

Redes de Datos

Las tecnologías que transforman los negocios y mejoran nuestras vidas

1

- 
- 1 Presentación
 - 2 El Contexto
 - 3 La Materia
 - 4 Introducción

AGENDA

TELEINFORMATICA Y REDES

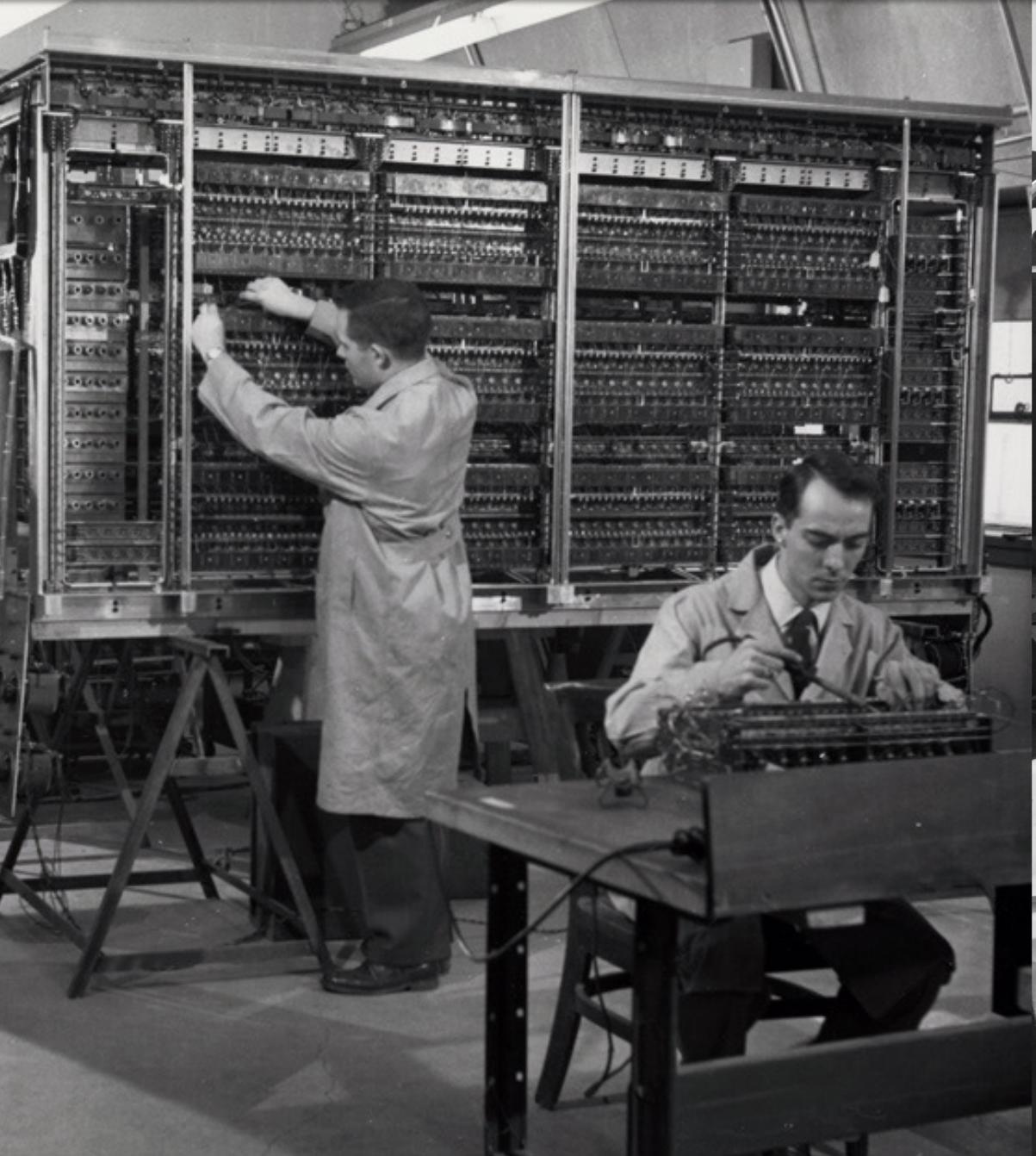
1

EL CONTEXTO

EL MERCADO



COMO ERA IT EN EL PASADO



COMO ES IT HOY



DIGITALIZACIÓN



The out-there AI ideas designed to keep the US ahead of China

China is developing artificial intelligence on an unparalleled scale, but the US has some big ideas of its own.

by Will Knight March 8, 2019

OBJETIVO

TELEINFORMATICA Y REDES

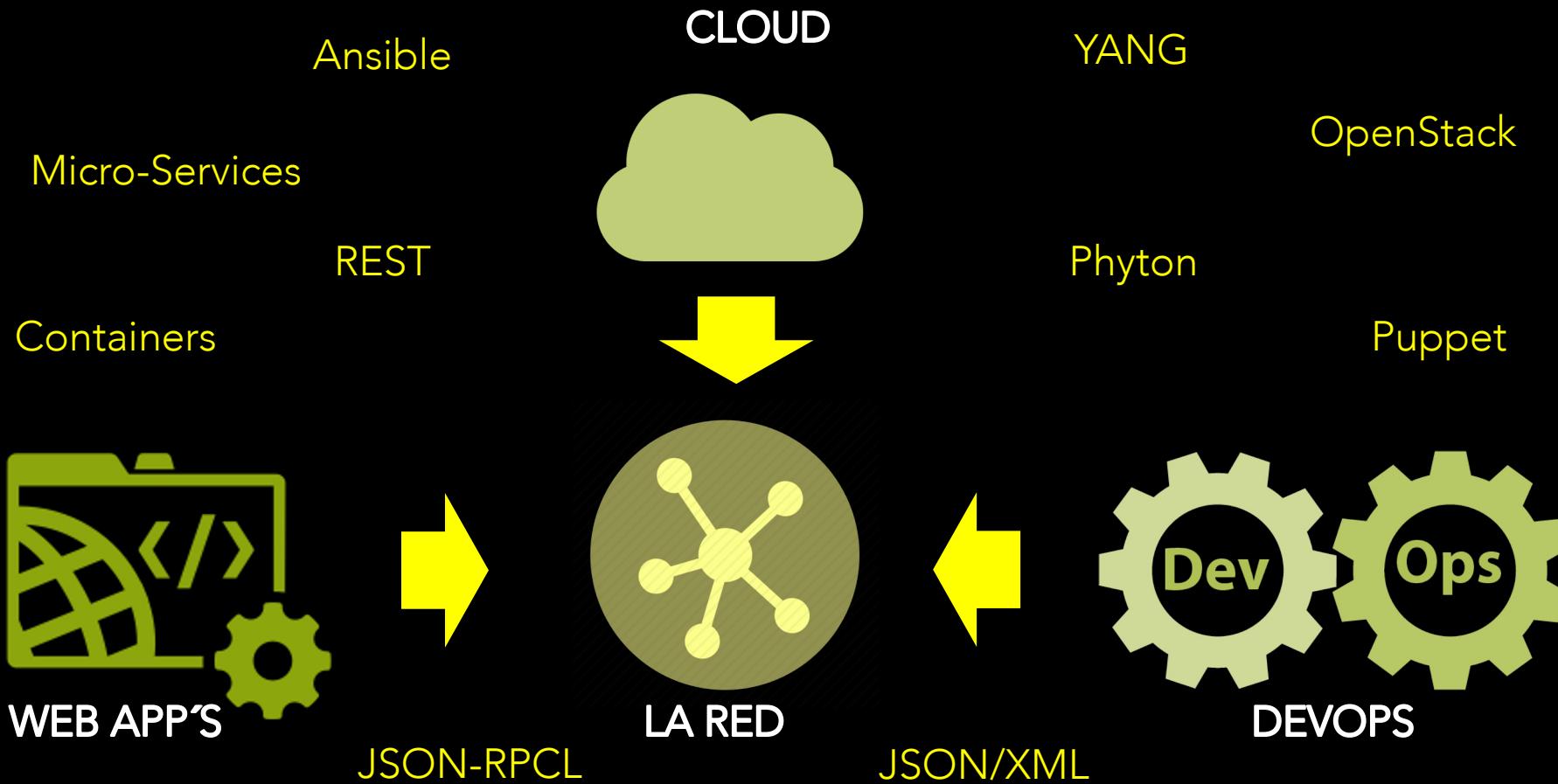
1

“Preparar a los alumnos para afrontar las necesidades actuales y futuras de la digitalización de los negocios y/o entidades públicas ”



LA MATERIA

EL ROL ACTUAL DEL INGENIERO EN
REDES



LA MATERIA

DESCRIPCIÓN

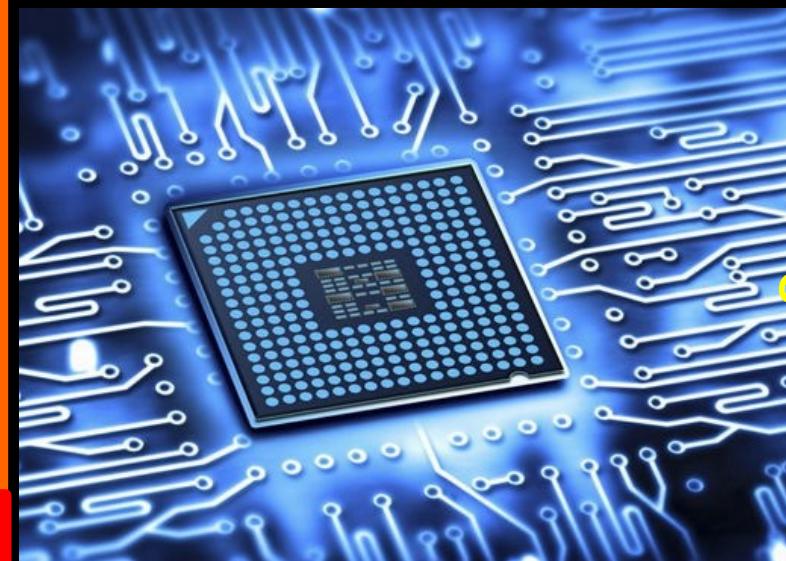
Informática



Redes de
Datos

1

+ CCNA



Telécomunicaciones

PILARES



Negocio

Ejemplos

+ Análisis de
casos reales de la
región

Tecnología

Historia
Conocimiento
Tendencias
Diseño

+ Investigación
+ Configuración
+ Documentación

Habilidades
Personales

Preventa
Presentar
Documentar
Analizar
Competir

+ Investigar

Postventa
Documentar
Explicar
Analizar

+ Configurar

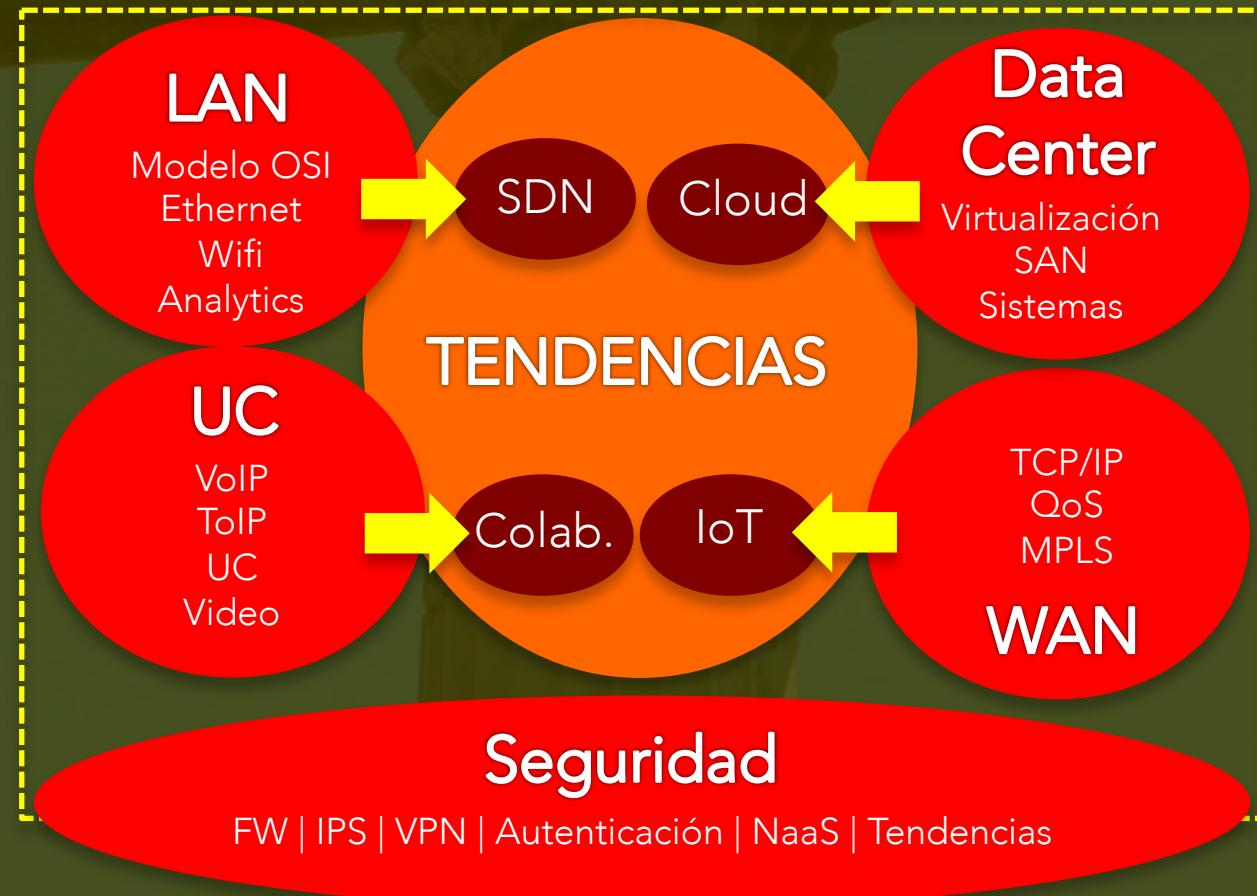
NEGOCIO

TECNOLOGÍA

HABILIDADES

Proveedores | Gartner | Ejemplos | Normas | Arquitecturas

Transporte
Gobierno
Finanzas
Oil & Gas
Retail
Salud
Educación
Manufactura



X = Clases

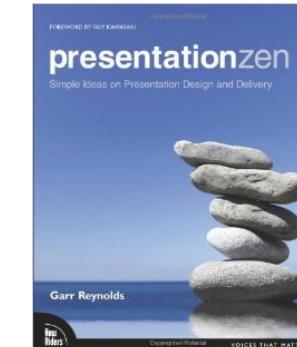
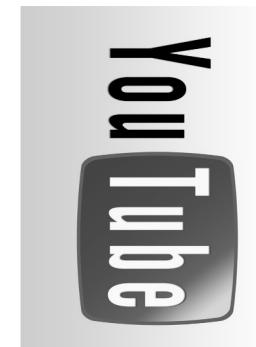
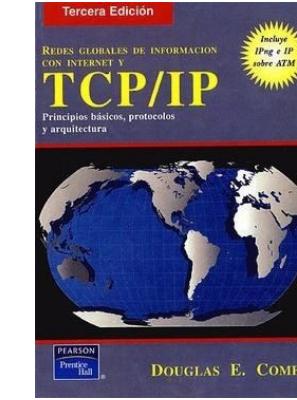
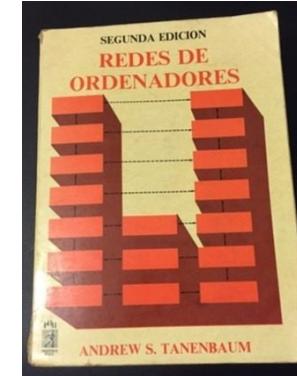
15

+1 Evaluación

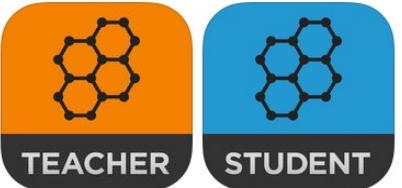
Presentar
Efetivamente
Proyectos
Investigar
Configurar
Informes
Documentos
Explicar
Analizar

LINEAMIENTOS

- Historias | Números | Videos
- Bibliografías | Revistas | Internet | Organismos
- Resumen | Apunte
- Visita a Cisco | Laboratorio | Prácticas
- Grupos de Trabajo | TP Diseño | Investigación
- Skills | Presentación
- Examen con devolución



HERRAMIENTAS



socrative

Gartner



I E T F®

IEEE

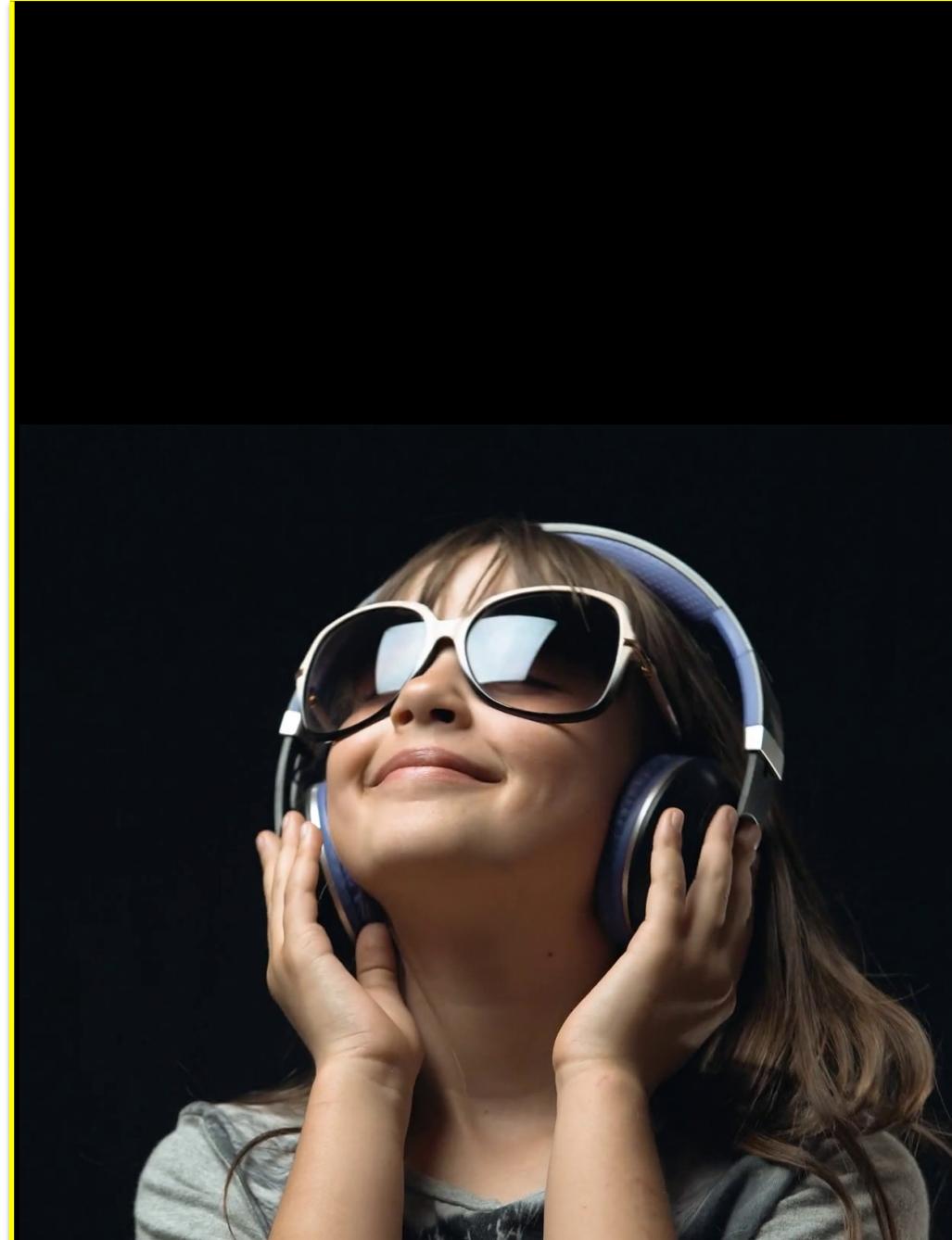


Prezi



SPEEDTEST™

YouTube



Redes de Datos

1



FRASE

“Caminante,
no hay camino,
se hace camino al
andar.”



Antonio Machado

1875 | 1939

VIDEOS | HISTORIA



DOCUMENTAL | Maravillas Modernas | El Teléfono y el Telégrafo

<https://www.youtube.com/watch?v=o-si4LbiHsk&nohtml5=False>

DOCUMENTAL | Maravillas Modernas | Computadoras

https://www.youtube.com/watch?v=Zer_oV88HDk

DOCUMENTAL | Mentes brillantes | Tesla vs Edison

https://www.youtube.com/watch?v=CUVG2_HSnpo

DOCUMENTAL | Tesla el inventor más importante de la historia

<https://www.youtube.com/watch?v=DdDh2Tc3oPg>



DOCUMENTAL | Distancia Cero | Telecomunicaciones

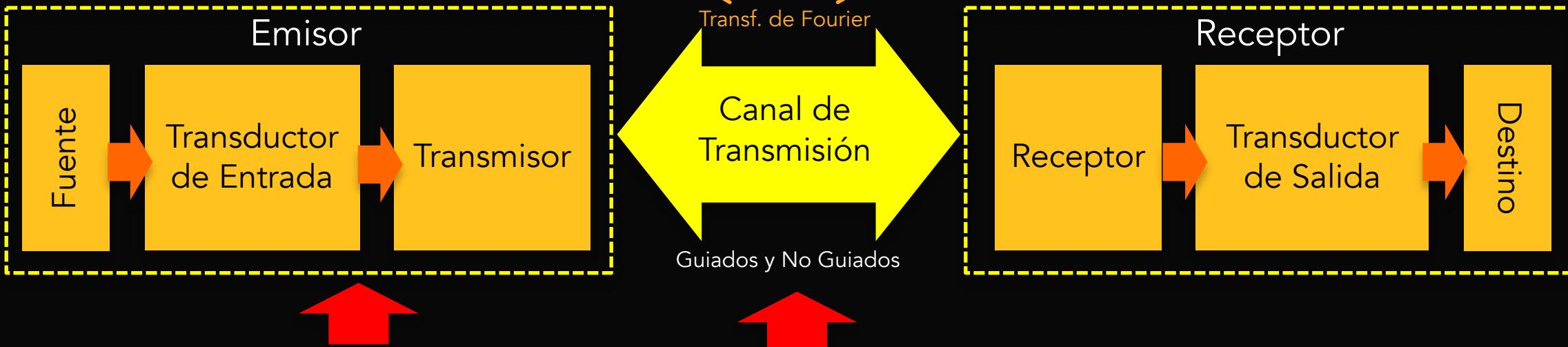
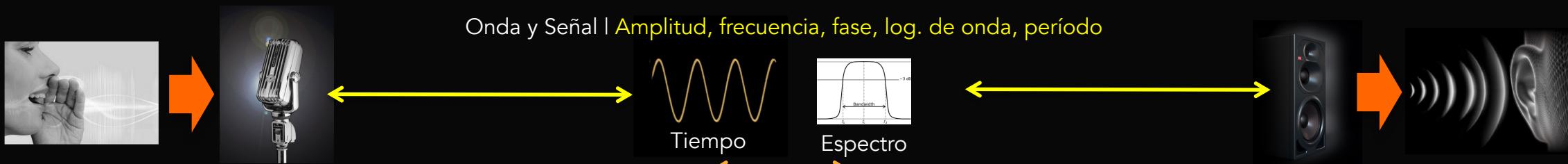
<https://www.youtube.com/watch?v=dC7Rx332DBM>

DOCUMENTAL | Distancia Cero | Los satélites

<https://www.youtube.com/watch?v=j3f-268N2Jc>



CONCEPTOS TEÓRICOS



Muestro | Cuantificación | Codificación
Modulación
Analógicas AM | FM | PM,
Digitales ASK | FSK | PSK

Limitaciones del canal | Ancho de Banda y Ruido

$$C = B \log_2 \left(1 + \frac{S}{N}\right) \text{(bits/seg.)}$$

Personajes de la historia

Morse | Bell | Hertz | Tesla | Maxwell | Lodge
| Marconi | Popov | Braid | Nyquist | Ericsson
| Galvin | Turing | Armstrong

COMO ESTÁN CON ESTOS CONCEPTOS

1

Redes de Datos

LAN

REDES DE ÁREA LOCAL

UADE



AGENDA

Camino | Pasado | Presente | Futuro

Ethernet | Norma 802.3

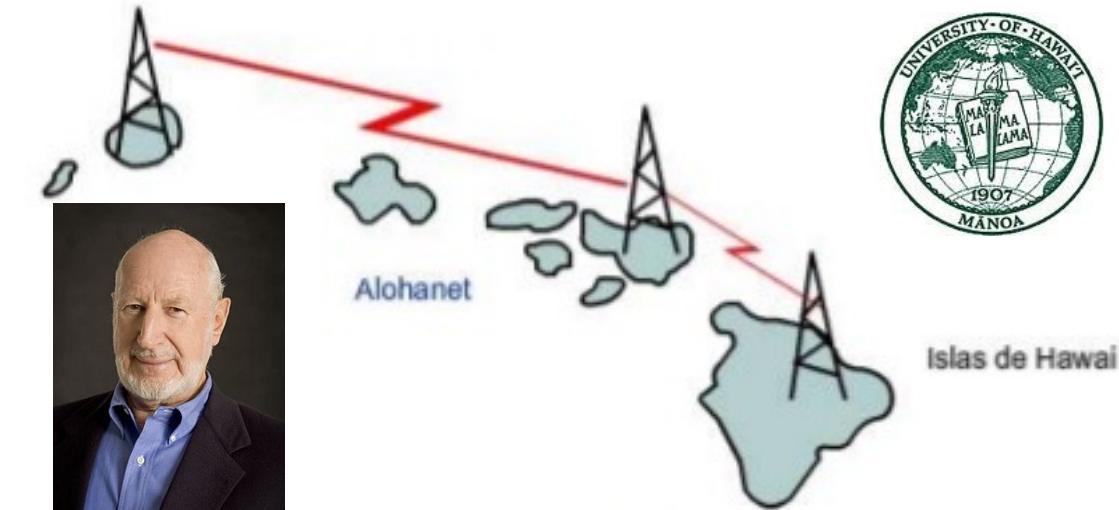
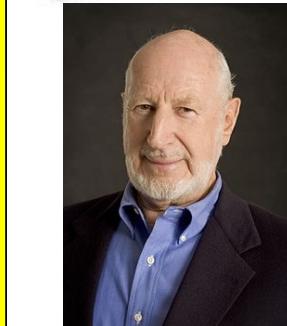
Componentes | Hub, Bridge y Switch

Arquitecturas | Red LAN

Funcionalidades | STP | PoE | LACP | 802.1x

Proveedores | Cisco | HPE | Huawei

Selección | CAPEX | OPEX



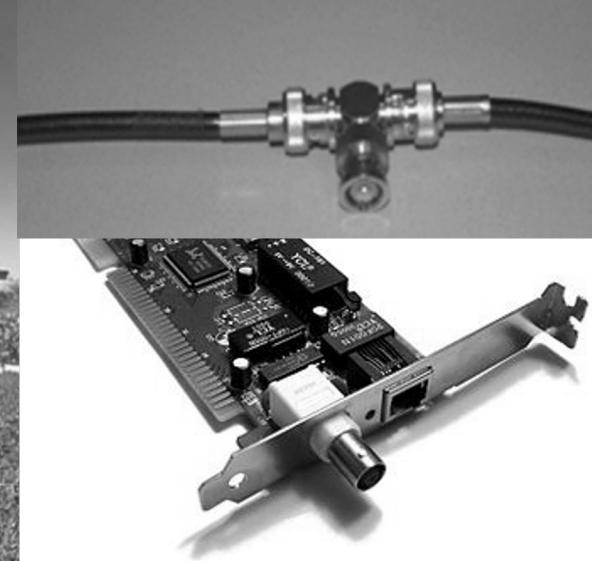
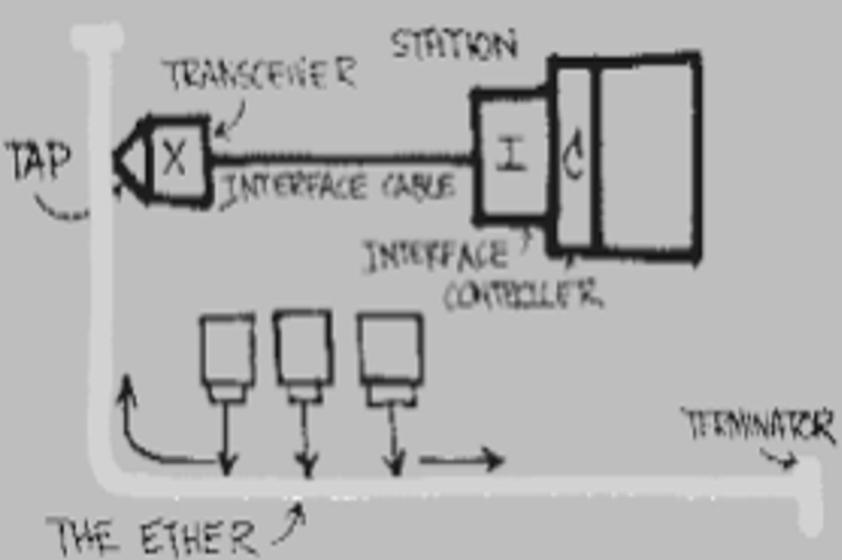
Norman Abramson | Universidad de Hawaii

Redes LAN | Ethernet

1970

CSMA/CD





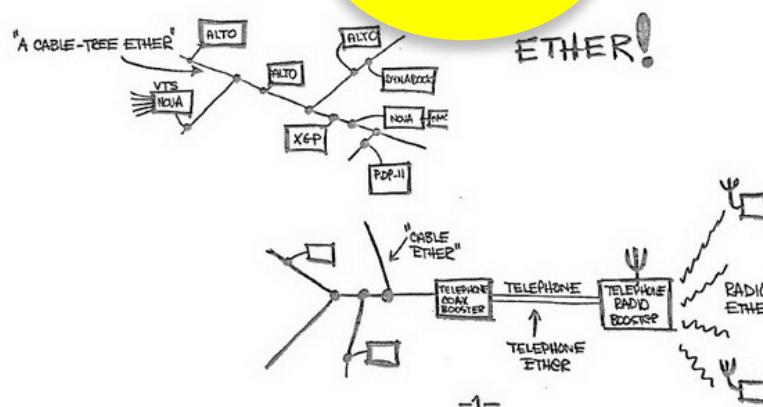
Robert Metcalfe

Xerox & MIT

1972



1973



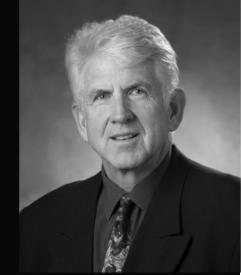
Massachusetts Institute of Technology

XEROX

Nace Microsoft



PC Apple II



Metcalfe funda 3com
"Computer Communication Compatibility"



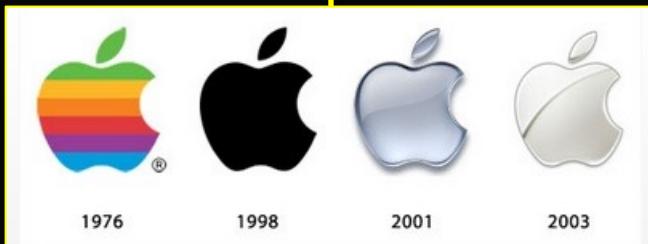
1975

1976

1977

1978

1979



Nace Apple

XEROX | Ethernet |
2,85 Mbit/s sobre cable
coaxial en topología de bus.
Fin del proceso de
Experimentación

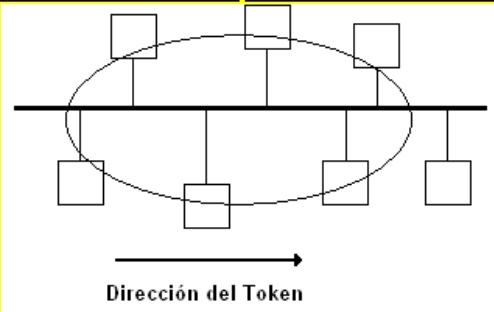




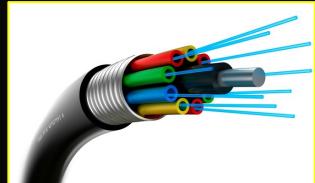
Token Bus | GM
Bus (Industrial)
802.4



1980

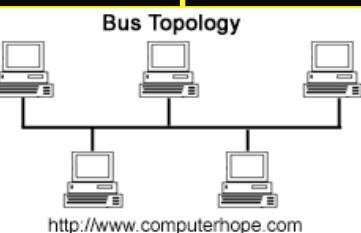


Dirección del Token



Nace la Fibra Óptica

Ethernet II
Bus 10 Mbps
802.3



Nace el
concepto de
FDDI
100Mbps |
X3T9.5

ISO
Publica el modelo OSI



1984

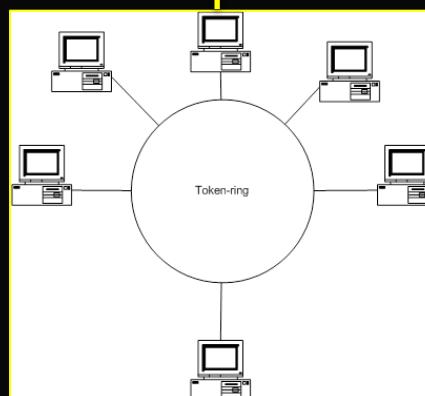


Nace Cisco

Token Ring | IBM
Anillo: 4 Mbps
802.5



1985



Token Ring | IBM
Anillo: 16 Mbps

Teoría → LANs

Necesidades 80'

Interoperabilidad

 DECnet

 SNA

 TCP/IP

 Modelo

Tecnológicas



Beneficios

Divide

Normaliza

Modularidad

Independencia

Simplifica

Capas

TCP | IP



OSI



International
Organization for
Standardization

Protocolos

HTTP | RTP

Aplicación

TCP | UDP

Transporte



Internet

Ethernet

Red

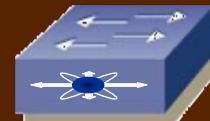


Software

Hardware



Switch | Bridge



Hub

Aplicación

Presentación

Sesión

Transporte

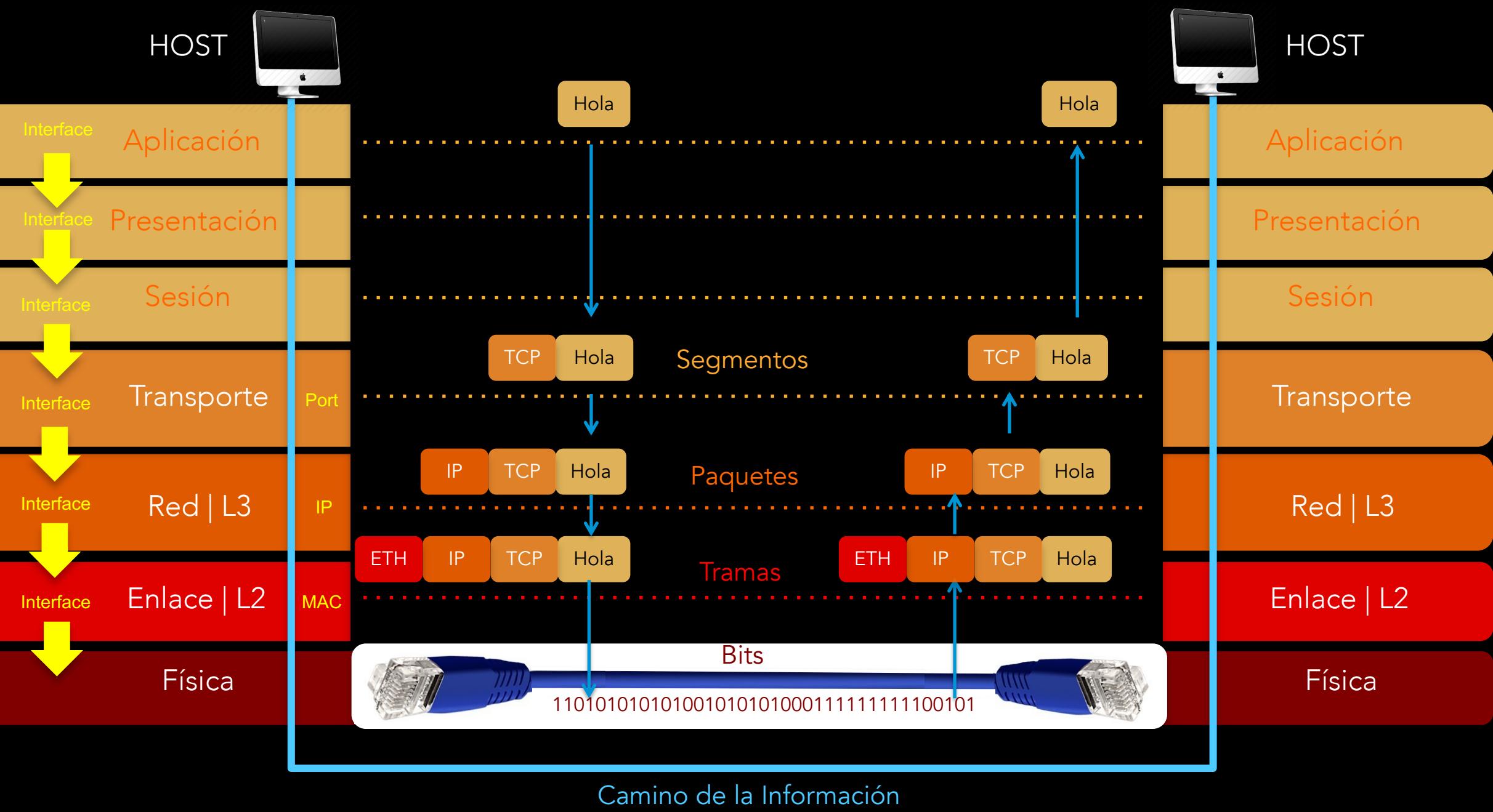
Red | L3

Enlace | L2

Física

Modelo de Referencia OSI

Open System
Interconnection



QUÉ ES UNA RED LAN

LAN son las siglas de Local Area Network, Red de área local.

Una LAN es una red que conecta los ordenadores en un área relativamente pequeña y predeterminada (como una habitación, un edificio, o un conjunto de edificios).

ETHERNET 802.3

ENLACE | L2

FÍSICA | L1

8

6

6

2

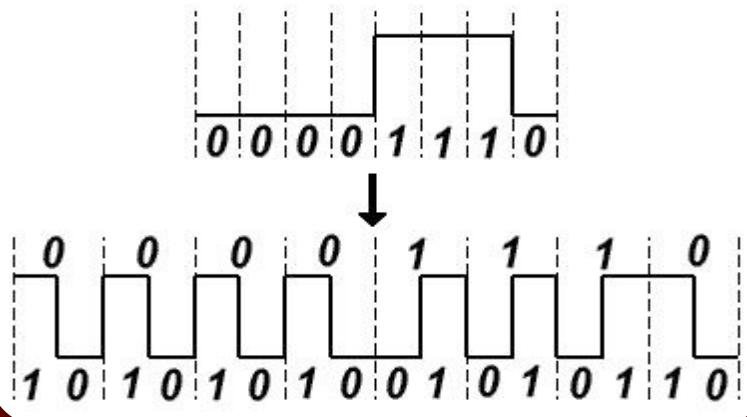
46-1500

4

Preamble	Destination Address	Source Address	Type	DATA	FCS
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CSMA/CD

Codificación Manchester



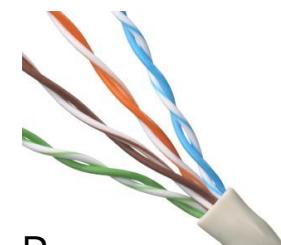
Velocidad: 10 Mbps

Banda:

Cable:

10 Base T

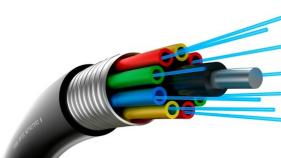
Types of Ethernet	Bandwidth	Cable Type	Duplex	Maximum Distance
10Base-5	10 Mbps	Thicknet Coaxial	Half	500 m
10Base-2	10 Mbps	Thinnet Coaxial	Half	185 m
10Base-T	10 Mbps	Cat3/Cat5 UTP	Half	100 m
100Base-T	100 Mbps	Cat5 UTP	Half	100 m
100Base-TX	200 Mbps	Cat5 UTP	Full	100 m
100Base-FX	100 Mbits	Multimode Fiber	Half	400 m
100Base-FX	200 Mbps	Multimode Fiber	Full	2 km
1000Base-T	1 Gbps	Cat 5e UTP	Full	100 m
1000Base-TX	1 Gbps	Cat 6 UTP	Full	100 m
1000Base-SX	1 Gbps	Multimode Fiber	Full	550 m
1000Base-LX	1 Gbps	Single-Mode Fiber	Full	5 km
10GBase-CX4UTP	10 Gbps	Twinaxial	Full	15 m
10GBase-T	10 Gbps	Cat6a/Cat7 UTP	Full	100 m
10GBase-LX4	10 Gbps	Multimode Fiber	Full	300 m
10GBase-LX4	10 Gbps	Single-mode Fiber	Full	10 km



Par Trenzado



Coaxil



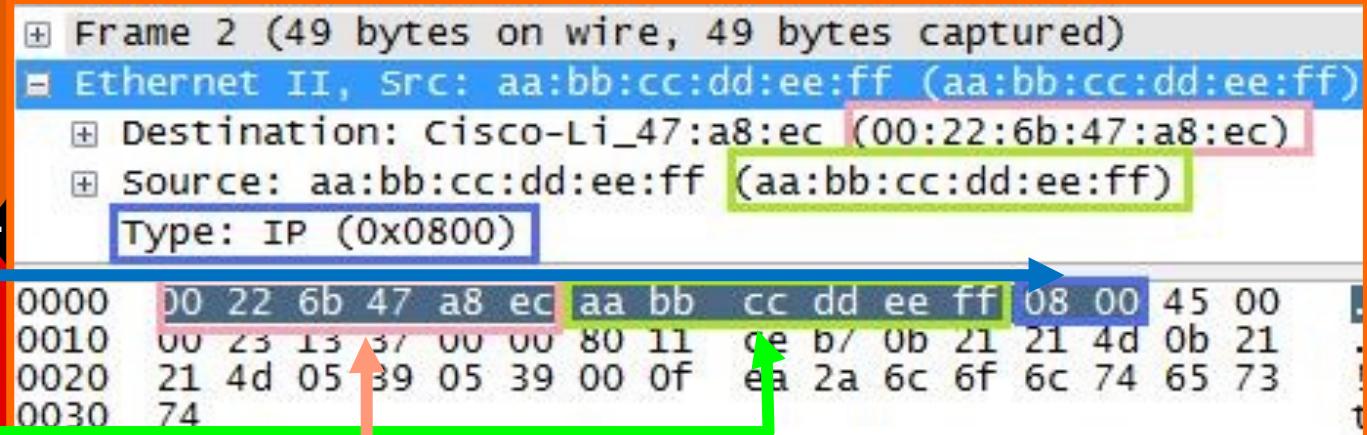
Fibra Óptica

ETHERNET 802.3



LLC 802.2

Control de Enlace Lógico

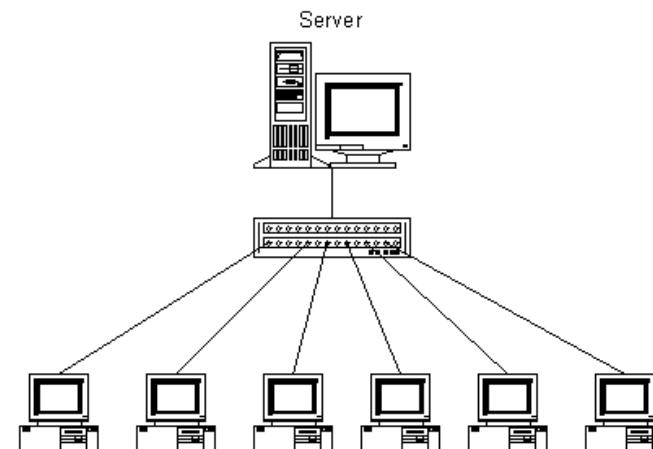


Types of Ethernet	Bandwidth	Cable Type	Duplex	Maximum Distance
10Base-5	10 Mbps	Thicknet Coaxial	Half	500 m
10Base-2	10 Mbps	Thinnet Coaxial	Half	185 m
10Base-T	10 Mbps	Cat3/Cat5 UTP	Half	100 m
100Base-T	100 Mbps	Cat5 UTP	Half	100 m
100Base-TX	200 Mbps	Cat5 UTP	Full	100 m
100Base-FX	100 Mbps	Multimode Fiber	Half	400 m
100Base-FX	200 Mbps	Multimode Fiber	Full	2 km
1000Base-T	1 Gbps	Cat 5e UTP	Full	100 m
1000Base-TX	1 Gbps	Cat 6 UTP	Full	100 m
1000Base-SX	1 Gbps	Multimode Fiber	Full	550 m
1000Base-LX	1 Gbps	Single-Mode Fiber	Full	5 km
10GBase-CX4	10 Gbps	Twinaxial	Full	15 m
10GBase-T	10 Gbps	Cat6a/Cat7 UTP	Full	100 m
10GBase-LX4	10 Gbps	Multimode Fiber	Full	300 m
10GBase-LX4	10 Gbps	Single-mode Fiber	Full	10 km

Dispositivos

HUB

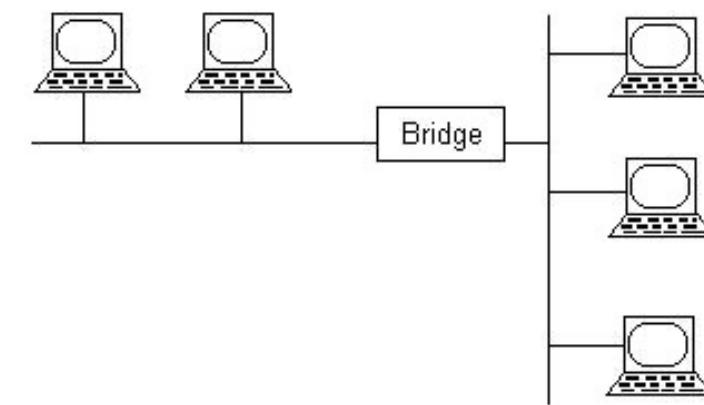
Es el dispositivo que permite centralizar el cableado de una red de computadoras



Cable Inteligente

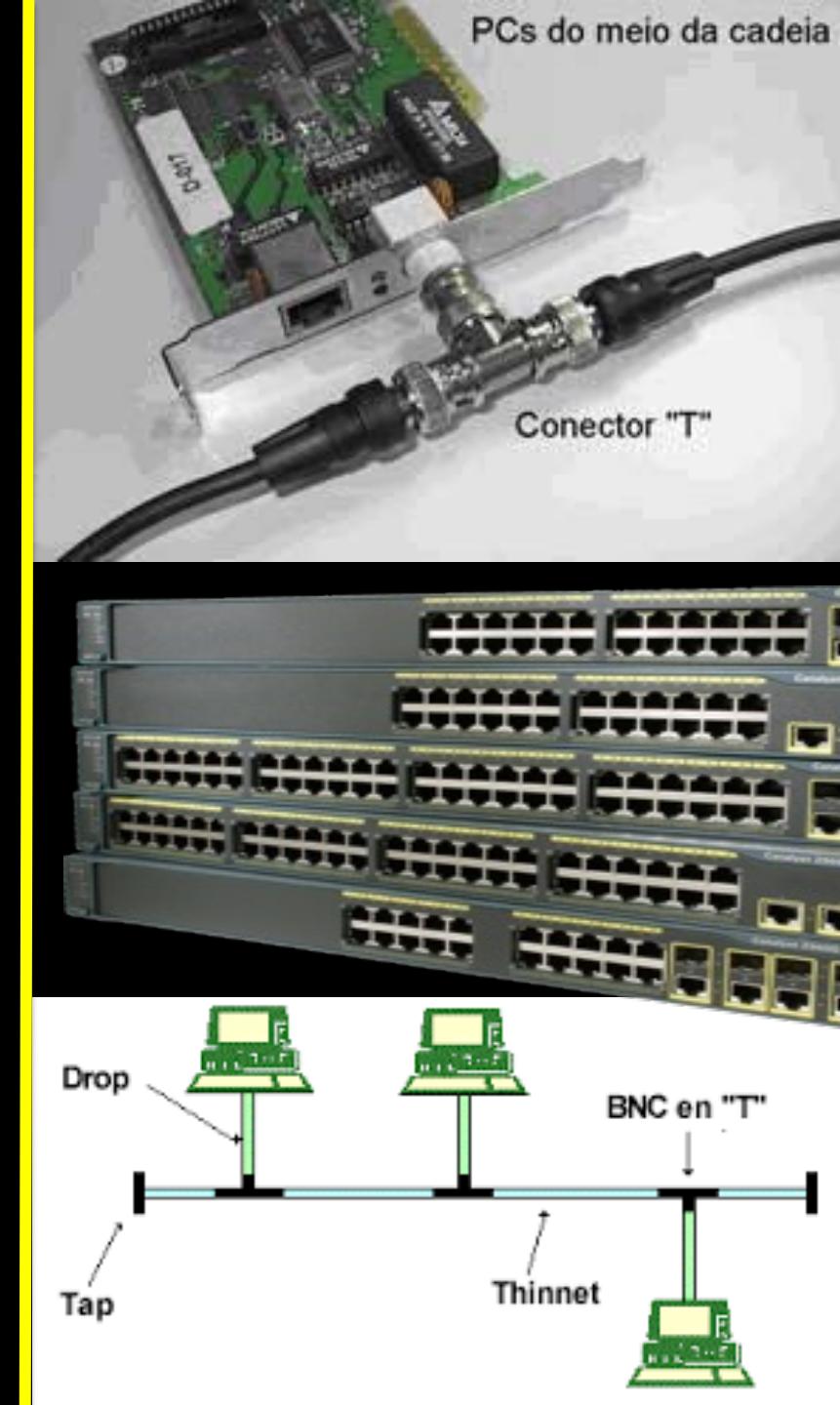
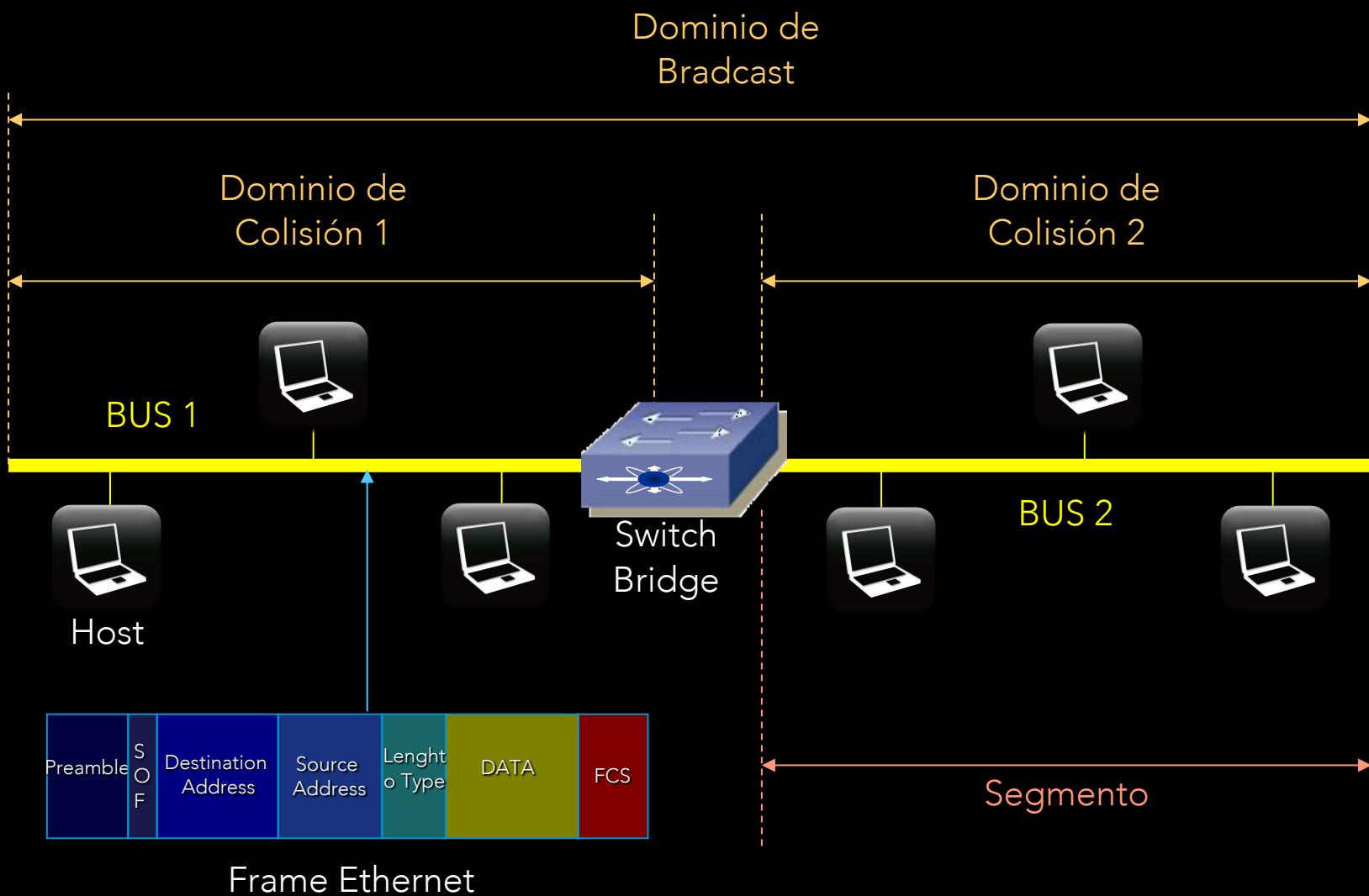
BRIDGE

Es un dispositivo de red que crea una única red global de múltiples redes de o segmentos de red



Separa dominios de colisión

SWITCH | Bridge Multipuerto





Plano
de
Control

Plano
de
Datos

Funciones | Control Plane

STP | Caminos Redundantes | Loops

Tabla de direcciones MAC

* Administración | A veces se considera otro plano

* Configuración | Función Administrativa

* Monitoreo | Función Administrativa

* = Plano de administración

Funciones | Forwarding Plane

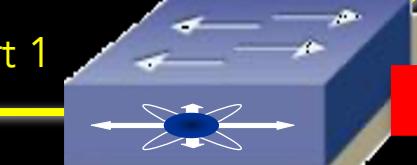
Mueve los paquetes de datos de una interface a otra en función de la información del plano de Control

SWITCH | Funcionamiento

MAC A



Port 1



Port 2

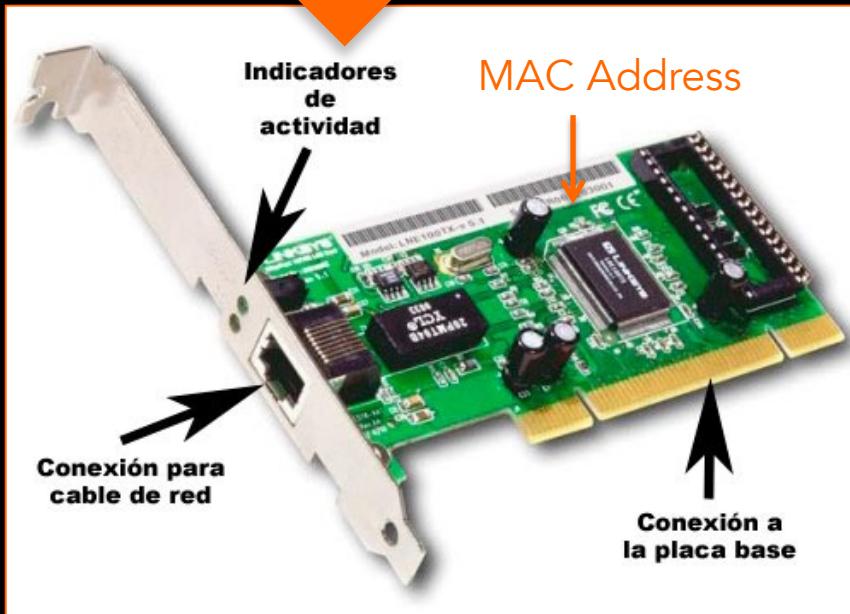
Puerto	Dirección
1	A
2	
3	

CAM

MAC B



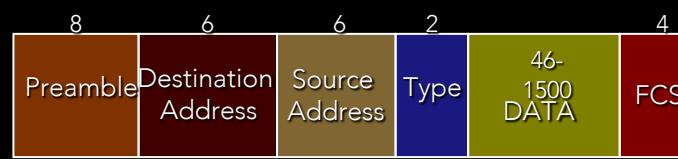
MAC C



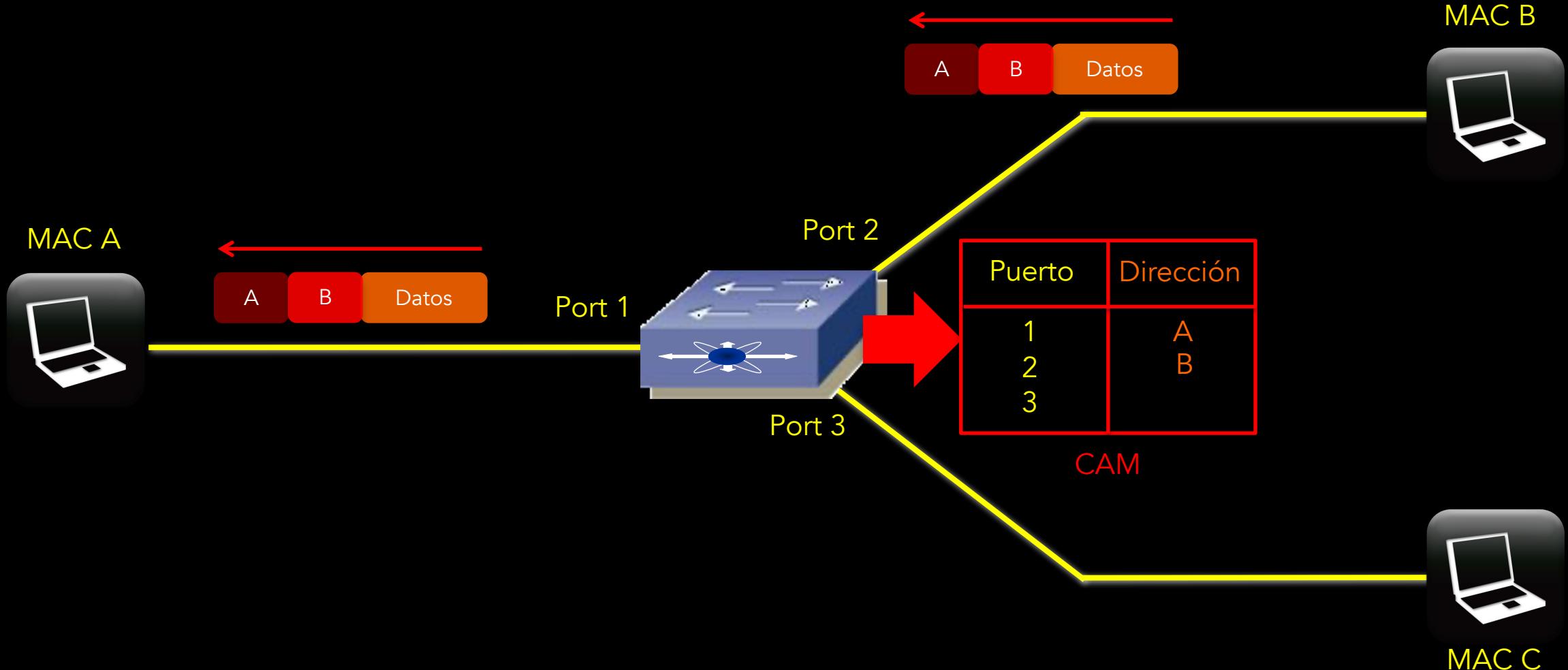
24:23:22:12:13:14

Vendor
(3 bytes)

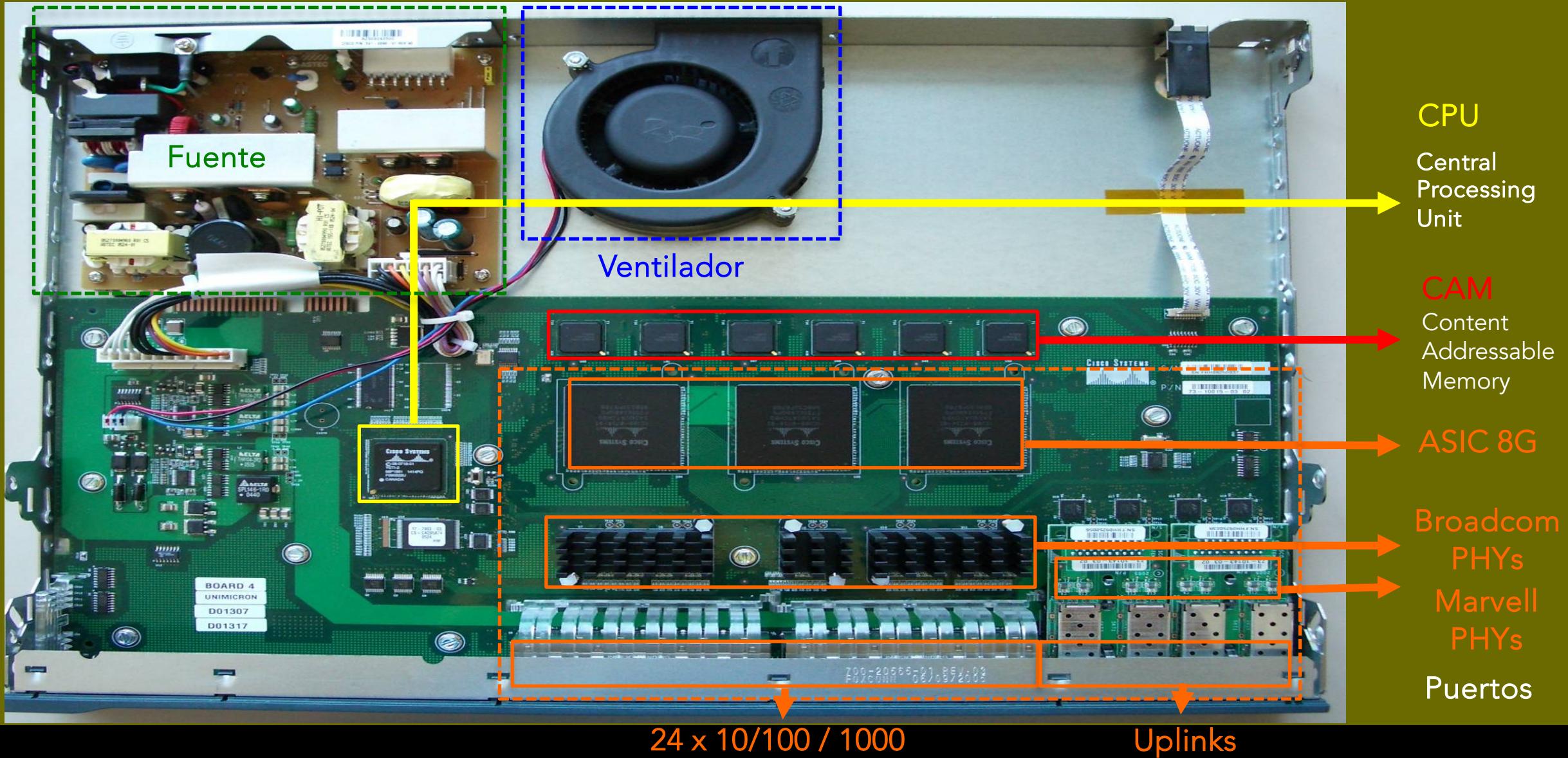
NIC
(3 bytes)



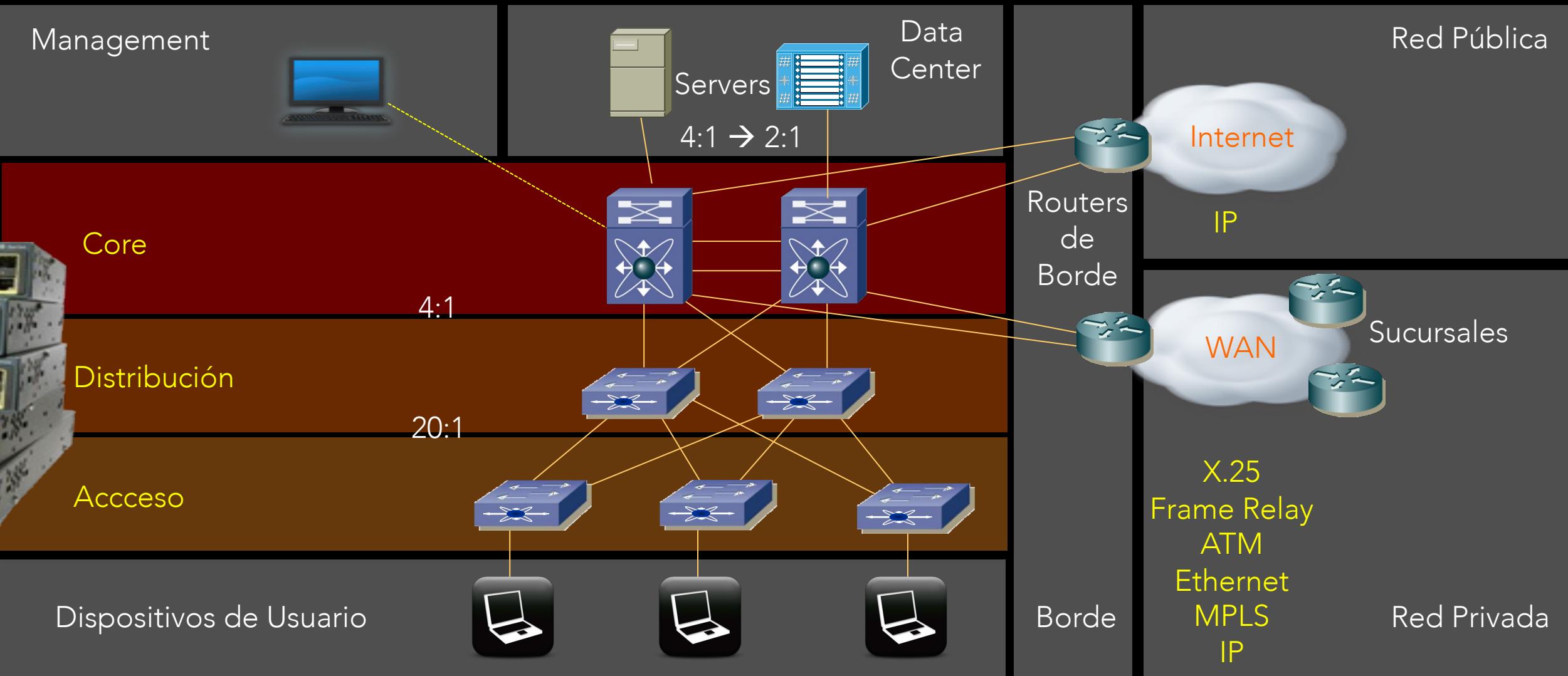
SWITCH | Funcionamiento



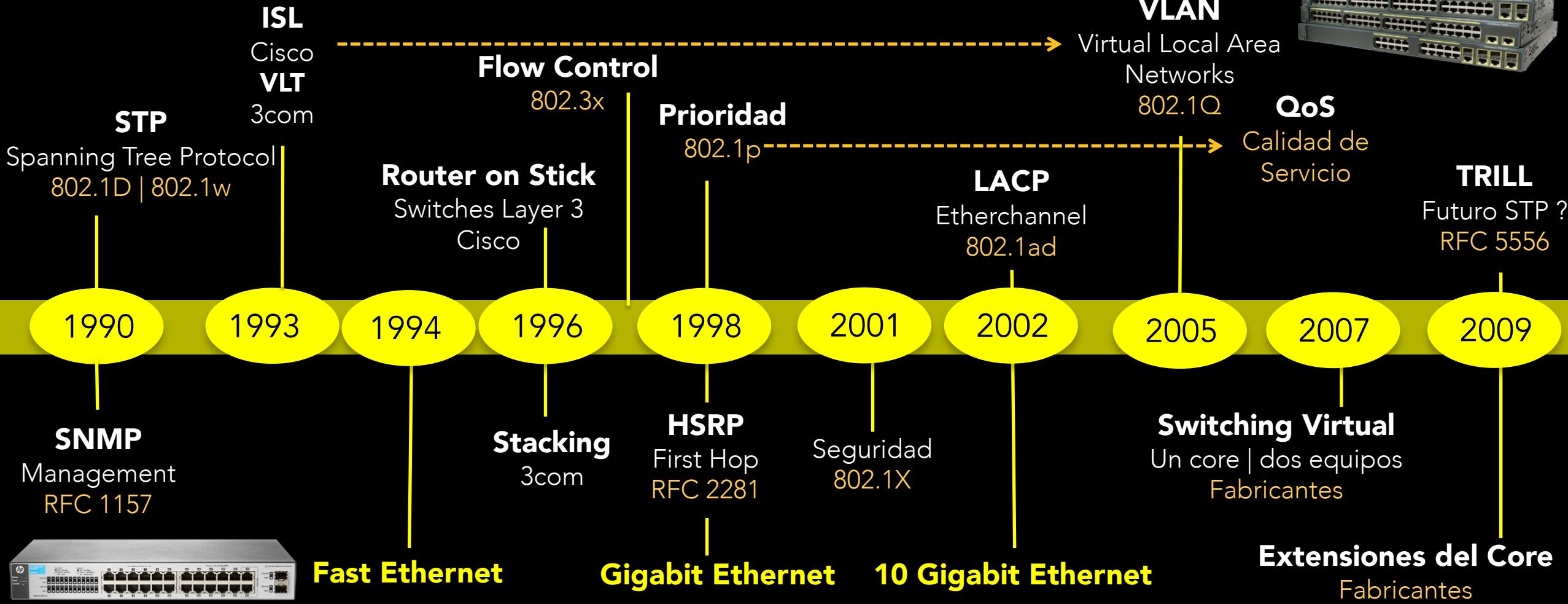
SWITCH | Arquitectura Interna



ARQUITECTURA



SWITCHING | Funcionalidades



Diferenciación | Estandarización

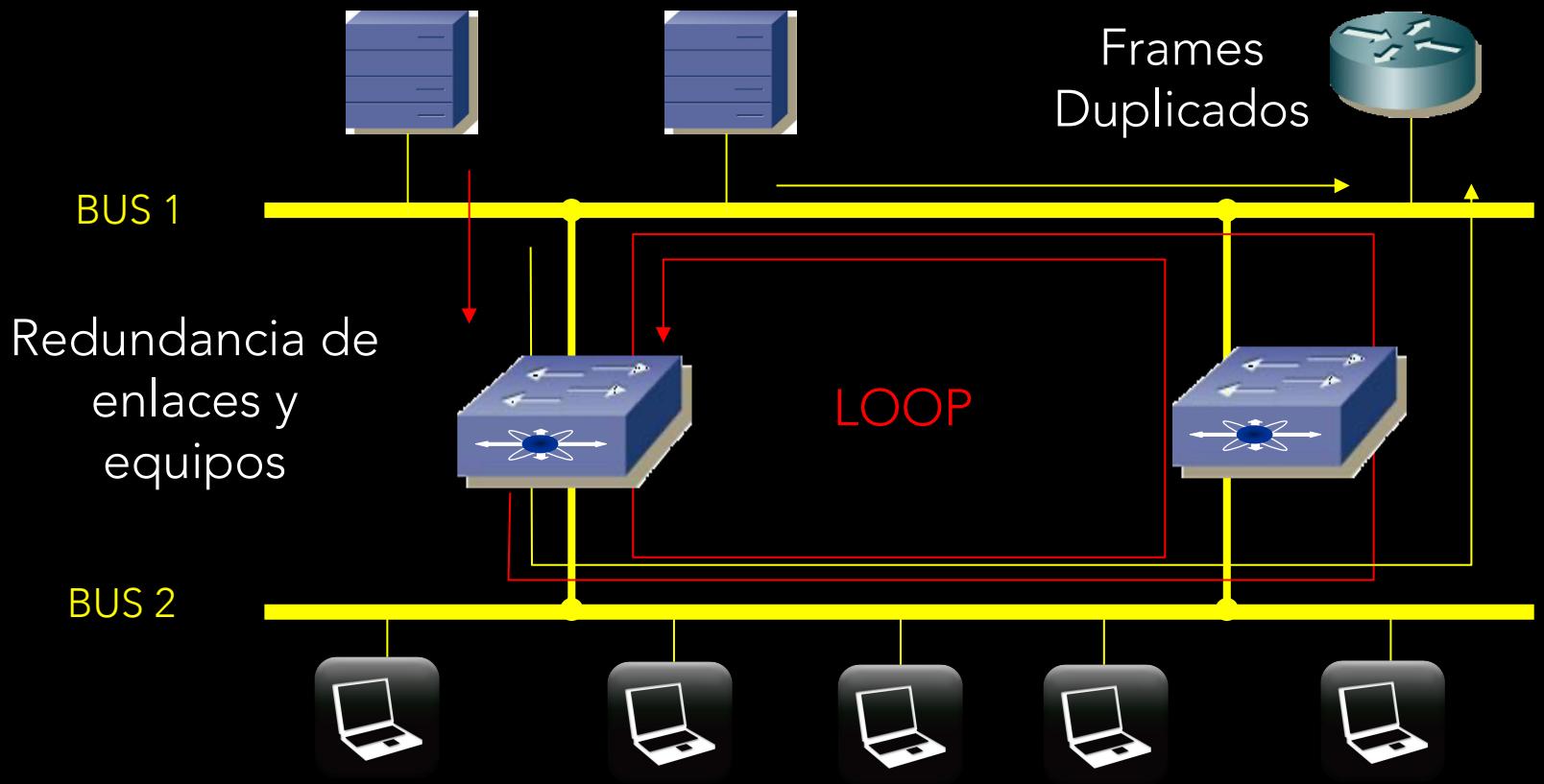


STP | Spanning Tree Protocol | 802.1D

Se requiere Redundancia
Esto genera Loops

STP SOLUCIONA

Loops o Bluces
Paquetes duplicados

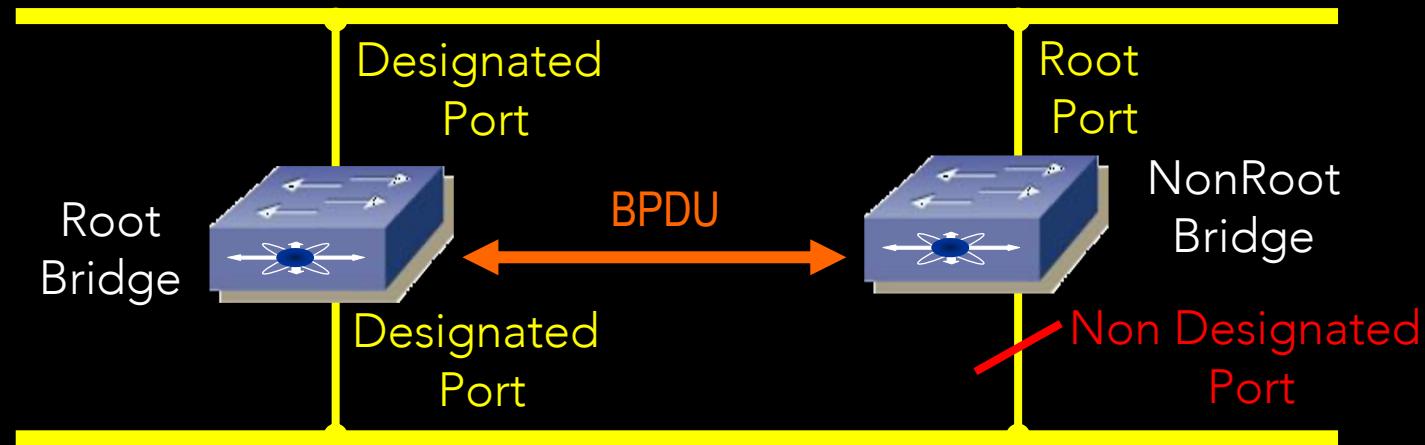


Un Root Bridge por red

Un root port por nonroot brigde

Un designated port por segmento

BPDU (Bridge Protocol Data Unit) – Cada 2 seg.



Bridge ID = Bridge Priority + Bridge MAC Address

Es el que posee el menor Bridge ID es el Root

Estados de los puertos

No Forwarding
Check BPDU

Blocking

20 seg.

Listening

15 seg.

Learning

15 seg.

Forwarding

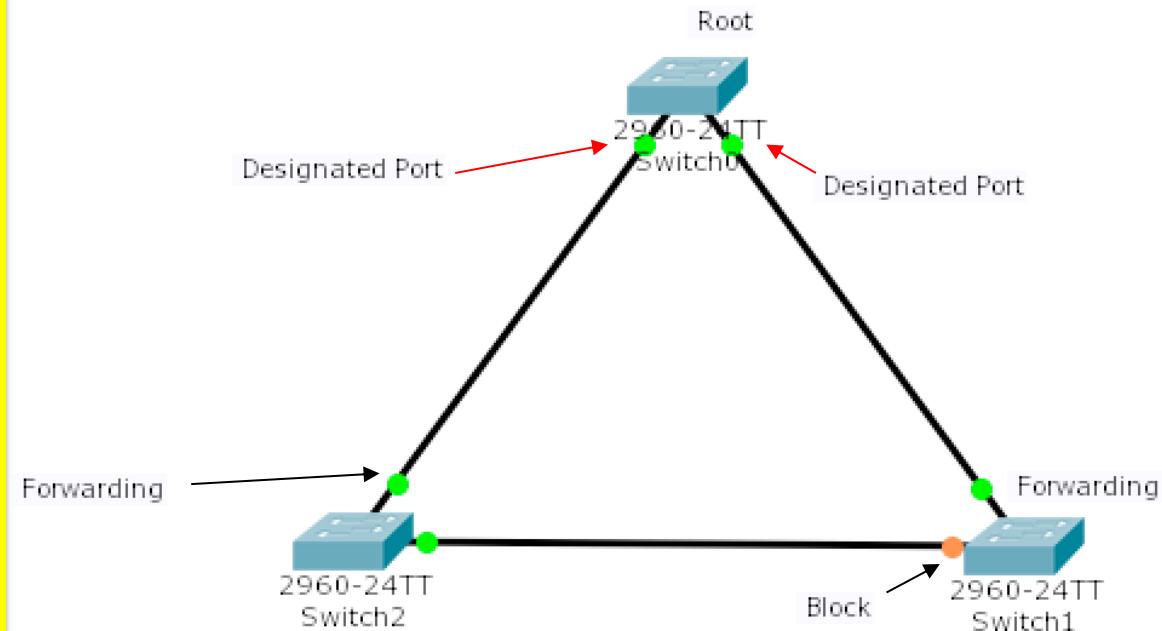
Forwarding
Check Frames (MACs)

No Forwarding
Listen Frames

Disable

No Forwarding
Check Frames (MACs)

Spanning Tree Protocol | Configuración en el IOS



```
Switch#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
              Address     0060.2F61.6D93
              → This bridge is the root
  Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

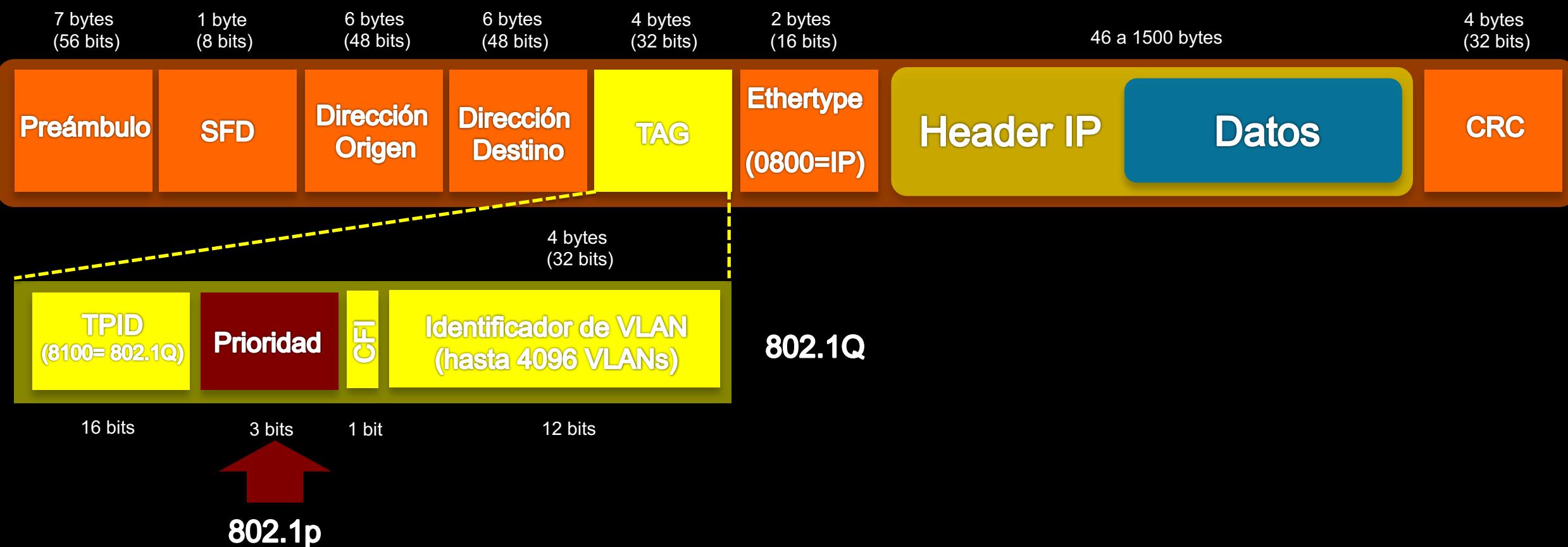
  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
              Address     0060.2F61.6D93
              Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time 20

  Interface      Role Sts Cost      Prio.Nbr Type
  ----------
  Gi0/2          Desg FWD 4      128.26  P2p
  Gi0/1          Desg FWD 4      128.25  P2p

Designated Port Link Speed   Cost (Revised IEEE Spec)
  10 Gbps      2
  1 Gbps       4
  100 Mbps    19
  10 Mbps     100
```

VLANs | 802.1Q

Trama Ethernet 802.3





```

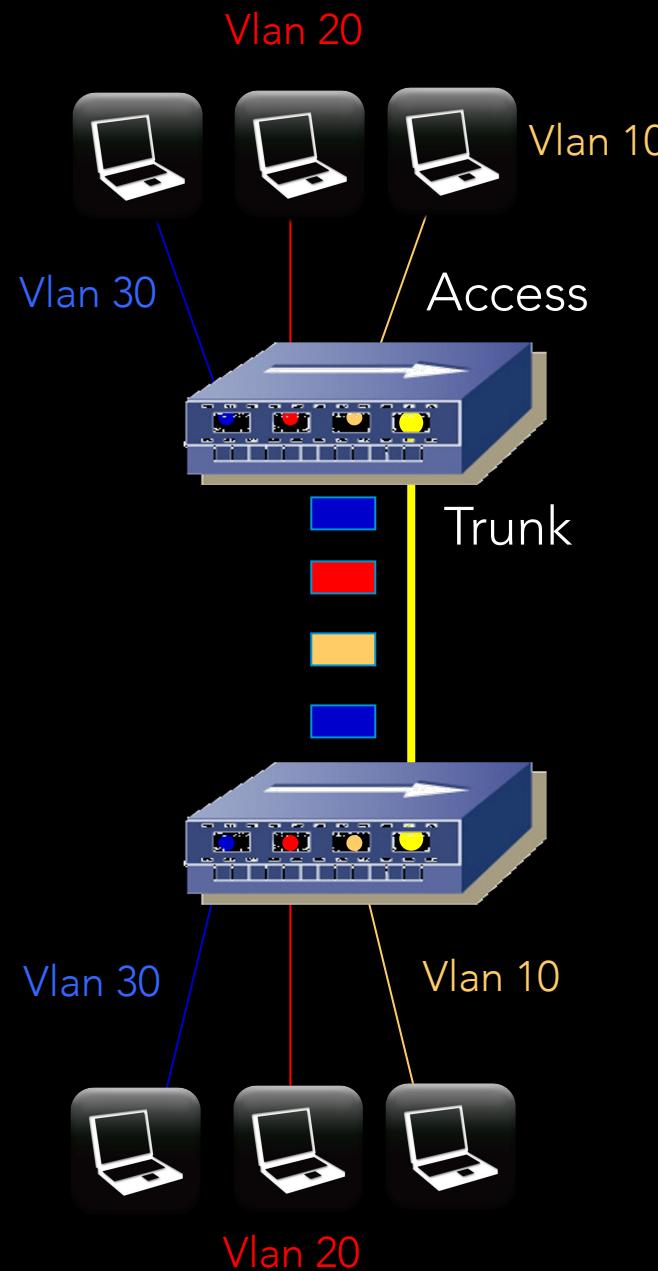
> Frame 7: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
< Ethernet II, Src: 16:7b:93:05:4f:7a (16:7b:93:05:4f:7a), Dst: f6:37:f8:0b:a6:e0 (f6:37:f8:0b:a6:e0)
  > Destination: f6:37:f8:0b:a6:e0 (f6:37:f8:0b:a6:e0)
  > Source: 16:7b:93:05:4f:7a (16:7b:93:05:4f:7a)
    Type: 802.1Q Virtual LAN (0x8100) ← Red arrow
< 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 100
  000. .... .... = Priority: Best Effort (default) (0) ← Orange arrow
  ...0 .... .... = CFI: Canonical (0)
  .... 0000 0110 0100 = ID: 100 ← Yellow arrow
  Type: IP (0x0800)
> Internet Protocol Version 4, Src: 192.168.77.11 (192.168.77.11), Dst: 192.168.77.10 (192.168.77.10)
< Transmission Control Protocol, Src Port: 47629 (47629), Dst Port: http (80), Seq: 1, Ack: 1, Len: 4
  Source port: 47629 (47629)
  Destination port: http (80)

```

802.1Q → 0x8100

802.1p → 000

VLAN → 100



Access

```
Switch# configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

```
Switch(config)# interface ethernet0/1
```

```
Switch(config-if)# switchport mode access
```

```
Switch(config-if)# switchport access vlan 10
```

```
Switch(config-if)# end
```

Trunk

```
Switch# configure terminal
```

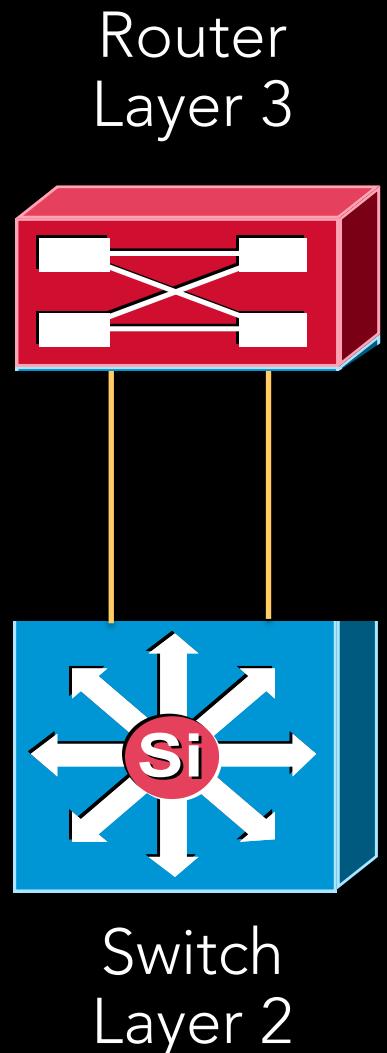
Enter configuration commands, one per line. End with CNTL/Z.

```
Switch(config)# interface gigabitethernet0/2
```

```
Switch(config-if)# switchport trunk encapsulation dot1q
```

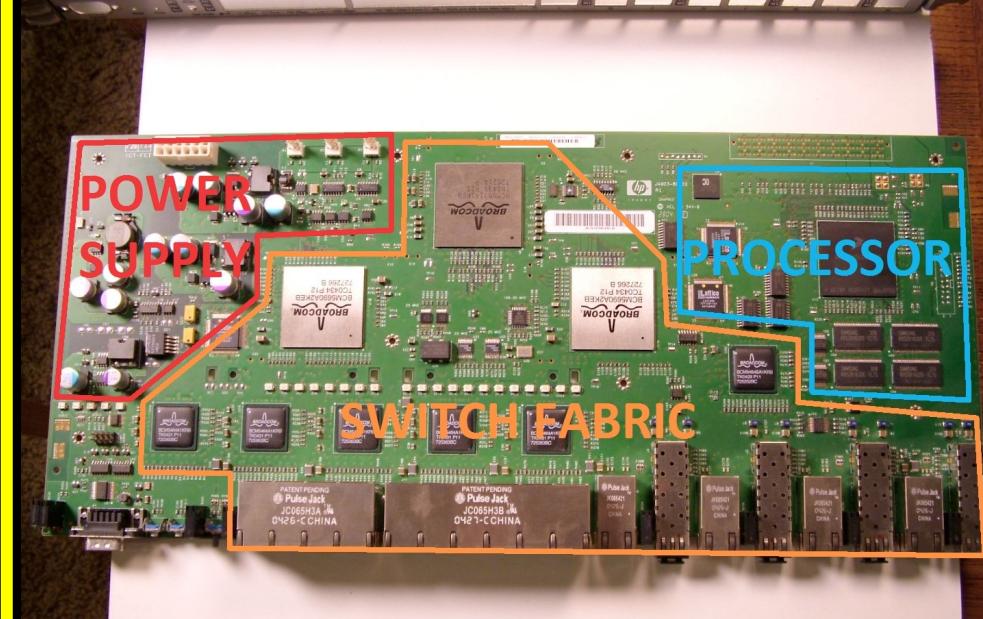
```
Switch(config-if)# end
```

CORE | Router on stick & Layer 3

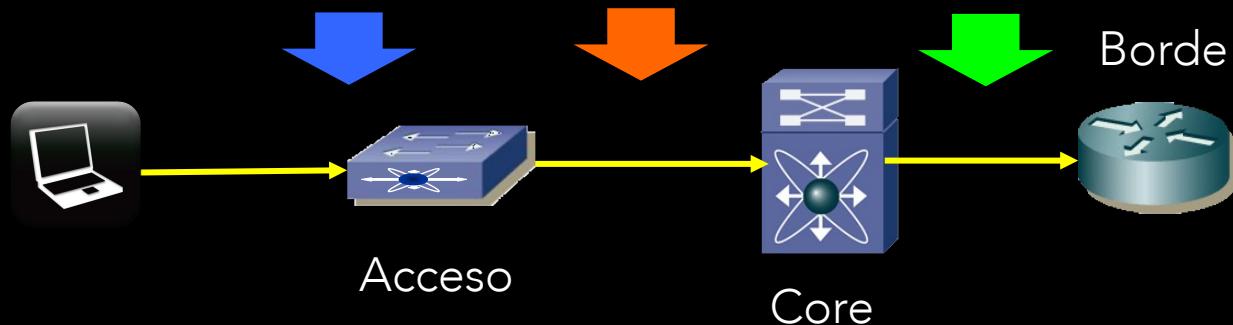
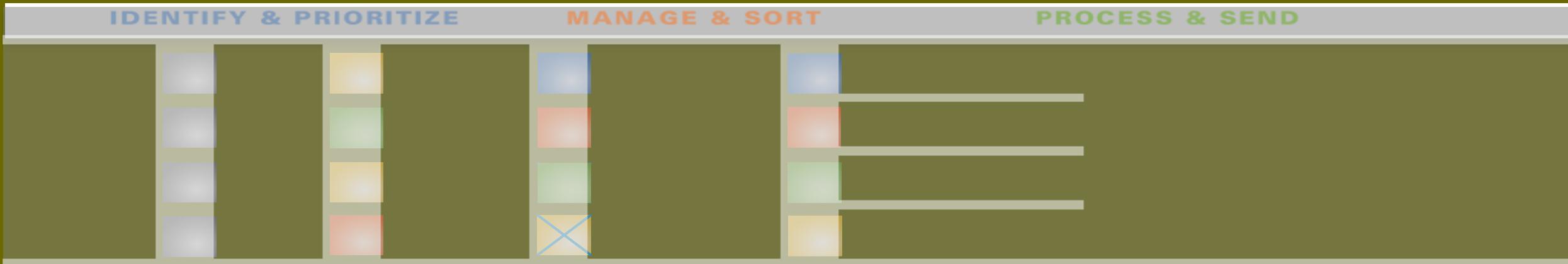


Router on stick

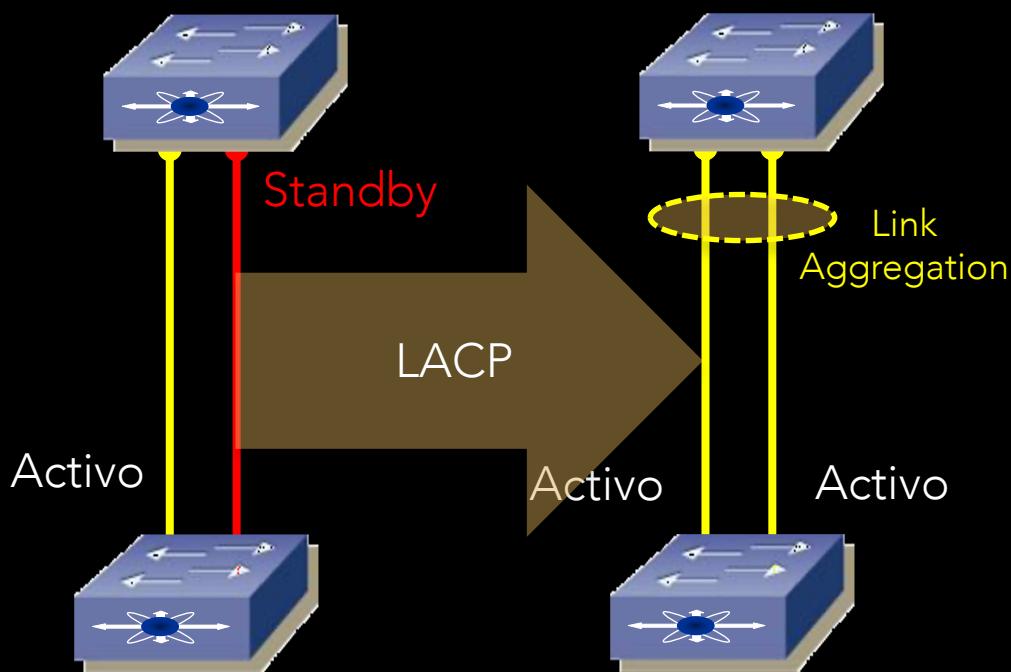
Switch Layer 3



CoS | Class of Service → 802.1p



LACP | 802.3ad



```
Switch# configure terminal
```

```
Switch(config)# interface range gigabitethernet0/1 -2
```

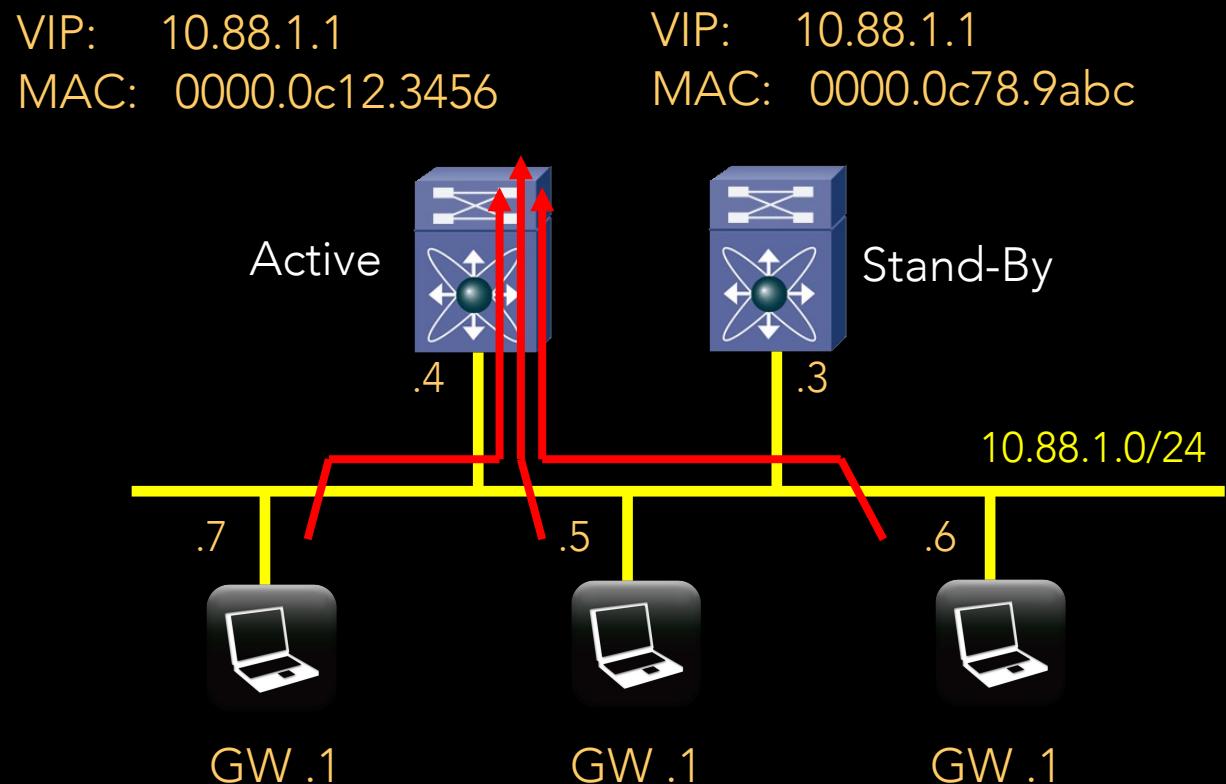
```
Switch(config-if-range)# switchport mode trunk
```

```
Switch(config-if-range)# channel-group 5 mode active
```

```
Switch(config-if-range)# end
```

FIRST HOP | HSRP | RFC 2281

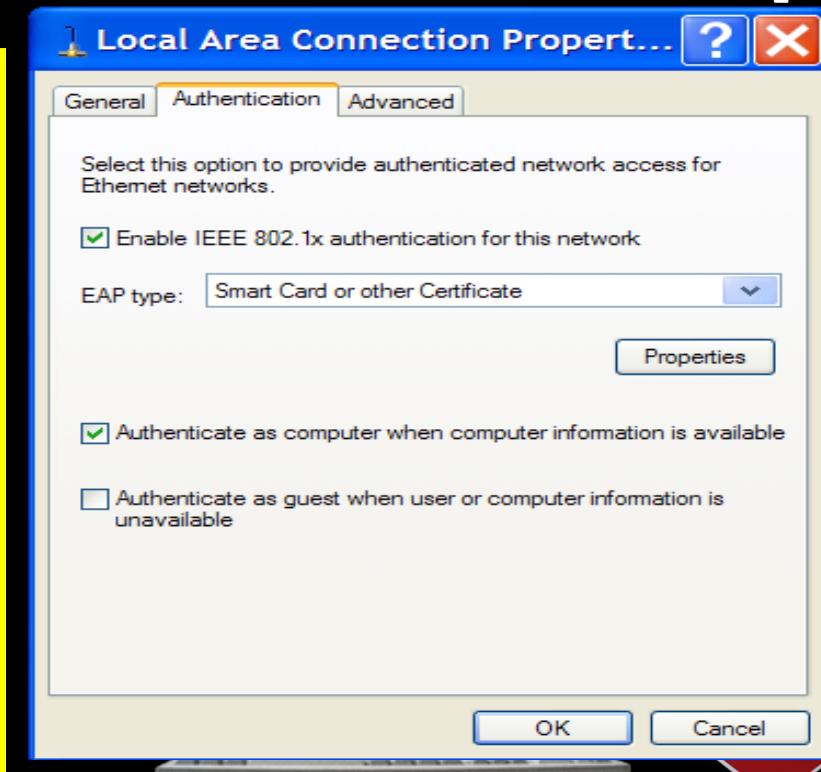
1st Hop or Default Gateway
Redundancy Allows a Highly Available Network to Recover from the Failure of the Device Acting as the Default Gateway for the End Stations on a Physical Segment



Protocolos: HSRP | VRRP | GLBP

Como sabe un host que tiene que comutar si la IP es la misma

SEGURIDAD | 802.1x



der a la red debe recibir autorizacion basada en su usuario y

Valido
Valido

TACACS+ or Radius
Server

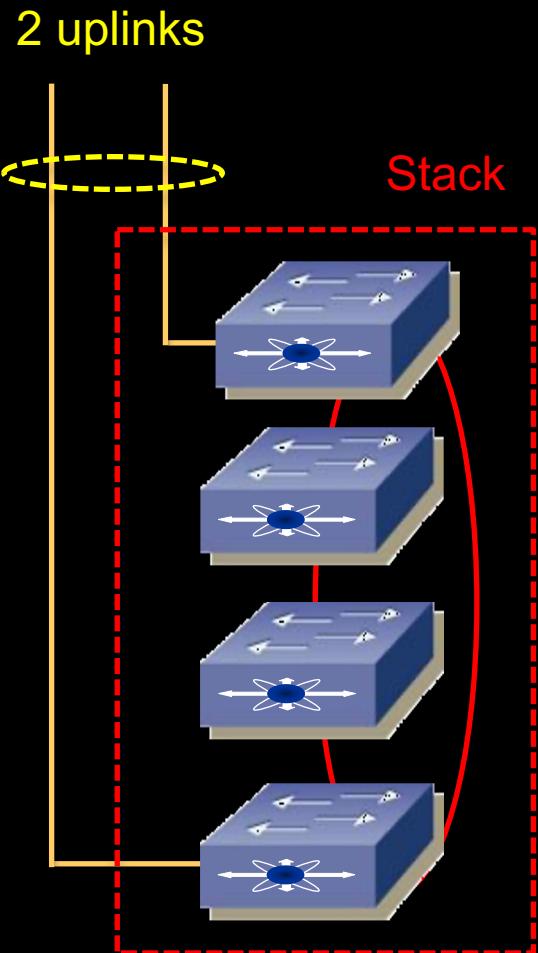
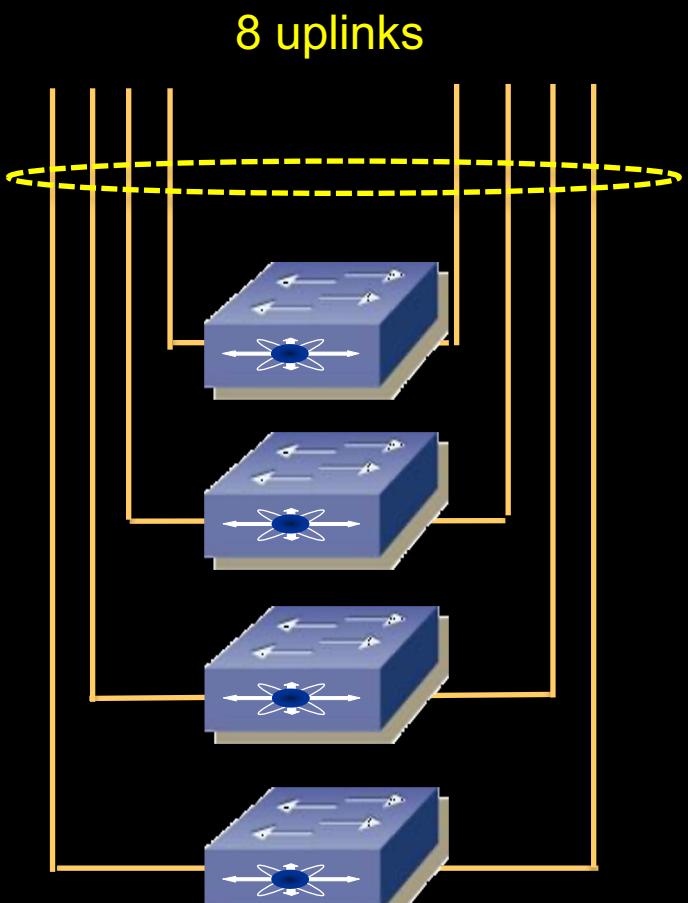
SI
No

Usuario invalido
Password Invalido
Cliente accediendo al Switch



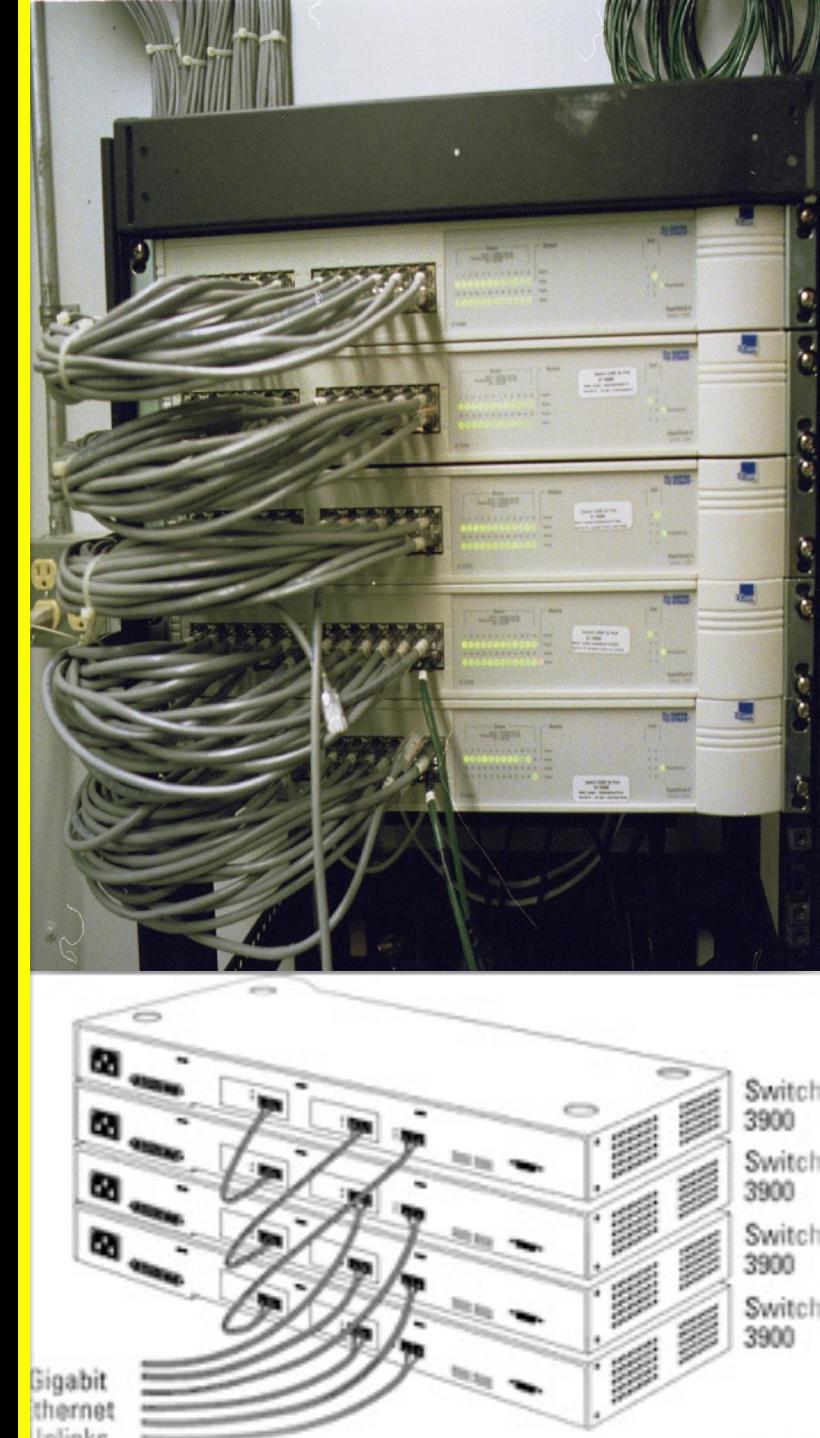
```
Switch (config) #aaa new-model
Switch (config) #aaa authentication dot1x default group radius
Switch (config) #dot1x system-auth-control
Switch (config)#interface fastethernet 9/1
Switch (config-if)#dot1x port-control auto
Switch (config-if)#end
```

CORE Y ACCESO | Stacking



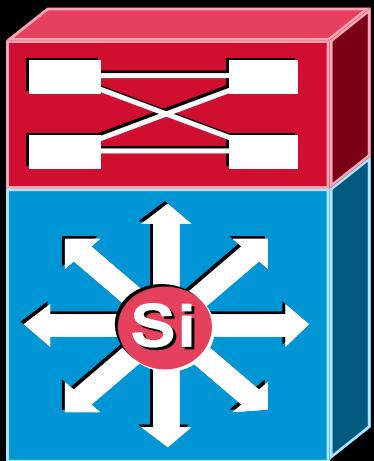
Acceso
sin Stack

Acceso
con Stack



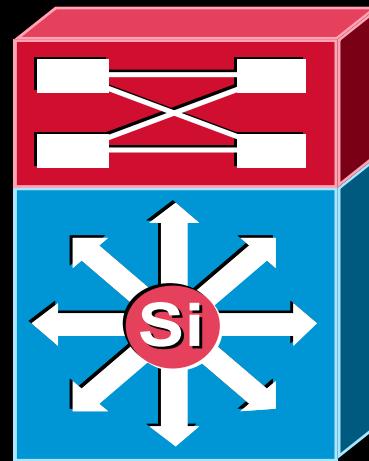
CORE | Dos equipos, un core

Switch 1
(Físico)



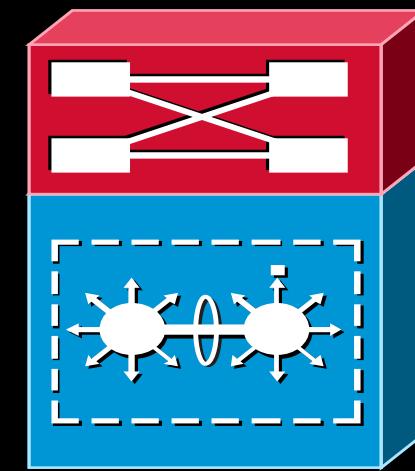
+

Switch 2
(Físico)



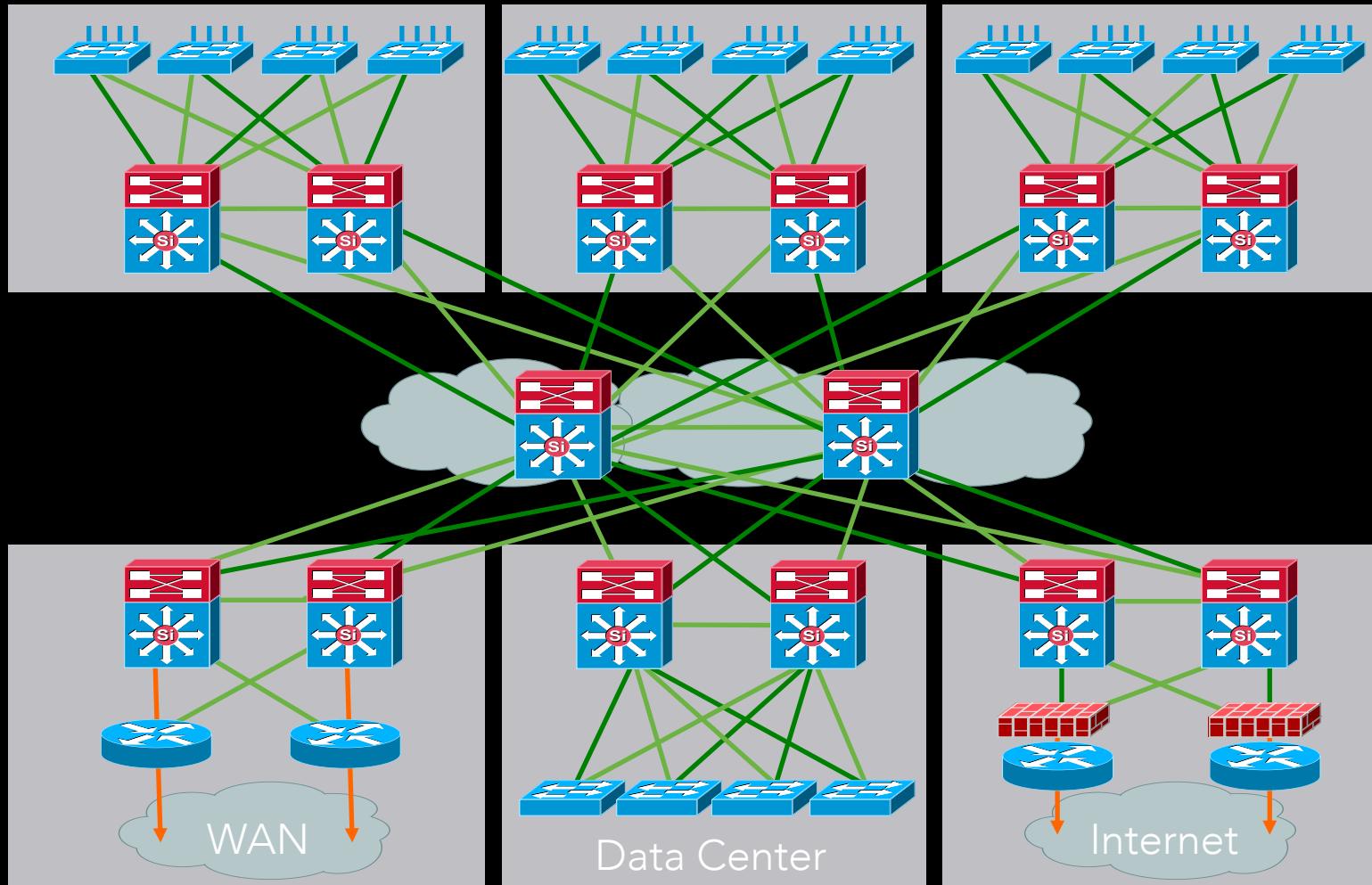
=

Switch Virtual



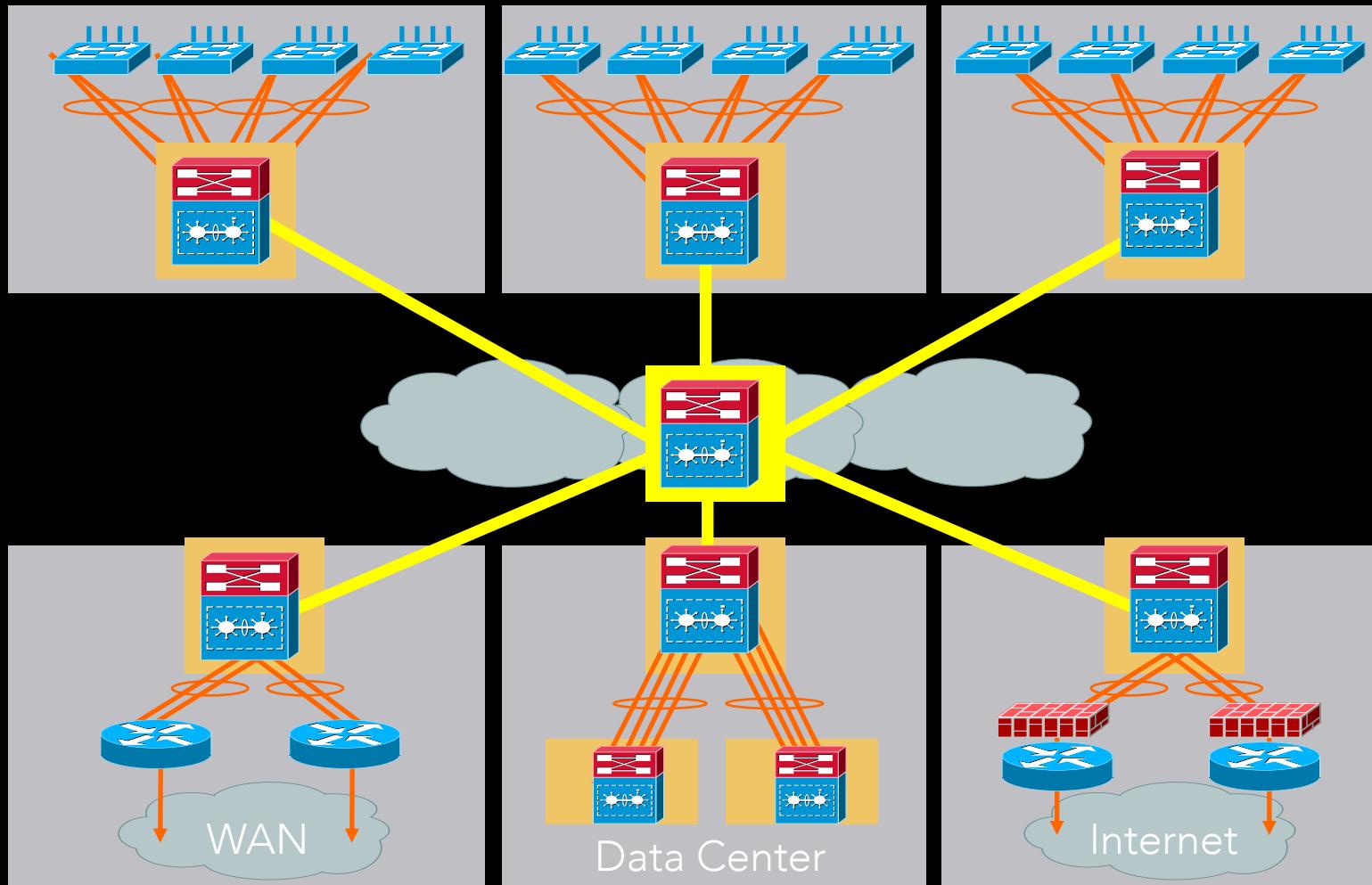
CORE | Dos equipos, un core

Antes

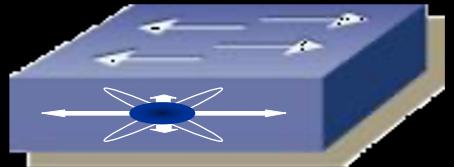


CORE | Dos equipos, un core

Después



PoE | 802.3af



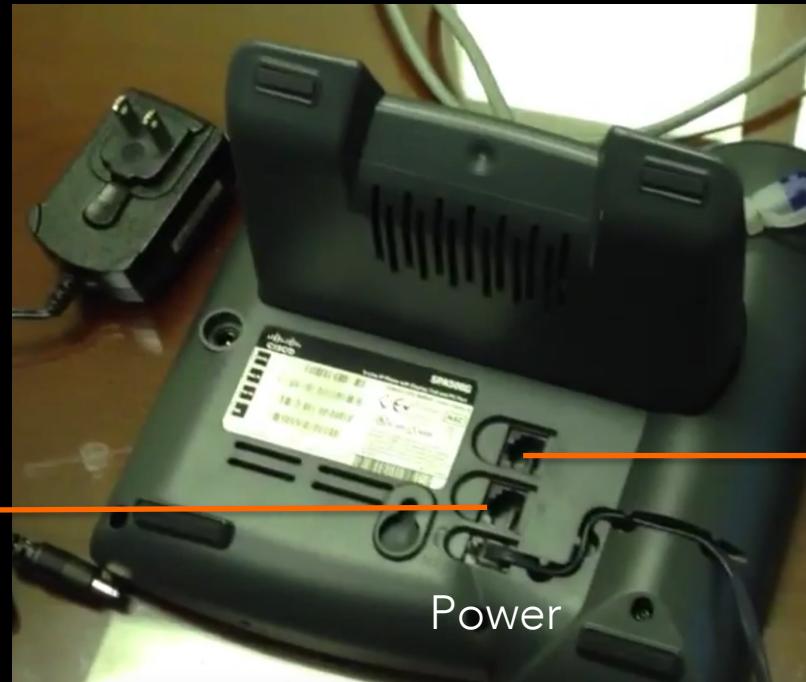
Switch

1. Phone Discovery (CDP)
2. Provide Power
3. Provide VLAN
4. DHCP (Get IP Address)



Support up to the maximum of **15.4** watts per port

Up to **370W** available for PoE, which is shared by all 24 ports



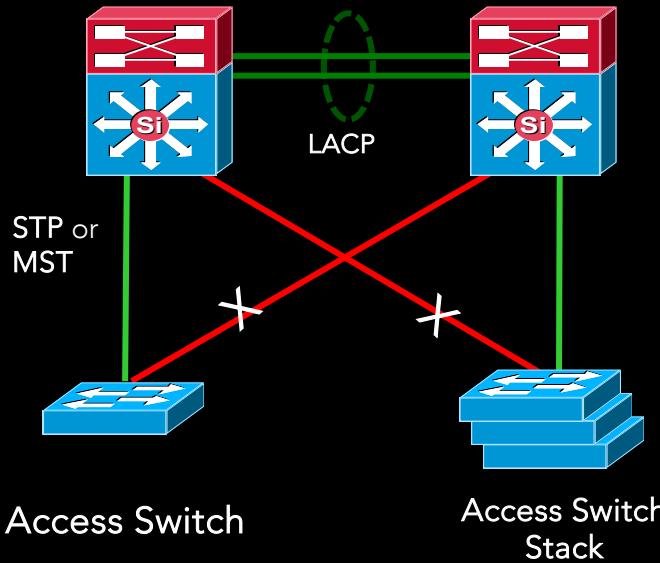
Switch

Power

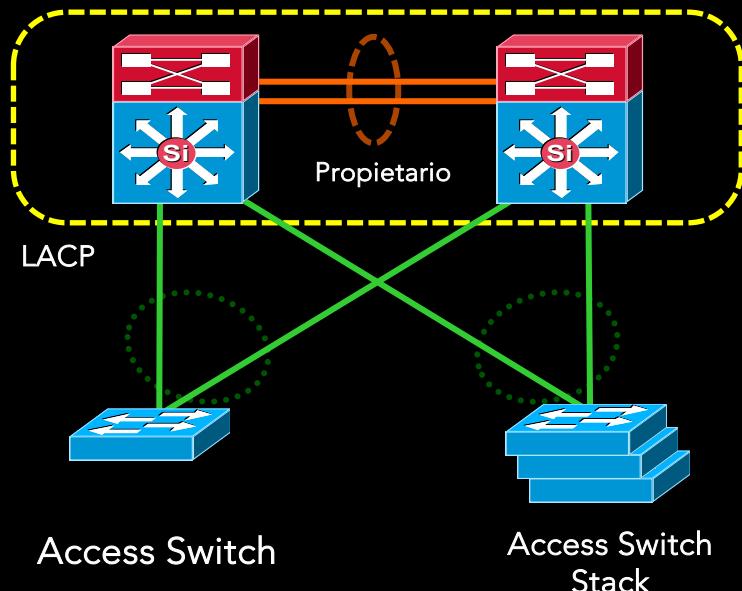
PC

Extensiones del Core

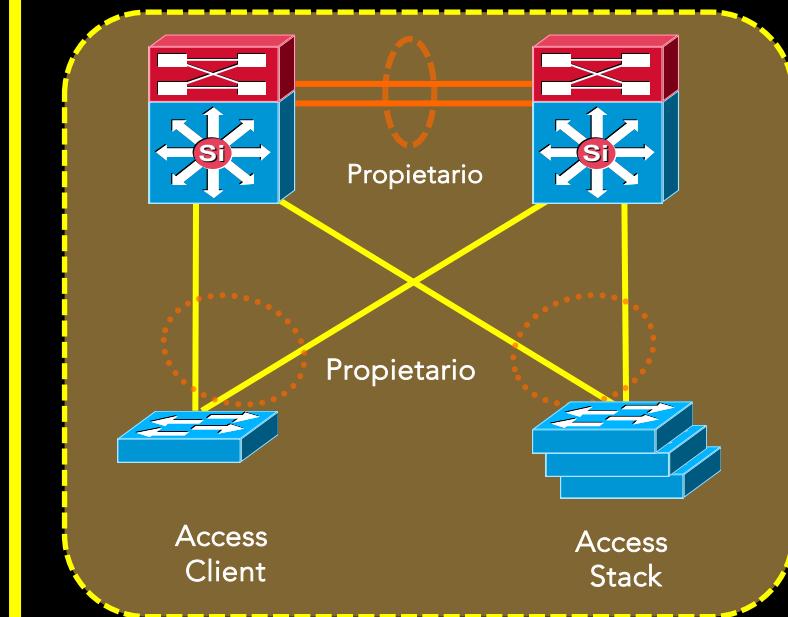
Standalone



Core Único



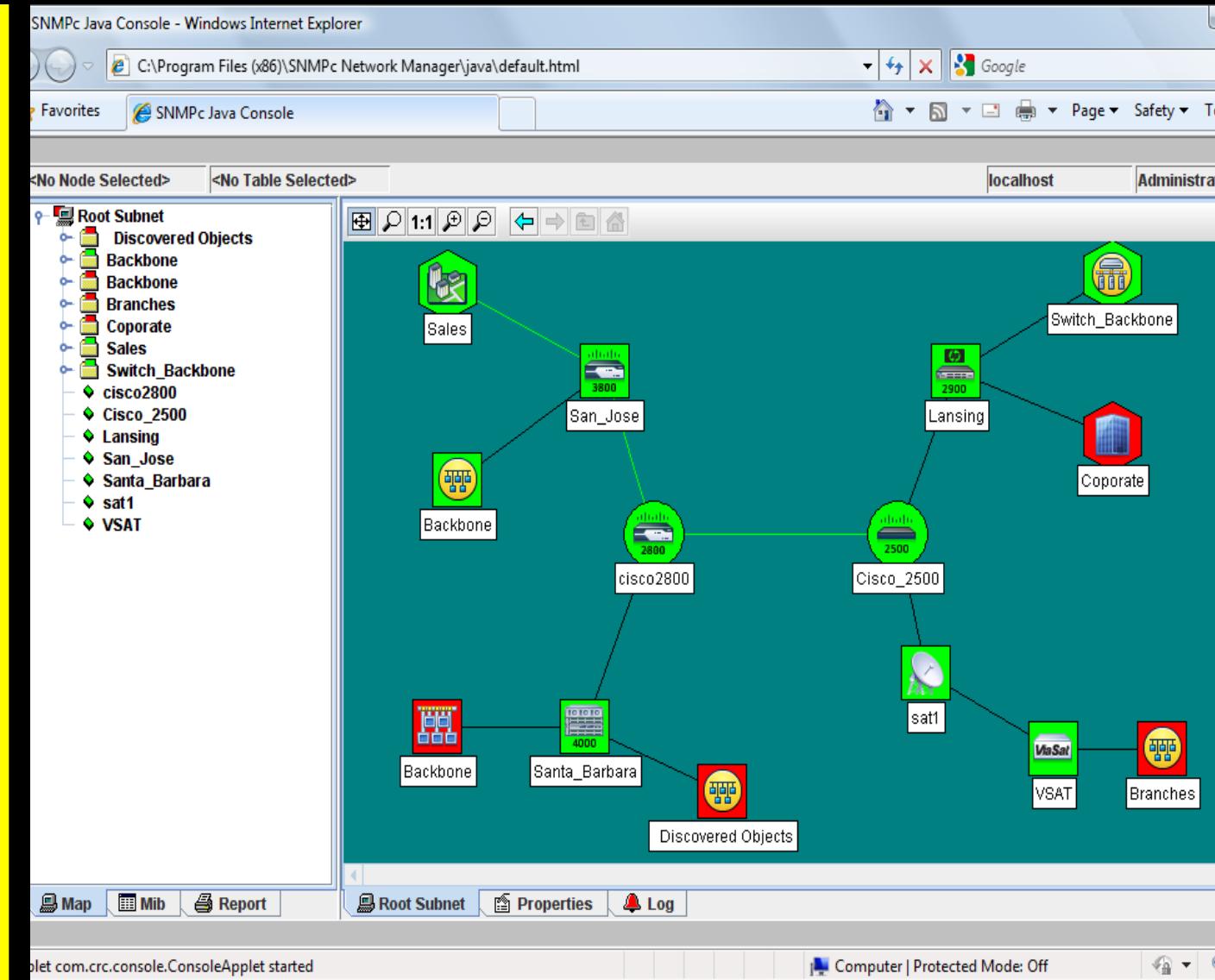
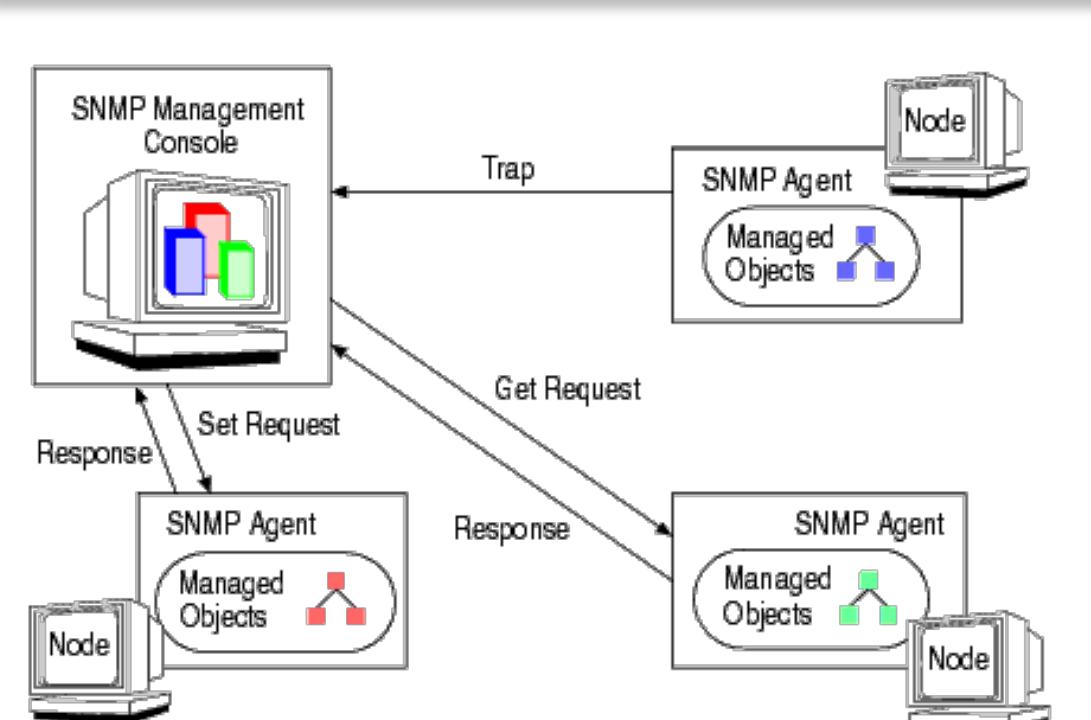
Extensiones



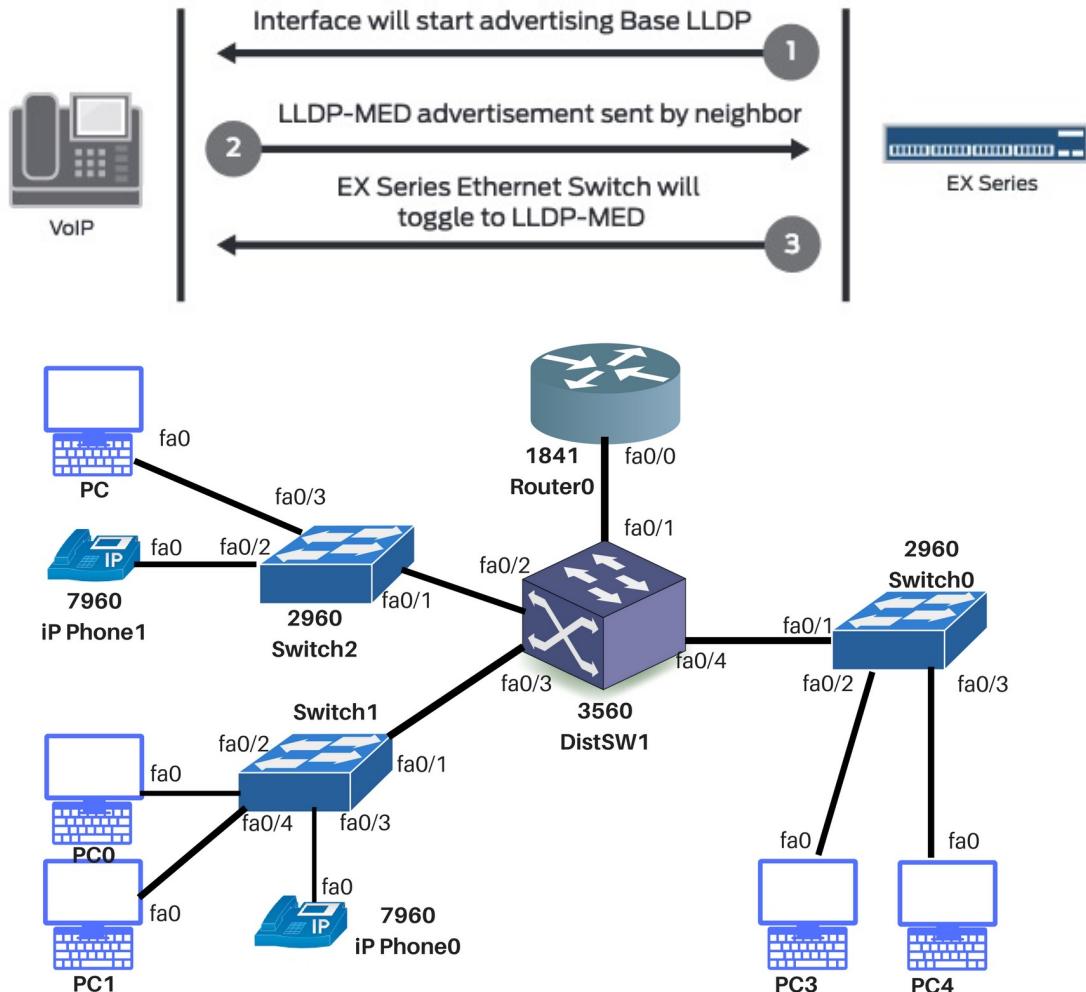
SNMP | Simple Network Management Protocol

v1 | RFC 1157 | 1990
v3 | RFC 3410 | 2002

Es un protocolo de la capa de aplicación que facilita el intercambio de información de administración entre los dispositivos de red



LLDP | Link Layer Discovery Protocol | 802.1AB



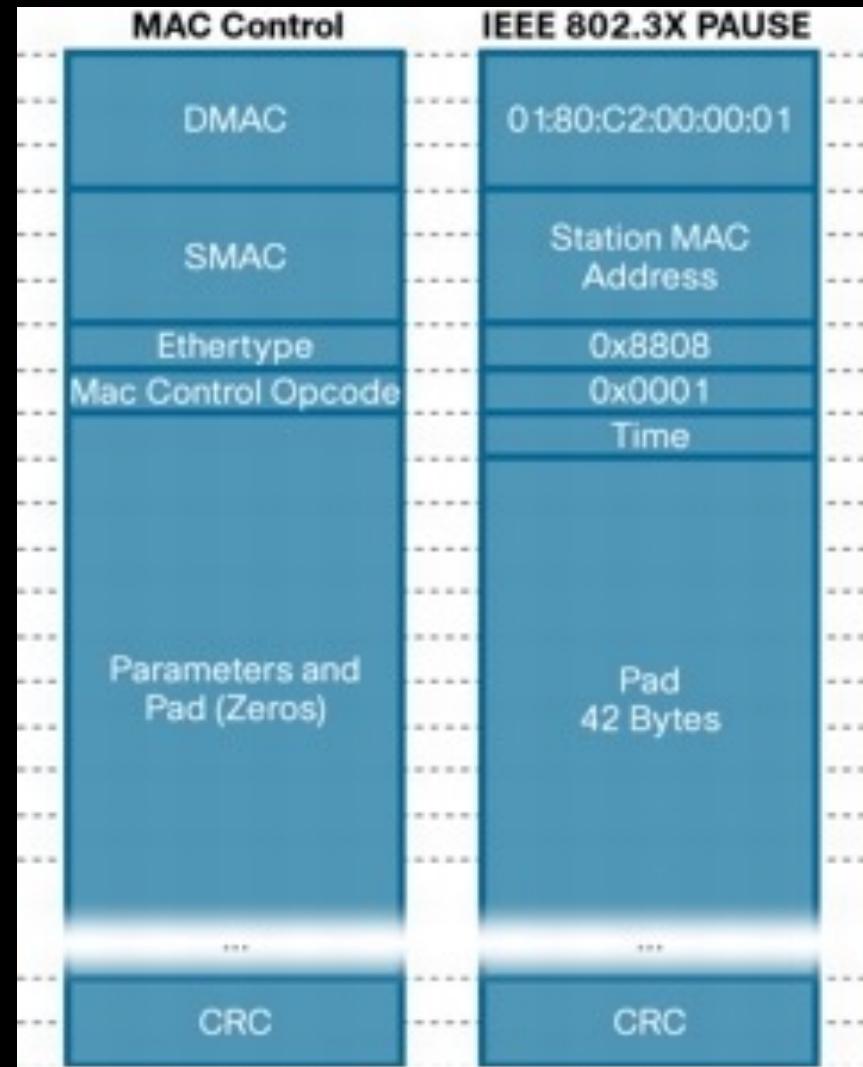
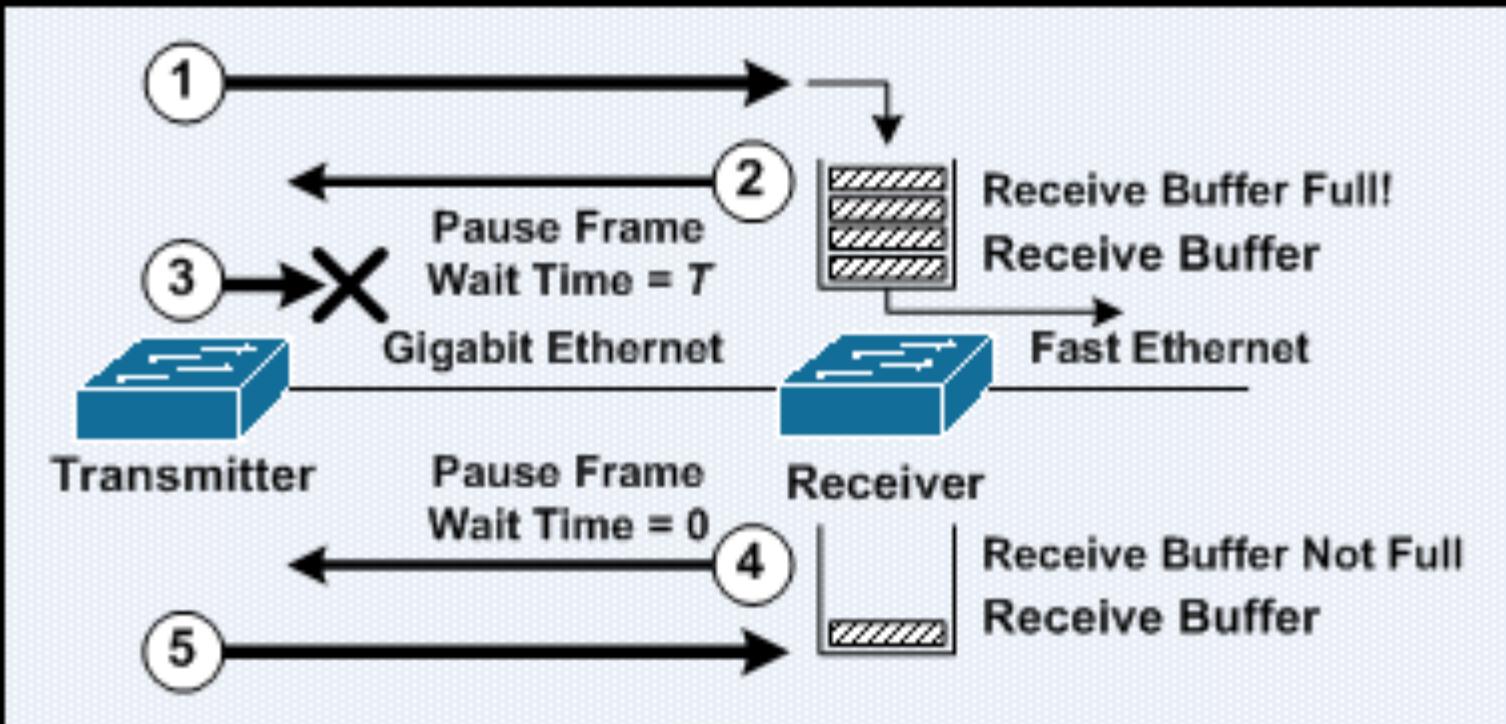
The Link Layer Discovery Protocol (LLDP) is a vendor-neutral link layer protocol used by network devices for advertising their identity, capabilities, and neighbors on an IEEE 802 local area network, principally wired Ethernet.

INFORMACIÓN

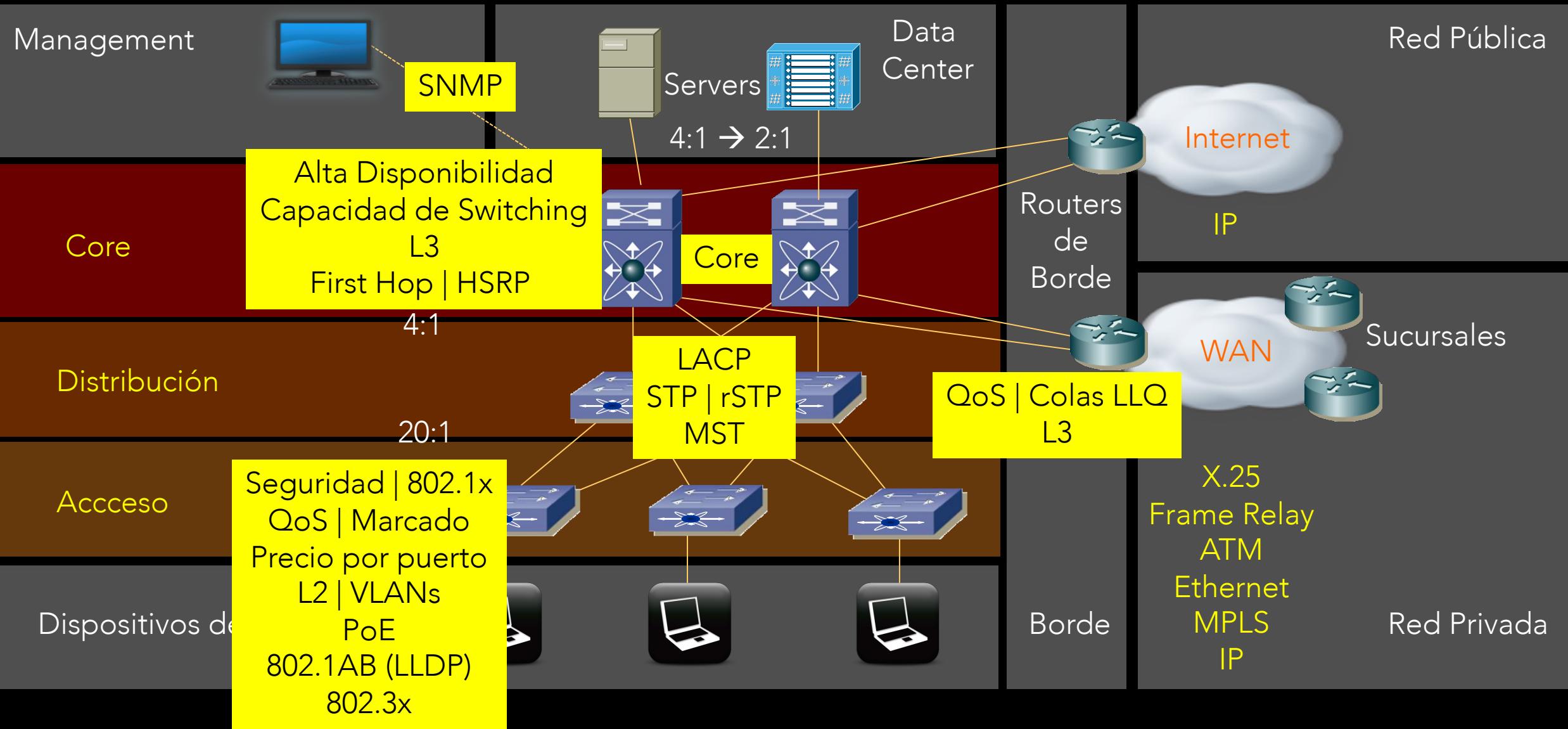
System name and description
Port name and description
VLAN name
IP management address
System capabilities (switching, routing, etc.)
MAC/PHY information
PoE
Link Aggregation

802.3x | Ethernet Flow Control

Ethernet flow control is a mechanism for temporarily stopping the transmission of data on Ethernet family computer networks. The goal of this mechanism is to ensure zero packet loss in the presence of network congestion.



ARQUITECTURA



LOS PLAYERS



SWITCHING

HISTORIA



Japanese Zero tenía
mejor maniobrabilidad
...los pilotos de los
Zeros eran conocidos
por los loops!



American P-38 era
rápido con gran poder
de fuego

Saburo Sakai

One of Japan's Top Aces
in WW II



Total de 64 victorias en la
Segunda Guerra

Todas contra los P38

Richard Bong

Highest-scoring U.S. Ace



Total de 40 victorias
volando los P-38s

Todas contra los Zero

"OK, pero como esto aplica a ventas"



Es el piloto y no el avión!

Hay que hacer que lo otros

jueguen nuestro juego

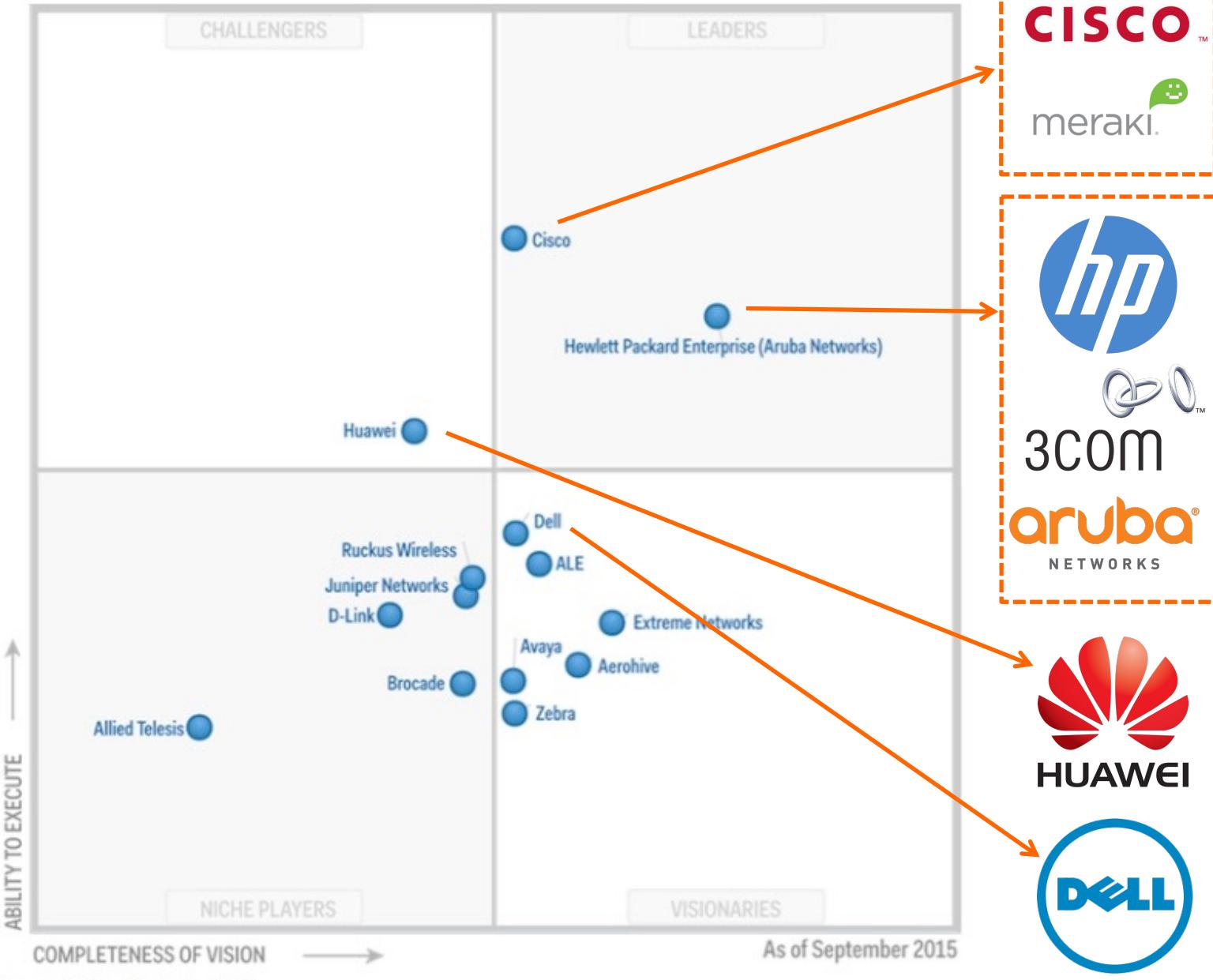
Ganar es más que buenas tácticas

PLAYERS

Gartner®

Magic Quadrant

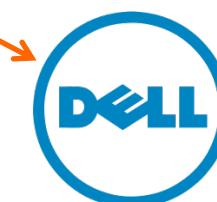
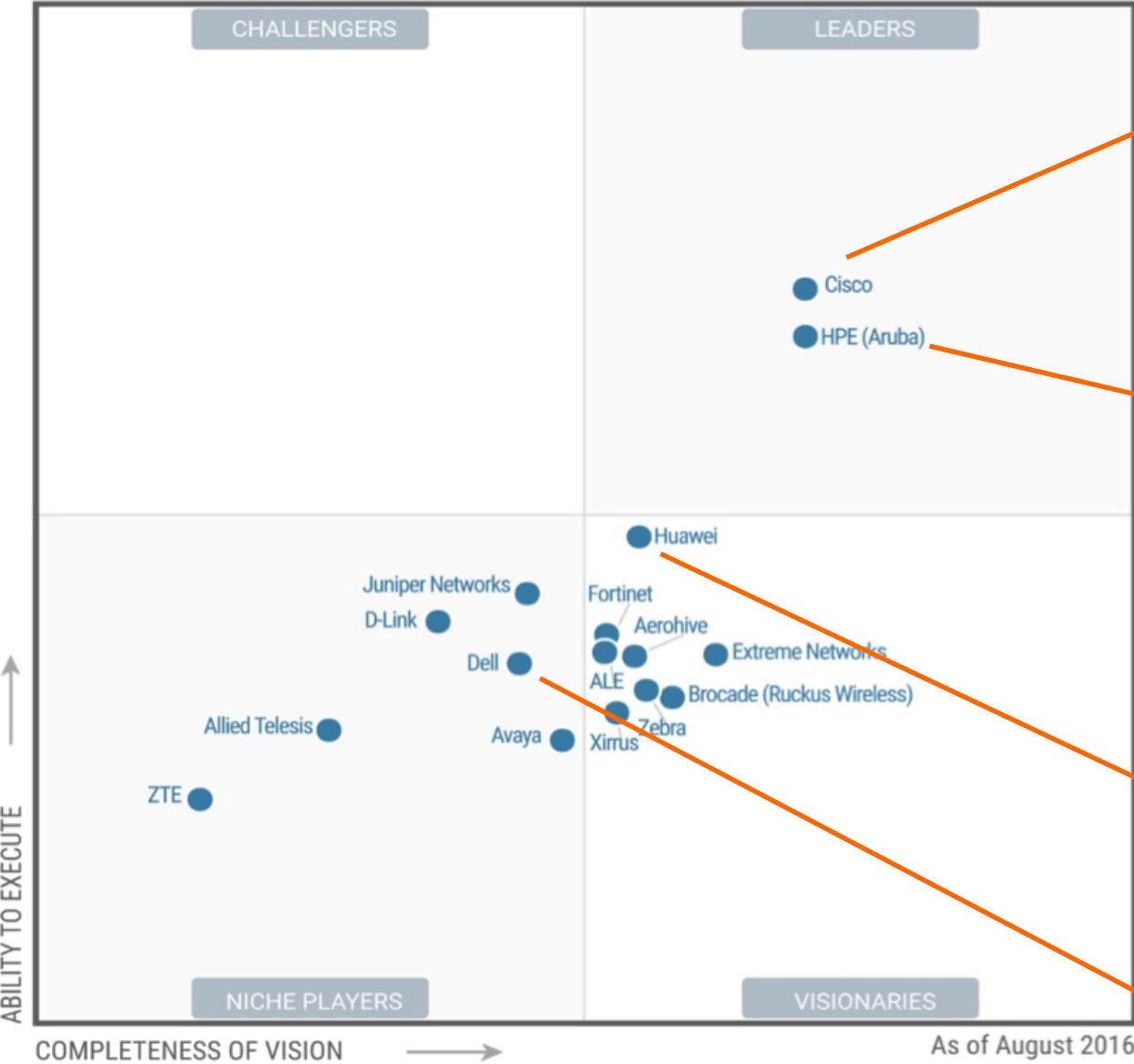
Figure 1. Magic Quadrant for the Wired and Wireless LAN Access Infrastructure



SWITCHING

PLAYERS

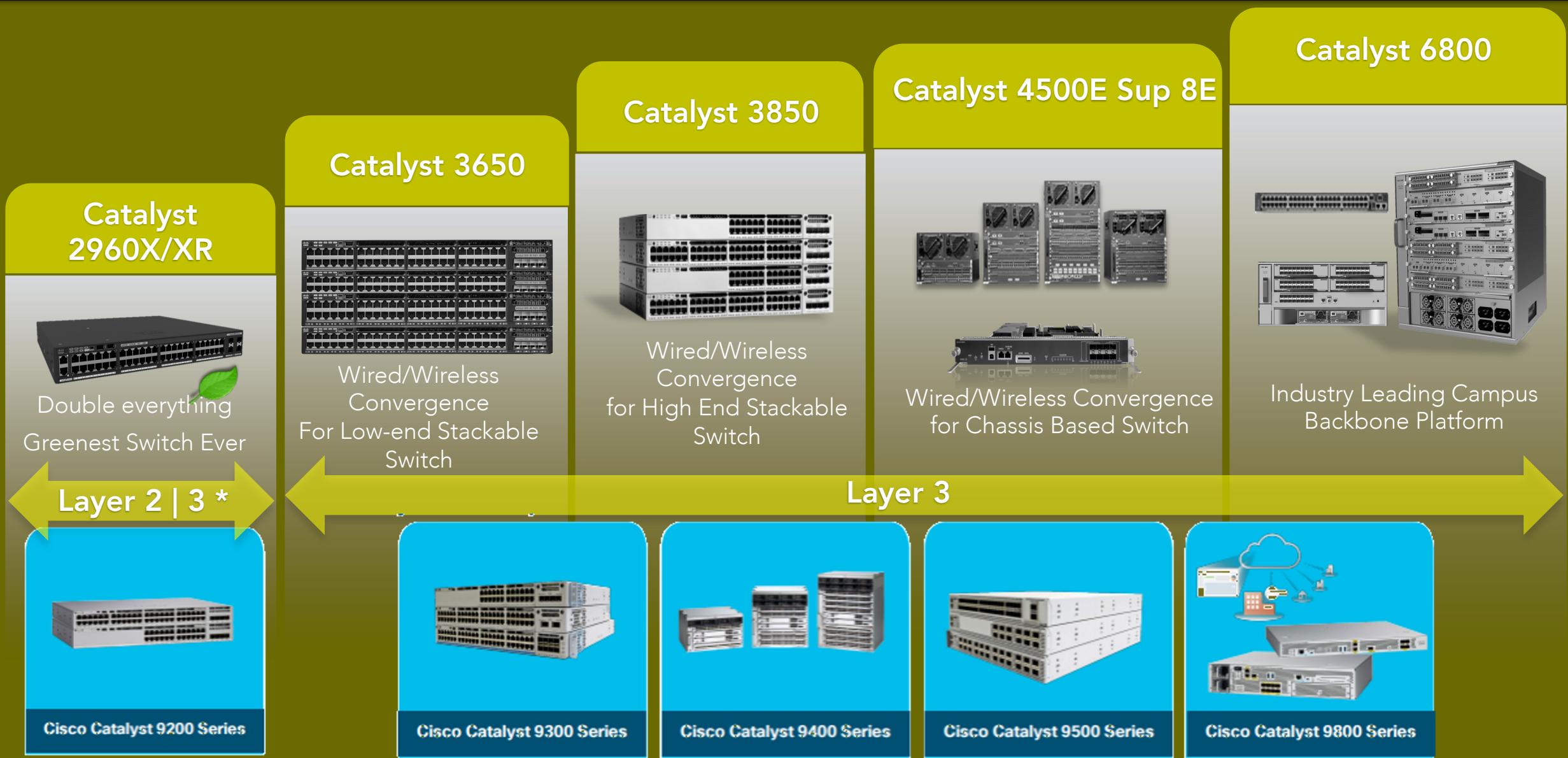
Gartner®



SWITCHING



Cisco Catalyst Portfolio



HP Switching Portfolio



5400/8200 zl/zl2
Switches



10500 Core
Switches



830/850/870 UA Switches



29xx/3800
Stackable
Switches



7500 Aggregation
Switches

FlexCampus

- Enables elimination of the distribution layer
- Delivers integrated security
- Converges wired and wireless



Standards	<ul style="list-style-type: none"> IEEE 802.1D Spanning Tree Protocol IEEE 802.1p CoS Prioritization IEEE 802.1Q VLAN IEEE 802.1s Multiple Spanning Trees IEEE 802.1w Rapid Spanning Trees IEEE 802.1X Security IEEE 802.1ab (LLDP) IEEE 802.3ad LACP IEEE 802.3af PoE IEEE 802.3ah (100BASE-X single/multimode fiber only) IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports IEEE 802.3 10BASE-T specification IEEE 802.3u 100BASE-TX specification IEEE 802.3ab 1000BASE-T specification IEEE 802.3z 1000BASE-X specification 	<ul style="list-style-type: none"> 100BASE-BX (SFP) 100BASE-FX (SFP) 100BASE-LX (SFP) 1000BASE-BX (SFP) 1000BASE-SX (SFP) 1000BASE-LX/LH (SFP) 1000BASE-ZX (SFP) 1000BASE-CWDM SFP 1470 nm 1000BASE-CWDM SFP 1490 nm 1000BASE-CWDM SFP 1510 nm 1000BASE-CWDM SFP 1530 nm 1000BASE-CWDM SFP 1550 nm 1000BASE-CWDM SFP 1570 nm 1000BASE-CWDM SFP 1590 nm 1000BASE-CWDM SFP 1610 nm 10GBASE-LR (SFP+) 10GBASE-SR (SFP+) 10GBASE-LRM (SFP+) 10GBASE-CX1 (SFP+) RMON I and II standards SNMP v1, v2c, and v3 	Management	<ul style="list-style-type: none"> RFC 768 - UDP RFC 783 - TFTP RFC 791 - IP RFC 792 - ICMP RFC 793 - TCP RFC 826 - ARP RFC 854 - Telnet RFC 951 - Bootstrap Protocol (BOOTP) RFC 959 - FTP RFC 1112 - IP Multicast and IGMP RFC 1157 - SNMP v1 RFC 1166 - IP Addresses RFC 1256 - Internet Control Message Protocol (ICMP) Router Discovery RFC 1305 - NTP RFC 1492 - TACACS+ RFC 1493 - Bridge MIB RFC 1542 - BOOTP extensions RFC 1643 - Ethernet Interface MIB RFC 1757 - RMON 	<ul style="list-style-type: none"> RFC 1901 - SNMP v2C RFC 1902-1907 - SNMP v2 RFC 1981 - Maximum Transmission Unit (MTU) Path Discovery IPv6 RFC 2068 - HTTP RFC 2131 - DHCP RFC 2138 - RADIUS RFC 2233 - IF MIB v3 RFC 2373 - IPv6 Aggregatable Addrs RFC 2460 - IPv6 RFC 2461 - IPv6 Neighbor Discovery RFC 2462 - IPv6 Autoconfiguration RFC 2463 - ICMPv6 RFC 2474 - Differentiated Services (DiffServ) Precedence RFC 2597 - Assured Forwarding RFC 2598 - Expedited Forwarding RFC 2571 - SNMP Management RFC 3046 - DHCP Relay Agent Information Option RFC 3376 - IGMP v3 RFC 3580 - 802.1X RADIUS
------------------	--	--	-------------------	---	--

Performance and Scalability Numbers for All Switch Models

	Catalyst 2960-S	Catalyst 2960
Forwarding bandwidth	88 Gbps	16 Gbps 32 Gbps (2960G)
Switching bandwidth*	176 Gbps	32 Gbps 32 Gbps (2960G)
* Switching bandwidth is full-duplex capacity.		
Flash memory	64 MB	32 MB
Memory DRAM	128 MB	64 MB
Max VLANs	255	255
VLAN IDs	4000	4000
Maximum transmission unit (MTU)	9198 bytes	Up to 9000 bytes
Jumbo frames	9216 bytes	9018 bytes (2960G only)



Stack

Catalyst 2960-S

Switch Model	Maximum Number of PoE+(IEEE 802.3at) Ports*	Maximum Number of PoE (IEEE 802.3af) Ports*	Available PoE Power
10 Gigabit Uplinks with 10/100/1000 Ethernet Connectivity			
Cisco Catalyst 2960S-48FPD-L	24 ports up to 30W	48 ports up to 15.4W	740W
Cisco Catalyst 2960S-48LPD-L	12 ports up to 30W	24 ports up to 15.4W 48 ports up to 7.7W	370W
Cisco Catalyst 2960S-24PD-L	12 ports up to 30W	24 ports up to 15.4W	370W

Standards and protocols



2900 Stackable
Switches

Device management

RFC 1591 DNS (client)
HTML and telnet management

General protocols

IEEE 802.1D MAC Bridges
IEEE 802.1p Priority
IEEE 802.1Q VLANs
IEEE 802.1s Multiple Spanning Trees
IEEE 802.1v VLAN classification by Protocol and Port
IEEE 802.1w Rapid Reconfiguration of Spanning Tree
IEEE 802.3ad Link Aggregation Control Protocol (LACP)
IEEE 802.3x Flow Control

RFC 768 UDP
RFC 783 TFTP Protocol (revision 2)
RFC 792 ICMP
RFC 793 TCP
RFC 826 ARP
RFC 854 TELNET
RFC 868 Time Protocol
RFC 951 BOOTP
RFC 1058 RIPv1
RFC 1350 TFTP Protocol (revision 2)
RFC 2030 Simple Network Time Protocol (SNTP) v4

RFC 2131 DHCP
RFC 2453 RIPv2
RFC 3046 DHCP Relay Agent Information Option

IP multicast

RFC 3376 IGMPv3

IPv6

RFC 1981 IPv6 Path MTU Discovery

RFC 2460 IPv6 Specification
RFC 2710 Multicast Listener Discovery (MLD) for IPv6
RFC 2925 Remote Operations MIB (Ping only)

RFC 3019 MLDv1 MIB
RFC 3315 DHCPv6 (client only)

RFC 3513 IPv6 Addressing Architecture
RFC 3596 DNS Extension for IPv6

RFC 3810 MLDv2 (host joins only)
RFC 4022 MIB for TCP

RFC 4113 MIB for UDP
RFC 4251 SSHv6 Architecture
RFC 4252 SSHv6 Authentication

RFC 4253 SSHv6 Transport Layer
RFC 4254 SSHv6 Connection
RFC 4293 MIB for IP

RFC 4419 Key Exchange for SSH
RFC 4443 ICMPv6
RFC 4541 IGMP & MLD Snooping Switch

RFC 4861 IPv6 Neighbor Discovery

RFC 4862 IPv6 Stateless Address Auto-configuration

MIBs

RFC 1213 MIB II
RFC 1493 Bridge MIB
RFC 1724 RIPv2 MIB
RFC 2021 RMONv2 MIB
RFC 2613 SMON MIB
RFC 2618 RADIUS Client MIB
RFC 2620 RADIUS Accounting MIB

RFC 2665 Ethernet-Like-MIB

RFC 2668 802.3 MAU MIB
RFC 2674 802.1p and IEEE 802.1Q Bridge MIB
RFC 2737 Entity MIB (Version 2)
RFC 2863 The Interfaces Group MIB

Network management

IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events)
RFC 3176 sFlow
ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)
SNMPv1/v2c/v3
XMON

QoS/Cos

RFC 2474 DiffServ Precedence, including 8 queues/port
RFC 2597 DiffServ Assured Forwarding (AF)
RFC 2598 DiffServ Expedited Forwarding (EF)

Security

IEEE 802.1X Port Based Network Access Control
RFC 1492 TACACS+
RFC 2138 RADIUS Authentication
RFC 2866 RADIUS Accounting
Secure Sockets Layer (SSL)
SSHv1/SSHv2 Secure Shell

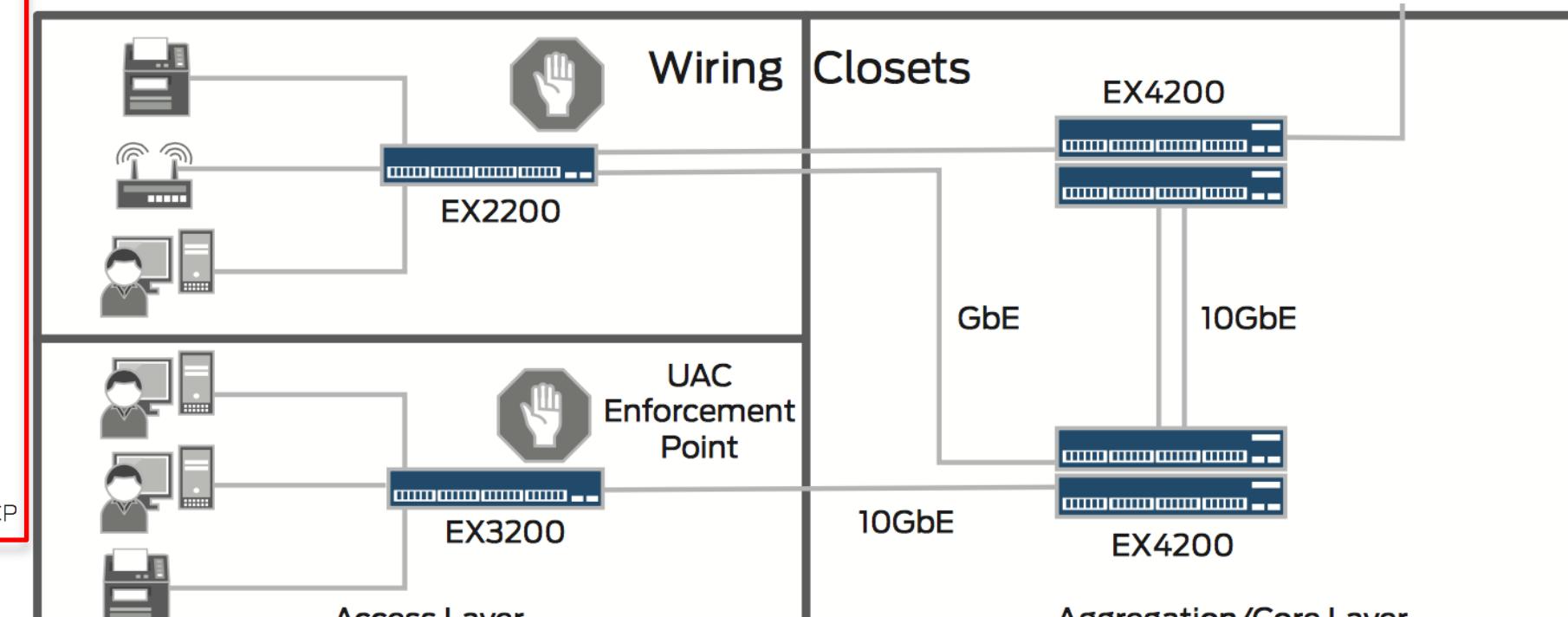
Layer 2 Switching

- Maximum MAC addresses in hardware: 16,000
 - Jumbo frames: 9216 bytes
 - Number of VLANs: 1,024 (VLAN IDs: 4,096)
 - Port-based VLAN
 - MAC-based VLAN
 - Voice VLAN
 - Private VLAN (PVLAN)
 - IEEE 802.1ak: Multiple VLAN Registration Protocol (MVRP)
 - Multicast VLAN Registration (MVR)
 - Compatible with Per-VLAN Spanning Tree Plus (PVST+)
 - RVI (Routed VLAN Interface)
- IEEE 802.1AB: Link Layer Discovery Protocol (LLDP)
 - LLDP-MED with VoIP integration
 - IEEE 802.1D: Spanning Tree Protocol
 - IEEE 802.1p: CoS prioritization
 - IEEE 802.1Q: VLAN tagging
 - IEEE 802.1Q-in-Q: VLAN Stacking
 - IEEE 802.1s: Multiple Spanning Tree Protocol (MSTP)
- Number of MST instances supported: 64
- IEEE 802.1w: Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.1X: Port Access Control
- IEEE 802.3: 10BASE-T
- IEEE 802.3u: 100BASE-T
- IEEE 802.3ab: 1000BASE-T
- IEEE 802.3z: 1000BASE-X
- IEEE 802.3af: PoE
- IEEE 802.3at: PoE+
- IEEE 802.3x: Pause Frames/Flow Control
- IEEE 802.3ad: Link Aggregation Control Protocol (LACP)
- IEEE 802.3ah: Ethernet in the First Mile
- IEEE 802.1ag: Connectivity Fault Management (CFM)

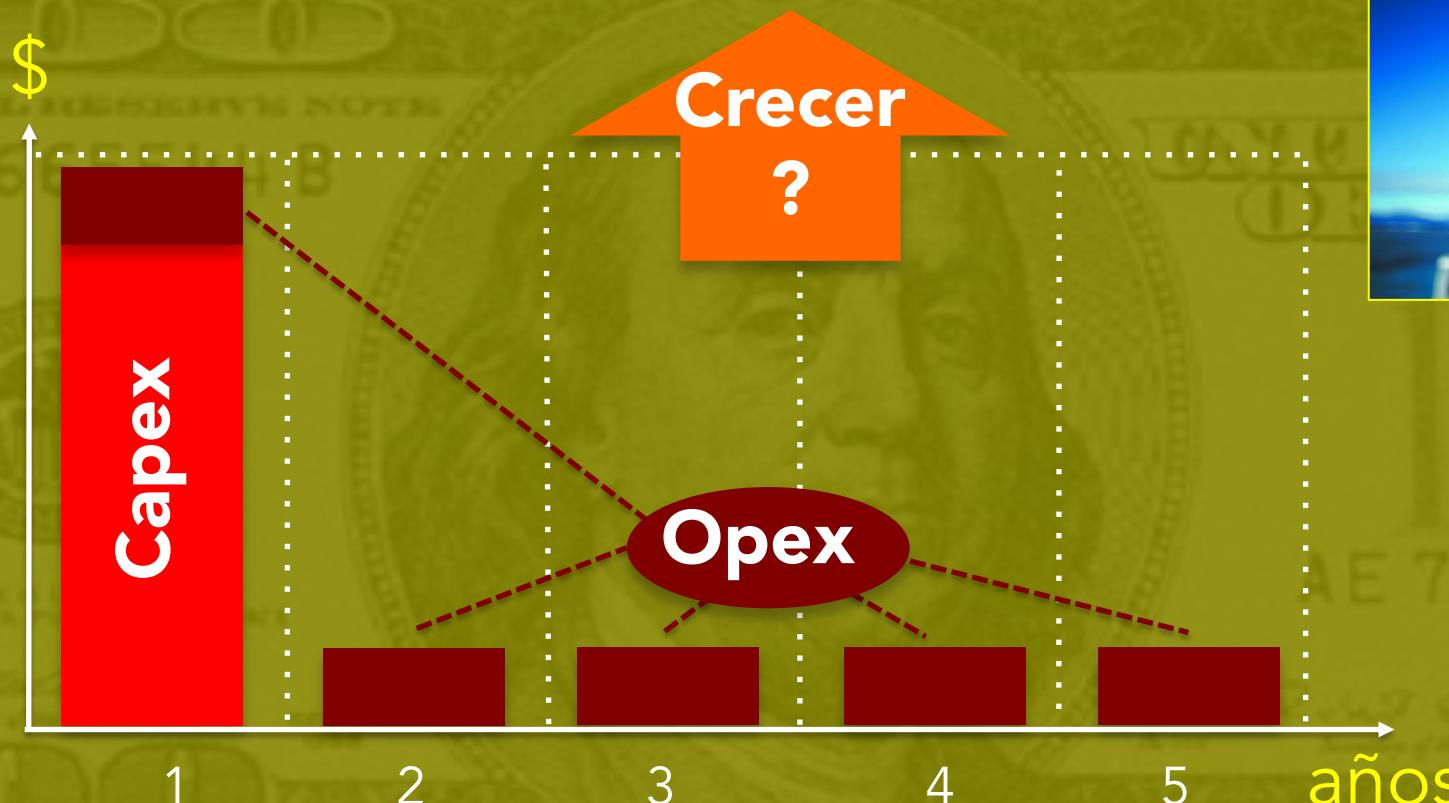


Security

- MAC limiting
 - Allowed MAC addresses—configurable per port
 - Sticky MAC (persistent MAC address learning)
 - Dynamic ARP inspection (DAI)
 - Proxy ARP
 - Static ARP support
 - DHCP snooping
 - IP source guard
- 802.1X port-based
 - 802.1X multiple supplicants
 - 802.1X with VLAN assignment
 - 802.1X with authentication bypass access (based on host MAC address)
 - 802.1X with VoIP VLAN support
 - 802.1X dynamic ACL based on RADIUS attributes
 - 802.1X Supported EAP types: Message Digest 5 (MD5), Transport Layer Security (TLS), Tunneled Transport Layer



Costos | Capex + Opex + Crecimiento + Empresa



A quién

Visión
R&D
Historia
Gartner

1 | Caso de Estudio |

Cliente |

Nombre: Medical Plus | Medicina Prepara

Posición: Jefe de Redes

Descripción |

Posee un edificio de 3 pisos con 90 puestos por piso. Actualmente tiene una red Ethernet de 100Mbps que tiene 7 años de antigüedad y desea migrar a 1Gbps toda la red interna.

El negocio esta en crecimiento, siguen aumentando la cantidad de afiliados y la red actual puede soportar dicho crecimiento. Los prestadores médicos a veces tardan en conectarse a la sede central y entonces hacen facturas escritas a los afiliados y luego las rinden a la empresa de medicina.

Desafío |

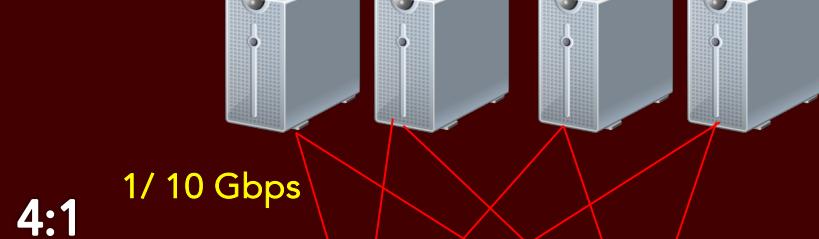
Como presentaría el caso en la empresa para pedir presupuesto
Armar la red con dos proveedores, grafique el esquema y
los modelos de los equipos

Describa los beneficios que le provee a la empresa
Analice las posibilidades del cableado. Costos?



Types of Ethernet	Bandwidth	Cable Type	Duplex	Maximum Distance
10Base-5	10 Mbps	Thicknet Coaxial	Half	500 m
10Base-2	10 Mbps	Thinnet Coaxial	Half	185 m
10Base-T	10 Mbps	Cat3/Cat5 UTP	Half	100 m
100Base-T	100 Mbps	Cat5 UTP	Half	100 m
100Base-TX	200 Mbps	Cat5 UTP	Full	100 m
100Base-FX	100 Mbits	Multimode Fiber	Half	400 m
100Base-FX	200 Mbps	Multimode Fiber	Full	2 km
1000Base-T	1 Gbps	Cat 5e UTP	Full	100 m
1000Base-TX	1 Gbps	Cat 6 UTP	Full	100 m
1000Base-SX	1 Gbps	Multimode Fiber	Full	550 m
1000Base-LX	1 Gbps	Single-Mode Fiber	Full	5 km
10GBase-CX4	10 Gbps	Twinaxial	Full	15 m
10GBase-T	10 Gbps	Cat6a/Cat7 UTP	Full	100 m
10GBase-LX4	10 Gbps	Multimode Fiber	Full	300 m
10GBase-LX4	10 Gbps	Single-mode Fiber	Full	10 km

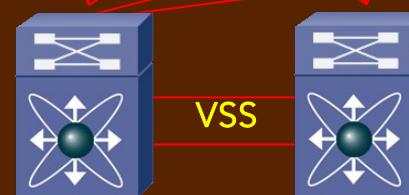
DATA CENTER



4:1
1 / 10 Gbps

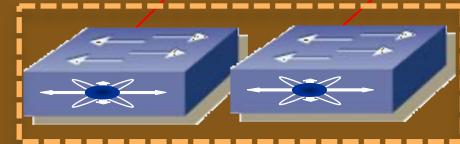
CORE

Catalyst 4500
Sup VIII
VSS
Layer 3

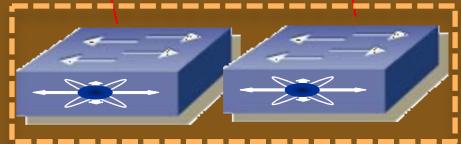


4.8:1

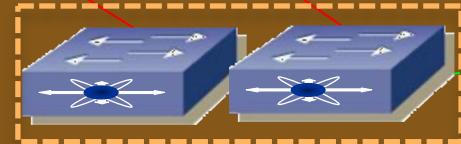
ACCESS



Catalyst 2960-S
Layers 2 | Stack | PoE



Catalyst 2960-S
Layers 2 | Stack | PoE



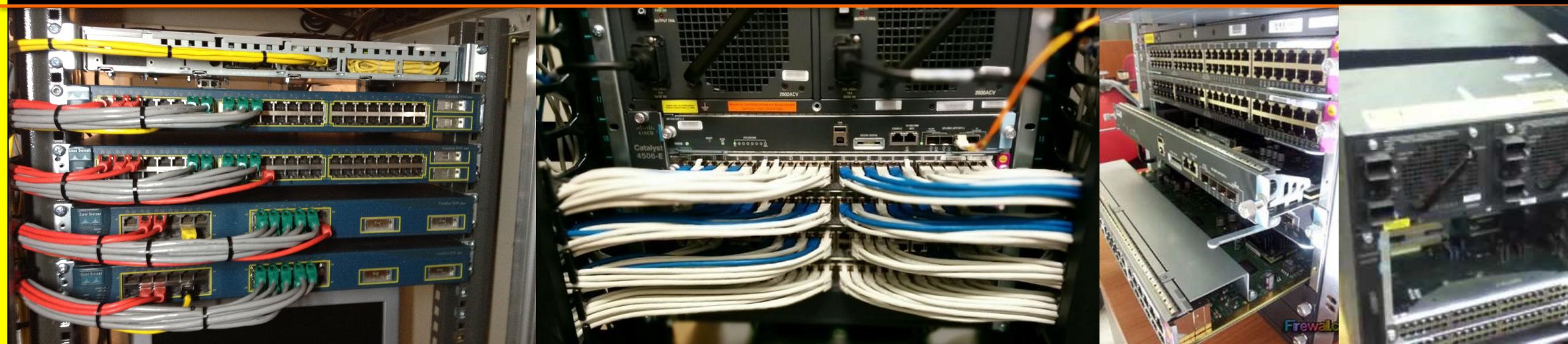
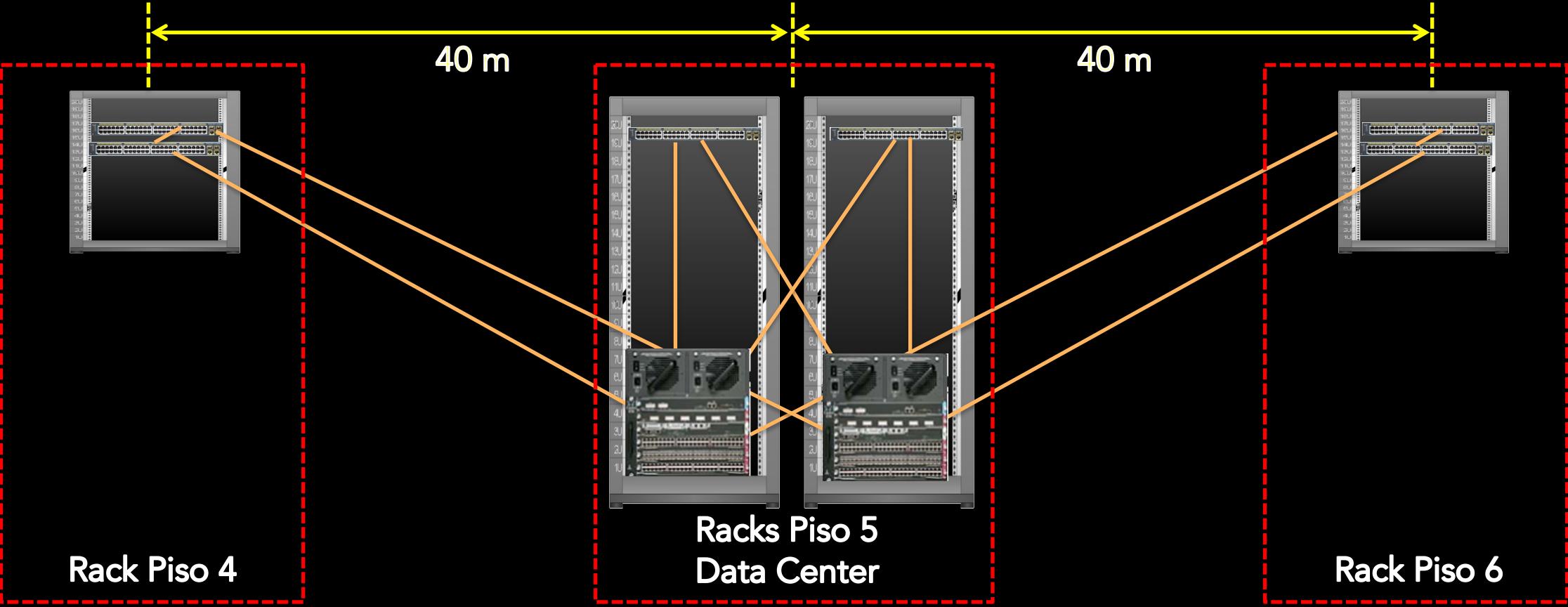
Catalyst 2960-S
Layers 2 | Stack | PoE

2 Gbps

2 Gbps



Nota: Cableado sujeto a relevamiento | Confeccionarlo con Cisco ONE



Part Number	Description	Service Duration (Months)	Lead Time	Unit List Price	Qty	Unit Net Price	Disc(%)	Extended Net Price
C1-C4506-E	Cisco ONE Cat4500 E-Series 6-Slot Chassis, fan, no ps	---	21	4,995.00	1	4,995.00	0.00	4,995.00
CON-SNT-C1C4506E	SNTC-8X5XNBD Csco1 C4500 ESeries 6-Slot Chass,fan, no ps	12	N/A	1,478.00	1	1,478.00	0.00	1,478.00
S45EU-S8-38E	CAT4500e SUP8e Universal Image	---	21	0.00	1	0.00	0.00	0.00
C4K-SLOT-CVR-E	Catalyst 4500 E-Series Family Slot Cover	---	21	0.00	3	0.00	0.00	0.00
WS-X45-SUP8-E	Catalyst 4500 E-Series Supervisor 8-E	---	28	19,995.00	1	19,995.00	0.00	19,995.00
WS-X4248-FE-SFP	Catalyst 4500 48-Port 100BASE-X (SFPs Optional)	---	21	8,044.00	1	8,044.00	0.00	8,044.00
WS-X4712-SFP+E	Catalyst 4500 E-Series 12-Port 10GbE (SFP+)	---	21	26,995.00	1	26,995.00	0.00	26,995.00
SFP-10G-LR	10GBASE-LR SFP Module	---	14	3,995.00	1	3,995.00	0.00	3,995.00
SFP-10G-SR	10GBASE-SR SFP Module	---	14	995.00	1	995.00	0.00	995.00
SFP-H10GB-CU3M	10GBASE-CU SFP+ Cable 3 Meter	---	14	100.00	1	100.00	0.00	100.00
PWR-C45-4200ACV	Catalyst 4500 4200W AC dual input Power Supply (Data + PoE)	---	21	2,995.00	1	2,995.00	0.00	2,995.00
PWR-C45-4200ACV/2	Catalyst 4500 4200W AC dual input Power Supply (Data + PoE)	---	21	2,995.00	1	2,995.00	0.00	2,995.00
C1FBPCAT4500S	Cisco ONE Foundation Perpetual Cat4500 Bundles Std	---	21	10,200.00	1	10,200.00	0.00	10,200.00
CON-ECMU-C1FBC45S	SWSS UPGRADES C1 FND Perpetual Cat4500 Bndl Std	12	N/A	1,530.00	1	1,530.00	0.00	1,530.00
C1-PI-LFAS-4K6K-K9	Cisco ONE PI Device License for LF & AS for Cat 4k, 6k	---	21	0.00	1	0.00	0.00	0.00
C1-EGW-150-K9	Cisco ONE Energy Mgmt Perpetual Lic - 150 DO End Points	---	14	0.00	1	0.00	0.00	0.00
C1-ISE-BASE-CAT4K	Cisco ONE Identity Services Engine 150 EndPoint Base Lic	---	14	0.00	1	0.00	0.00	0.00
C1-CAND-1	Cisco ONE Connected Analytics Net Deployment -1 Dev Lic 1 YR	---	21	0.00	1	0.00	0.00	0.00
C1FBVCAT4500S-01	Tracker PID v01 Fnd Perpetual CAT4500S - no delivery	---	21	0.00	1	0.00	0.00	0.00
CAB-IR2073-C19-AR	IRSM 2073 to IEC-C19 14ft Argen	---	21	0.00	4	0.00	0.00	0.00
C1-PI-LFAS-2K3K-K9	Cisco ONE PI Device License for LF & AS for Cat 2k, 3k	---	21	0.00	1	0.00	0.00	0.00
C1-ISE-BASE-48P	Cisco ONE Identity Services Engine 50 EndPoint Base Lic	---	14	0.00	1	0.00	0.00	0.00
C1-EGW-50-K9	Cisco ONE Energy Mgmt Perpetual Lic - 50 DO End Points	---	14	0.00	1	0.00	0.00	0.00
C1-CAND-1	Cisco ONE Connected Analytics Net Deployment -1 Dev Lic 1 YR	---	21	0.00	1	0.00	0.00	0.00
C1F1VCAT29002-01	Tracker PID v01 Fnd Perpetual CAT29002 - no delivery	---	14	0.00	1	0.00	0.00	0.00
C2960X-STACK	Catalyst 2960-X FlexStack Plus Stacking Module	---	14	1,195.00	1	1,195.00	0.00	1,195.00
CAB-STK-E-0.5M	Cisco FlexStack 50cm stacking cable	---	14	0.00	1	0.00	0.00	0.00

Part Number	Description	Service Duration (Months)	Lead Time	Unit List Price	Qty	Unit Net Price	Disc(%)	Extended Net Price
C1-C2960X-48FPS-L	Catalyst 2960-X 48 GigE PoE 740W, 4 x 1G SFP, LAN Base	---	14	6,595.00	1	6,595.00	0.00	6,595.00
CON-SNT-2948FPL	SNTC-8X5XNBD Cat 2960-X 48 GigE PoE 740W,4x1G SFP	12	N/A	396.00	1	396.00	0.00	396.00
CAB-ACR	AC Power Cord (Argentina), C13, EL 219 (IRAM 2073), 2.5m	---	21	0.00	1	0.00	0.00	0.00
C1FPCAT29002K9	Cisco ONE Foundation Perpetual - Catalyst 2900 48 Port	---	21	200.00	1	200.00	0.00	200.00
CON-ECMU-C1FPC292	SWSS UPGRADES C1 FND Perpetual - Cat2900 48 Port	12	N/A	30.00	1	30.00	0.00	30.00
C1-PI-LFAS-2K3K-K9	Cisco ONE PI Device License for LF & AS for Cat 2k, 3k	---	21	0.00	1	0.00	0.00	0.00
C1-ISE-BASE-48P	Cisco ONE Identity Services Engine 50 EndPoint Base Lic	---	14	0.00	1	0.00	0.00	0.00
C1-EGW-50-K9	Cisco ONE Energy Mgmt Perpetual Lic - 50 DO End Points	---	14	0.00	1	0.00	0.00	0.00
C1-CAND-1	Cisco ONE Connected Analytics Net Deployment -1 Dev Lic 1 YR	---	21	0.00	1	0.00	0.00	0.00
C1F1VCAT29002-01	Tracker PID v01 Fnd Perpetual CAT29002 - no delivery	---	14	0.00	1	0.00	0.00	0.00
C2960X-STACK	Catalyst 2960-X FlexStack Plus Stacking Module	---	14	1,195.00	1	1,195.00	0.00	1,195.00
CAB-STK-E-0.5M	Cisco FlexStack 50cm stacking cable	---	14	0.00	1	0.00	0.00	0.00
C1-C2960X-48FPD-L	Catalyst 2960-X 48 GigE PoE 740W, 2 x 10G SFP+, LAN Base	---	14	7,995.00	1	7,995.00	0.00	7,995.00
CON-SNT-2948FPDL	SNTC-8X5XNBD Cat 2960-X 48 GigE PoE 740W,2x10G SFP+	12	N/A	480.00	1	480.00	0.00	480.00
CAB-ACR	AC Power Cord (Argentina), C13, EL 219 (IRAM 2073), 2.5m	---	21	0.00	1	0.00	0.00	0.00
C1FPCAT29002K9	Cisco ONE Foundation Perpetual - Catalyst 2900 48 Port	---	21	200.00	1	200.00	0.00	200.00
CON-ECMU-C1FPC292	SWSS UPGRADES C1 FND Perpetual - Cat2900 48 Port	12	N/A	30.00	1	30.00	0.00	30.00
C1-PI-LFAS-2K3K-K9	Cisco ONE PI Device License for LF & AS for Cat 2k, 3k	---	21	0.00	1	0.00	0.00	0.00
C1-ISE-BASE-48P	Cisco ONE Identity Services Engine 50 EndPoint Base Lic	---	14	0.00	1	0.00	0.00	0.00
C1-EGW-50-K9	Cisco ONE Energy Mgmt Perpetual Lic - 50 DO End Points	---	14	0.00	1	0.00	0.00	0.00
C1-CAND-1	Cisco ONE Connected Analytics Net Deployment -1 Dev Lic 1 YR	---	21	0.00	1	0.00	0.00	0.00
C1F1VCAT29002-01	Tracker PID v01 Fnd Perpetual CAT29002 - no delivery	---	14	0.00	1	0.00	0.00	0.00
C2960X-STACK	Catalyst 2960-X FlexStack Plus Stacking Module	---	14	1,195.00	1	1,195.00	0.00	1,195.00
CAB-STK-E-0.5M	Cisco FlexStack 50cm stacking cable	---	14	0.00	1	0.00	0.00	0.00

1

Redes de Datos

LAN | Las redes de área local | Ethernet



Preguntas



Comentarios