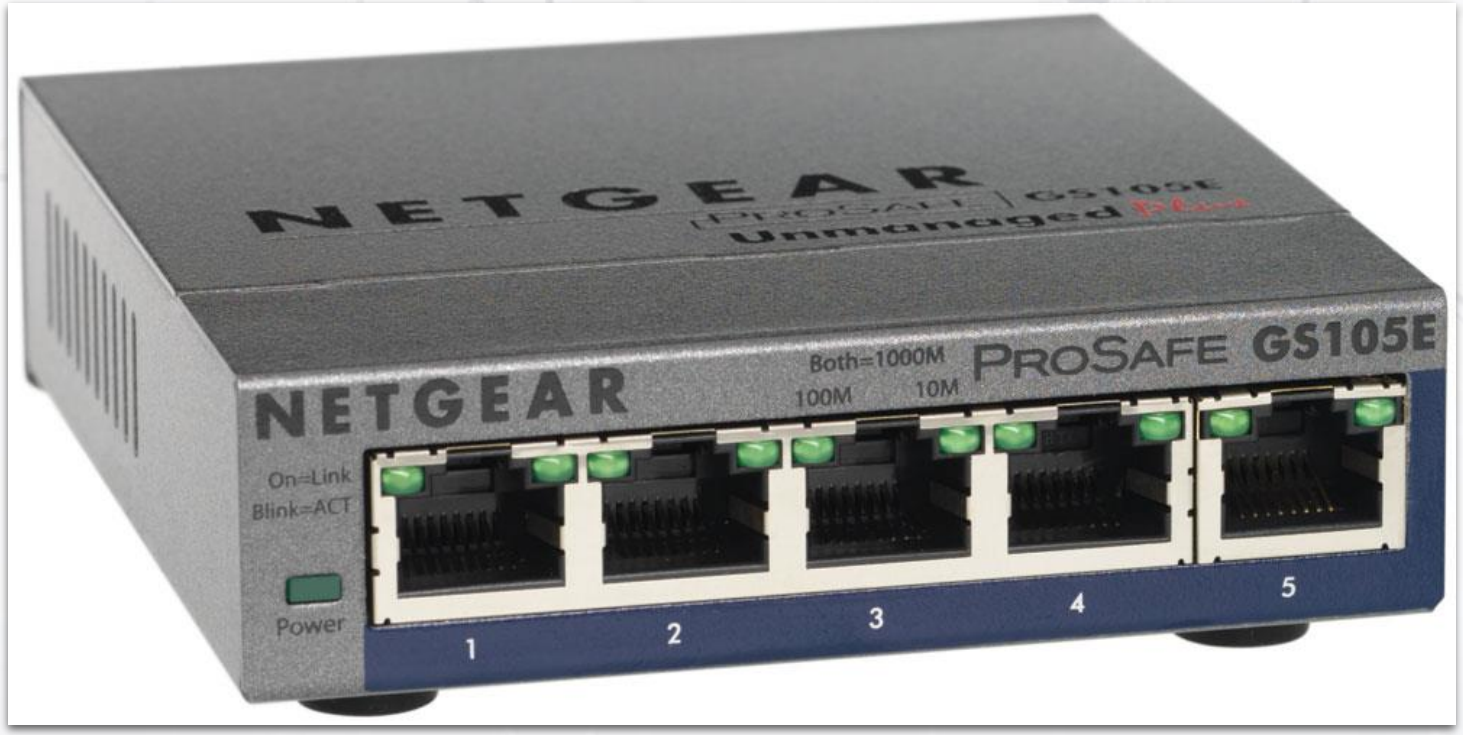
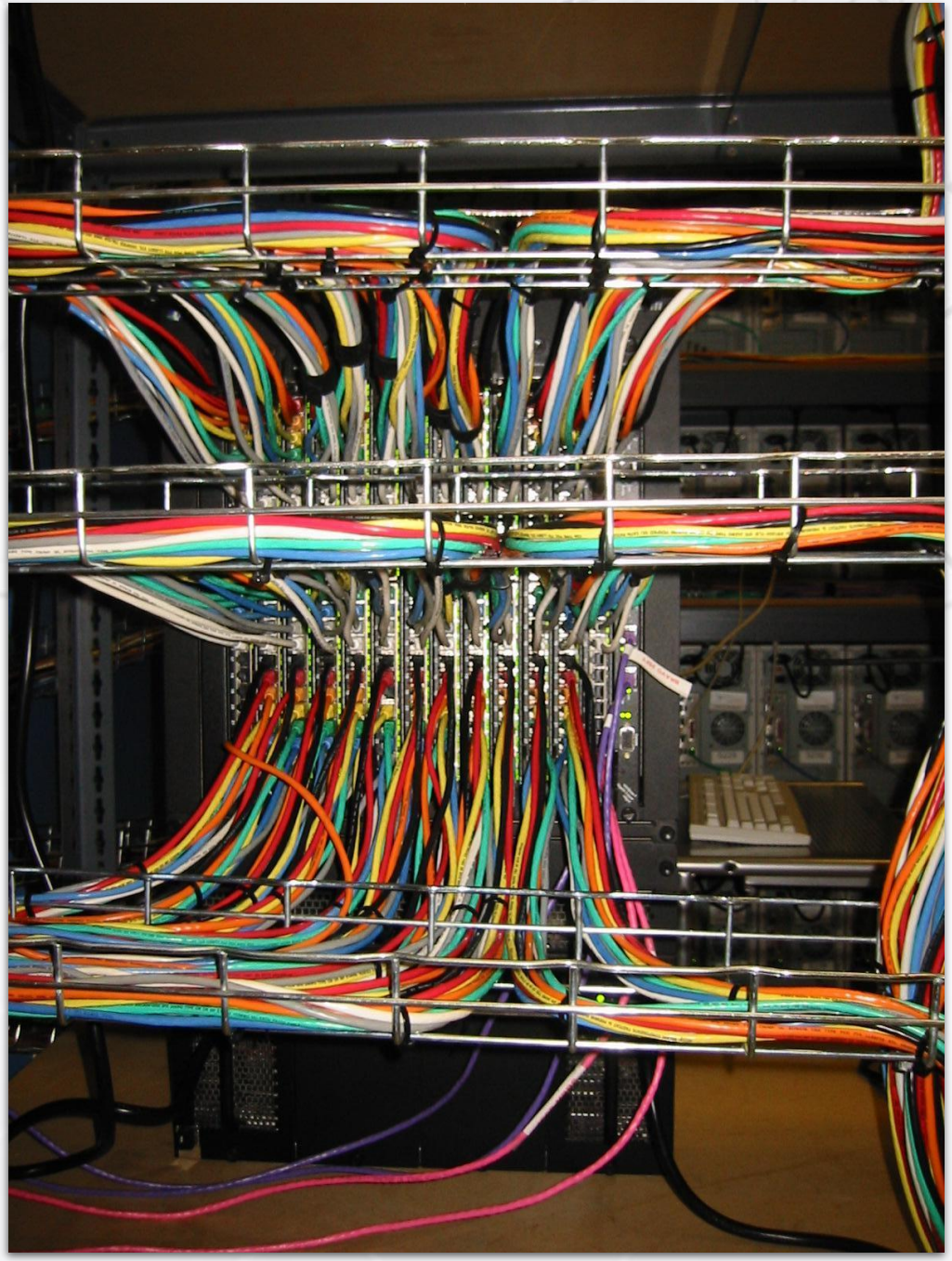
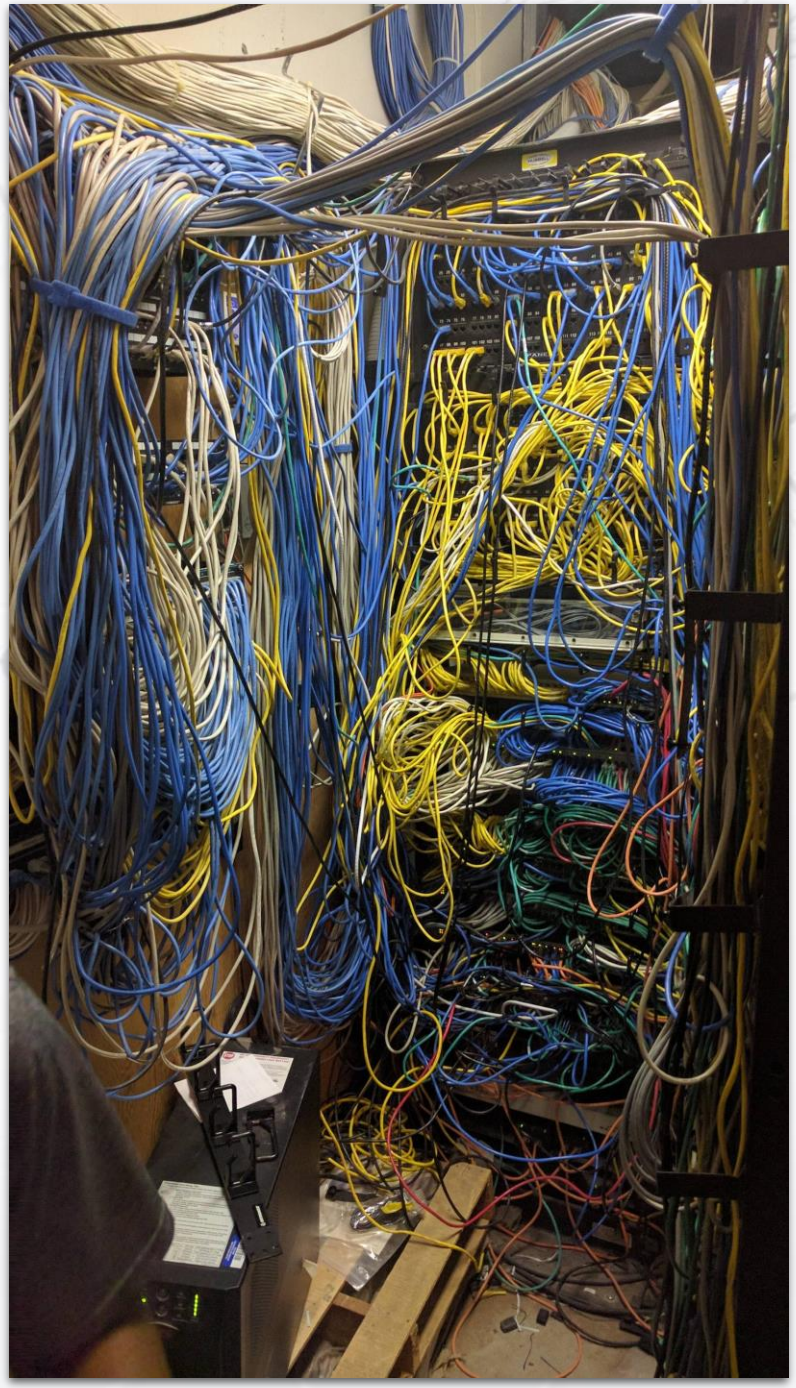

NETGEAR
ProSafe | GS105E
Unmanaged
NETGEAR
Both=1000M
100M
10M
ProSafe GS105E
On=Link
Blink=ACT
Power
1
2
3
4
5

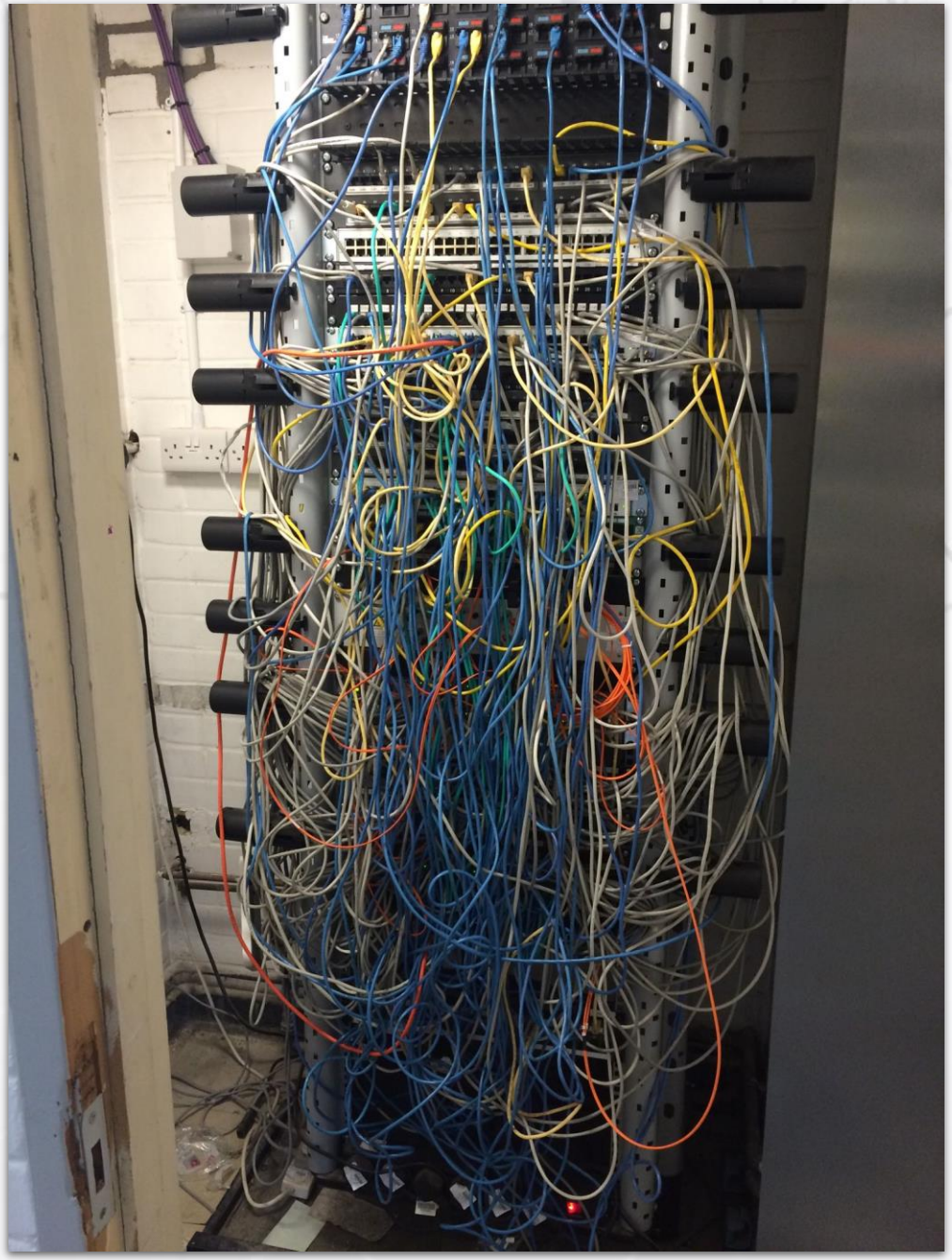
DES-1016R+
10/100 Fast Ethernet Switch
D-Link
DES-1024R+
10/100 Fast Ethernet Switch
D-Link

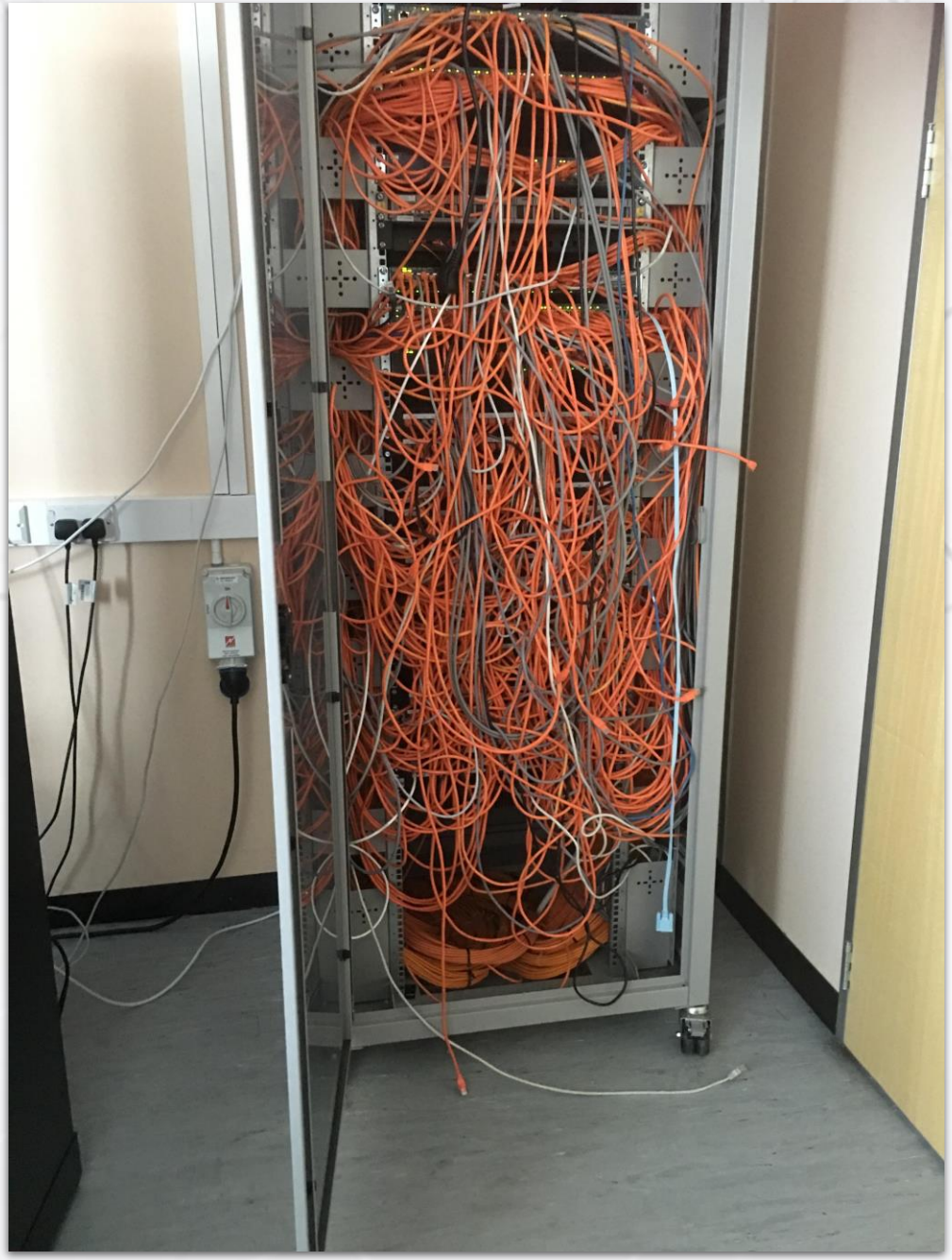


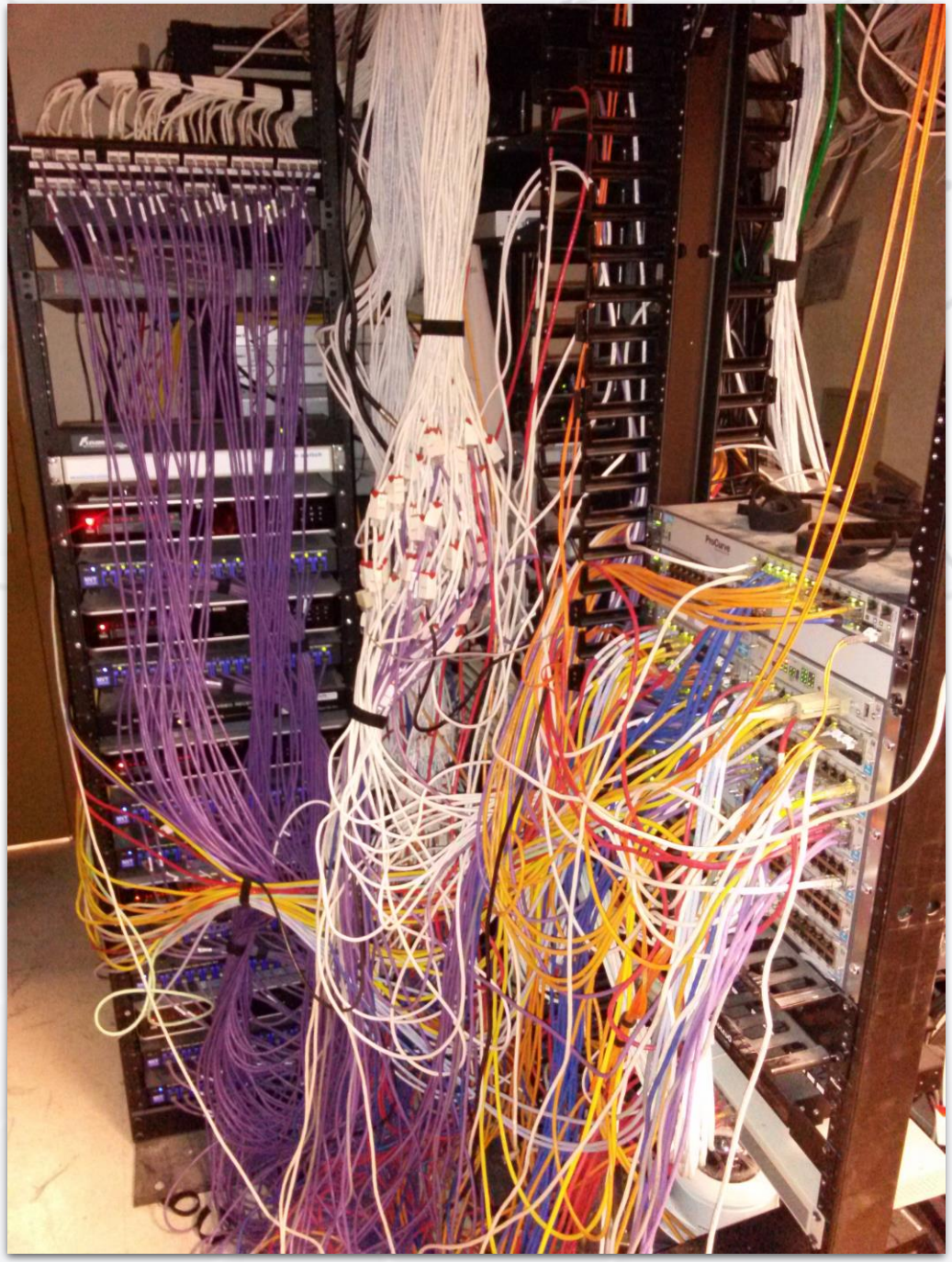
Hercul
U.P.
Marcus Farrell

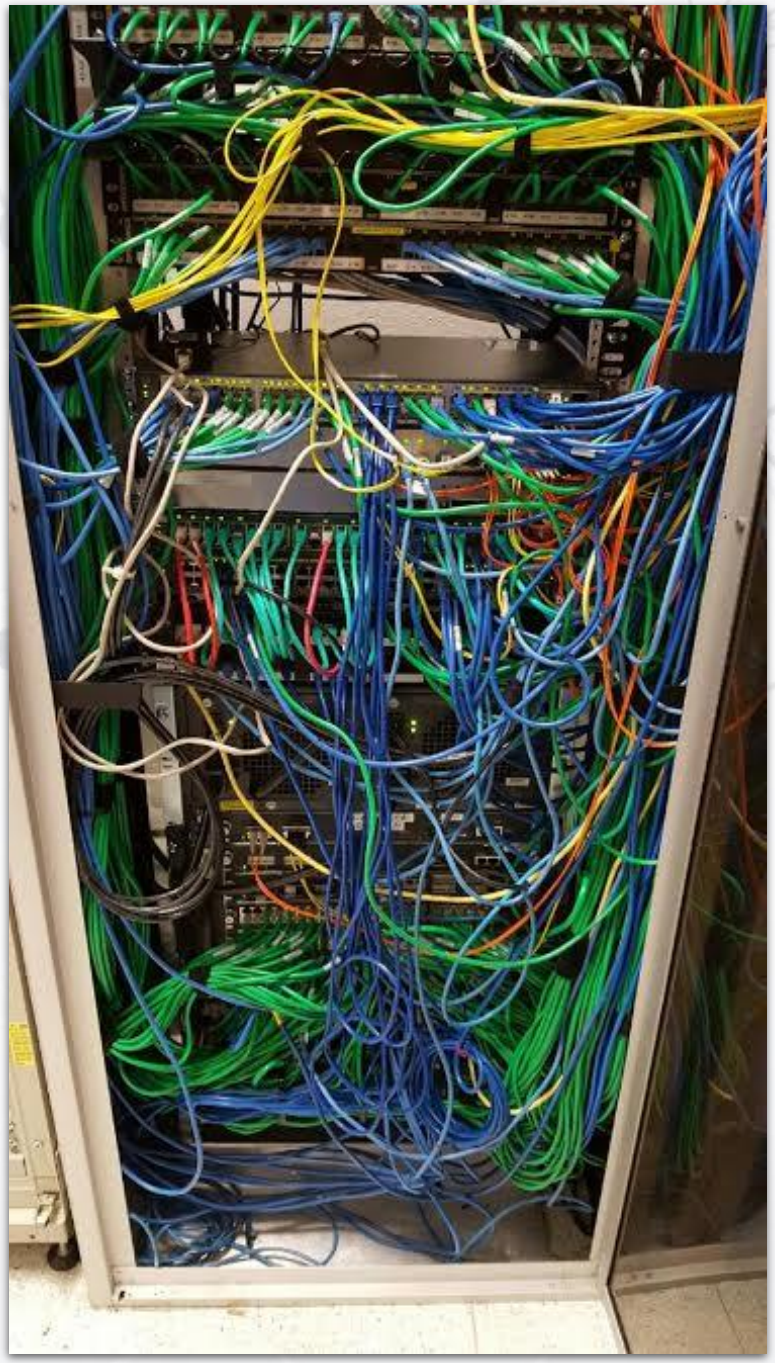
SALT











Networking

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  - Related hardware
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    - NIC
    - Hub
    - Switch
    - Router

    - NOS

Wireless-G 2.4GHz
Broadband Router
LINKSYS®
CISCO SYSTEMS
Wireless-G
Power
DMZ
WLAN
1
2
3
4
Internet
Wireless-G
Broadband Router
With 4-Port Switch
Model WRT54G
LINKSYS®

Reset
WAN
1
2
3
4
Uplink
Power
Instant Wireless™
Instant Broadband™
EtherFast Wireless AP + Cable/DSL Router with 4-Port Switch
Model BEFW11S4
WLAN ACT
WLAN ER
Power
Link/Act
Full/Col
10D
1 2 3 4
Link
Act
Diag
WAN

LINKSYS
A Division of Cisco Systems, Inc.
Firmware Version: v3.37.2 - HyperWRT 2.0
Administration
Wireless-G Broadband Router with SpeedBooster
WRT54GS
Setup
Wireless
Security
Access Restrictions
Applications & Gaming
Administration
Status
Management | Log | Diagnostics | Factory Defaults | Firmware Upgrade | Config Management
Router Password
Local Router Access
Router Password:
Re-enter to confirm:
Web Access
Access Server: HTTP HTTPS
Wireless Access Web: Enable Disable
Remote Router Access
Remote Management: Enable Disable
Management Port: 8080
Use https:
UPnP
UPnP: Enable Disable
Command Shell
Command Shell
Telnet Daemon
Telnet Daemon
Startup & Firewall Scripts
Startup
Firewall
Reboot Router
Reboot Router
Local Router Access: You can change the Router's password from here. Enter a new Router password and then type it again in the Re-enter to confirm field to confirm.
Web Access: Allows you to configure access options to the router's web utility.
More...
Remote Router Access: Allows you to access your router remotely. Choose the port you would like to use. You must change the password to the router if it is still using its default password.
UPnP: Used by certain programs to automatically open ports for communication.
More...

Networking

Key Networking technologies

- Client / Server Computing
- Packet Switching
- TCP / IP
  - Has 7 layers
  - Each layer provides a unique service or function
  - Some remappings and simplifications have been attempted
  - Foundation of all networking

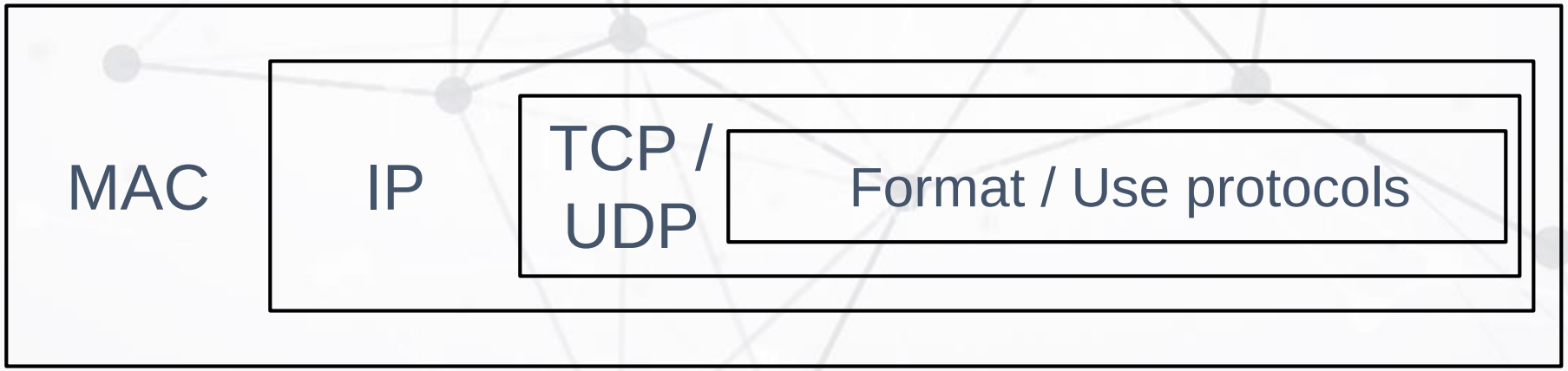
Networking

Key Networking technologies

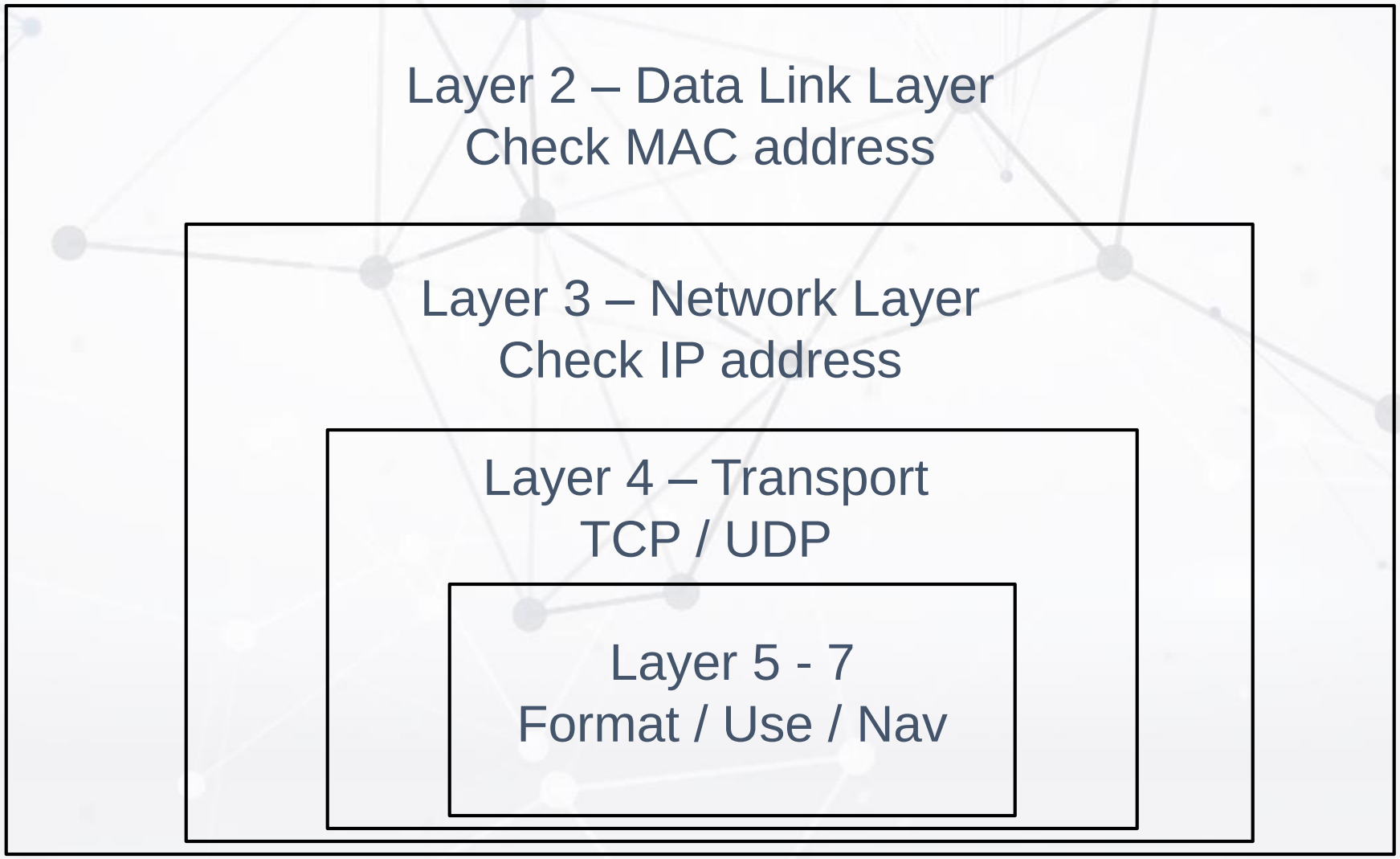
- TCP / IP (OSI Model)
  - Application
  - Presentation
  - Session
  - Transport
  - Network
  - Data-link
  - Physical

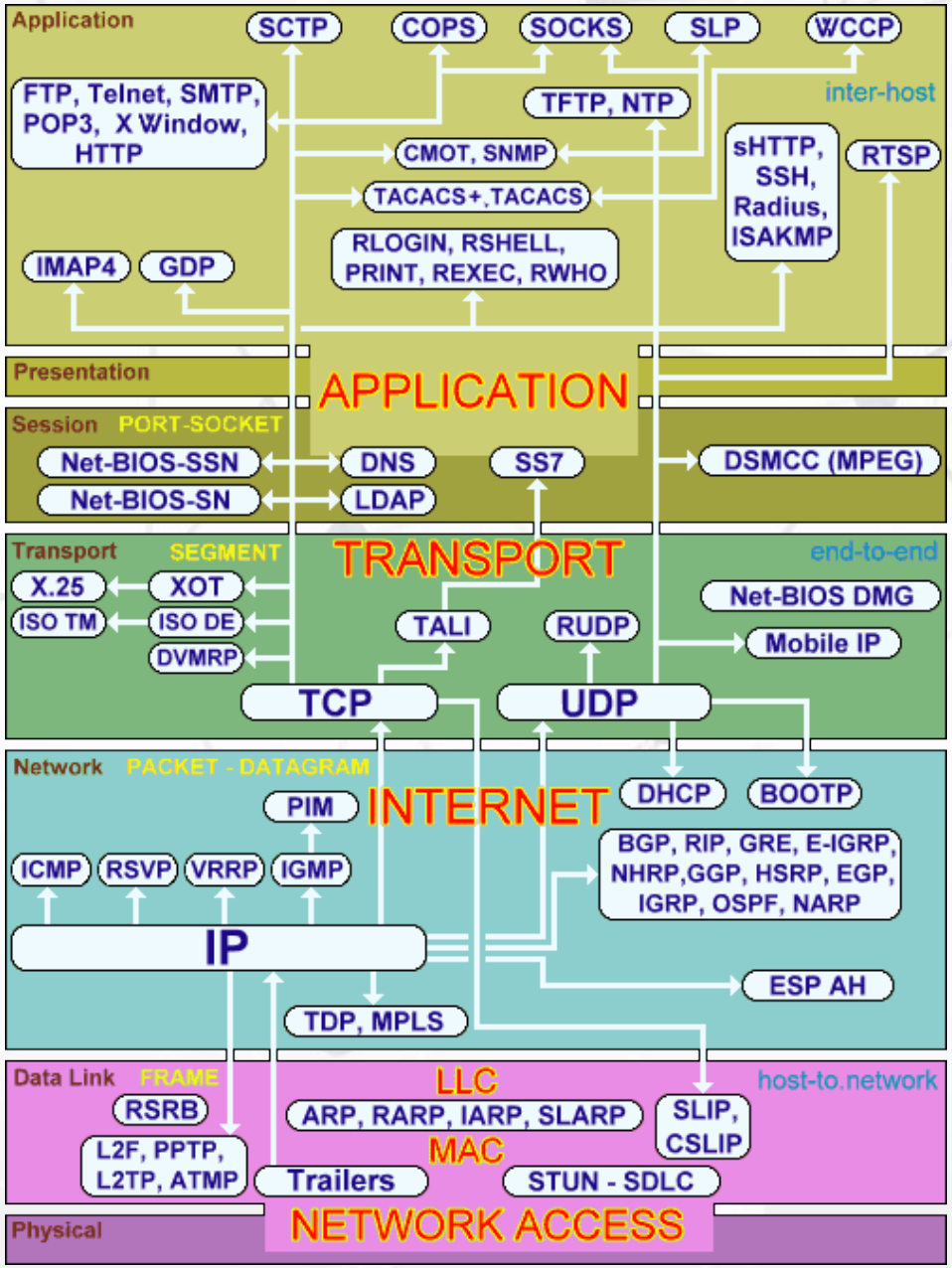
Networking

- Packet structure



Network Packet Structure (another view)

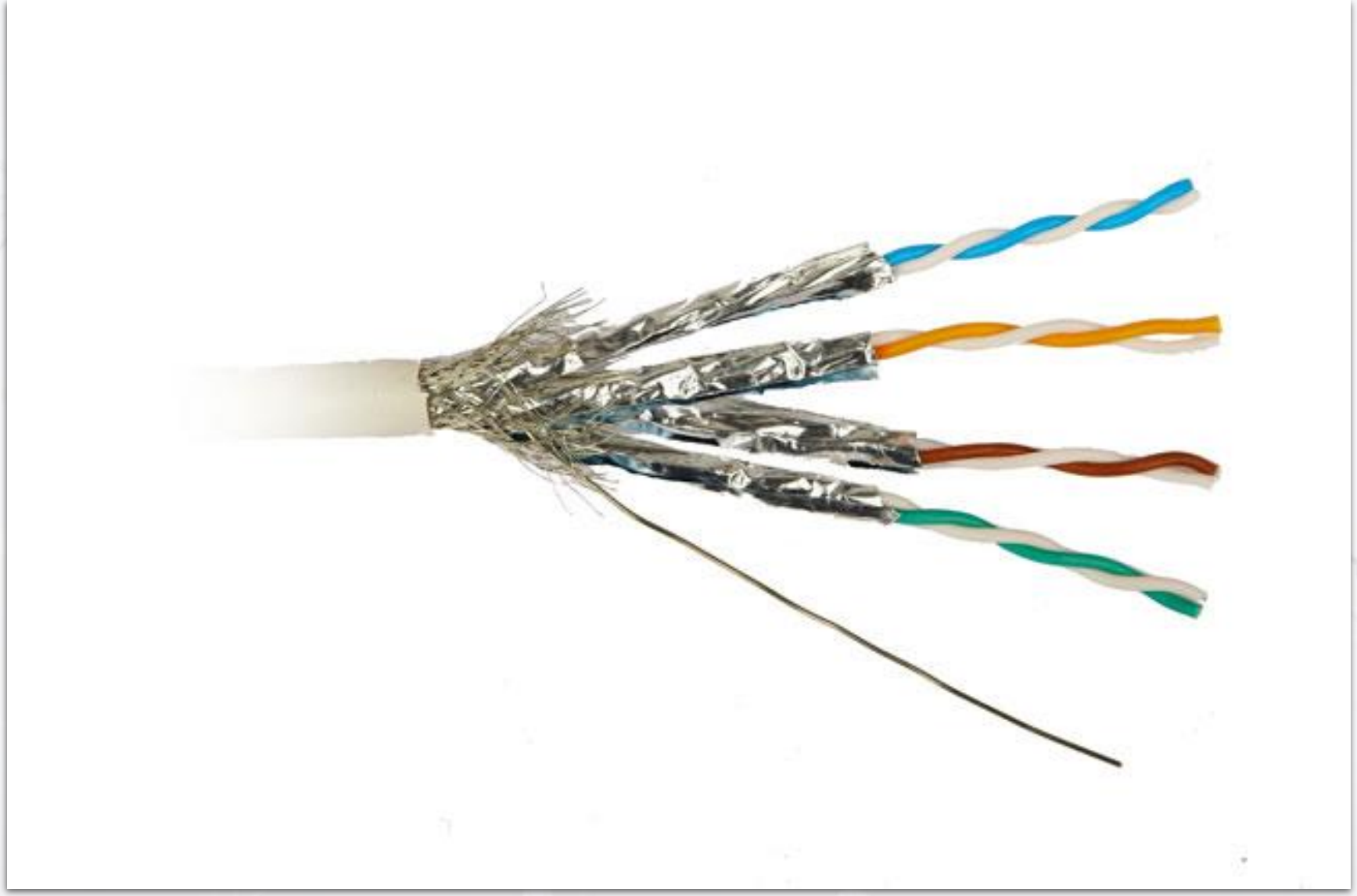



Application
SCTP
COPS
SOCKS
SLP
WCCP
FTP, Telnet, SMTP, POP3, X Window, HTTP
TFTP, NTP
inter-host
CMOT, SNMP
sHTTP, SSH, Radius, ISAKMP
RTSP
TACACS+,TACACS
RLOGIN, RSHELL, PRINT, REXEC, RWHO
IMAP4
GDP
Presentation
APPLICATION
Session PORT-SOCKET
Net-BIOS-SSN
DNS
SS7
DSMCC (MPEG)
Net-BIOS-SN
LDAP
Transport SEGMENT
TRANSPORT
end-to-end
X.25
XOT
Net-BIOS DMG
ISO TM
ISO DE
TALI
RUDP
Mobile IP
DVMRP
TCP
UDP
Network PACKET - DATAGRAM
INTERNET
PIM
DHCP
BOOTP
BGP, RIP, GRE, E-IGRP, NHRP,GGP, HSRP, EGP, IGRP, OSPF, NARP
ICMP
RSVP
VRRP
IGMP
IP
ESP AH
TDP, MPLS
Data Link FRAME
LLC
host-to.network
RSRB
ARP, RARP, IARP, SLARP
SLIP, CSLIP
L2F, PPTP, L2TP, ATMP
MAC
Trailers
STUN - SDLC
Physical
NETWORK ACCESS

Networking

Physical transmission media

- Twisted wire / Twisted pair / Twisted pair wire
  - Analog signal v. Digital signal
  - MODEM
  - Evolution
  - Benefits / Problems



Networking

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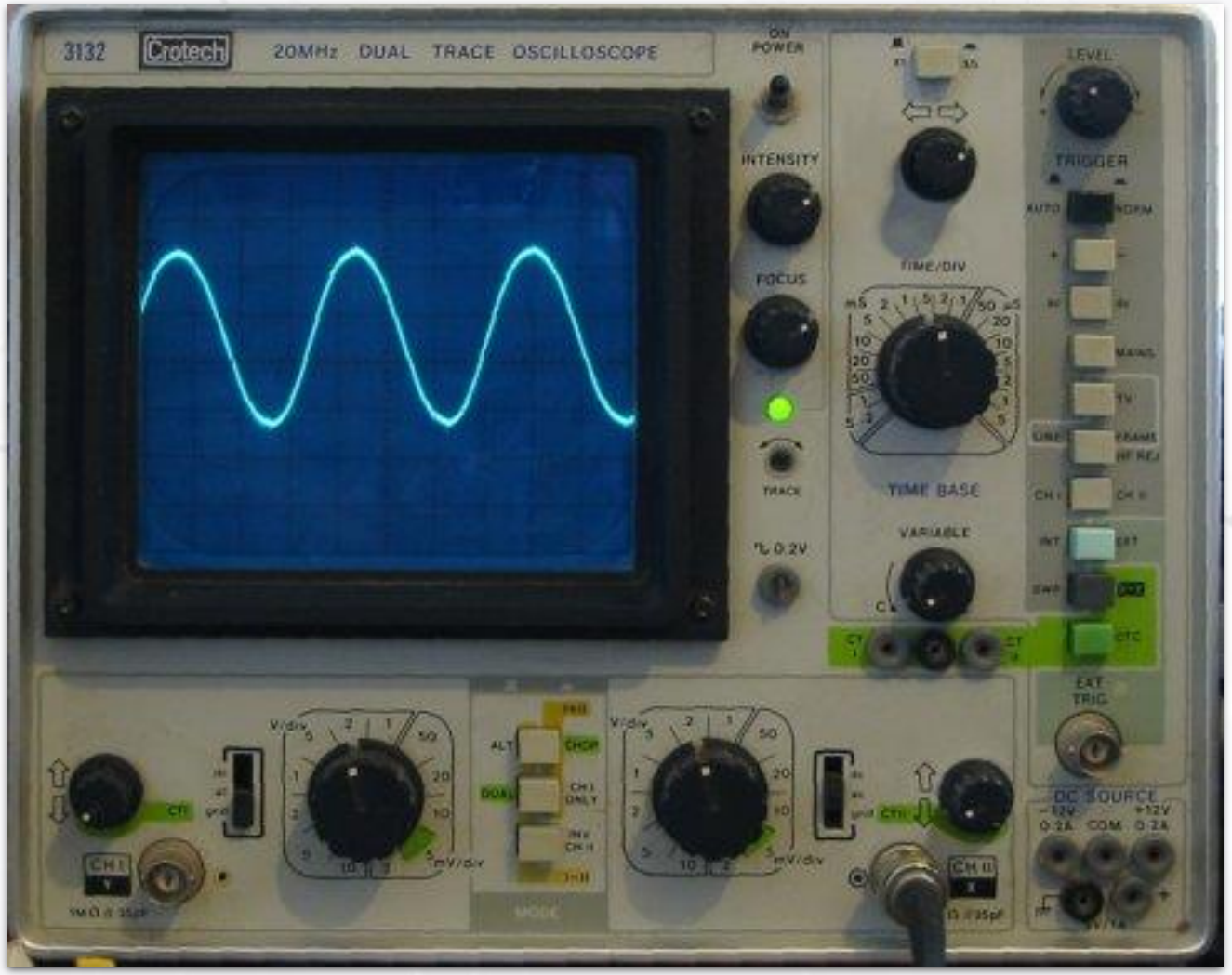

3132
Crotech
20MHz DUAL TRACE OSCILLOSCOPE
ON POWER
INTENSITY
FOCUS
TRACE
TIME/DIV
TIME BASE
VARIABLE
LEVEL
TRIGGER
AUTO
NORM
MAINS
TV
LINE
FRAME
CH I
CH II
INT
EXT
SWP
CTC
EXT TRIG
DC SOURCE
COM
ALT
CHOP
DUAL
CH I ONLY
CH II
V/div
mV/div
CH I
CH II

Networking

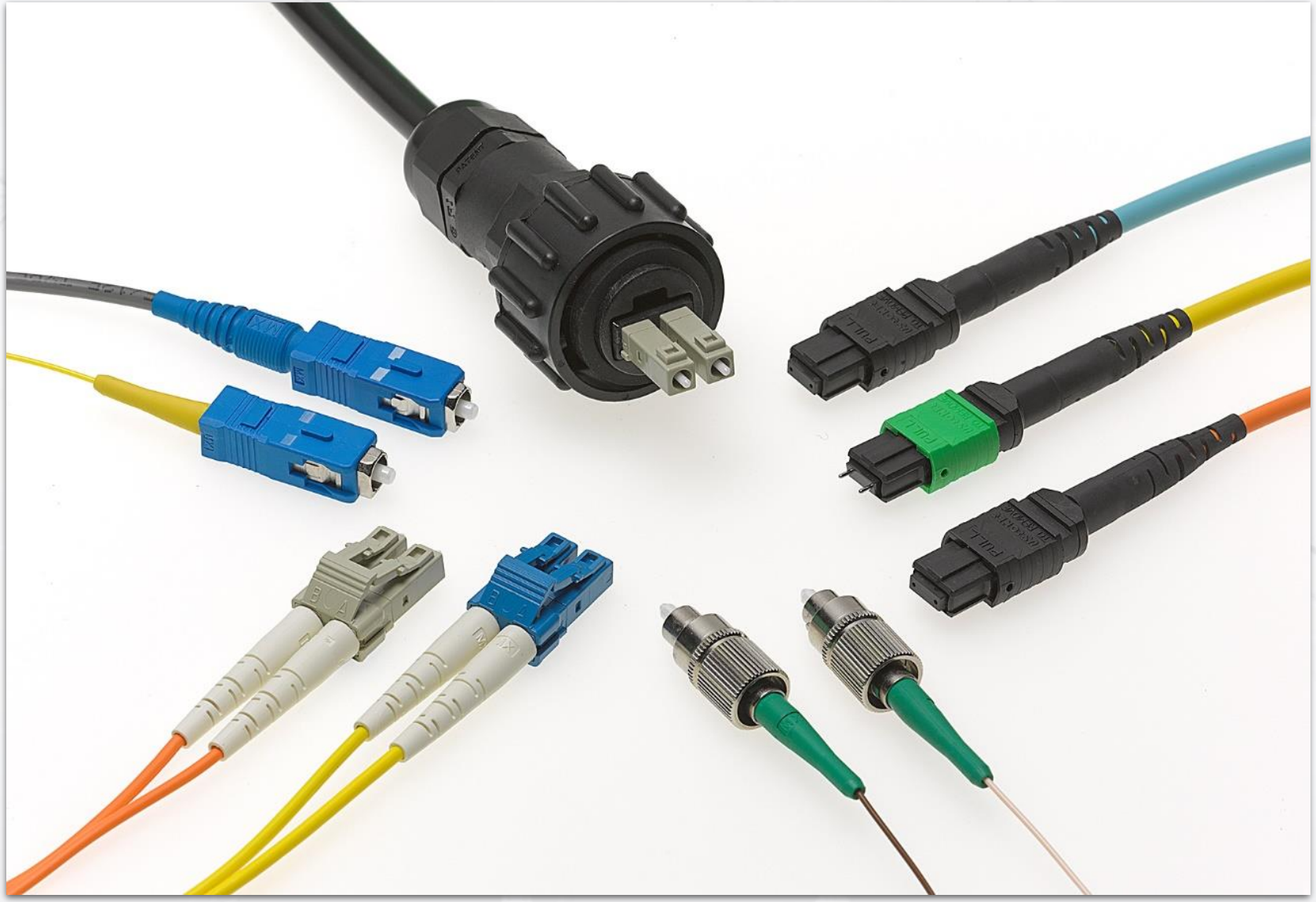
Physical transmission media

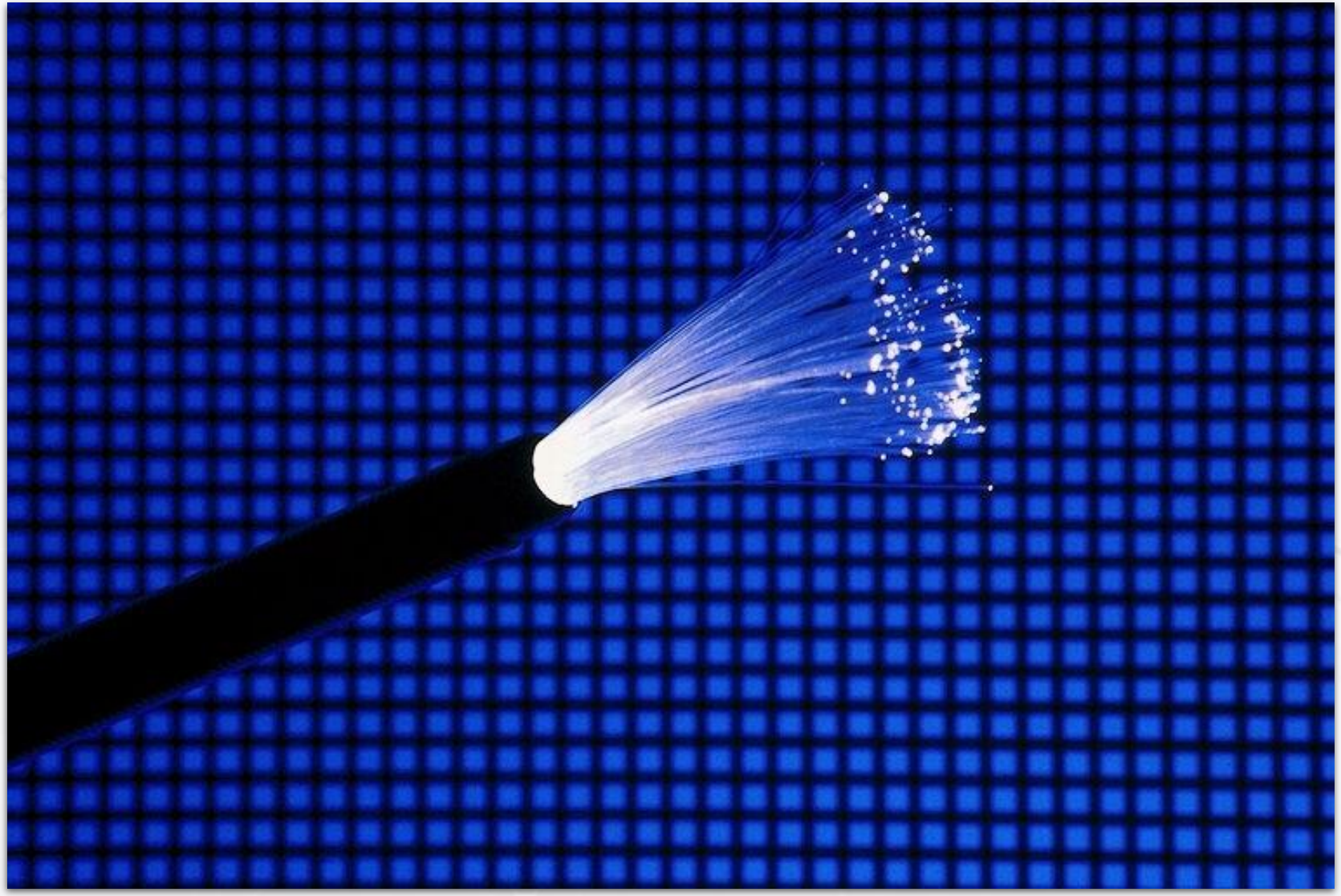
- Twisted wire / Twisted pair / Twisted pair wire
  - Analog signal v. Digital signal
  - MODEM
  - Evolution
  - Benefits / Problems
- Coaxial cable

Networking

Physical transmission media

- Fiber optics and optical media
  - Fiber optic cable
  - Internet Backbone
  - Optical networks





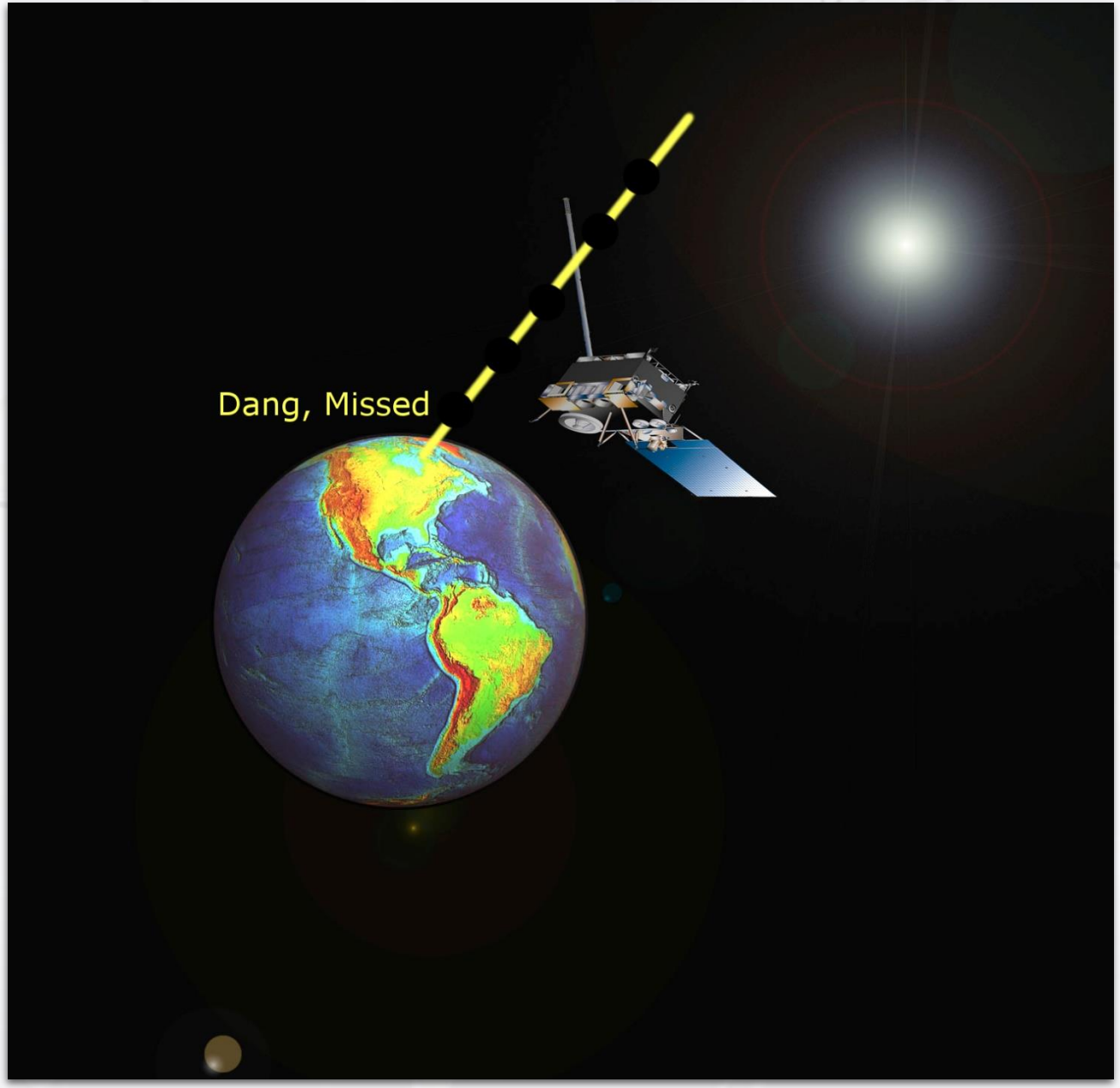
Networking

Physical transmission media

- Fiber optics and optical media
  - Fiber optic cable
  - Internet Backbone
  - Optical networks
- Wireless Transmission
  - Microwave signals
  - Satellites
  - Cell towers

WildBlue

dish


Dang, Missed

Networking

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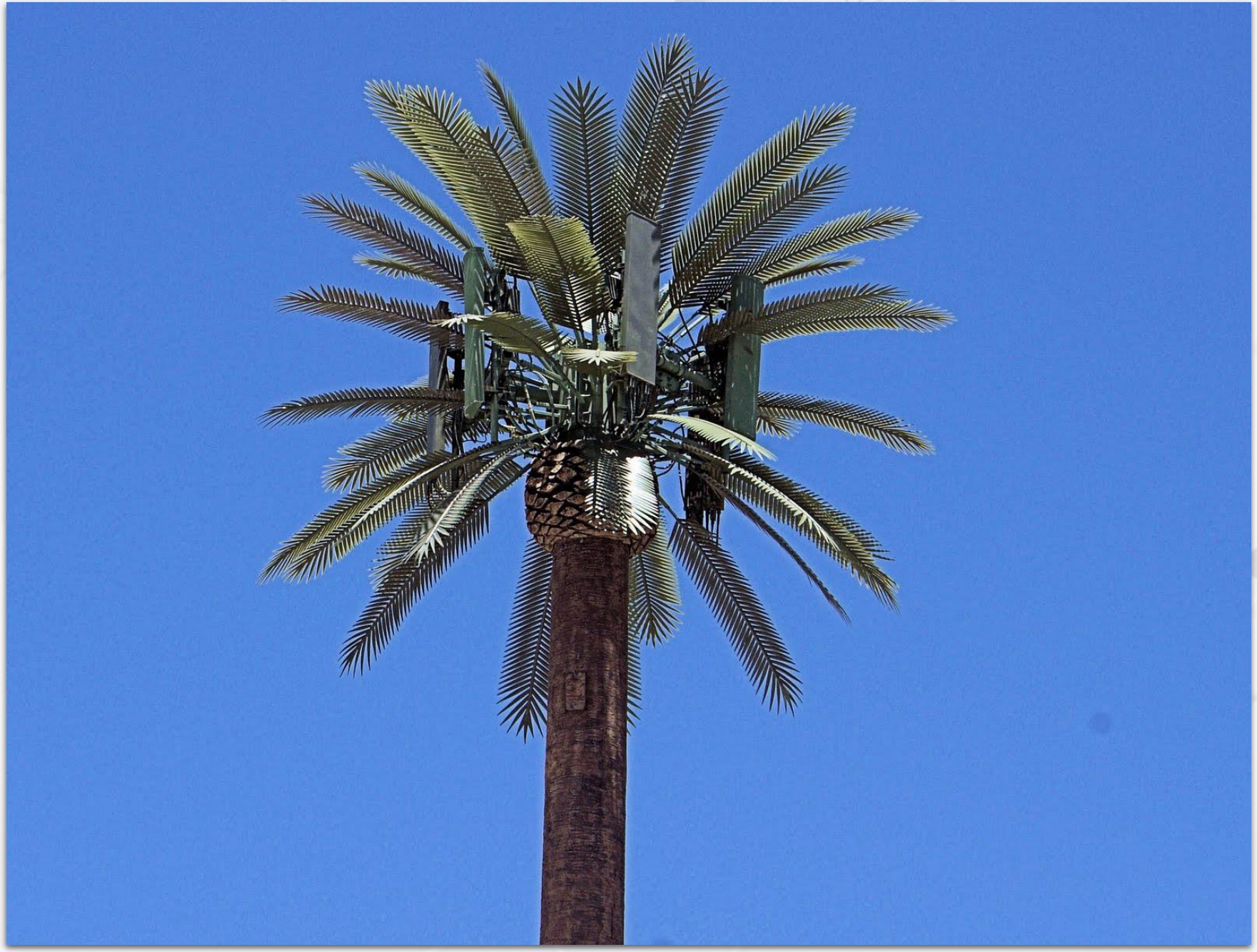


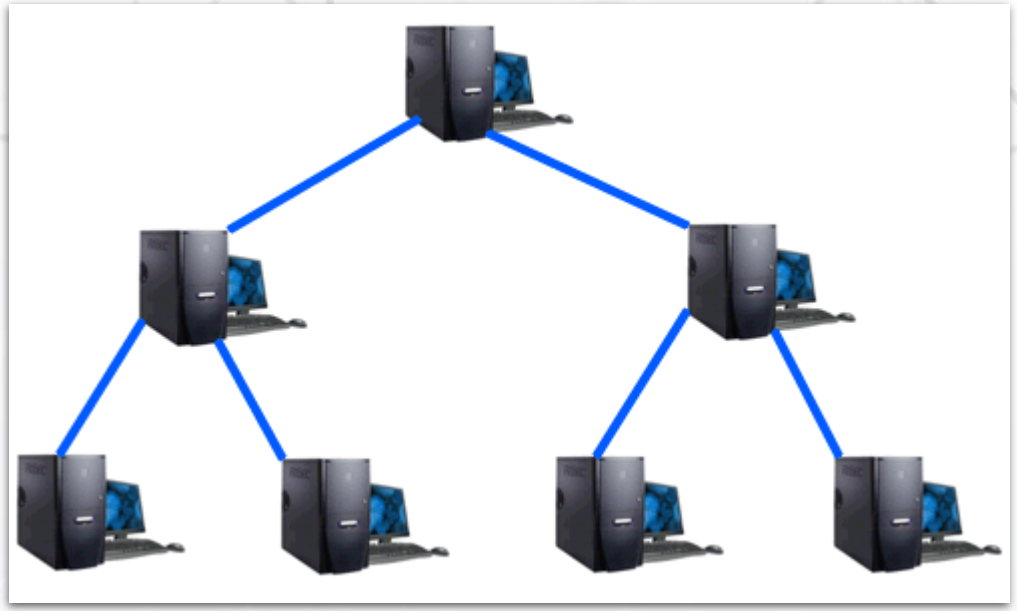
Networking

Types of Networks

- LAN
- WAN
- Peer to Peer
- Topologies
  - Hierarchical

Networking

- Hierarchical



Networking

Types of Networks

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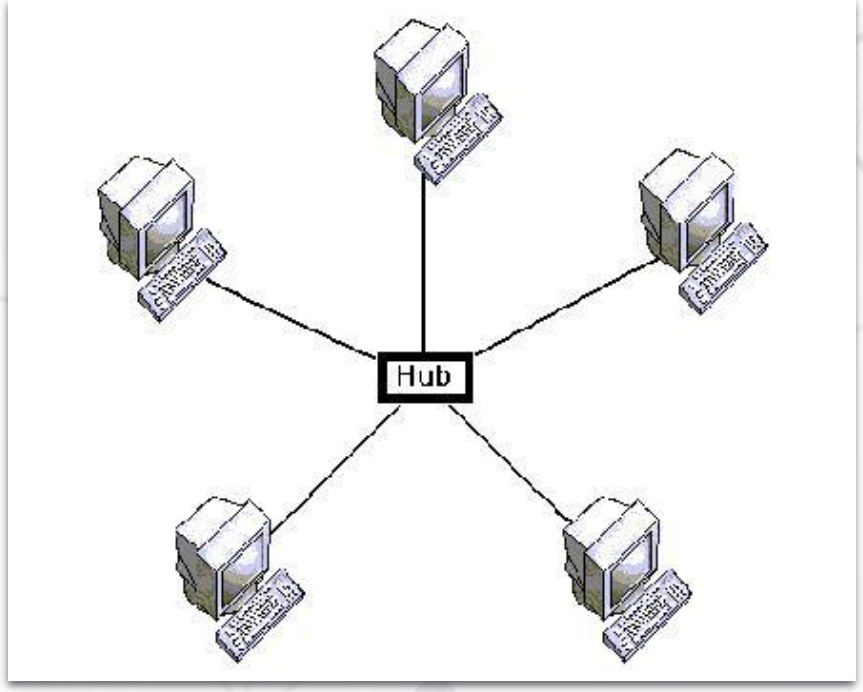
Networking

- Star



Networking

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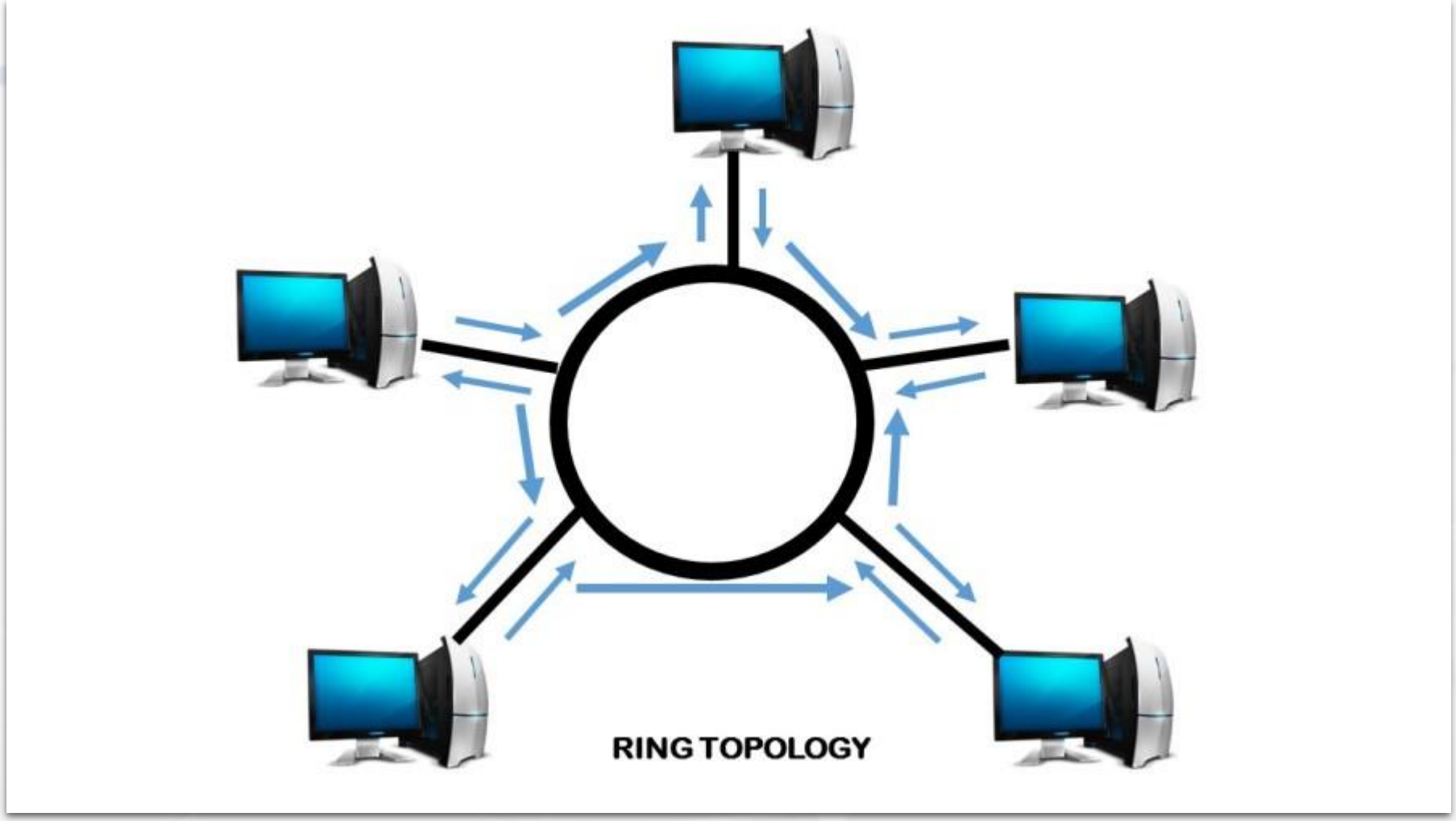
Networking

- Ring



Networking

<u>Types of Networks</u>

- LAN
- WAN
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- Topologies
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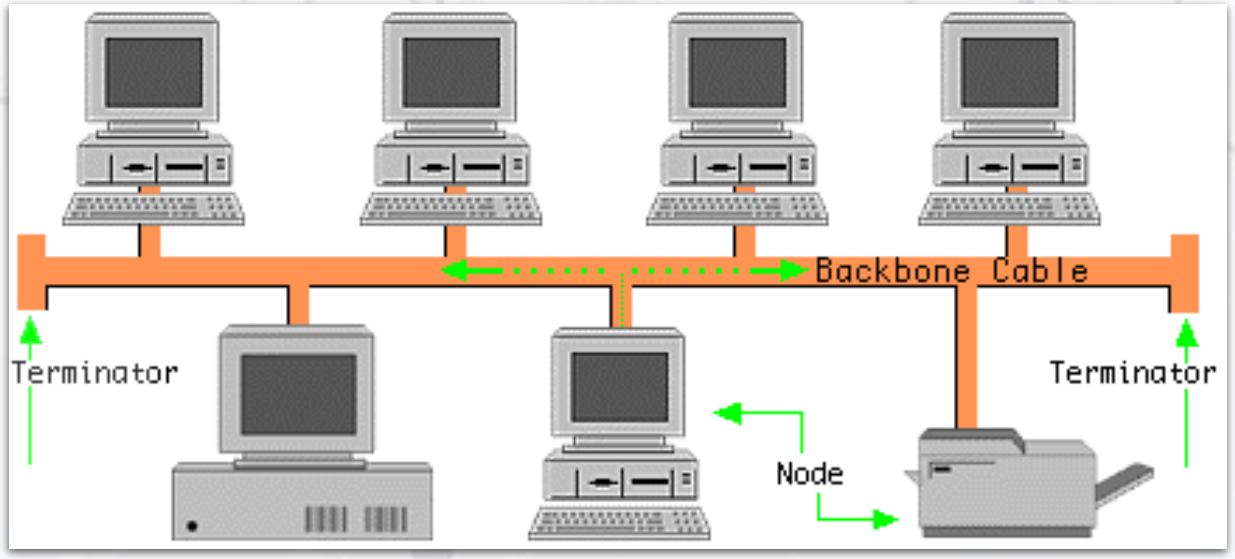
  - Star
  - Ring
  - Bus

Networking

- Bus



Networking

Internet addressing and architecture

- Uses the TCP / IP
- Internet protocol address
  - IPv4 – 131.216.44.22
  - IPv6 – 2002:83D8:9016:0:0:0:0:0
- Types of IP address
  - Static
  - Dynamic (Requires DHCP)

Networking

Internet Addressing and Architecture

- IPv4: 4,294,967,296
- IPv6: 340,282,366,920,938,463,463,000,000,000,000,000,000

Networking

Internet addressing and architecture

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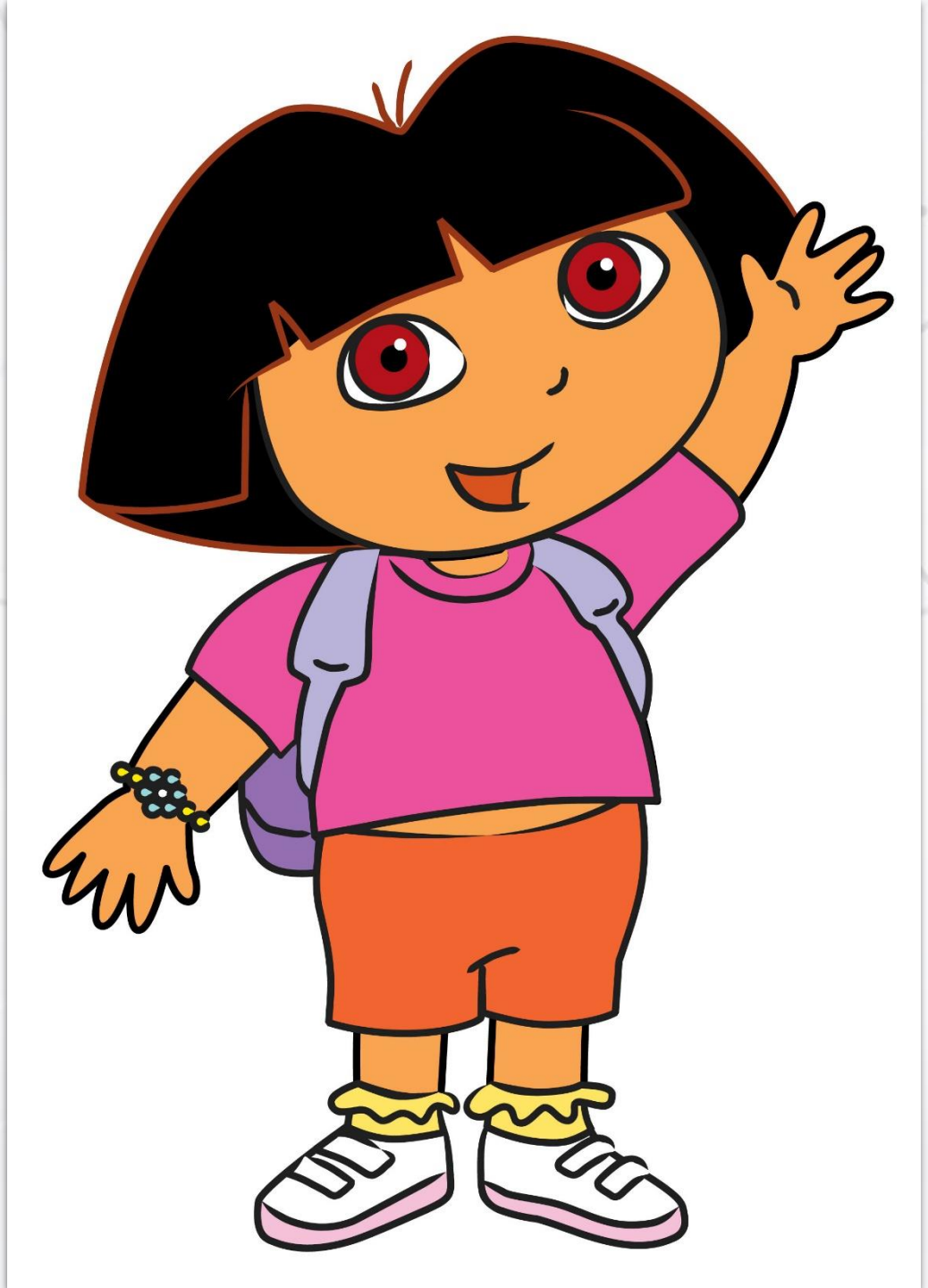

Networking

- DORA for DHCP
  - Discover
  - Offer
  - Request
  - Acknowledge

Networking – IP Classes

- Class A
  - Leading bit: 0
  - 1.0.0.0 to 126.0.0.0
  - 8 bits for network ID
- Class B
  - Leading bits: 10
  - 128.0.0.0 – 191.255.255.0
  - 16 bits for network ID
- Class C
  - Leading bits: 110
  - 192.0.0.0 – 223.255.255.0

Networking – IP Classes

- Reserved IP numbers within max range
  - 0.0.0.0
  - 255.255.255.255
  - 127.0.0.1
  - 169.254.0.1 to 169.254.255.254

Networking

- Domain Name System (DNS)
  - English-ish name, usually
  - Domain extensions
  - Reading addresses
  - DNS Servers
- Internet architecture and governance
  - Internet Architecture Board
  - Internet Corporation for Assigned Names and Numbers
  - World Wide Web Consortium

Networking

Internet Services

- Email
- Newsgroups
- LISTSERVs
- Instant / video / Text messaging
- Telnet
- File Transfer Protocol
- IoT

Networking

IoT Protocols

- Bluetooth
- ZigBee
- NFC
- MQTT
- LowPAN
- XMPP

Networking

Some notes on web pages and languages

- Hypertext
  - HTML
  - HTTP
  - URL
    - DOI – Digital Object Identifier

Networking

Wireless Networks and Internet Access

- Bluetooth / Personal Area Networks
- Wi - Fi
  - Infrastructure Mode
  - Access Points
  - Ad-Hoc Mode
  - Wireless NICs
  - Hotspots
  - Wi-Max
- Radio Frequency