

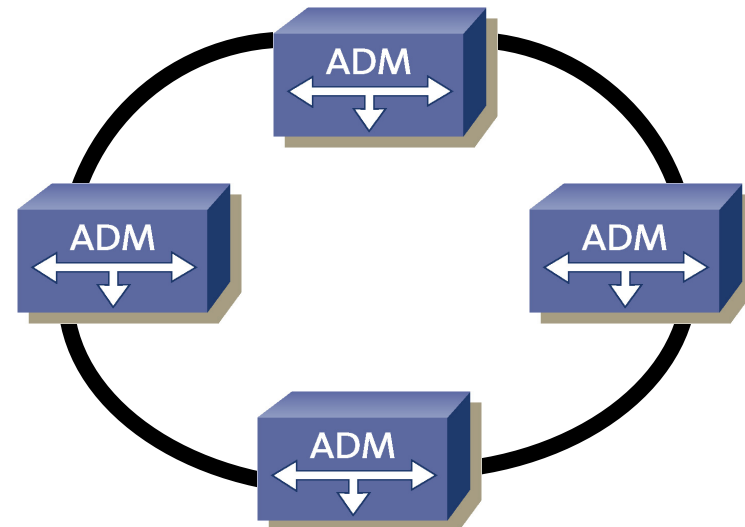
Protección en anillos SDH

Area de Ingeniería Telemática
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Redes de Banda Ancha
5º Ingeniería de Telecomunicación

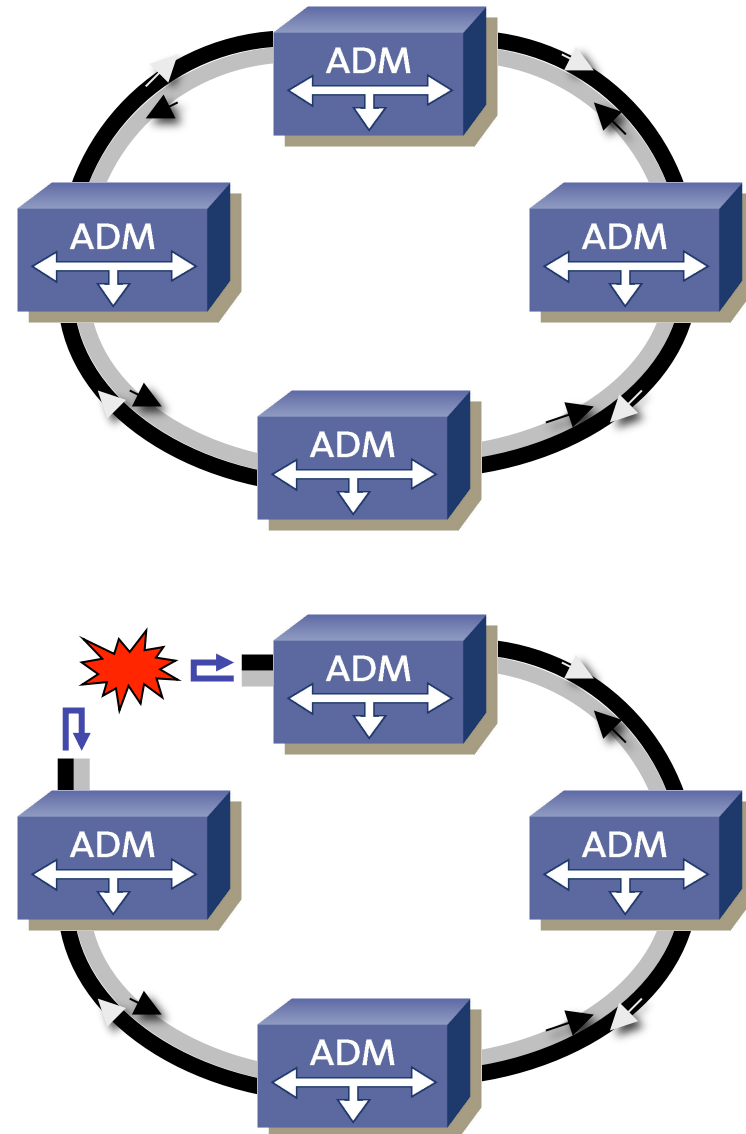
Anillos

- Perfectos para ADMs con solo 2 puertos de agregados
 - Más simples que DXCs
 - Más baratos que DXCs
 - Disponibles antes que DXCs
- ¡ Sencillas decisiones de encaminamiento !
- Existe un camino alternativo para protección
- Técnicas de protección:
 - MS-SP Ring
 - MS-DP Ring
 - SNCP Ring

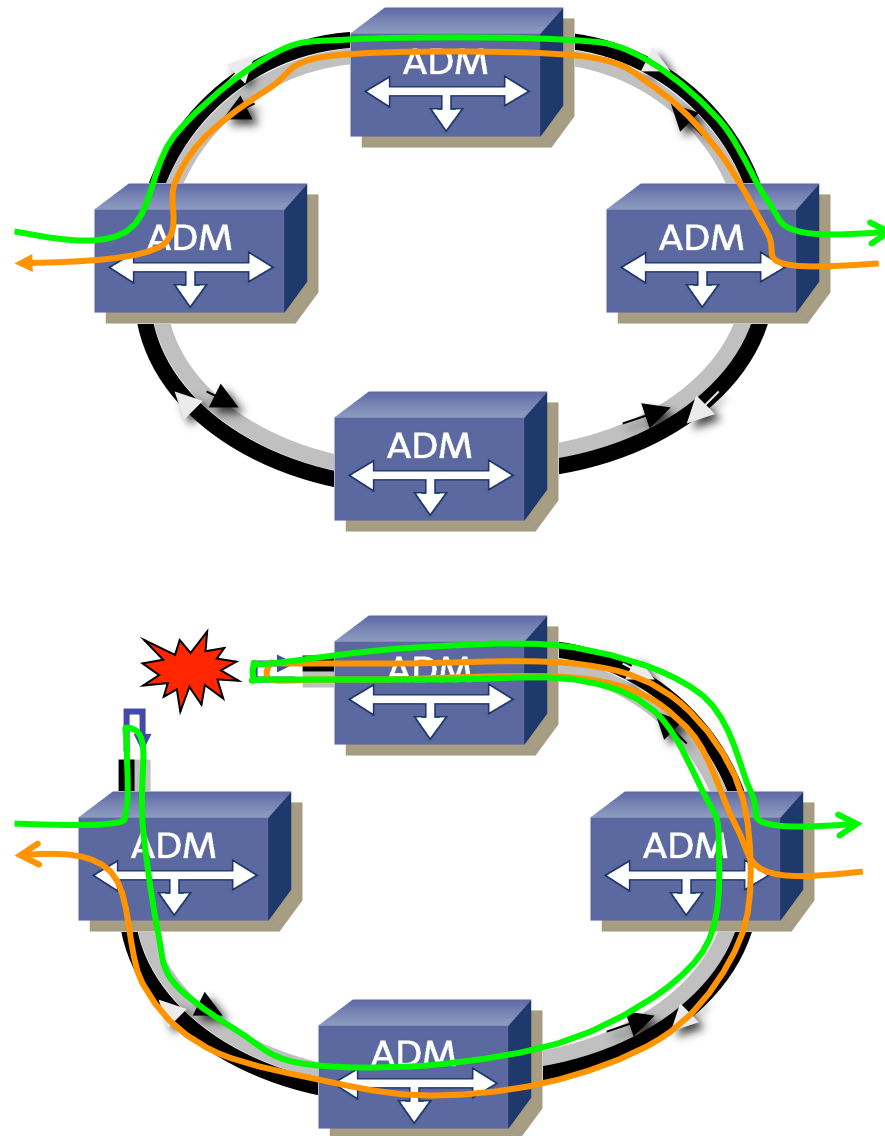


MS-SP Ring

- *Multiplex Section - Shared Protection Ring*
- Se emplea solo **la mitad** de la capacidad en cada sentido (*clockwise y counterclockwise*)
- Máximo 16 nodos
- Ante un fallo:
 - Nodos adyacentes lo detectan
 - Devuelven el tráfico por el otro sentido
- Ejemplo con 2 fibras (...)

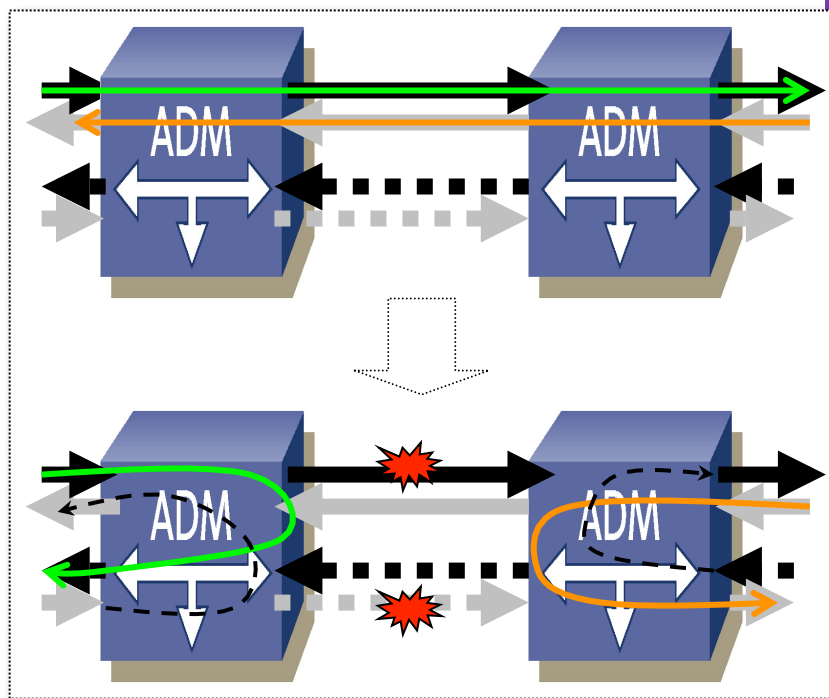
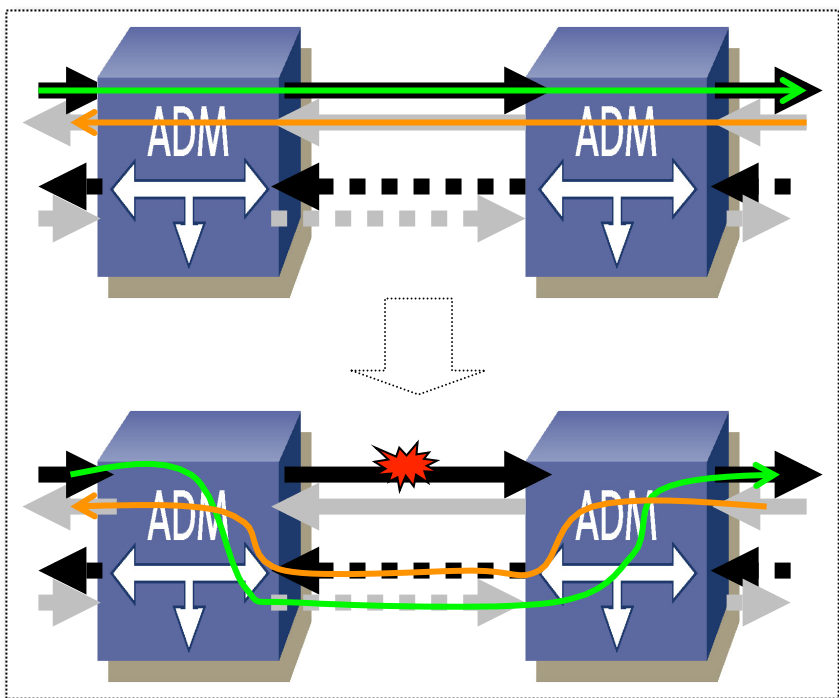
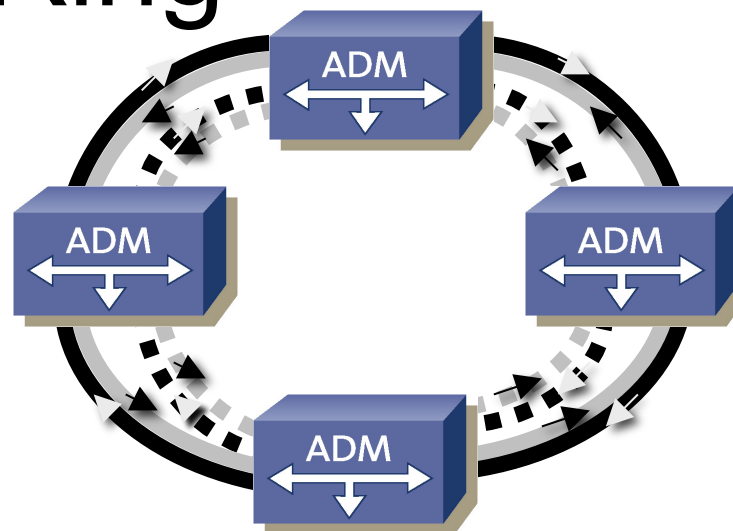


MS-SP Ring (Ejemplo)



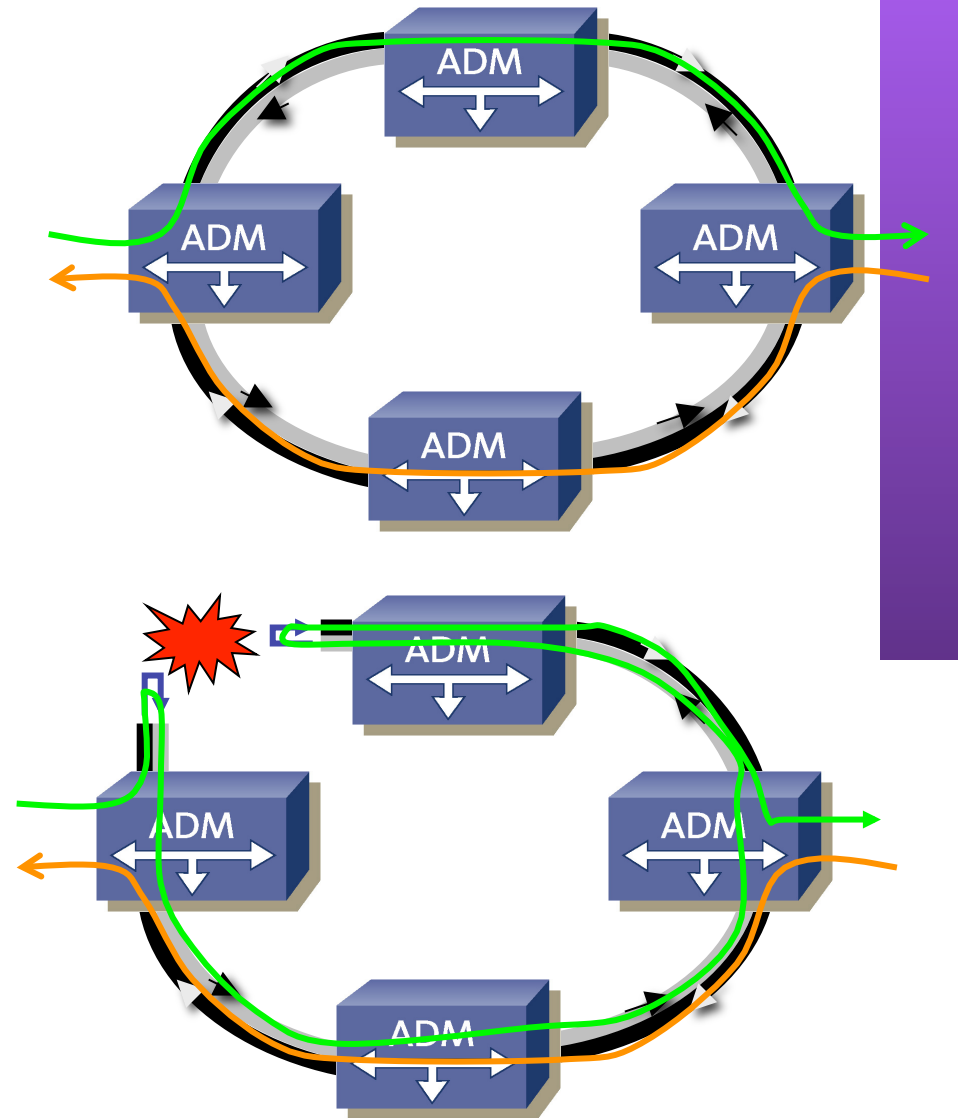
MS-SP Ring

- Con 4 fibras
- Un par dedicado a *working capacity*
- Segundo par como *spare/protection capacity*



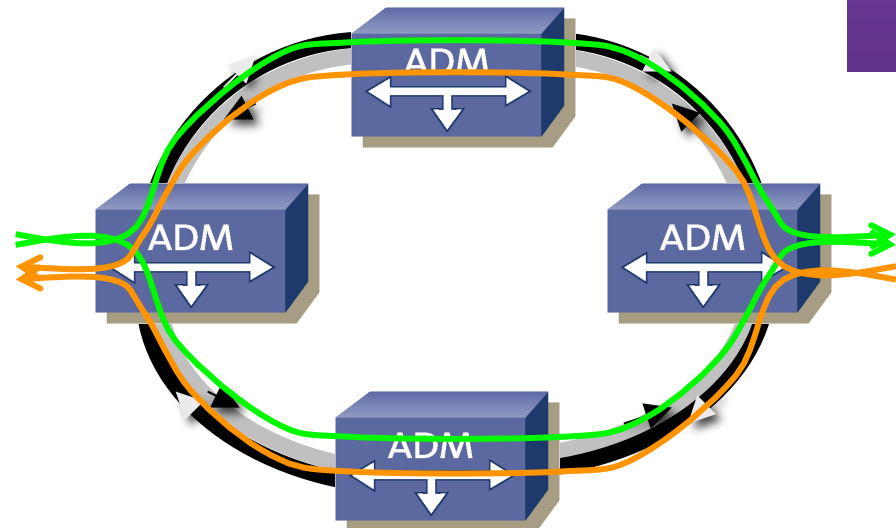
MS-DP Ring

- *Multiplex Section-Dedicated Protection Ring*
- Cada sentido de una conexión bidireccional emplea un camino distinto siguiendo un sentido del anillo
- El sentido contrario sería el backup
- Un inconveniente es que cada conexión bidireccional consume BW en todo el anillo
- Máximo 16 nodos (por limitaciones en señalización)



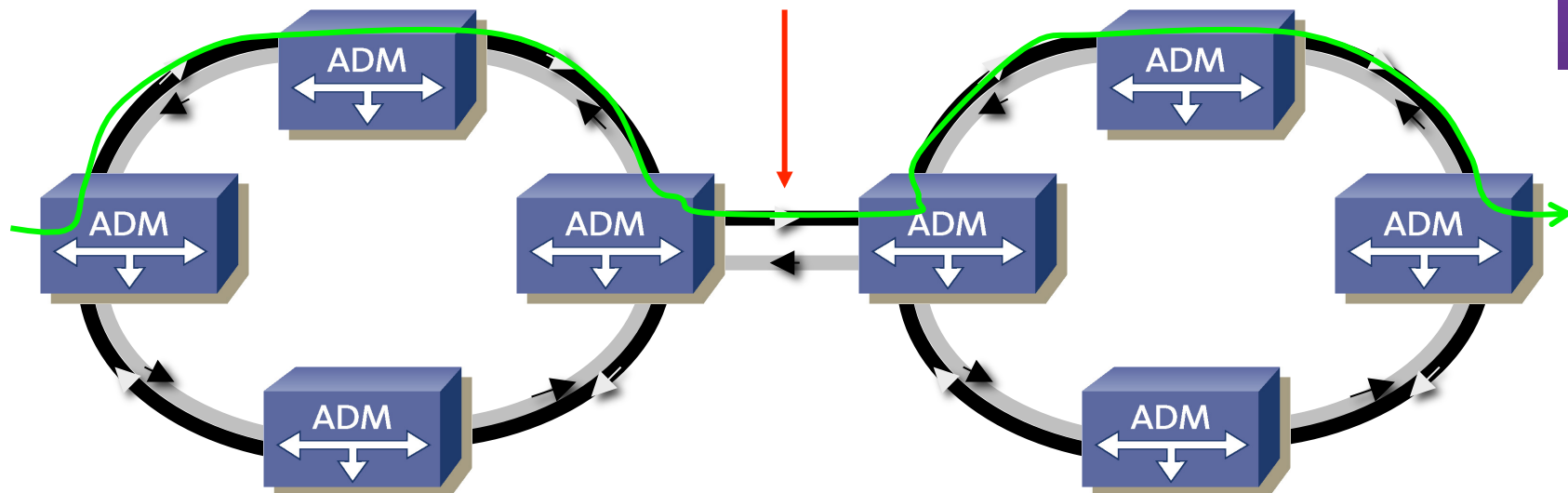
SNCP Ring

- *Subnetwork Connection Protection Ring*
- Misma filosofía que SNCP pero empleada en un anillo
- Cada conexión unidireccional emplea ambos caminos en el anillo (es un 1+1)
- No tiene la limitación de 16 nodos
- Soporta el fallo de un nodo



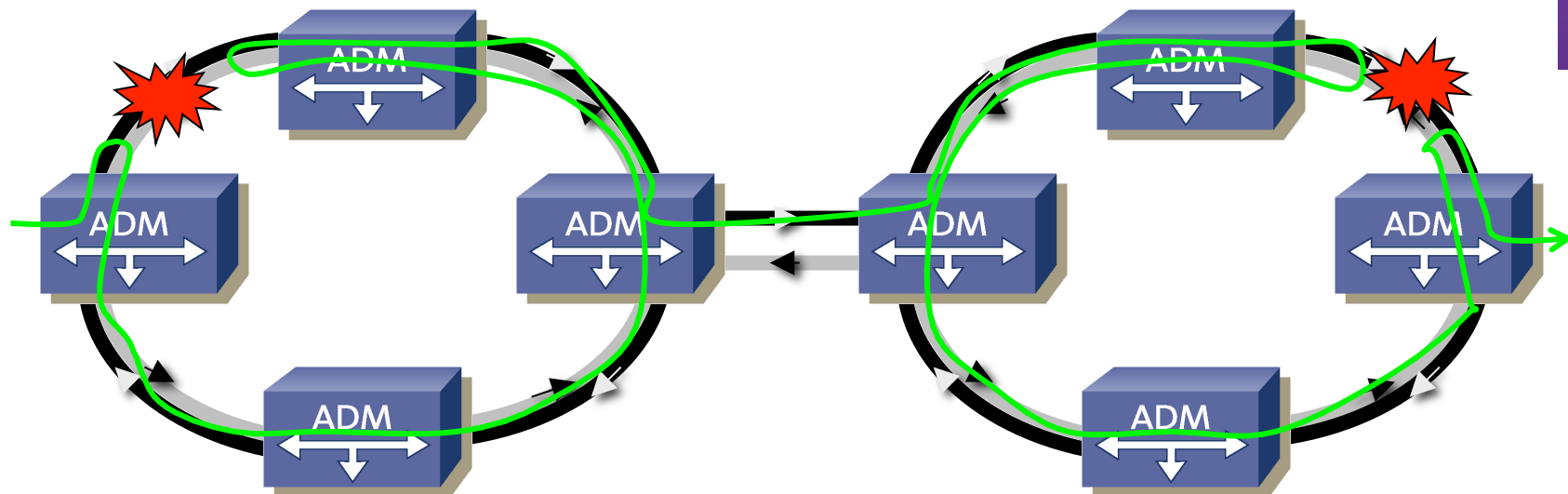
Interconexión de anillos

- Las redes SDH normalmente están formadas por varios anillos
- Un inconveniente es que la unión entre ellos puede ser un punto de fallo

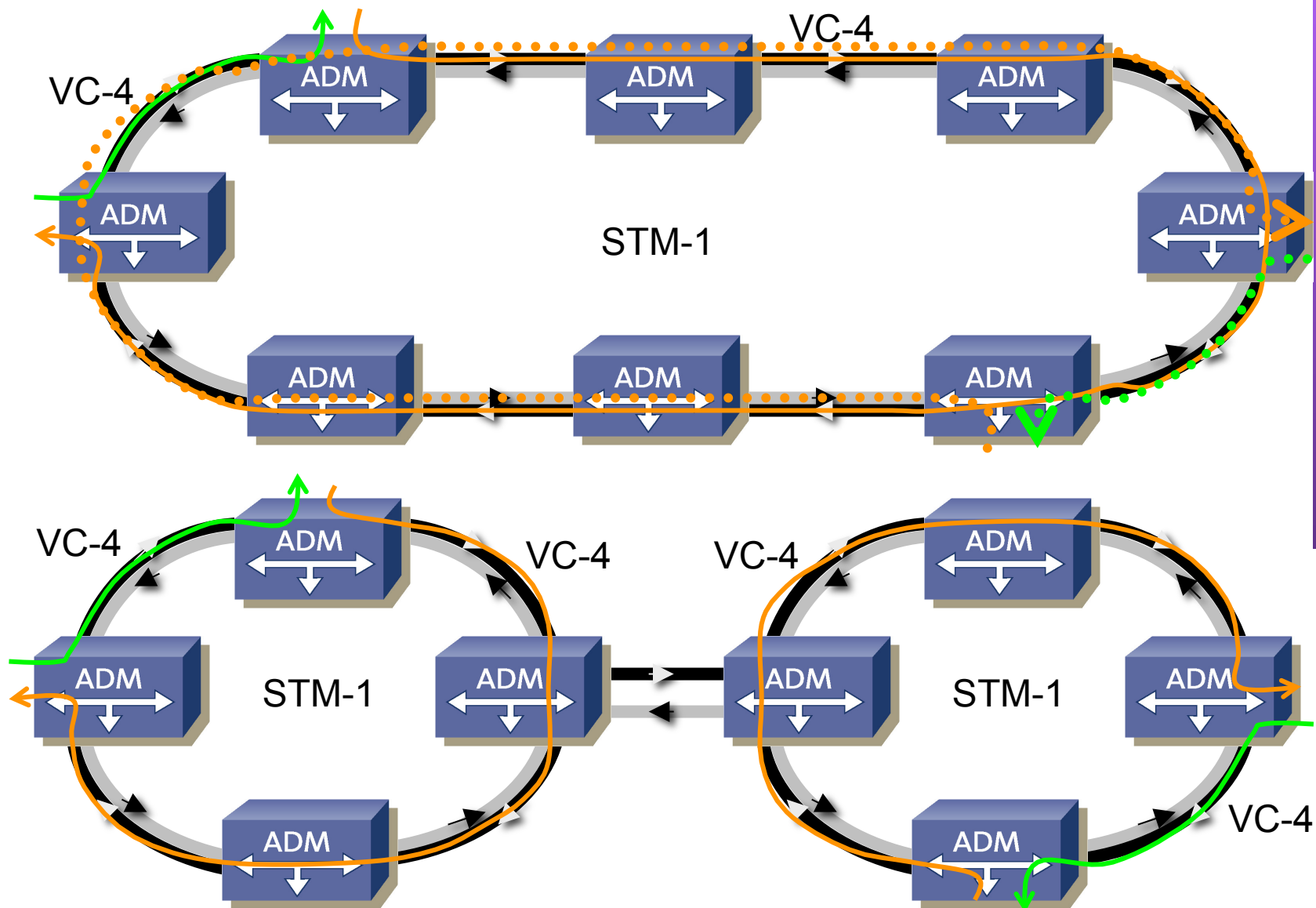


Interconexión de anillos

- Las redes SDH normalmente están formadas por varios anillos
- Un inconveniente es que la unión entre ellos puede ser un punto de fallo
- Una ventaja frente a un solo anillo es que soportan fallos dobles simultáneos si se dan en diferentes anillos
- Además permiten separar el tráfico local para que no ocupe todo el anillo (...)

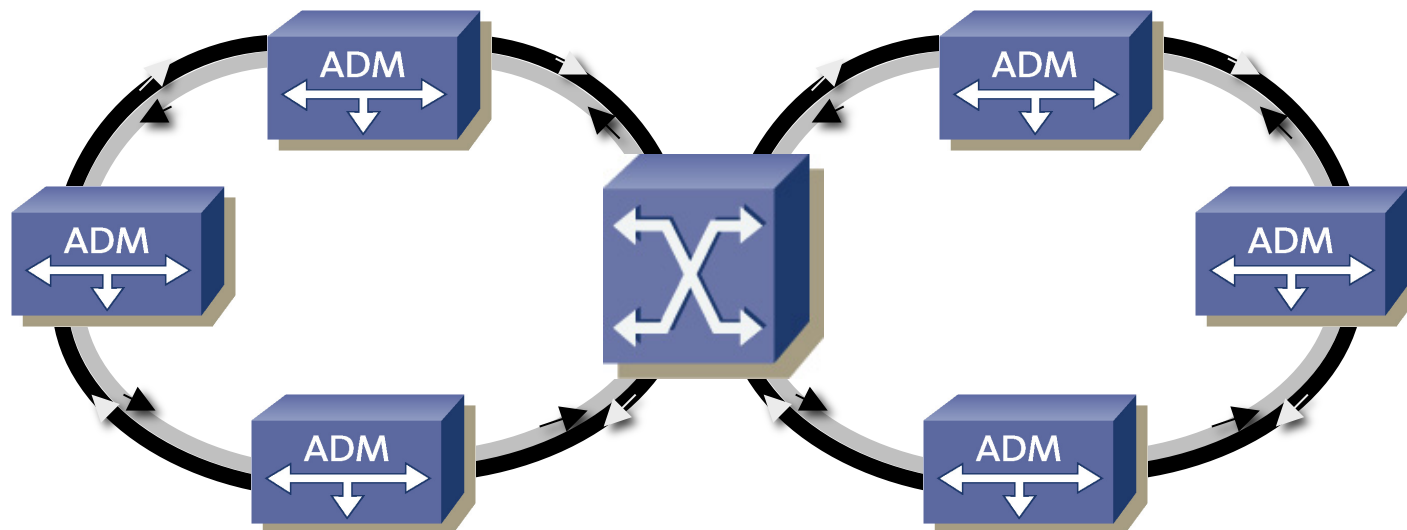


Interconexión de anillos



Interconexión de anillos

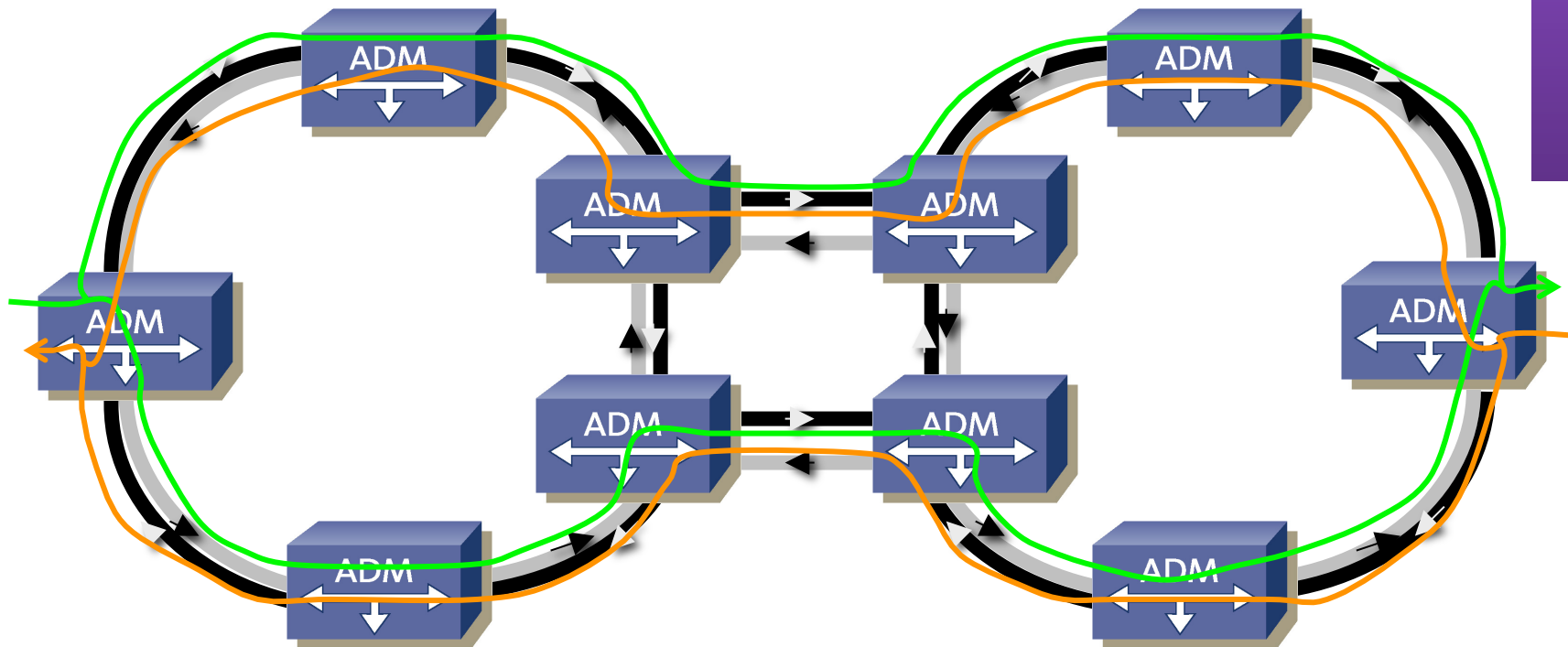
- Se puede tener mayor flexibilidad interconectando los anillos con un DXC



Protección en la interconexión

Virtual Ring interconnection

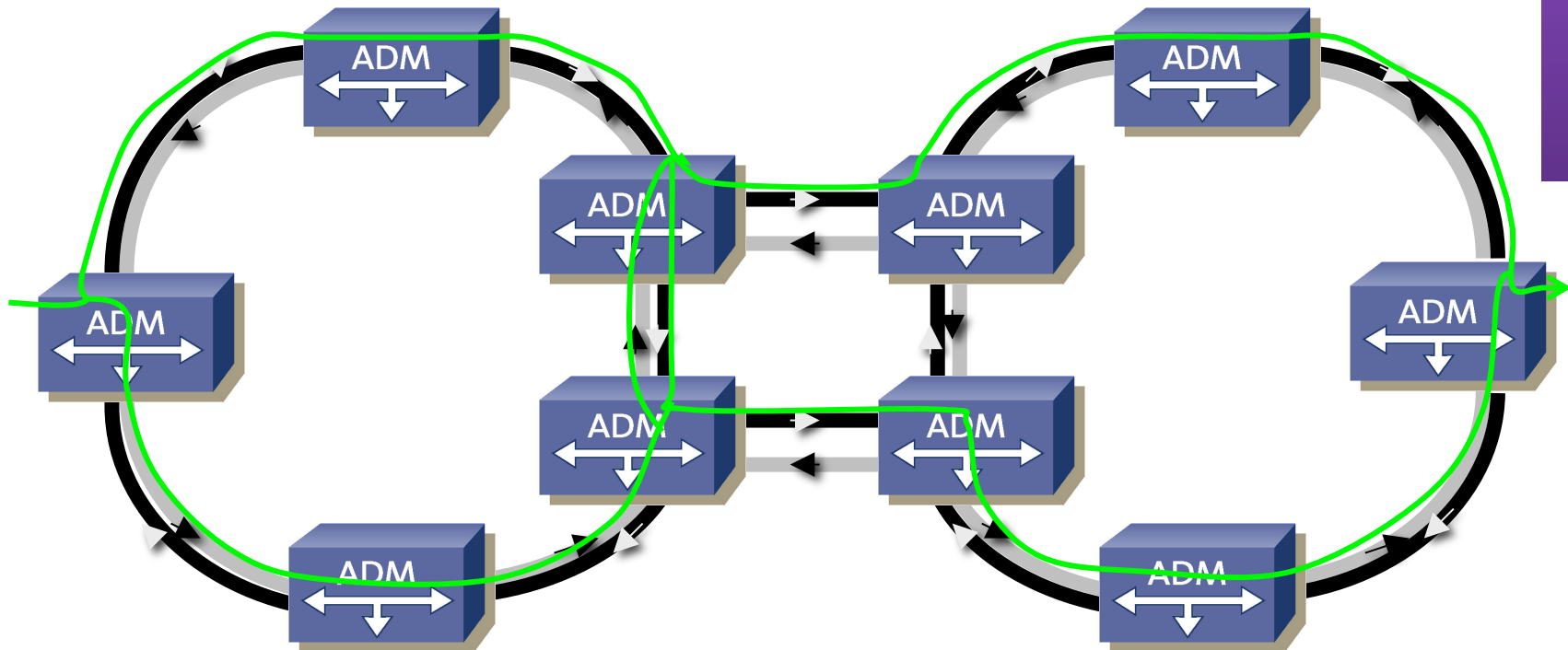
- Similar a SNCP, se usan simultáneamente (1+1) dos caminos por diferentes *gateways*



Protección en la interconexión

D&C (Drop and Continue)

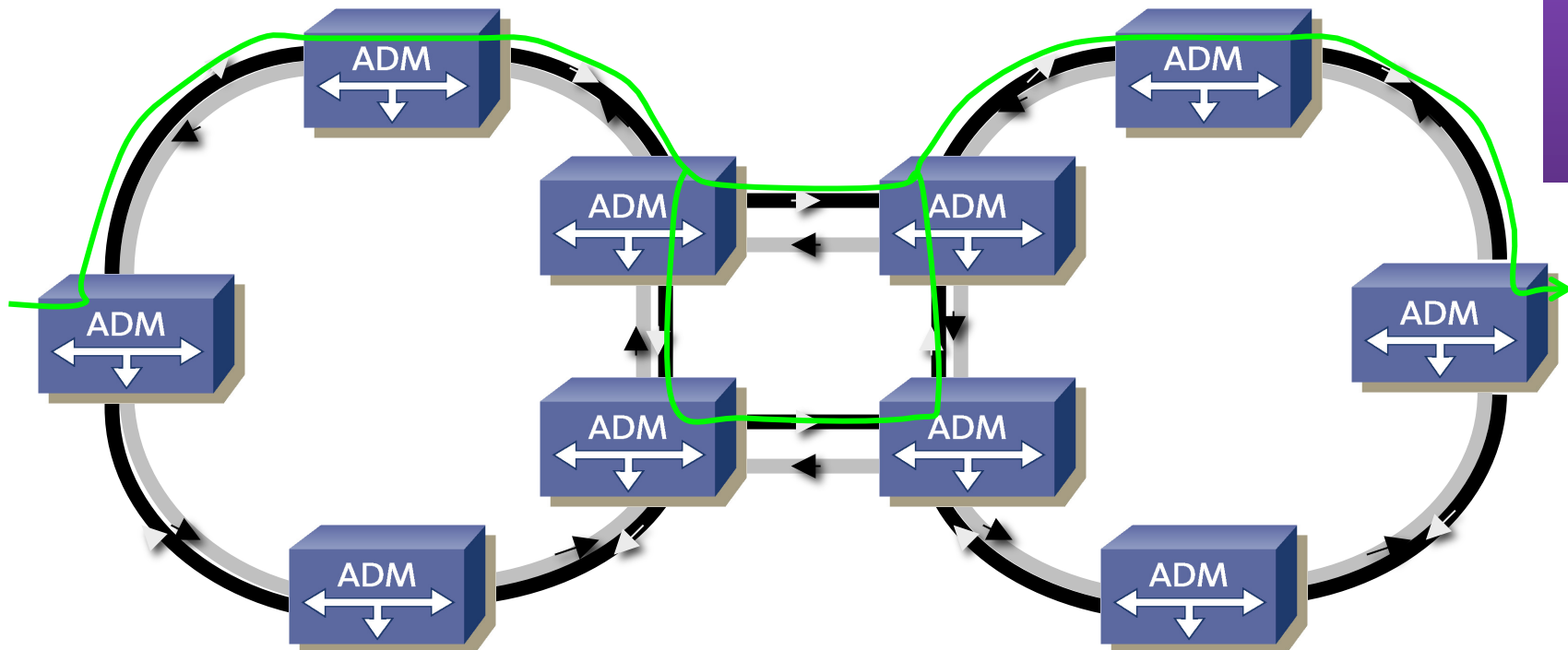
- La señal continúa hasta el siguiente *gateway*
- Puede conectar anillos SNCP



Protección en la interconexión

D&C (Drop and Continue)

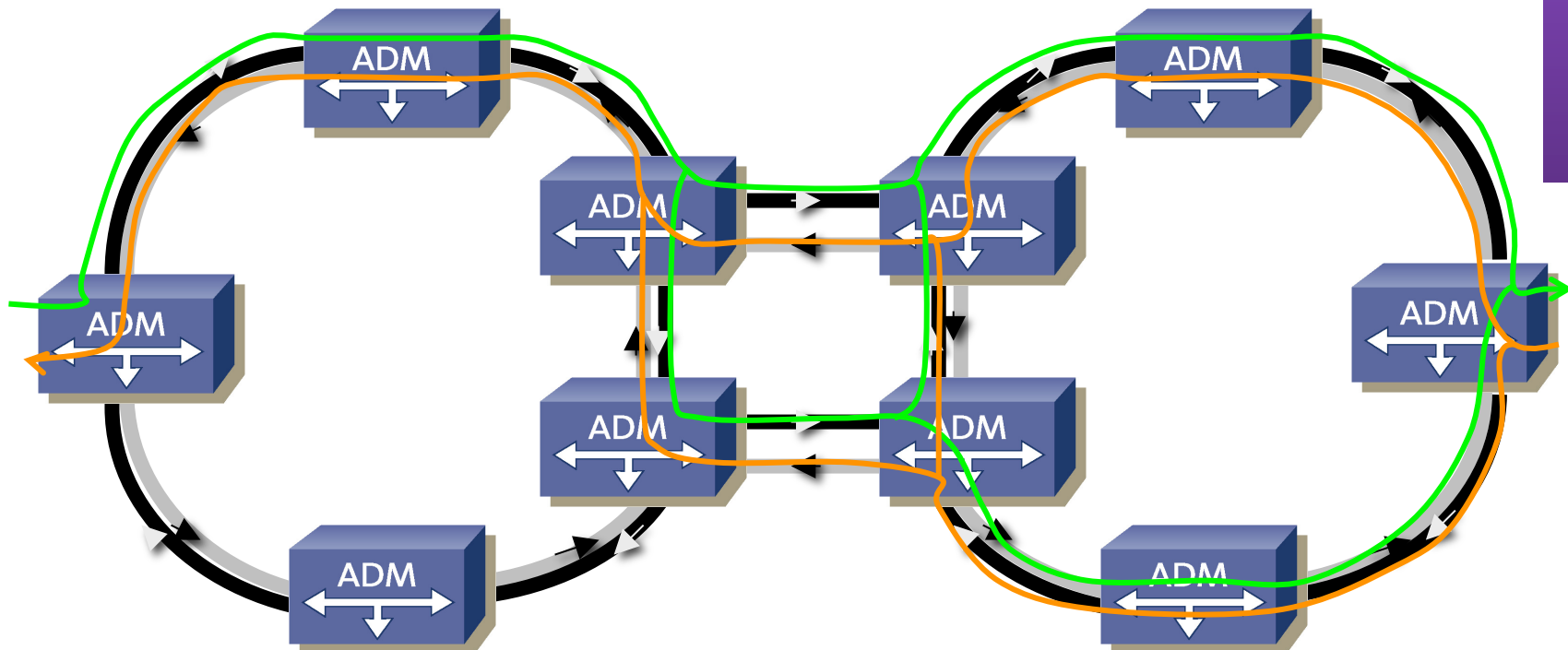
- La señal continúa hasta el siguiente *gateway*
- También puede conectar anillos MS-SP



Protección en la interconexión

D&C (Drop and Continue)

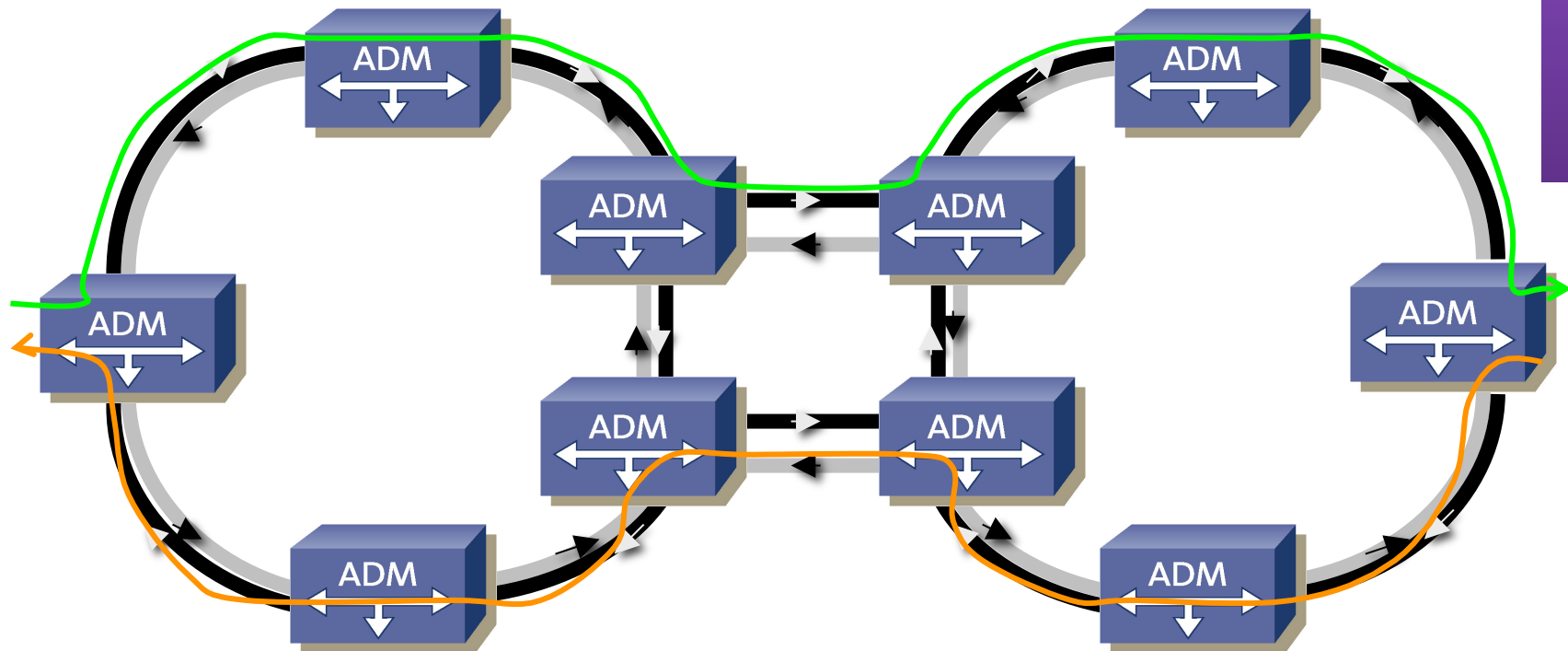
- La señal continúa hasta el siguiente *gateway*
- O un anillo MS-SP con un SNCP



Protección en la interconexión

Anillos MS-DP

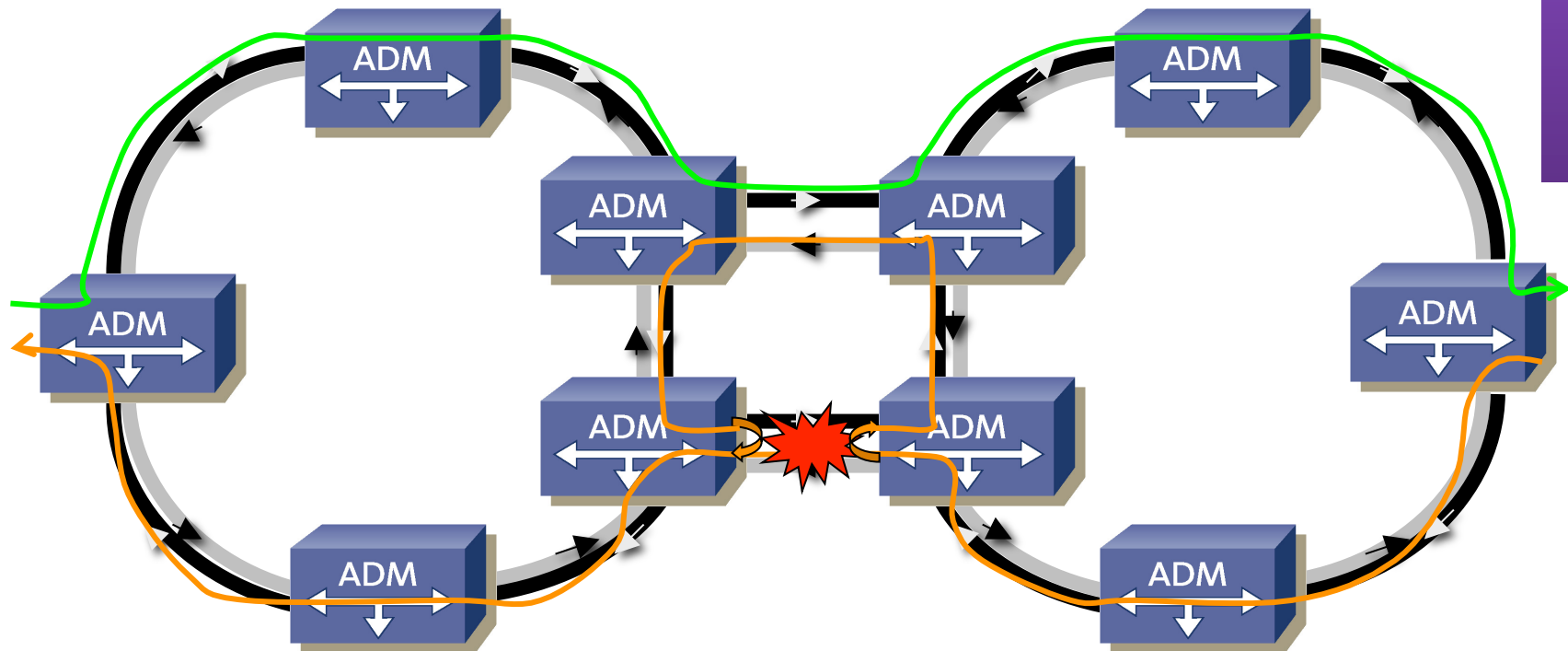
- Similar a un D&C (...)



Protección en la interconexión

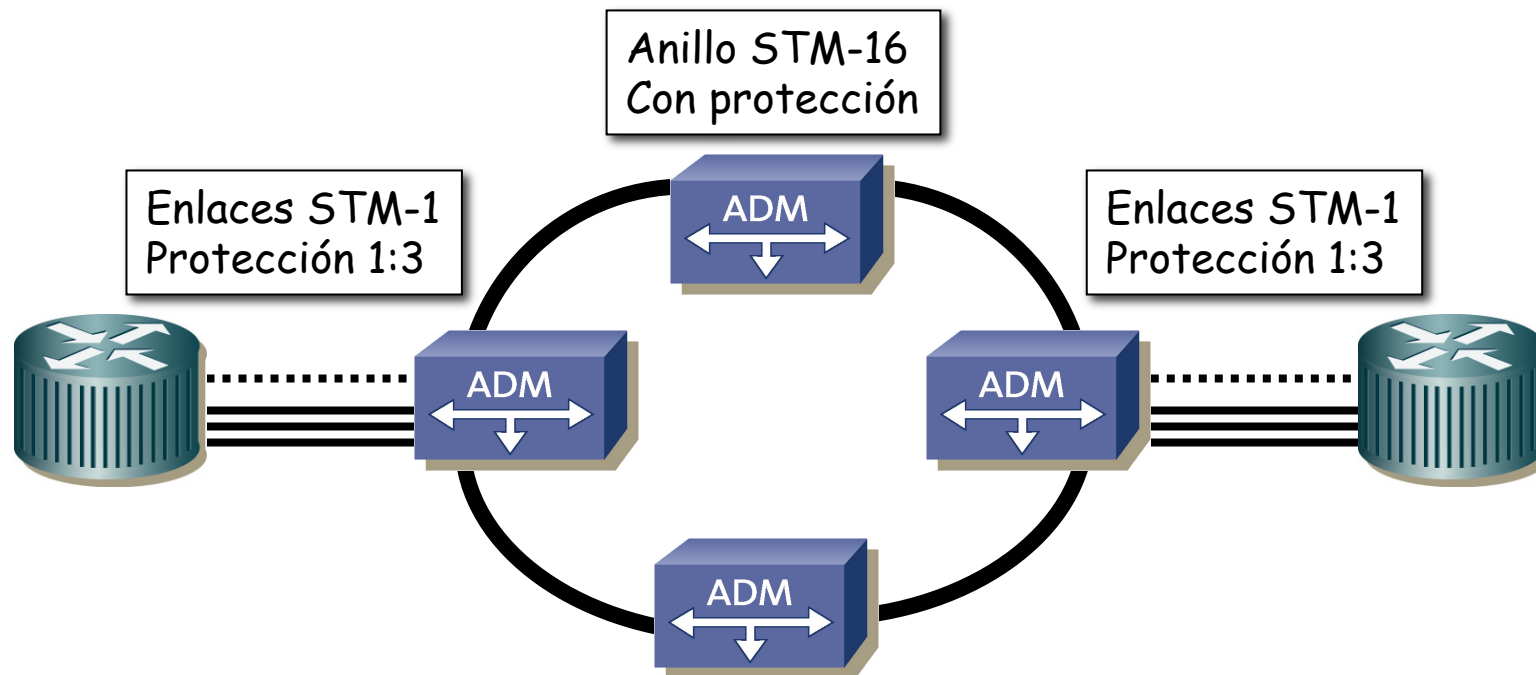
Anillos MS-DP

- Similar a un D&C (...)



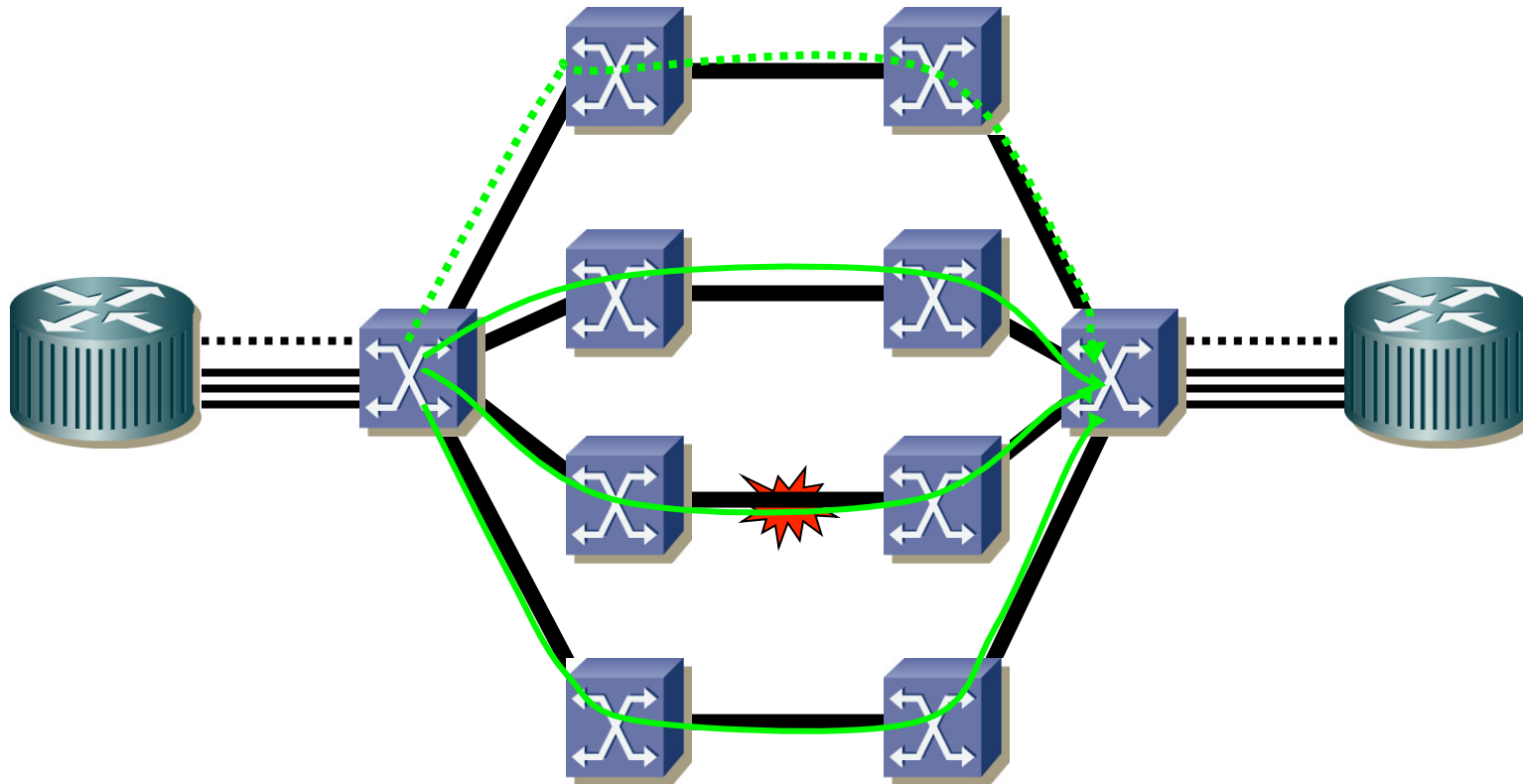
Ejemplo

- Protección de sección



Más posibilidades

- Protección del camino en vez de sección
- Hay que terminar los VCs



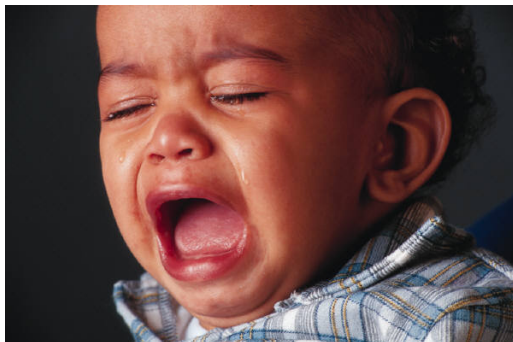
Protection vs Restoration

- *Protection* implica soluciones de backup precalculadas y preconfiguradas
- El tiempo de recuperación es muy corto
- Requiere reservar considerables recursos para la protección
- *Restoration* implica calcular la solución (camino alternativo) cuando se produce el fallo
- El fallo se comunica al NMS (*Network Management System*)
- El NMS calcula un camino alternativo y lo configura
- Mayores tiempo de recuperación



Bad things happen

- Los fallos pueden ser de un enlace: separar los caminos físicos que usan las fibras en uso y de protección
- Pueden fallar las tarjetas (soluciones 1:N)



- Puede fallar el nodo: soluciones que protejan ante ese tipo de fallos (por ejemplo SNCP)
- ¡ Fallos múltiples !

Equipos PDH y SDH

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5º Ingeniería de Telecomunicación

Equipos PDH y SONET/SDH

- CSU/DSU
- Interfaz E1 para Router
- Puerto POS STM-4c para Router
- STM-1/4 Multi-Service Node
- MultiService Platform
- MSPPs

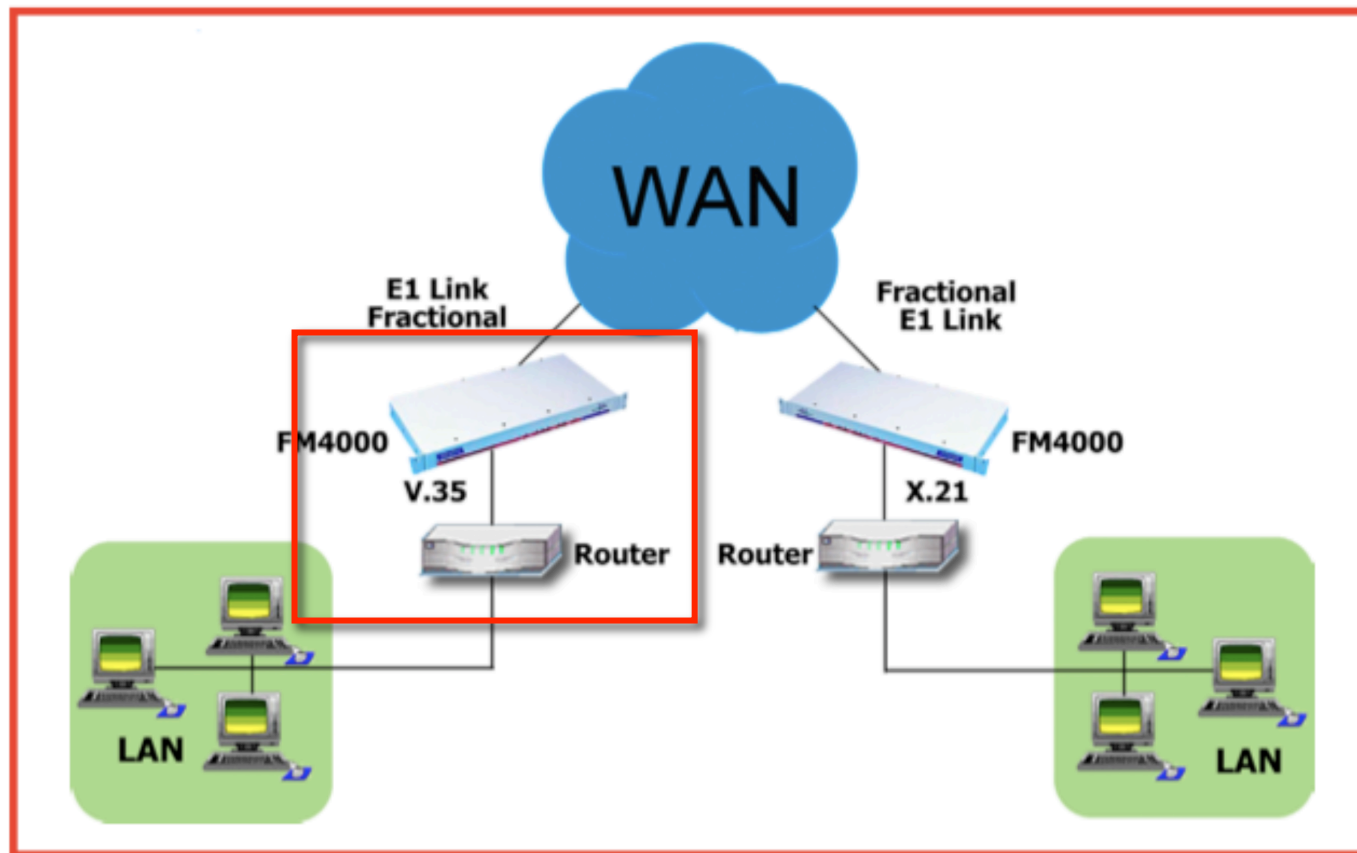
Equipos PDH y SONET/SDH

- **CSU/DSU**
- Interfaz E1 para Router
- Puerto POS STM-4c para Router
- STM-1/4 Multi-Service Node
- MultiService Platform
- MSPPs

CSU/DSU

FM4000

Application Diagram



CSU/DSU

FM4000

E1 (n*64k) G.703/G.704
X.21/ V.35 Converter

- High Speed E1 G.703 2.048 Mbps interfacing
- Fractional E1 by allowing n*64Kbps channels
- X.21 or V.35 ports
- External Alarm relay port
- Remote configuration and testing of units across the network
- Comprehensive performance monitoring of both device and line
- Optional SNMP management
- Optional -48 volt DC supply



CSU/DSU

The Metrodata FM4000 DSU is used to interface high performance DTE equipment such as bridges or routers to 2.048 Mbps E1 services. The fractional E1 service is allocated on an n*64Kbps basis. The DTE equipment may present an X.21 or a V.35 interface. FM4000s are used in pairs with one unit at either end of the Wide Area link. Error conditions and usage statistics are gathered and stored by the FM4000. Unit set-up is done via a comprehensive menu system which is accessed via a local or remote terminal. The optional Metrodata LM1100 SNMP Enabler permits management via a LAN using an SNMP system.

About Metrodata

Metrodata are experts in network connectivity solutions. Based near London Heathrow Airport, we are leading designers and manufacturers of high performance communication hardware for the Fixed line, Satellite, Wireless, Systems integration, Service provision and Corporate networking communities.

Metrodata connectivity products provide solutions for interface conversion, interface extension and ATM networking from n*64Kbps through to Sonet/SDH.

Metrodata's sound technical and commercial understanding of international data networking issues ensures that we have the solutions for current and future networking needs. Our continuous development program means that Metrodata solutions are state of the art and provide an economic cost of ownership to our customers.



CSU/DSU

Specifications

Line E1 Interface		Status LED & Diagnostics	
Port	G.703, 75 ohm unbalanced, 120 ohm balanced	Loopbacks	Local loop, Remote loop
Framing	G.704 (CRC4 or No CRC4) or Unframed	BERT	2 ¹⁵ -1 PRBS
Interface	BNC (75 ohm), RJ45 (120 ohm)	Statistics	Per G.821, 15min, 24 hour totals
Line coding	HDB3	Major Alarms	LOS, LOF, SQ
Bit rate	2.048 Mbps +/- 50ppm	Minor Alarms	AIS, RAI
Cable length	E1 BNC RG59 = 600m	Data	DTE Tx Data, DTE Rx Data, DTE fault
	E1 BNC UR202 = 750m	Test	Test via menu, Test LED on front panel
	E1 RJ45 Belden 8132 = 175m	Compliance & Approvals	
	E1 RJ45 Belden 9841 = 300m	Performance	G.703, G.704., G.706, G.823
DTE Interface		BNC version	OTR.001 2DS, BABT# NS/4043I/P/603813
Port	X.21 or V.35	RJ45 version	CTR12, CTR 13, BABT# AA606631
Interface	X.21: ISO4903, 15-way D type	Safety	EN41003, EN 60950
	V.35: ISO2593, 34-way M-rack	EMC	EN55022, EN50082
Bit Rate	n*64Kbit/s, n = 1 to 31, or 2.048Mbps	Statistics	G.821, AT&T 54016:15 min, 24hr totals
Configuration & Management		Management	RFC1213 (MIB II), RFC1495 (telnet), RFC1157 (SNMP), RFC1406 (DS1/E1), MetroDte MIB (DSU), RFC1215 (Traps)
Type	Menu driven	Environment	
Access	System console, telnet, SNMP	Temp	0 - 50 deg C
Interface	V.24, Ethernet 10baseT via RJ45	Humidity	0 - 95% RH, non-condensing
Security	Access by 2-level password	Pressure	86 - 106 KPA
System	Non-volatile set-up	Packaging	
Clock modes	Internal, E1 loop or DTE (CCITT cct 113)	Type	1U, 19 inch rackmount
Power supply		Dimensions	435 x 213 x 44 mm (W x D x H)
AC Mains	100-250 VAC, 50-400 Hz, 50mA		
-48 VDC Supply	-36 to -72 VDC, 200-100mA		

Equipos PDH y SONET/SDH

- CSU/DSU
- **Interfaz E1 para Router**
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Interfaz E1 para Router

CISCO ONE AND TWO PORT T1/E1 MULTIFLEX VOICE/WAN INTERFACE CARDS



Flexible multiservice solution supports multiple voice, data and integrated voice/data applications, facilitating the migration from data only or channelized voice and data to packet voice solutions and simplifying deployment, management and sparing.

INTRODUCTION

The Cisco 1 and 2-port T1/E1 Multiflex Voice/WAN Interface Cards ("Multiflex VWICs") support voice, and data applications in Cisco 2600, 2800, 3600, 3700, and 3800 multiservice routers. The Multiflex VWIC combines WAN Interface Card (WIC) and Voice Interface Card (VIC) functionality to provide unparalleled flexibility, versatility and investment protection through its many uses. Customers who choose to integrate voice and data in multiple steps preserve their investment in a T1/E1 WAN interface since the Multiflex VWIC can be reused in packet voice applications.

The T1/E1 Multiflex Voice/WAN Interface Cards are offered in single and dual port versions which can be used and then re-deployed as network requirements change, thereby addressing several applications:

- *Data*—As a WIC for T1/fractional T1, and E1/fractional E1 applications. The 1- and 2- port E1 versions include models that support unframed G.703. To simplify remote management issues the T1 version integrates a fully managed data service unit/channel service unit (DSU/CSU) and the E1 version includes a fully managed DSU.
- *Packet Voice*—As a VIC for the Digital T1/E1 Packet Voice Trunk Network Module (NM-HDV), IP Communication Voice Network Module (NM-HD-2VE), and IP Communication High-Density Voice Network Module (NM-HDV2) to provide T1 or E1 connections to Private Branch Exchanges (PBXs) and central offices (COs) enabling new services and reducing voice/fax toll charges.
- *Multiplexed Voice/Data*—As a dual port T1 or E1 Drop and Insert Multiplexer with integrated DSU/CSUs, reducing the complexity and number of network components and facilitating a graceful migration to bandwidth efficient packet voice.

Interfaz E1 para Router

- Reduces training, deployment, management and sparing inventory over single purpose interfaces Maximizes investment protection
- Multifunction support for LAN to LAN routing, multiplexed voice and data, and packetized voice
- Modules shared between Cisco 2600, 2800, 3600, 3700 and Cisco 3800 series
- E1 versions support both balanced and unbalanced modes
- Specific models to support E1 G.703 unframed for utilizing the full 2.048 Mbps (Note: The G.703 models can also be configured for framed mode where they support all the features of the other VWIC models). Improves branch-office network manageability and reliability
- Eliminates costly external third party CSU/DSUs and drop and insert multiplexers
- Simplifies remote network management by allowing a single management tool such as CiscoView or CiscoWorks to support router, CSU/DSU, drop and insert multiplexer

Maximizes system resources

- Increases T1/E1 port density supported on Cisco 2600, 2800, 3600, 3700 and 3800 multiservice access routers - up to 4 T1/E1 with integrated CSU/DSU in a single Network Module slot or up to two T1/E1 connections in a single WIC slot
- Easy Migration to bandwidth efficient packet voice, enabling new services

Customers who choose to integrate voice and data in stages preserve their investment in WAN interfaces. For example, the Multiflex VWIC can support data only applications as a WAN interface, then be re-used to integrate voice and data with the Drop and Insert multiplexer functionality and/or configured to support packetized voice (Voice over IP [VoIP] or Voice over Frame Relay [VoFR]) when in the NM-HDV, NM-HD-2VE, or NM-HDV2.

APPLICATIONS

Packet Voice Solutions: PBX and CO Connectivity

The Multiflex VWICs supply private branch exchange (PBX) and public switched telephone network (PSTN) connectivity for the NM-HDV, NM-HDV-2VE, or NM-HDV2 via digital T1/E1 ports. The NM-HDV, NM-HDV-2VE, and NM-HDV2 support industry standard H.323 based VoIP, industry standards FRF.11 and FRF.12 based VoFR, and AAL5 based VoATM.

Please note that for each of these packet voice applications (VoIP, VoFR, or VoATM), an appropriate WAN interface card is also required.

Interfaz E1 para Router

Data Solutions: 1 and 2-port T1/E1 WIC with Integrated DSU/CSU

The Multiflex VWICs simplify branch office connectivity by integrating the functionality of a router, T1/E1, fractional T1/E1 serial interface with a fully managed DSU/CSU.

When used for “data-only” WAN connectivity, the Multiflex VWICs support numerous functions, including Cisco IOS® command line interface initiated loopback control, similar to the popular WIC-1DSU-T1. Additionally the Multiflex VWIC is also offered in a dual port versions, including dual E1 configurations, enabling increased WAN port density in Cisco 26/28/36/37/3800 series multiservice access routers. The E1 VWIC versions include integrated DSUs, while the T1 VWIC versions integrate CSU and DSU functionality, simplifying remote network management.

The 2-port Multiflex VWICs increase configuration flexibility on Cisco multiservice access routers eliminating the need for 2 single-port T1/E1 WAN interface cards. Increasing the T1/E1 port density in a single WIC slot enables applications such as local serial aggregation with the WIC-2T or WIC-2A/S, or ISDN backup with the WIC-1B-S/T or WIC-1B-U.

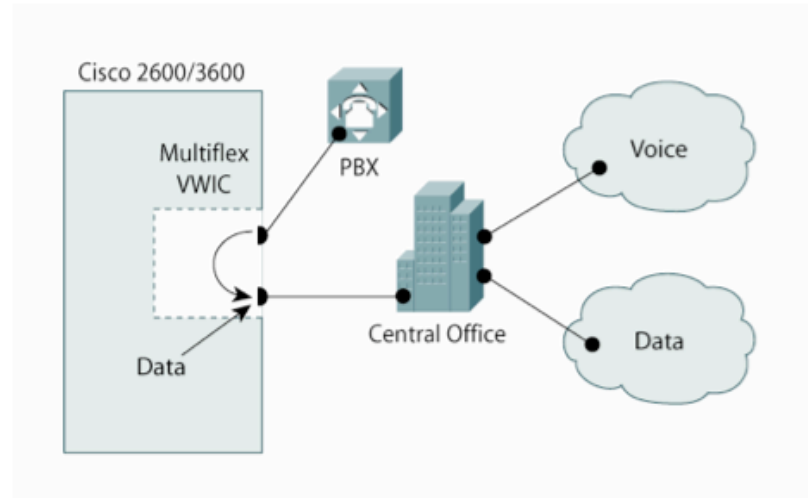
The VWICs also support a channelized capability where the T1 or E1 service can be flexibly split into two or more fractional channel groups. Thus a single physical port can provide connection to multiple sites. (Note: when choosing this mode only a single port can be supported in each WIC slot.)

The VWIC-1MFT-G703 and VWIC-2MFT-G703 not only support unframed G.703 but also support all the features of the other VWICs including Drop and Insert on the VWIC-2MFT-G703. Additional flexibility is provided on the VWIC-2MFT-G703 with the capability to configure one port for unframed G.703 while configuring the other for standard framed E1.



Interfaz E1 para Router

Figure 2. Drop and Insert to Share a T1/FT1 or E1/FE1 Service



To illustrate, consider the example of a PBX with a T1 interface that needs to support a maximum of 10 simultaneous calls. With 24 DS0s in a T1 Service (1.544 Mbps) this leaves 14 DS0s or 896 Kbps of bandwidth for data from the router (14 x 64 Kbps). The number of DS0s assigned for PBX calls and the remainder that are available for use with router data are fully configurable (statically, not dynamically). In the case of an E1 service 30 DS0s are available for division between voice and router data.

In this example one port of the 2-port Drop and Insert Multiflex VWIC is connected to the PBX and the other port is connected to the CO. The 10 DS0s from the PBX are TDM switched to the "CO port" and this switching is done on the VWIC itself. The configuration of this TDM switching is flexible so that DS0s on the "PBX port" do not have to be mapped to DS0s with the same timeslots on the "CO port". The remaining 14 DS0s on the VWIC "CO port" terminate through the VWIC's backplane connector on the router as a single aggregate channel group. The 14 DS0s are not individually addressable by the router as a channelized service, but can be split into two or more channel groups. (See Table 2 for specifics.)

The 2-port Drop and Insert Multiflex VWIC is the model included in the 2-port versions of the Digital T1/E1 Packet Voice Trunk Network Module. The term "drop and insert" is normally used when router data (or data from another data device) is multiplexed with voice calls. A more generic term for "drop and insert" is "digital cross connect". Digital cross connecting of voice channels only is supported by the 2-port Drop and Insert Multiflex VWIC when in the NM_HDV, NM-HD-2VE, or NM-HDV2. For example, a single T1 connection from a PBX to the "PBX port" on the VWIC can be divided up between DS0s that go to the NM-HDV for packetized voice (e.g. VoIP), and DS0s that are TDM switched to the "CO port" of the VWIC for standard circuit switched voice connectivity.

Interfaz E1 para Router



SPECIFICATIONS

Product Number	Description
VWIC-1MFT-T1	1-Port RJ-48 Multiflex Trunk-T1
VWIC-2MFT-T1	2-Port RJ-48 Multiflex Trunk-T1
VWIC-2MFT-T1-DI	2-Port RJ-48 Multiflex Trunk-T1 With Drop and Insert
VWIC-1MFT-E1	1-Port RJ-48 Multiflex Trunk-E1

Product Number	Description
VWIC-2MFT-E1	2-Port RJ-48 Multiflex Trunk-E1
VWIC-2MFT-E1-DI	2-Port RJ-48 Multiflex Trunk-E1 With Drop and Insert
VWIC-1MFT-G703	1-Port RJ-48 Multiflex Trunk-E1 G.703
VWIC-2MFT-G703	2-Port RJ-48 Multiflex Trunk-E1 G.703
CAB-E1-RJ45BNC	E1 Cable RJ-45 to Dual BNC (Unbalanced)
CAB-E1-RJ45TWIN	E1 Cable RJ-45 to Twinax (Balanced)

Equipos PDH y SONET/SDH

- CSU/DSU
- Interfaz E1 para Router
- **Puerto POS STM-4c para Router**
- STM-1/4 Multi-Service Node
- MultiService Platform
- MSPPs

Puerto POS STM-4c (OC-12c)

The Cisco® I-Flex design combines shared port adapters (SPAs) and SPA interface processors (SIPs), leveraging an extensible design that enables service prioritization for voice, video and data services. Enterprise and service provider customers can take advantage of improved slot economics resulting from modular port adapters that are interchangeable across Cisco routing platforms. The I-Flex design maximizes connectivity options and offers superior service intelligence through programmable interface processors that deliver line-rate performance. I-Flex enhances speed-to-service revenue and provides a rich set of QoS features for premium service delivery while effectively reducing the overall cost of ownership. This data sheet contains the specifications for the Cisco 1-Port OC-12c/STM-4c POS Shared Port Adapter (Cisco 1-Port OC-12 POS SPA; refer to Figure 1).

Figure 1. Cisco 1-Port OC-12 POS SPA with SFP Optics



PRODUCT OVERVIEW

The Cisco 1-Port OC-12 POS SPA is available on high-end Cisco Systems® routing platforms offering the benefits of network scalability with lower initial costs and ease of upgrades. The Cisco SPA/SIP portfolio continues the Cisco focus on investment protection along with consistent feature support, broad interface availability, and the latest technology. The Cisco SPA/SIP portfolio allows different interfaces (packet over SONET/SDH [POS], ATM, Ethernet, etc.) to be deployed on the same interface processor.

The Cisco 1-Port OC-12 POS SPA provides a single Small Form Factor Pluggable (SFP) interface. SFP modules are available in multiple optical reaches from 2 to 80 km.

Puerto POS STM-4c (OC-12c)

Features	Descriptions
Product Compatibility	• Cisco 7304 Router • Cisco 7600 Series Routers
Port Density per SPA	1 port
Physical Interface	• OC-12c/STM-4c SFP optics module (refer to optical parameters in Table 2) • Visual status indicators (LEDs): – SPA status LED – Per-port LEDs • Carrier and alarm • Active and loopback
Protocols	• High-Level Data Link Control (HDLC), RFC 2615 • Point-to-Point Protocol (PPP), RFC 1662 • Frame Relay, RFC 2427 • IPv4/IPv6
Features and Functions	• Synchronization – Local (internal) or loop timed (recovered from network) – Pointer activity monitoring • Local (diagnostic) and line (network) loopback • Section data communications channel (SDCC)---Platform-dependent feature • Payload mapping – POS with 1 + X⁴³ self-synchronous scrambler • SONET/SDH compliance – Telcordia (Bellcore) GR-253-CORE (as applicable) – ANSI T1.105, T1.231 – ITU-T G.707, G.957, G.825 (as applicable) • Supported SONET/SDH alarm and signal events – Signal failure bit error rate (SF-ber) – Signal degrade bit error rate (SD-ber)

Puerto POS STM-4c (OC-12c)

Table 2. OC-12c/STM-4c POS Optical Specifications

SFP Optics	Maximum Distance
Multimode (MM) Short Reach (SR)	Up to 0.25 mi (500 m)
Single-Mode (SM)	Up to 1.2 mi (2 km)
SM Intermediate Reach (IR-1)	Up to 9 mi (15 km)
SM Long Reach (LR-1)	Up to 25 mi (40 km)
SM Extended Reach (LR-2)	Up to 50 mi (80 km)

Equipos PDH y SONET/SDH

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STM-1/4 Multi-Service Node

Broadband Optical Connectivity To The Business

Medium/large enterprises and corporates rely more and more on optical connectivity to the Metro network for their mission-critical applications.

By extending fiber optics to the business, Service Providers' telecommunication infrastructures can effectively support end-customers' business profitability,

ensuring reliable services ranging from voice and data storage replication to high speed Internet Access and Ethernet Virtual Private Networks.

Alcatel 1640 FOX (Fiber Optics eXtension) is an ideal carrier-grade Optical Multi-Service CPE capable of delivering a flexible range of different services – ATM, Ethernet, Voice, TDM – supported by next generation SDH technology. Its is a compact (desktop or wall-mount) and scalable multi-service platform, which enables Service Providers to extend their service offerings and create new revenue opportunities – delivering optical access connectivity for enterprises and large businesses to the Metro.

Alcatel's Optical Multi-Service Nodes (OMSN) provide world-class next generation SDH functionality and capacity through aggregation of broadband multi-protocol traffic patterns.

Designed for metro and backbone applications, the OMSN product family offers telecom carriers and service providers the powerful solution to build intelligent optical networks and achieve the optimal balance between new competitive service offerings and traditional revenue-generating services.

The Alcatel 1640 FOX is the Optical Multi-Service Node addressing Customer Premises applications.



STM-1/4 Multi-Service Node

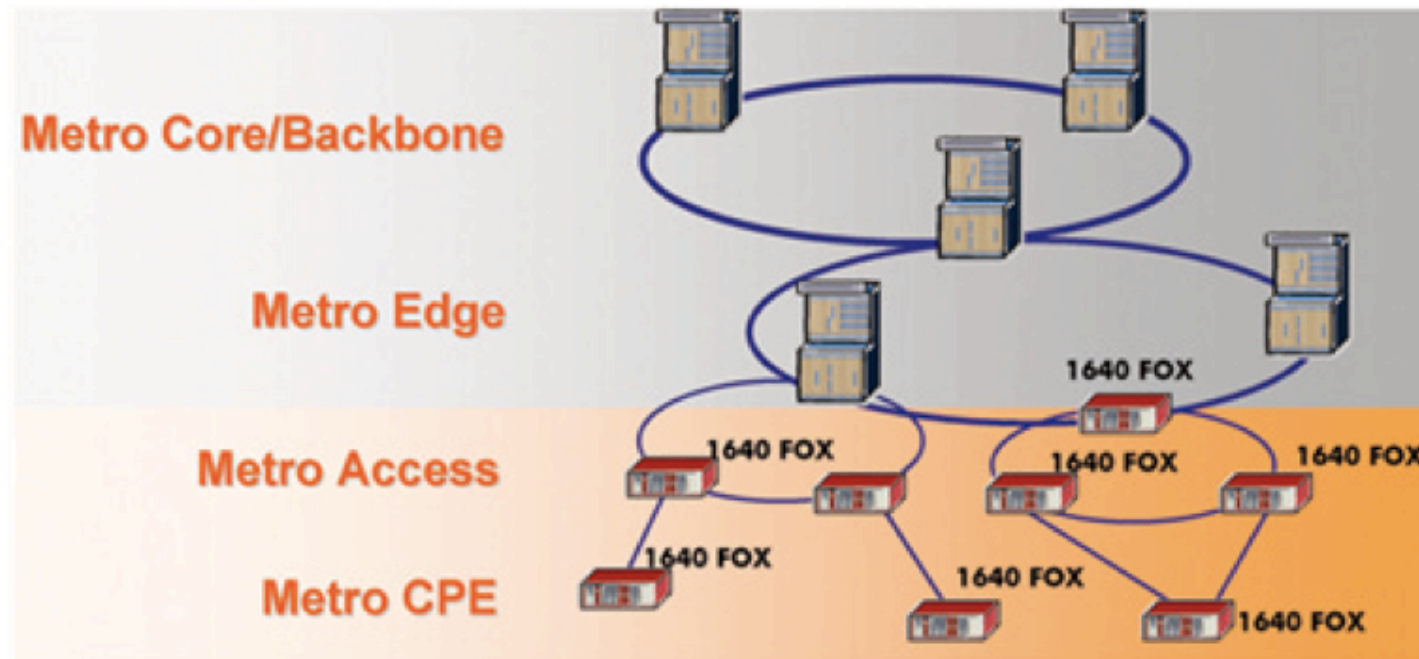


Fig. 1: How Alcatel 1640 FOX fits in the network

STM-1/4 Multi-Service Node

A Compact, Data-Oriented, Multi-Service CPE

Alcatel 1640 FOX is a next-generation synchronous Multi-Service Node designed for carrying optical access services to customer premises over the fiber medium.

Ideally suited for wall-mount or desktop applications, thanks to its symmetrical architecture it can be

configured as Terminal Multiplexer or Add Drop Multiplexer for deployment in spur, ring or meshed metro access network topologies.

Alcatel 1640 FOX provides STM-1 or STM-4 network interfaces for connection to the access network's

central office. It can be equipped with a wide variety of customer interfaces: 2Mbps, 34Mbps, 45Mbps, STM-1 and STM-4 as well as Ethernet 10/100 and Gigabit Ethernet SX/LX interfaces for direct LAN interconnections.

It also supports Packet Ring Edge Aggregator capability, which provides Layer 2 Ethernet/MPLS functions with differentiated QoS.

High-density Support for Large Uplink Capacity

The chassis of the Alcatel 1640 FOX has three card slots. One slot is for a Compact ADM-1 or ADM-4 card, which provides 2 x STM-1 or 2 x STM-4 connectivity to the optical access network, ideally suited for dual homing and high grade protection

applications. The other two additional slots may host different interfaces – PDH, SDH or Packet – to serve multiple types of customer services, for example:

- > Up to 16 x 2Mbps, 34/45 Mbps
- > Up to 22 x Ethernet 10/100 Mbps
- > Up to 8 x Gigabit Ethernet SX/LX
- > ATM switch or Packet Ring/MPLS switch with elastic bandwidth tuning and traffic policing for diff-QoS

Alcatel 1640 FOX features unmatched performances in terms of both interface density and uplink capacity.

Multi-service optical protected connectivity for large enterprises is achieved – for example – by supporting simultaneously 4 x Ethernet 100Mbps full rate lines, plus 16 x 2Mbps TDM lines, plus one Gigabit Ethernet line, all 1+1 network protected.

Multi-Service Applications

Alcatel 1640 FOX offers to operators the ability to deliver several different types of multi-protocol services and to fit into various network topologies. It can host ISA plug in modules performing Ethernet, MPLS and ATM switching functions.

STM-1/4 Multi-Service Node

Technical Summary

Applications

- > Terminal Multiplexer and Add Drop Multiplexer in protected or unprotected linear links, rings or meshed networks for multi-service optical access
- > Single fiber working
- > Metro Ethernet services (p2p, L2-VPN, Internet Access)

Interfaces

- > Network interfaces: 2 x STM-1 or 2 x STM-4
- > Customer interfaces (two slots available each):
 - 16 x 2Mbps (ISDN-PRA)
 - 1 x 34Mbps
 - 1 x 45Mbps
 - 2 x STM-1 (S-1.1, L-1.1, L-1.2)
 - 1 x STM-4 (S-4.1, L-4.1, L-4.2, L-4.2JE)
 - 11 x Ethernet 10/100 Base-TX (ISA-Eth plug-in)
 - 4 x Gigabit Ethernet Base-SX/LX (ISA-GbE plug-in)

Connectivity

- > 32x32 STM-1 equivalent full non-blocking SDH matrix (HO/LO) in all configurations
- > Unidirectional, bidirectional, broadcast connections
- > Line and VC loopbacks

Synchronization

- > Internal oscillator ± 4.6 ppm
- > Holdover drift ± 0.37 ppm per day
- > External sources: STM-n/2Mbps ports, 1 external 2MHz/2Mbps output
- > Priority and Quality (SSM) synchronization algorithms

Data Engines (ISA)

- > ISA-ATM: 600Mbps plug-in cell switch with STM-1 access on board; CBR, UBR, UBR+, VBR, GFR traffic contracts; point-to-multipoint from VC-12 up to VC4 payloads; policing and shaping; hard/soft PVCs connections (PNNI); equipment protection 1+1.
- > ISA-PR-FA (Packet Ring Edge Aggregator): 1.6 Gbps plug-in switch with 4 x Ethernet 10/100 Base-TX interfaces or 1 x GE SX/LX on board; Eth/GFP and Eth/MPLS/POS ports VC-12 up to VC-4, MPLS label switch and VLAN-tag forwarding criteria. Packet classification (VLAN 802.1Q, priority 802.1p, IP-DA, IP-TOS, MPLS+exp) and dual rate leaky bucket traffic policing/metering. Integrated L2/L3 forwarding function. Ethernet Virtual Private Line and LAN Services support.
- > ISA-Eth: Rate-adaptive Ethernet 10/100 transport. ITU-T G.7041 GFP mapping on N x VC-12, N x VC-3, VC-4 with in service Bond.
- > ISA-GbE: rate-adaptive Gigabit Ethernet transport (ITU-T G.7041 GFP mapping on 1..4 x VC-4).

Environment

- > Operating condition: ETS 300 019, class 3.2
- > Storage condition: ETS 300 019, class 1.2
- > Transportation condition: ETS 300 019, class 2.2
- > ESD/EMC: ETS 300 386, "Telecommunications Center" CLASS B

Operation

- > CMISE craft terminal through RS232 at 38.4kb/s
- > Network management access through QB3 interface or Qecc G.784
- > Local and remote SW download
- > Remote inventory
- > Housekeeping: 4 inputs + 2 outputs
- > Auxiliary channels: 1 x RS-232, 1 x V.11

Standards

> ITU-T/ETSI

In compliance to latest ITU-T/ETSI standards for SDH equipment

I.113, I.150, I.311, I.321, I.326, I.356, I.357, I.361, I.363.5, I.371, I.432.1, I.432.2, I.610, I.630, I.731, I.732, Q.2110 B-ISDN SAAL, Q.2130 B-ISDN SAAL, Q.2140 B-ISDN SAAL, ETS 300 298-1, ETS 300 298-2, EN 301 163-1-1, EN 301 163-2-1

STM-1/4 Multi-Service Node

Protections

- > Linear MSP single and dual-ended
- > SNCP/I, SNCP/N
- > SNCP Drop & Continue

Monitoring

- > POM (Path Overhead Monitoring) on 100%VCs
- > SUT (Supervisory Unequipped Trail)
- > TCM (Tandem Connection Monitoring)
- > Performance monitoring according to G.784, G.826, G.821
- > Ethernet performance counters

Power

- > Station battery: -48 to -60 V dc
- > Ac mains: optional external AC/DC rectifier inclusive of 2h-battery backup (same cover as transmission chassis)
- > Power consumption: 35 W (typical)

Physical Dimensions

- > Chassis size: 90W x 285H x 313D mm
- > Installation options: Desktop, wall-mount, ETSI rack

> ATM Forum

af-bici-0013.003, af-cs-0127.000, af-nm-0020.000, af-nm-0020.001, af-nm-0095.001, af-phy-0046.000, af-phy-0064.000, af-pnni-0055.000, af-pnni-0066.000, af-pnni-0081.000, af-tm-0121.000, af-uni-0010.002

> IETF

MPLS (Ethernet over MPLS)

> IEEE

IEEE 802.3, IEEE 802.3u, IEEE 802.3x, IEEE 802.3z, 802.1q/p