



Weidmüller 

COMUNICACIONES ETHERNET EN REDES INDUSTRIALES

Contenidos



Conexionado



Switches Industriales



Aplicaciones router



Weidmüller 

BREVES COMENTARIOS SOBRE CONEXIONADO

- Los conectores y el cableado así como los componentes Ethernet están catalogados en categorías según las normativas. Dependiendo de la categoría tienen una mayor capacidad de transmisión en ancho de banda y por tanto en velocidad de transmisión de datos. Para ello el cable y los conectores deberán garantizar esas propiedades.

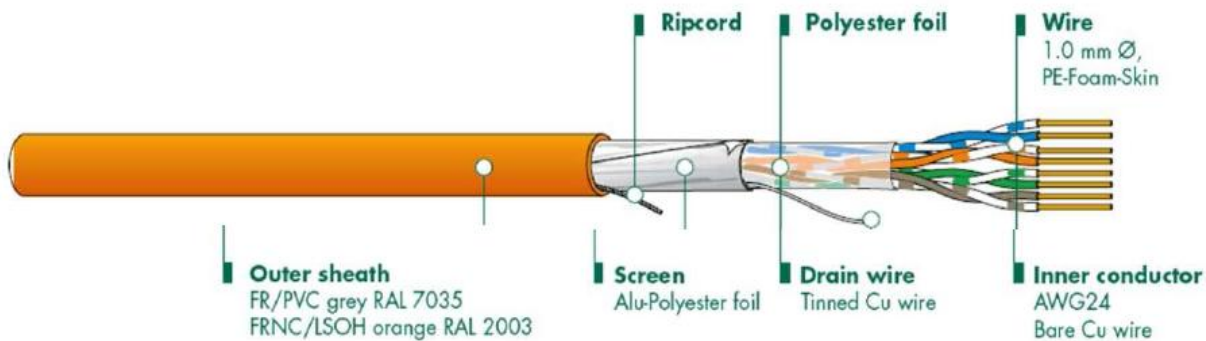
Categoría	Clase	Frecuencia	Apantallamiento?	Aplicaciones	Notas
1	A	100kHz	Sin Apantallar	Teléfono	Estándar Obsoleto
2	B	1 o 1,5MHz	Sin Apantallar	Cableado en edificios (ej: ISDN)	Estándar Obsoleto
3	C	16MHz	Sin Apantallar	ISDN 10BaseT	Utilizado a día de hoy para aplicaciones particulares
4		20MHz	Sin Apantallar	ISDN 10BaseT	Estándar Obsoleto
5	D	100MHz	Apantallado / Sin Apantallar	100BaseT	Most used Category world wide
5e	D	100MHz	Apantallado / Sin Apantallar	100BaseT 1000BaseT	Extension to Cat. 5 Same as IEC Cat 5
6	E	250MHz	Apantallado / Sin Apantallar	1000BaseT	
6A	EA	500MHz	Apantallado / Sin Apantallar	1000BaseT 10 Gigabit Ethernet	Máxima Categoría de Conector Standar RJ45
	F	600MHz	Apantallado por pares	10Gigabit Ethernet	
	FA	1200MHz	Apantallado por pares	Multimedia	DRAFT (borrador)

Distintas categorías existentes

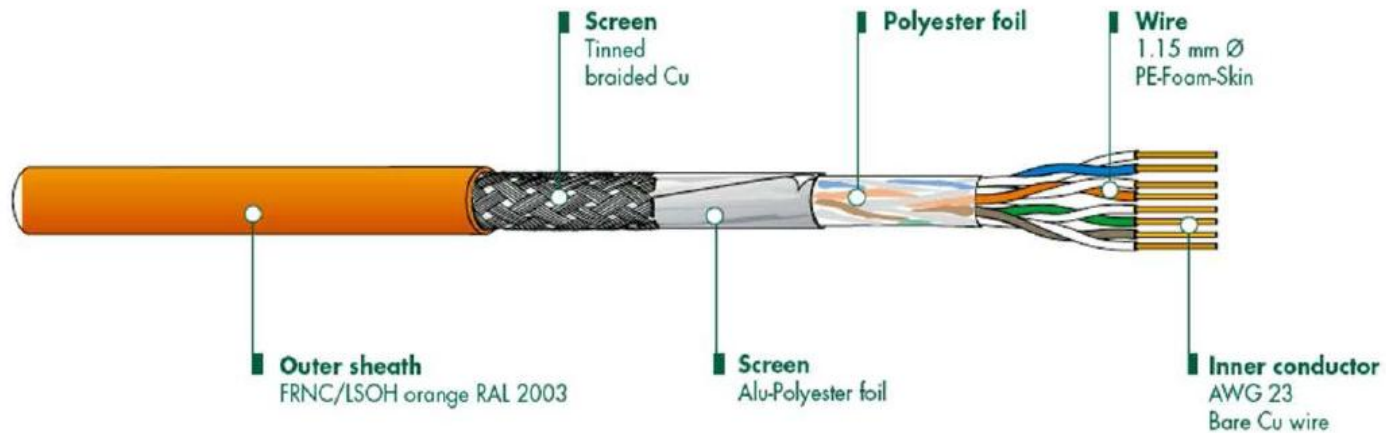
- Tipos de cableado según el apantallamiento:



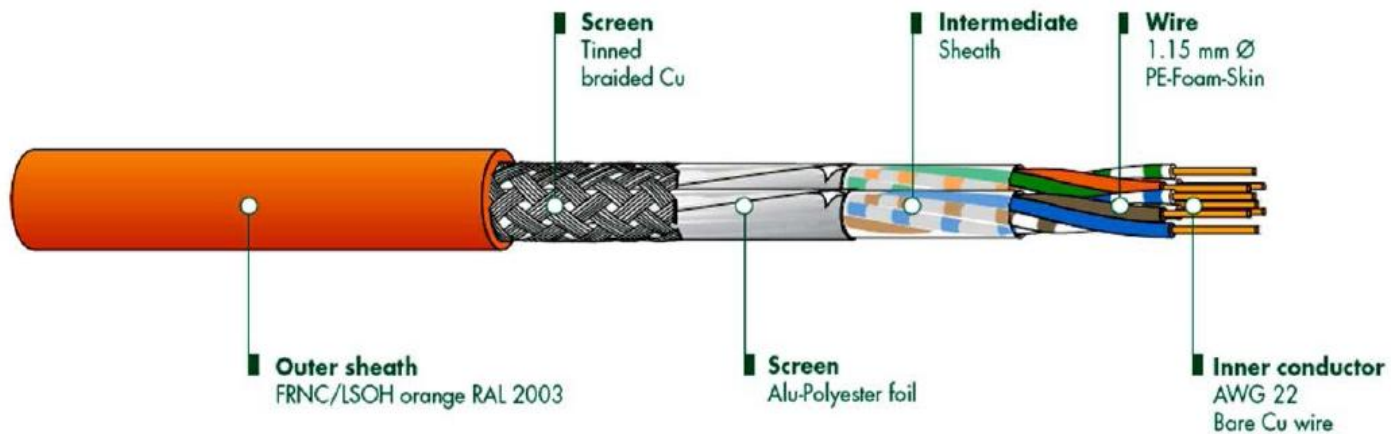
Cable UTP estándar



Cable F/UTP



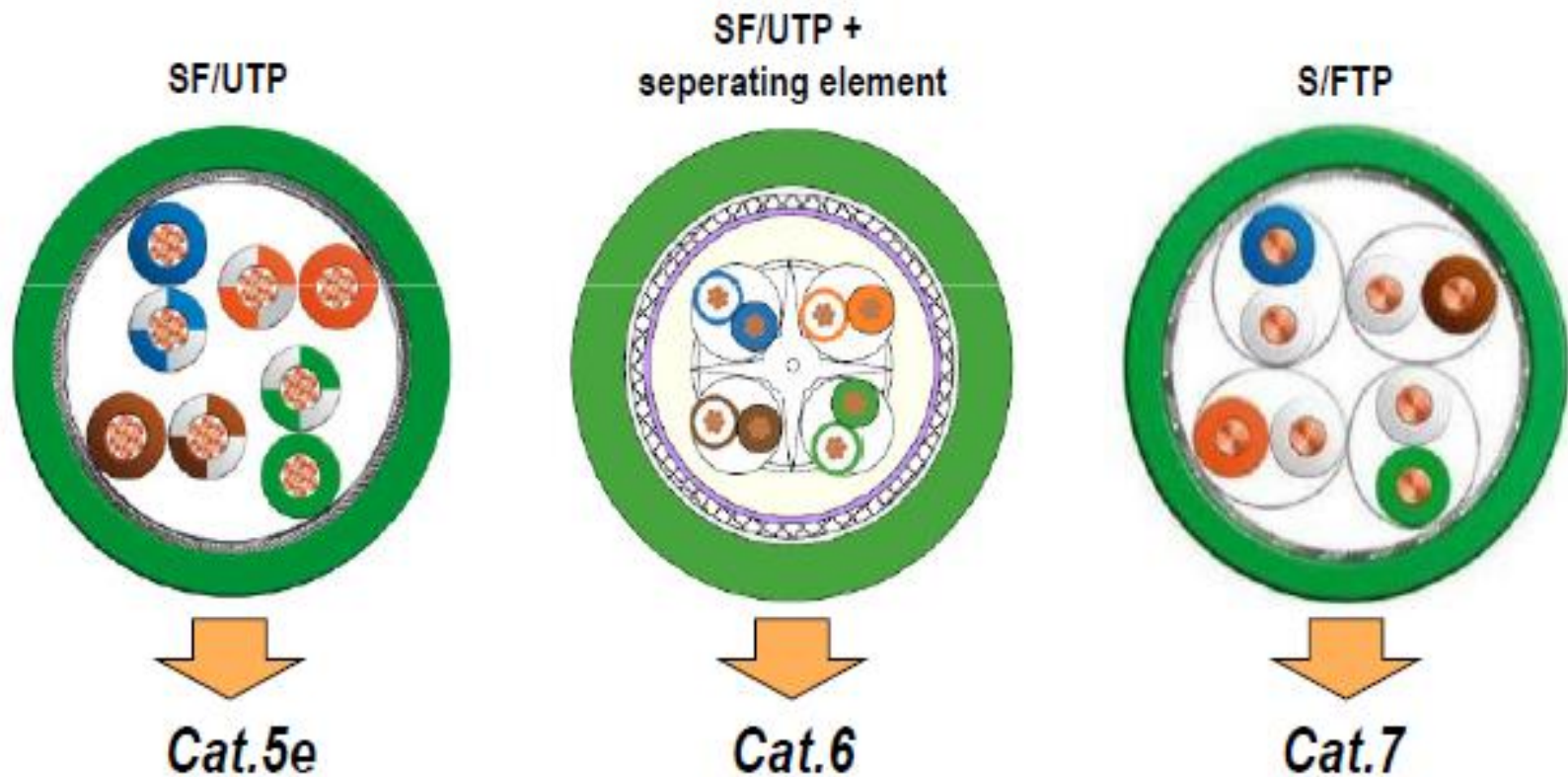
Cable SF/UTP



Cable S/FTP

Twisted pair cables

How to identify different cables/categories



Braid coverage

Standard office cable:
Braid coverage factor
App. 40%



Weidmüller industrial Cable:
Braid coverage factor
App. 65% - 80%



Weidmüller PROFINET Cable:
Braid coverage factor
App. > 90%

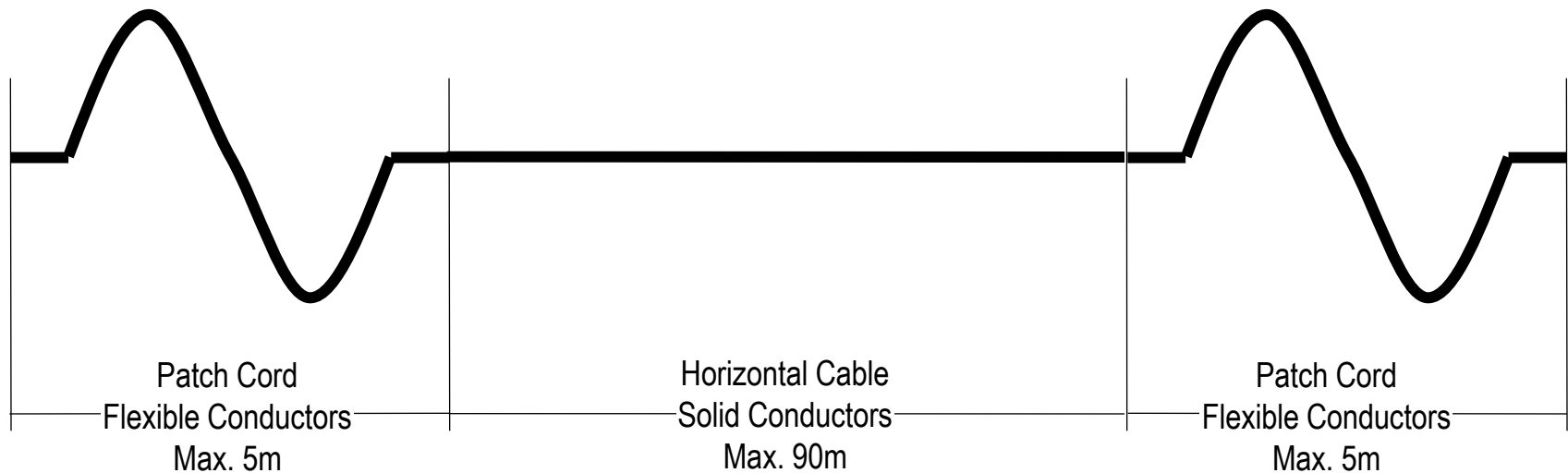


- Tipos de cubierta exterior del cable:

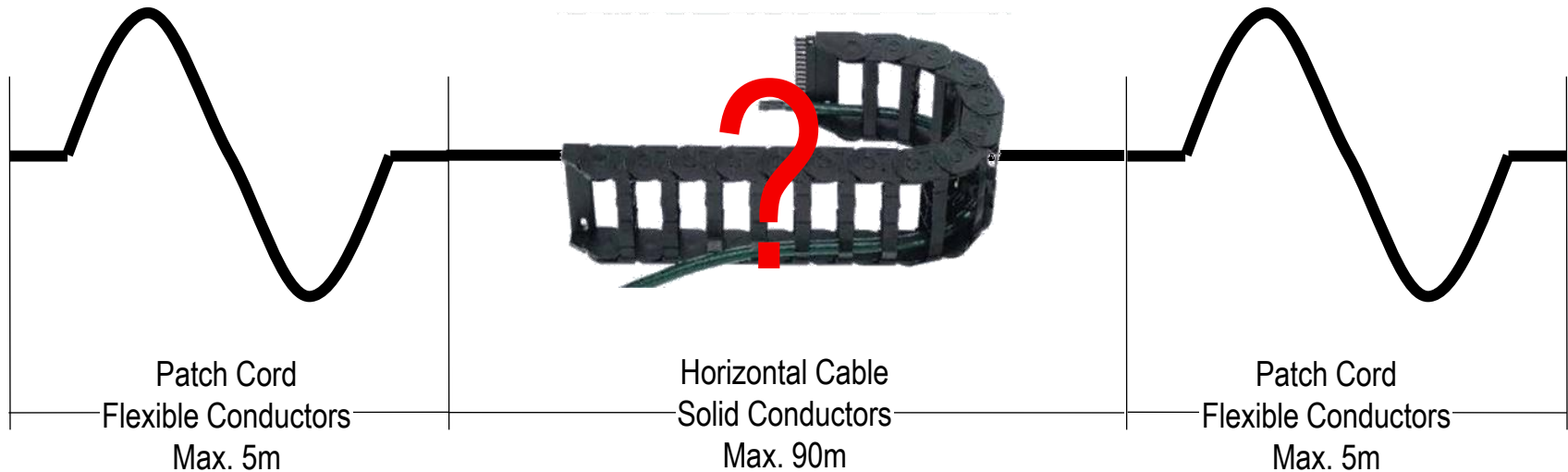
Cladding material	PVC	LSZH	PUR
VDE designation	Y	H	11Y
Standard temperature range	-40 °... +115 °C	-25 °... +70 °C	-40 °... +85 °C
UV resistance	yes	yes	yes
Flame resistance	++	++	+
Halogen-free	no	yes	yes
Oil resistance	+	no	++
Resistance to chemicals	+	no	++
Resistance to abrasion	+	-	++
Applications	Building	Fire safety	Industrial dragline
Water absorption	-	+	-
Can be used outside	yes	yes	yes
Flexibility	+	-	++
++ very good + good - minimal -- very minimal			

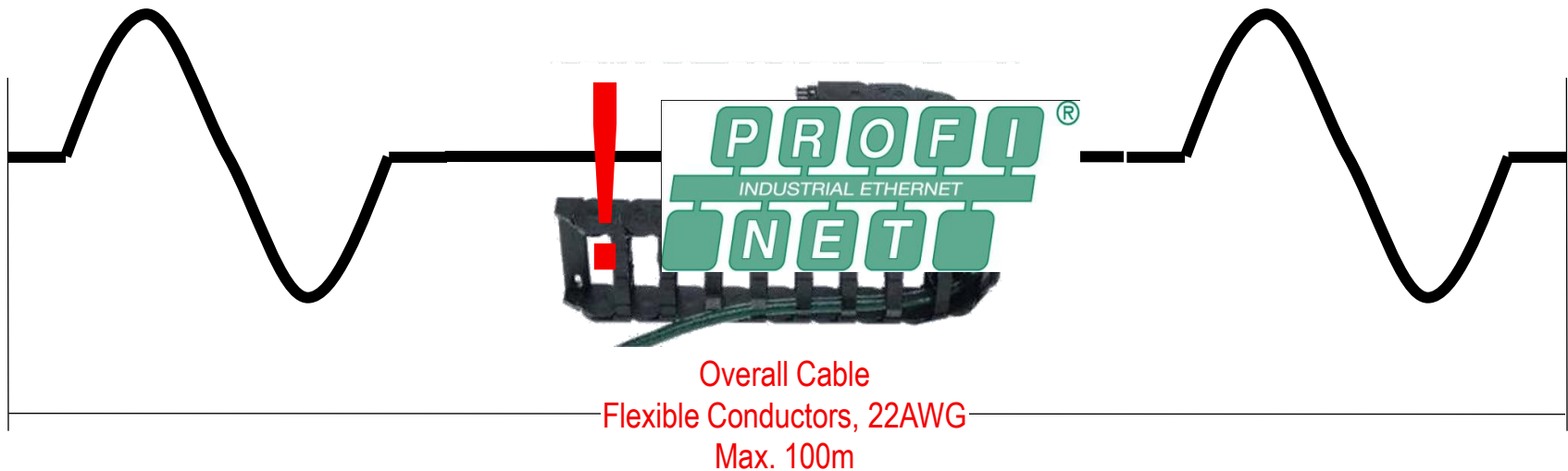
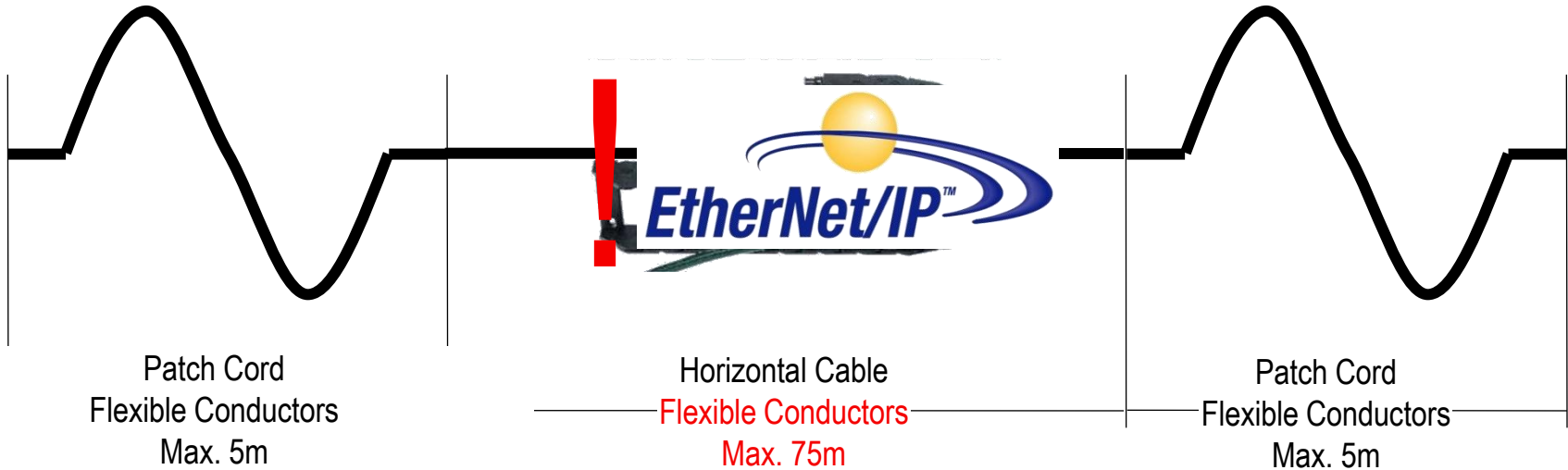
Características más importantes de los diferentes tipos de cubierta

Distancia máxima entre dos dispositivos



Uso de cables flexibles

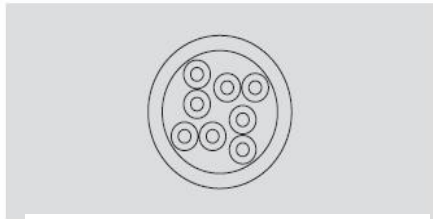




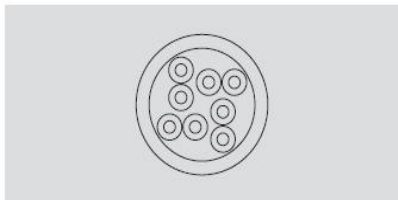
CONEXIONADO ETHERNET INDUSTRIAL (I)

• Categoría 5e:
Instalación:

PUR

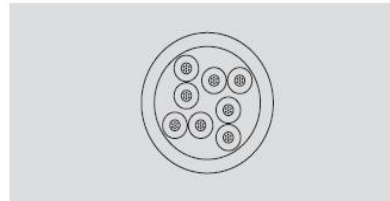


PVC

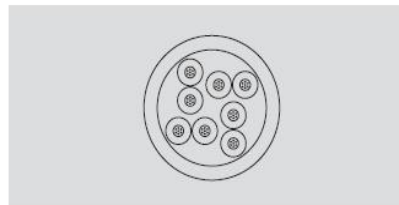


Conexión:

PVC

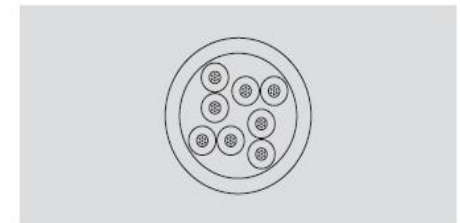


PUR



Cadena arrastre:

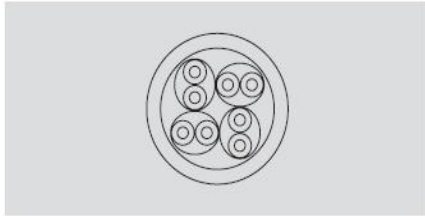
PUR, green



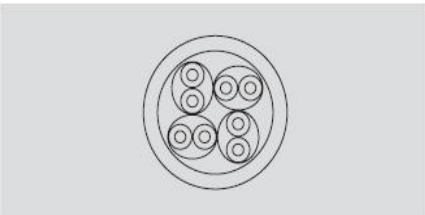
CONEXIONADO ETHERNET INDUSTRIAL (II)

• Categoría 7:
Instalación:

PVC



PUR



Conexión:

PVC

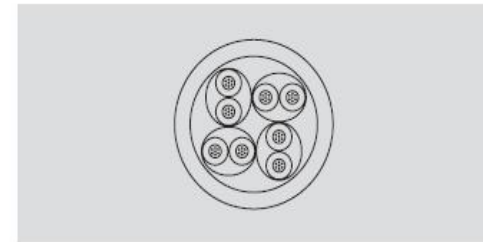


PUR



Interior:

LSZH

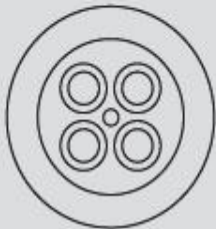


Diseño	Tipo A	Tipo B	Tipo C
Tipo de instalación	Instalación fija. Ningún movimiento después de instalación.	Uso flexible, movimiento ocasional o vibración.	Uso extra flexible, movimiento permanente, vibración o torsión.
Formación del conductor.	AWG22/1	AWG22/7	AWG22/...
Diámetro exterior cable.	5,5 ± 8,0 mm		Aplicación específica.
Coloración cubierta	Verde (RAL 6018)		Aplicación específica.
Coloración conductores	Blanco, amarillo, azul, naranja Par n°1 : blanco (RXD+), azul (RXD-) Par n°2 : amarillo (RXD+), naranja (TXT-)		
Diseño del cable	2 pares o 1 cuadrete estrella		
Retardo señal entre pares	<= 20 ns /100 m		
Apantallamiento	Encintado aluminio + trenza de cobre		Aplicación específica.

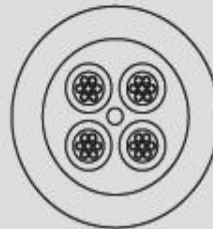
CONEXIONADO PROFINET (II)



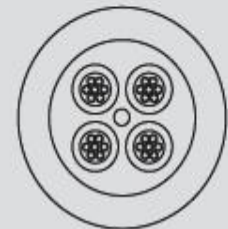
Installation cable type A



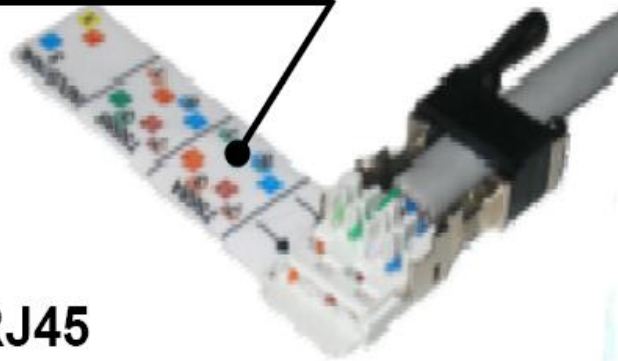
Connection cable type B



Dragline cable type C



Colour code on flag



Colour code RJ45



Colour code printed



Braid coverage

Standard office cable:
Braid coverage factor
App. 40%



Weidmueller industrial Cable:
Braid coverage factor
App. 65% - 80%



Weidmueller PROFINET Cable:
Braid coverage factor
App. > 90%



Weidmüller RJ45 connector: „Reliable“

■ Continuous

One-Piece shield connection
Low-resistance
4 contact points



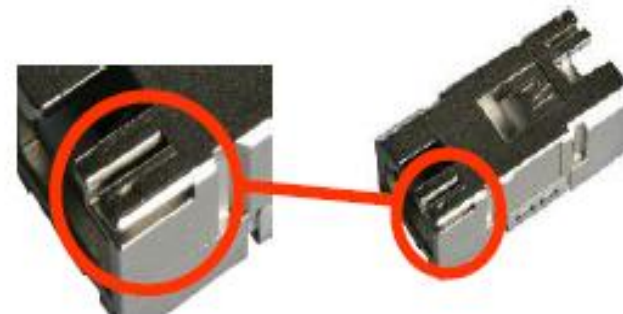
■ EMI resistant

Fully shielded
360 degree contacting



■ Grounding integrated

Equipotential bonding
with spade plug FS 2.8
on female and feed through connector



Weidmüller RJ45 connector: „Reliable“



Contact Technology

- **Steady**
 - high spring tension
 - Low mass
 - Shock and vibration resistant
- **Refined**
 - Spring steel
 - 0,8µm Gold plated
 - noncorrosive
- **According to standards**
 - 750 mating cycles
 - Self cleaning
 - Reusable



STEADYTEC® - Platform Strategy

Plug inserts



RJ45 AW024-27



RJ45 AW022-26

Outlets



IP20 mounting rail outlet for RJ45

Bulkhead inserts



USB coupler



RJ45 coupler



RJ45 jack



SC-RJ plugs



LC-Duplex plugs



SC-Duplex plugs



IP20 mounting rail outlet for FD



SC-RJ adaptor



LC-Duplex adaptor



SC-Duplex adaptor

STEADYTEC® - Platform Strategy



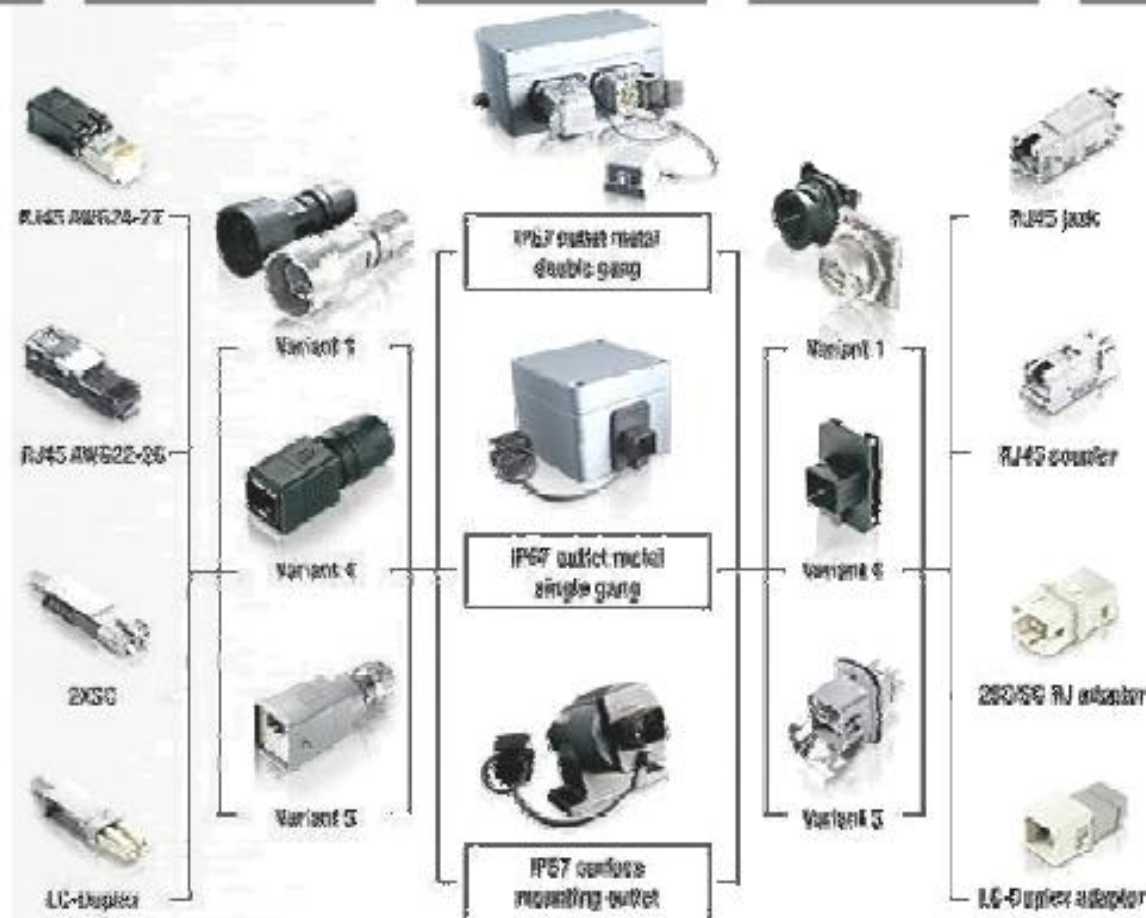
Plug inserts

Plug housing

Outlets

Bulkhead

Bulkhead inserts

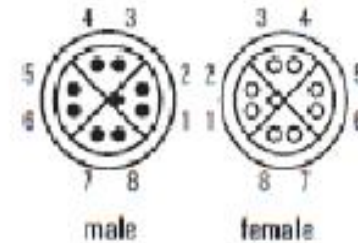


Passive Components: IE-LINE M12

D-Coding



X-Coding



AWG24
Max 5m/Cabinet



	 Industrial Installation Industrial Building	 AIDA		 the automation link	
Data Copper IP 20	 RJ45 IEC 60603-7	 RJ45 IEC 60603-7 PROFINET Spec.	 RJ45 IEC 60603-7 PROFINET Spec.	 RJ45 IEC 60603-7 PROFINET Spec.	 RJ45 IEC 60603-7
Data Fiber IP 20	 LC IEC 61754-22 SC IEC 61754-4	 SC-RJ IEC 61754-24 EN 50377-6-1	No definition	 SC-RJ IEC 61754-24 EN 50377-6-1	 SC-RJ IEC 61754-24 LC IEC 61754-22
Data Copper IP 67	 RJ45 Push Pull IEC 61076-3-106 V4	 RJ45 Push Pull IEC 61076-3-117 V14	No definition	 RJ45 Push Pull IEC 61076-3-117 V14	 RJ45 Bajonett IEC 61076-3-106 V1
Data Fiber IP 67	 LC Push Pull IEC 61076-3-106 V4	 SC-RJ Push Pull IEC 61754-24-11 V14	No definition	 SC-RJ Push Pull IEC 61754-24-11 V14	 SC-RJ Bajonett IEC 61076-3-106 V1
Data Copper IP 67	 M12 D-coded IEC 61076-2-101	 M12 D-coded IEC 61076-2-101	No definition	 M12 D-coded IEC 61076-2-101	 M12 D-coded IEC 61076-2-101
Data Copper IP 67	No definition	 M12 X-Type IEC 61076-2-109	No definition	No definition	No definition
Signal Copper IP 67	No definition	 Hybrid (Q10) AIDA IEC 61075-3-118	No definition	No definition	No definition
Power Copper IP 67	No definition	 Push Pull PROFINET Spec.	No definition	 Push Pull PROFINET Spec.	No definition

- ETHERNET/IP MEDIA PLANNING AND INSTALLATION MANUAL:

- http://www.odva.org/Portals/0/Library/Publications_Numbered/PUB00148R0_EtherNetIP_Media_Planning_and_Installation_Manual.pdf

- PROFINET CABLING GUIDE:

- <http://www.profibus.com/download/installation-guide/>



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SWITCHES INDUSTRIALES

- SWITCHES NO GESTIONADOS:
 - Plug & Play. Sin configuraciones.
 - Económicos y sencillos de usar.
 - Menores prestaciones y capacidad de procesado
 - Se pueden utilizar para pequeñas redes (ej: máquina con pocos dispositivos aislada)
 - no soportan protocolos de redundancia.
- SWITCHES GESTIONADOS:
 - Configurables
 - Más costosos y se deben programar
 - Prestaciones más elevadas con mayor capacidad de procesado
 - Utilizar en redes complejas
 - Soportan protocolos de redundancia, VLANs, control Tráfico Multicast, QoS, etcétera

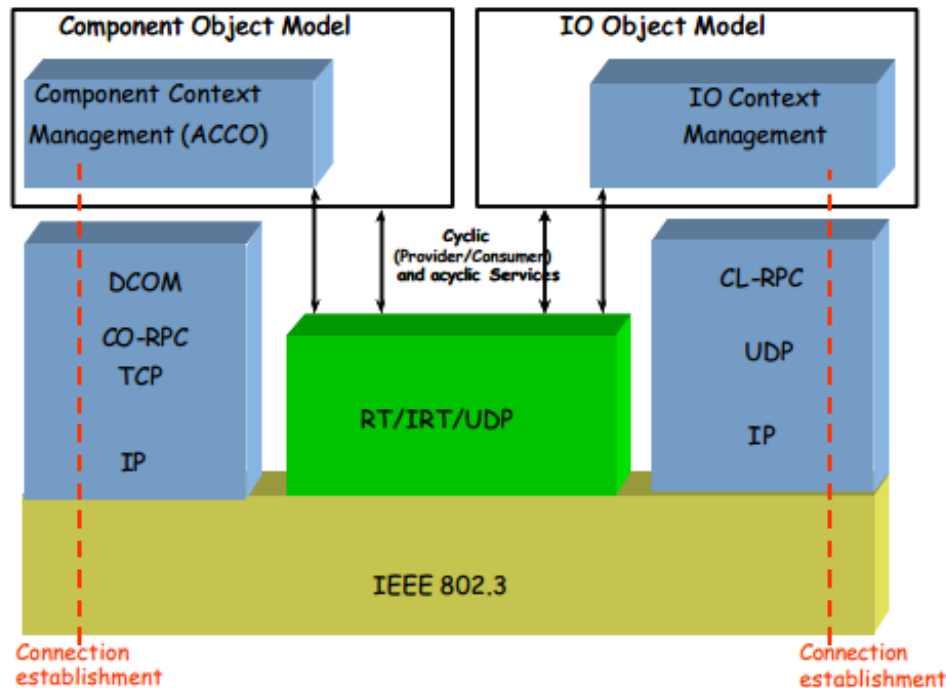
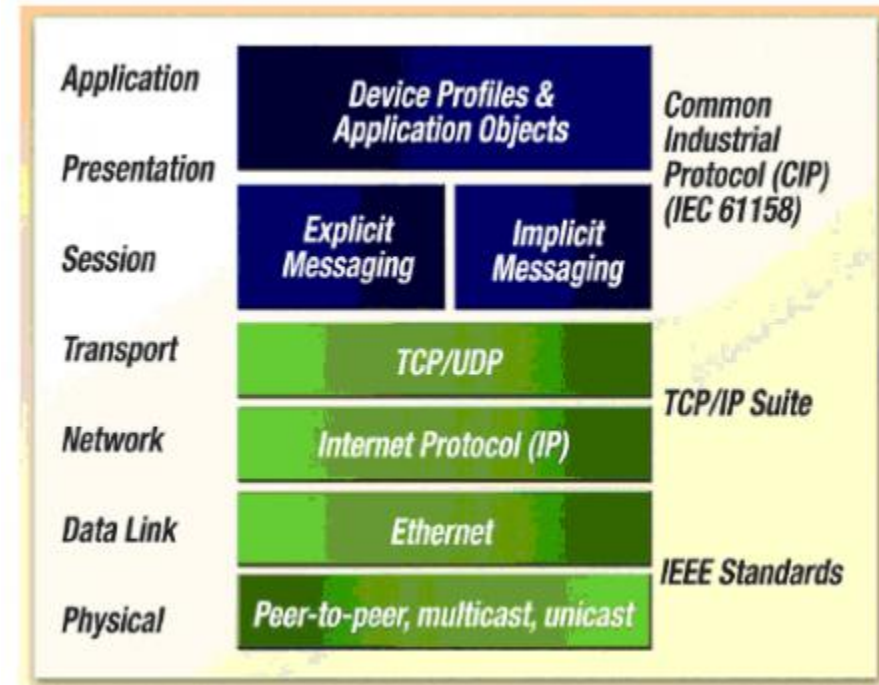
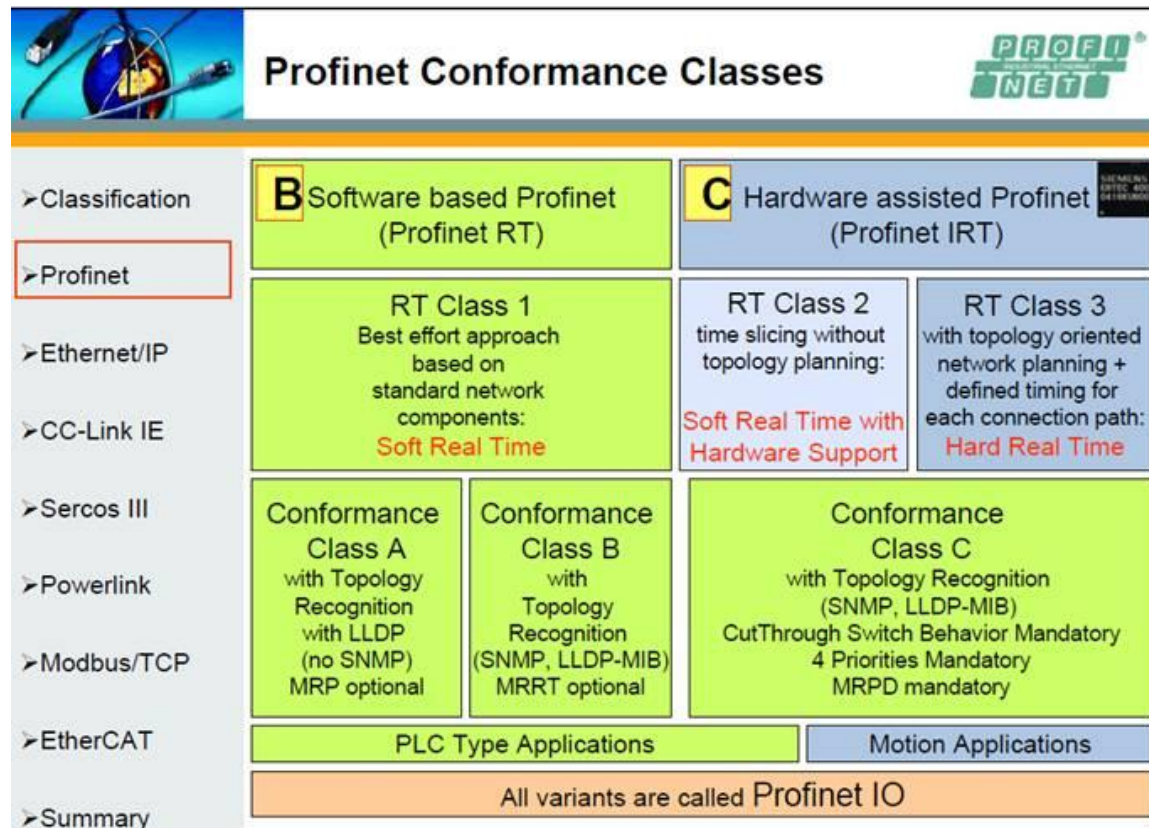
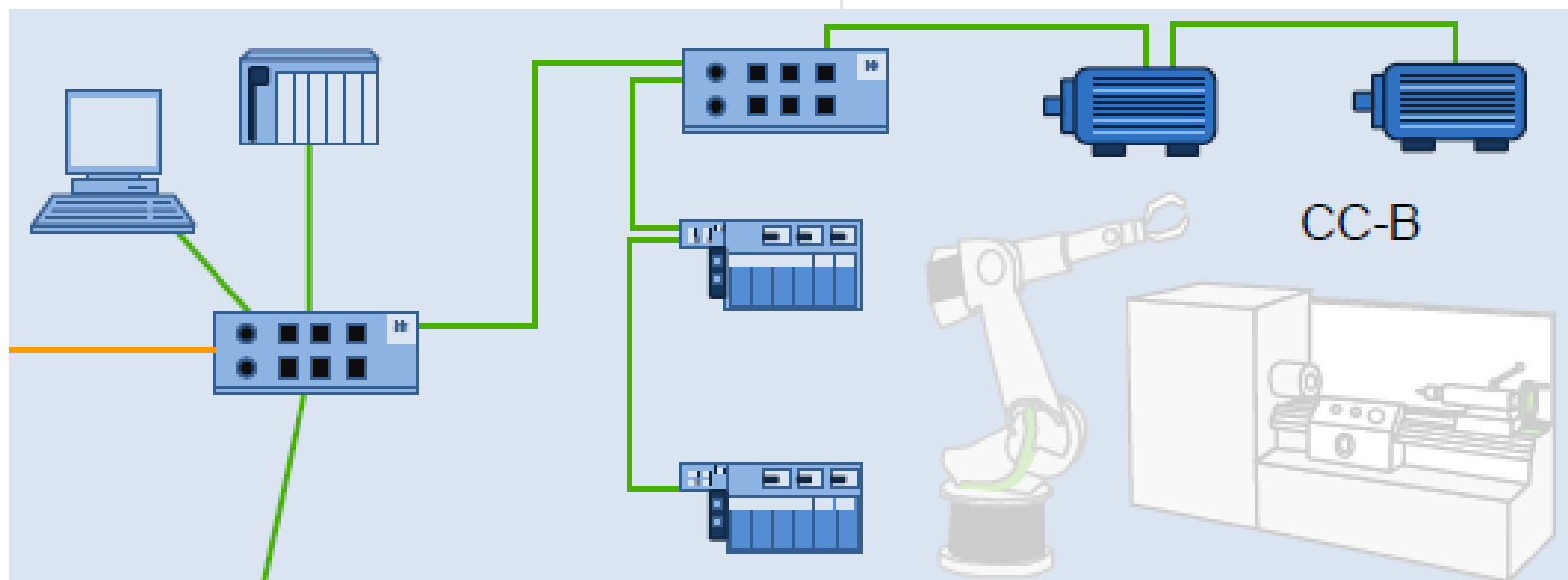


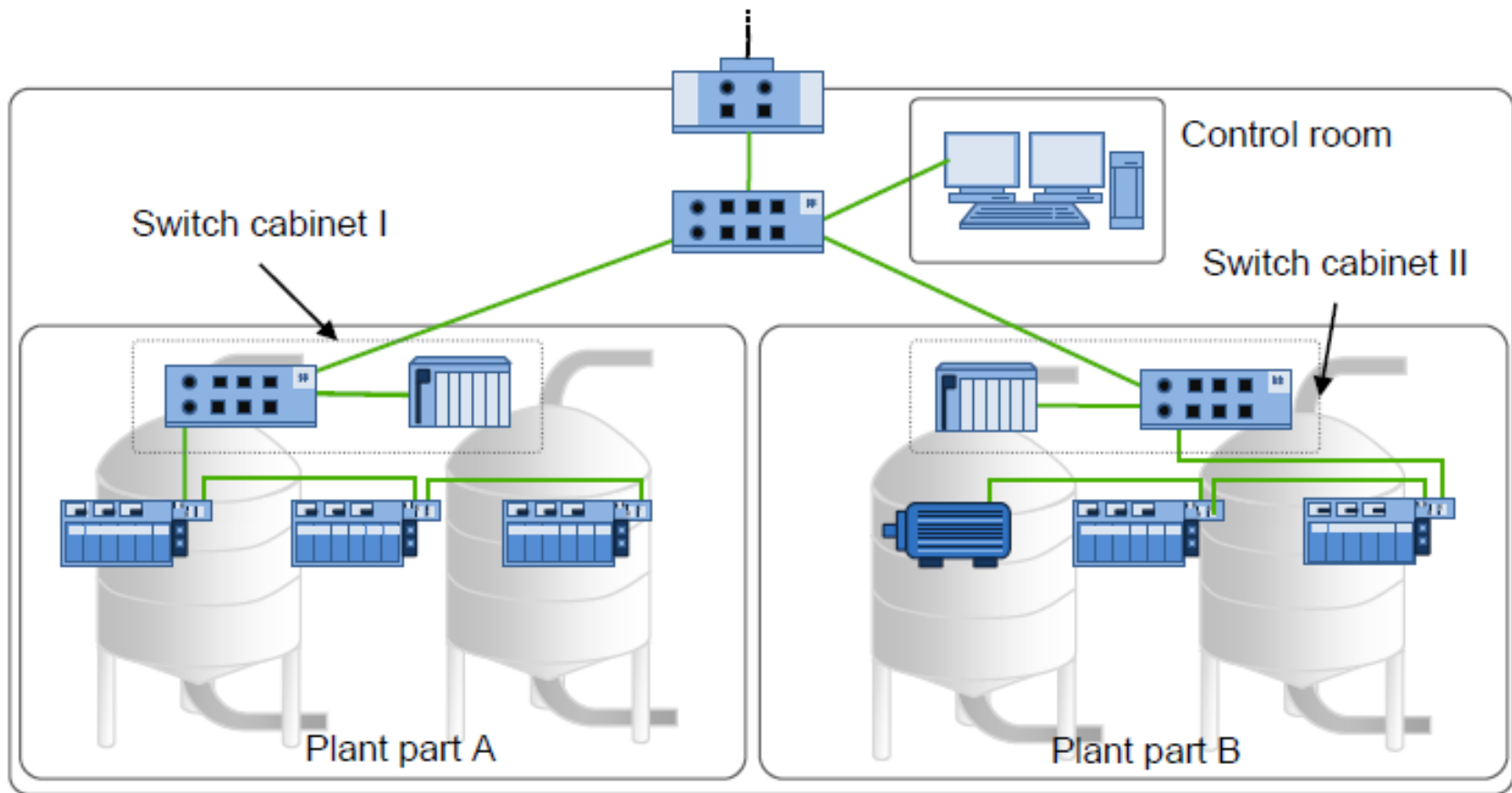
Figure 2. PROFINET stack architecture



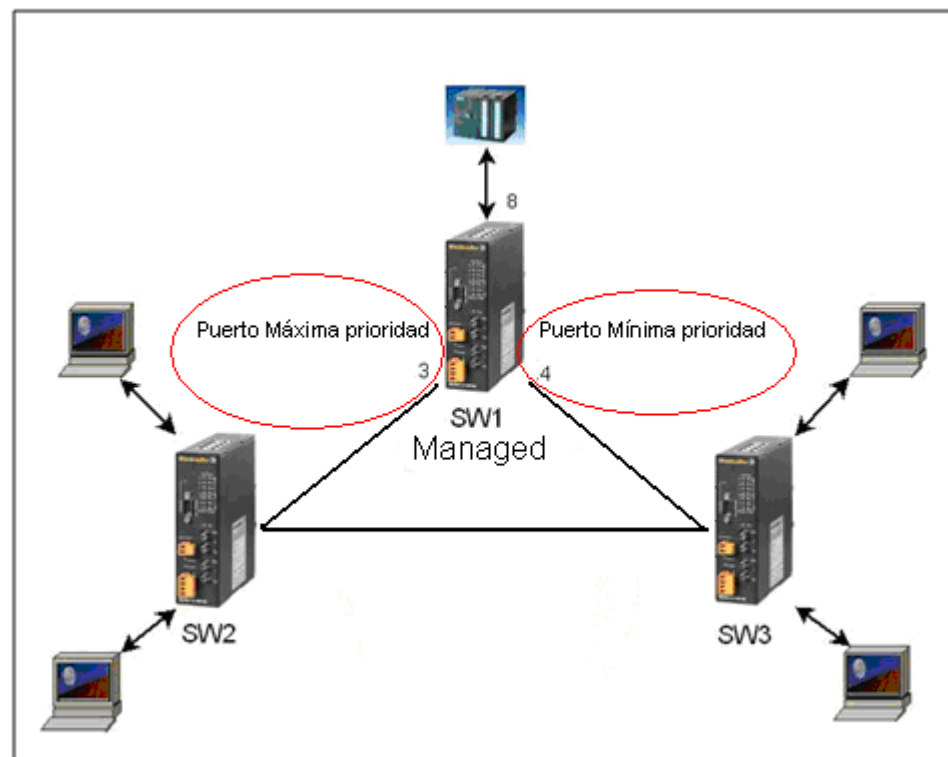
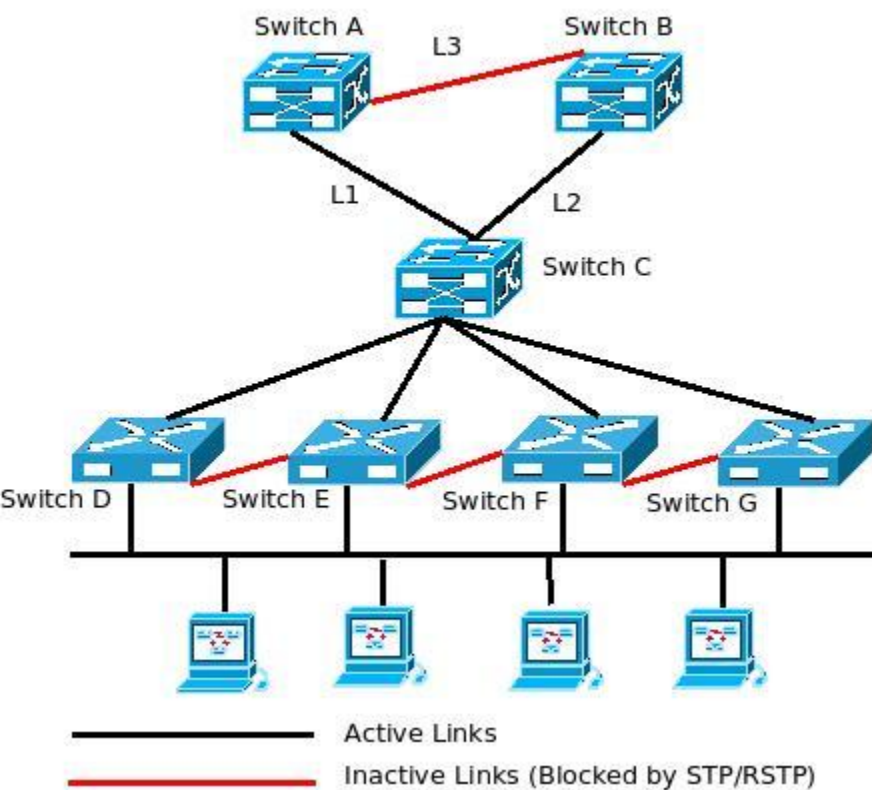
- ☐ Los protocolos industriales (como Ethernet/IP y Profinet) están basados en Ethernet
- ☐ Las capas inferiores son exactamente iguales, con lo que en principio cualquier switch sería válido.
- ☐ No obstante existen unos requerimientos debido a que los datos son críticos y los ciclos de scan tienen timeouts.
- ☐ Es por ello que se debe garantizar tanto la integridad de datos como la de la red
- ☐ Todo depende de la necesidad de protocolos:

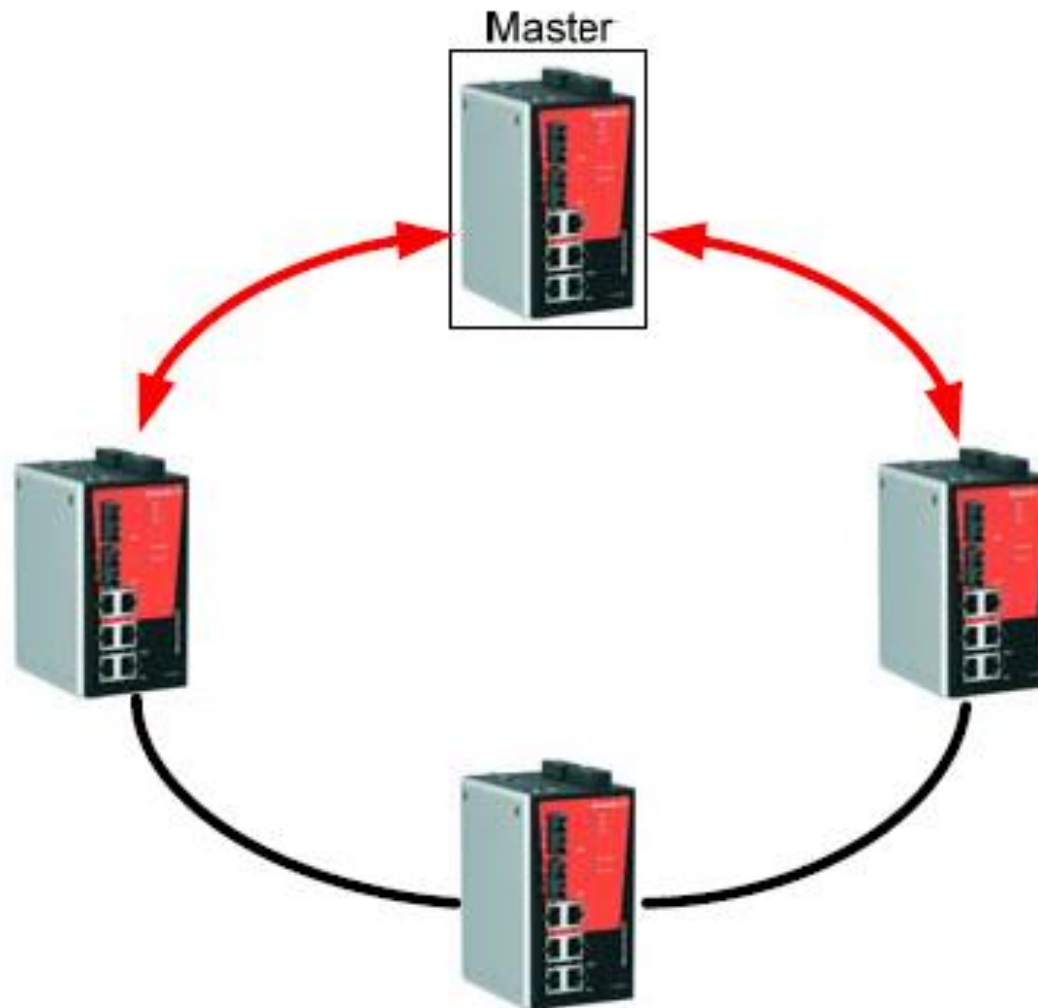




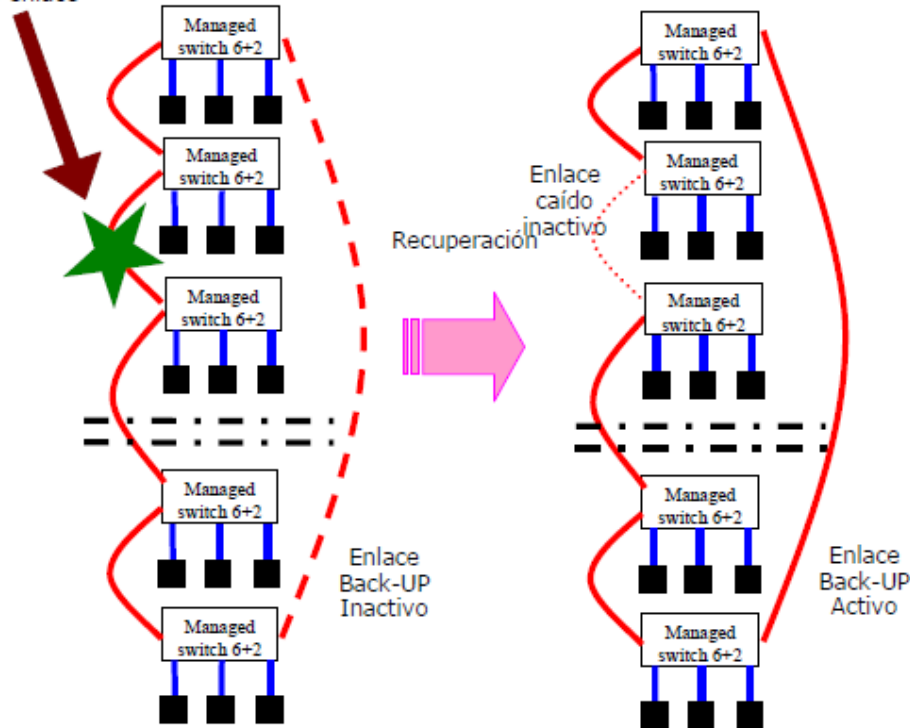


An Example Network to Illustrate STP/ RSTP

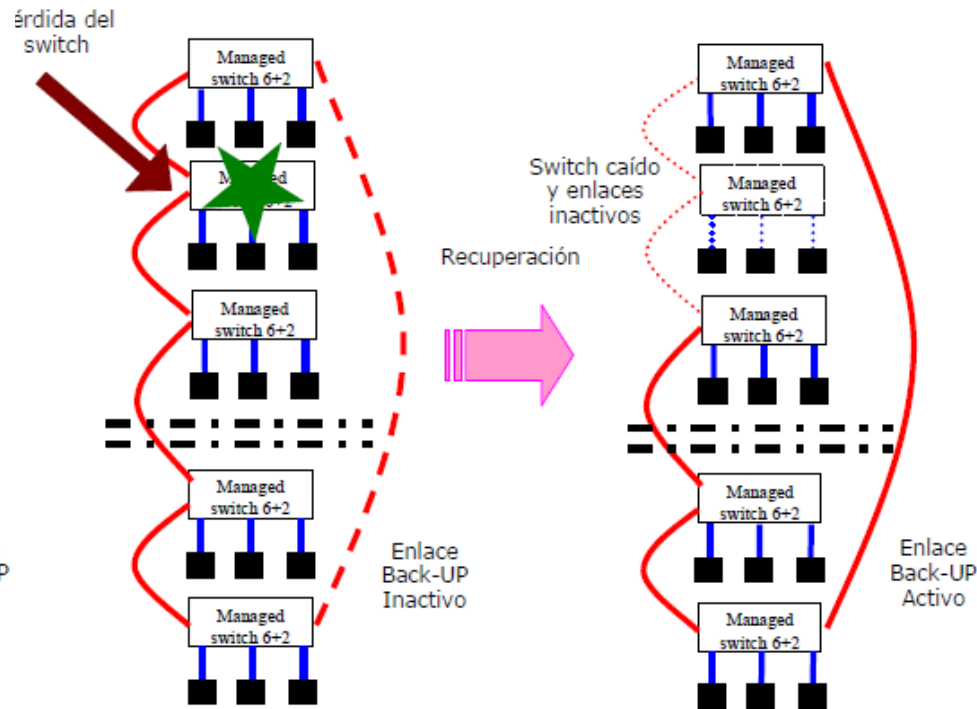


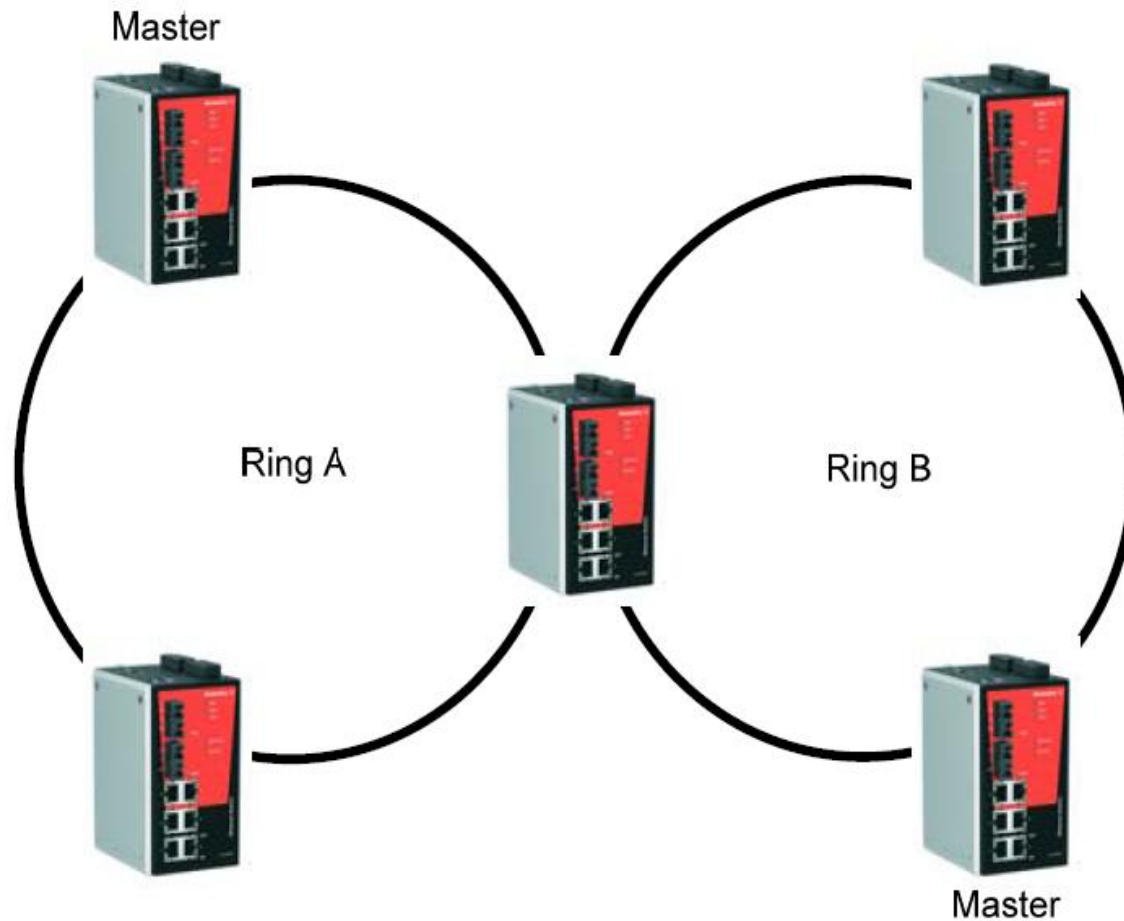


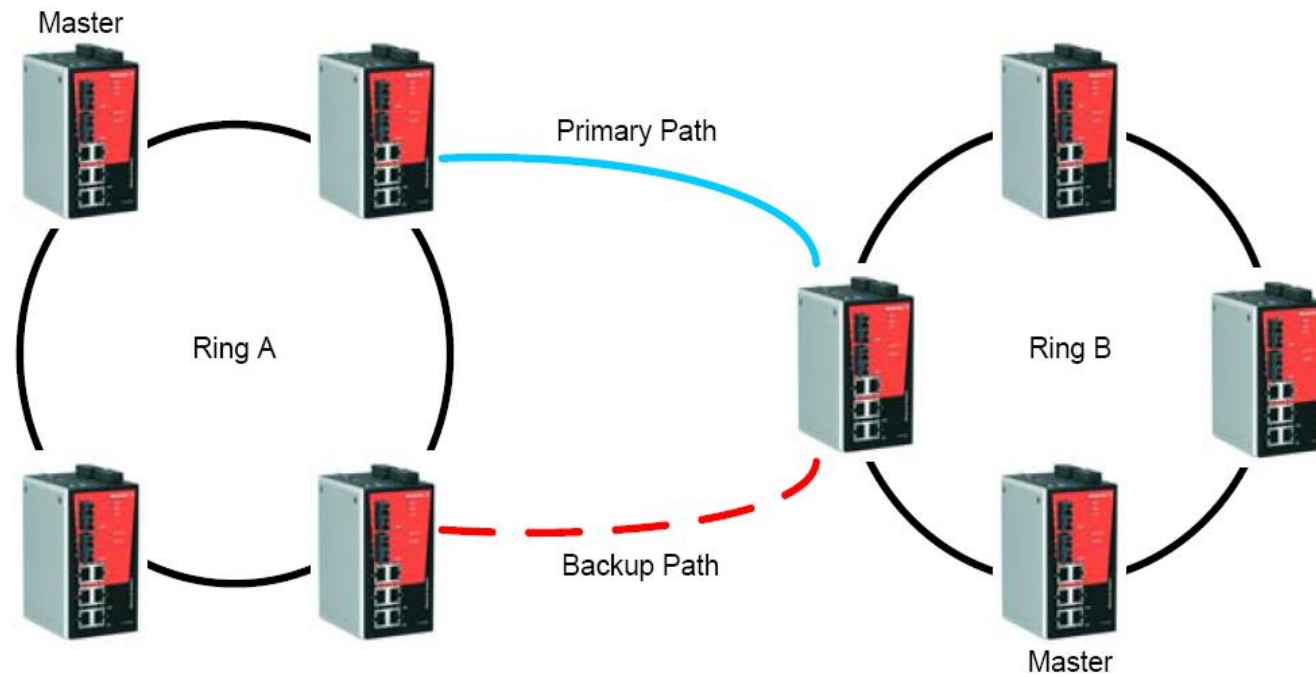
Pérdida del enlace

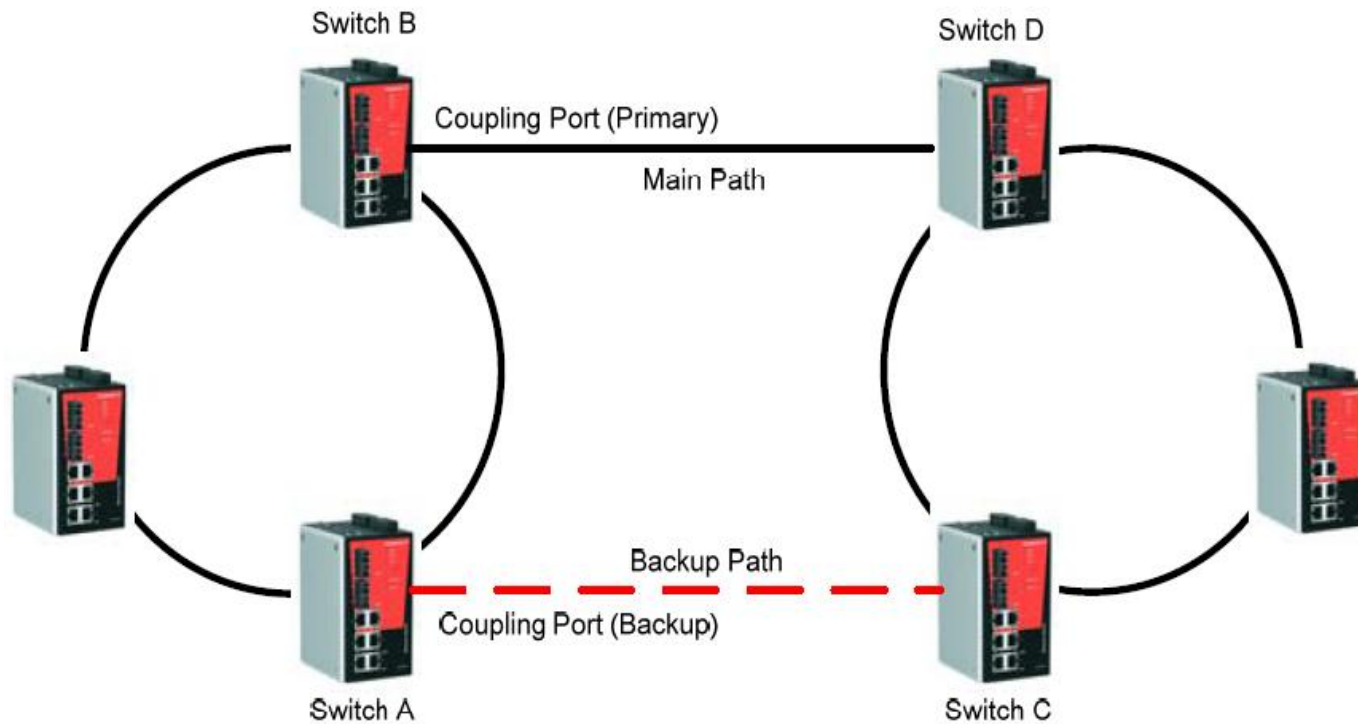


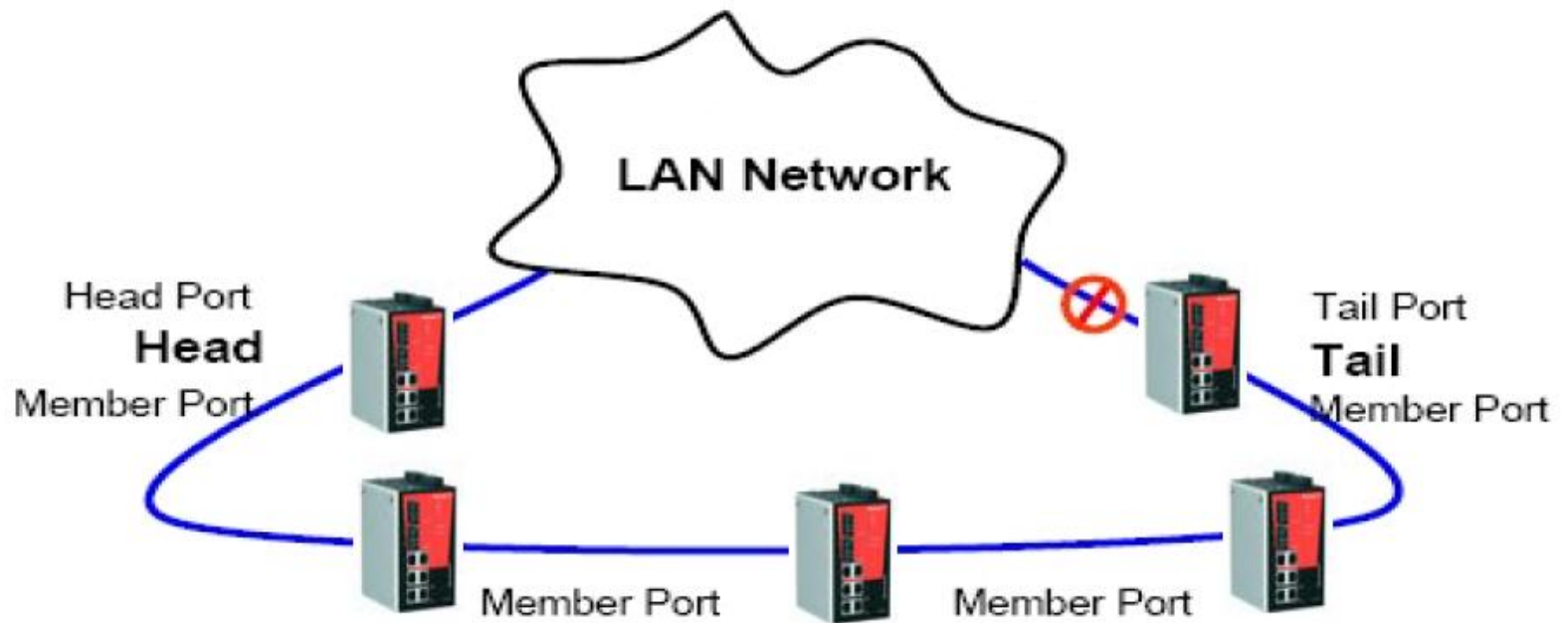
Pérdida del switch



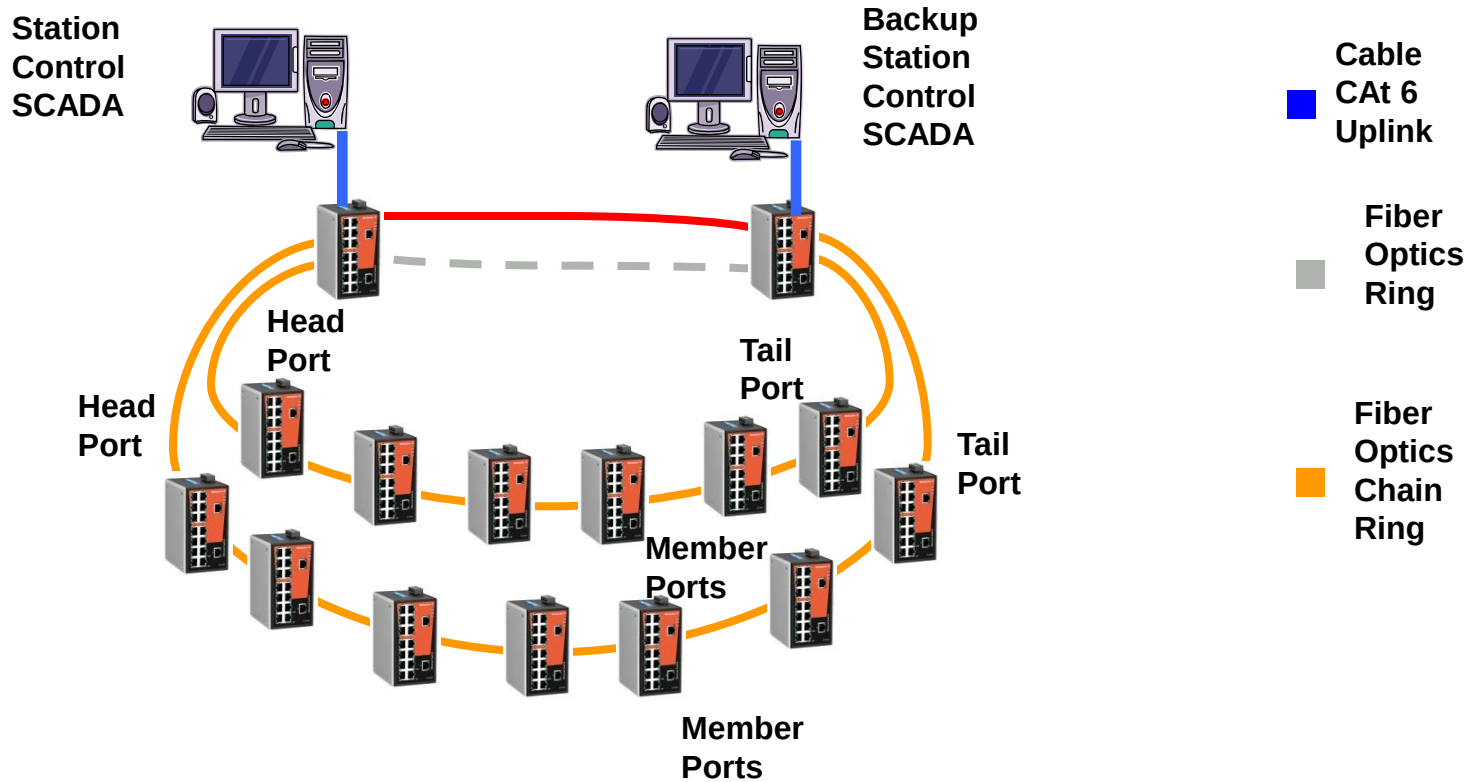




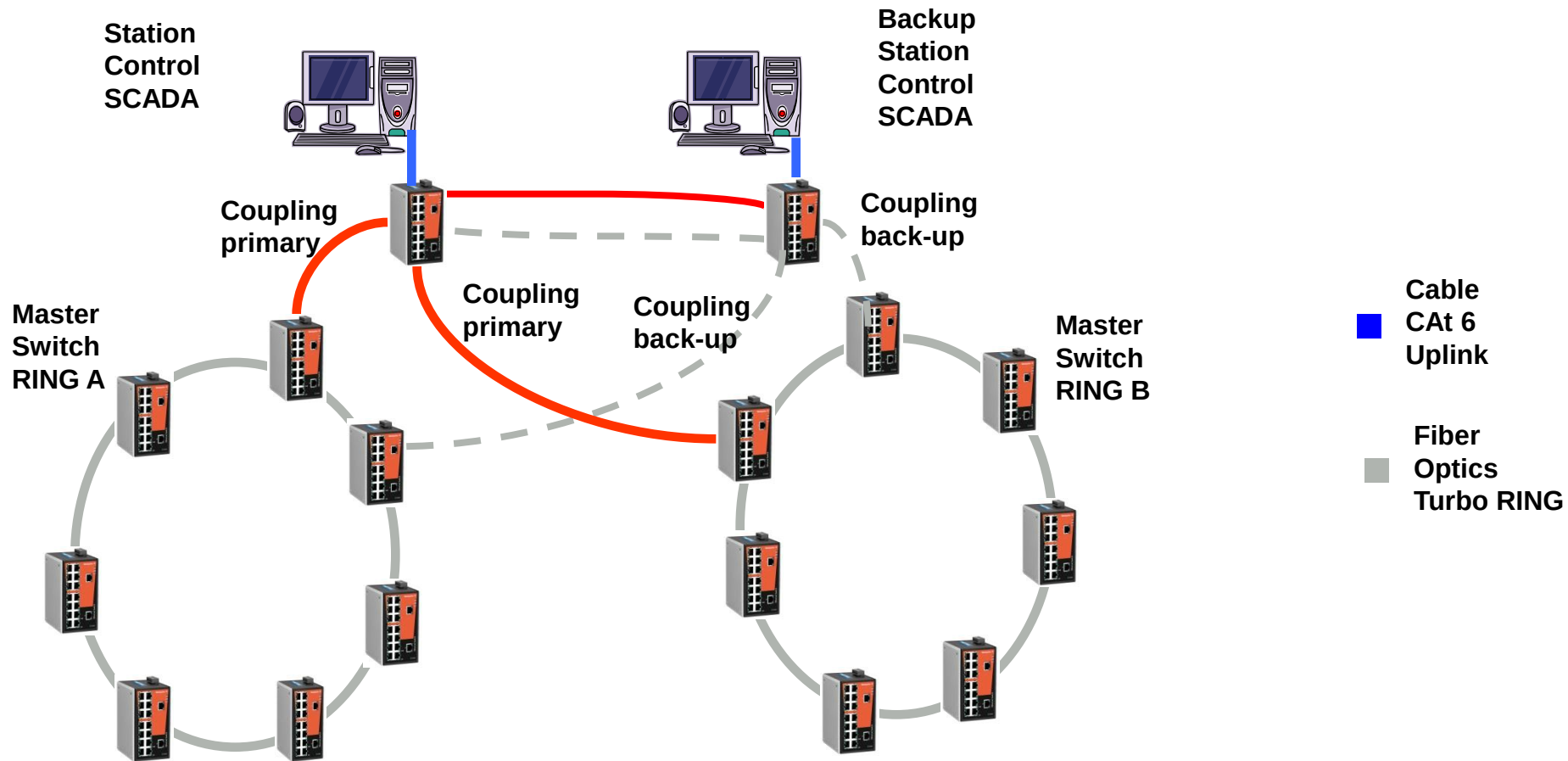




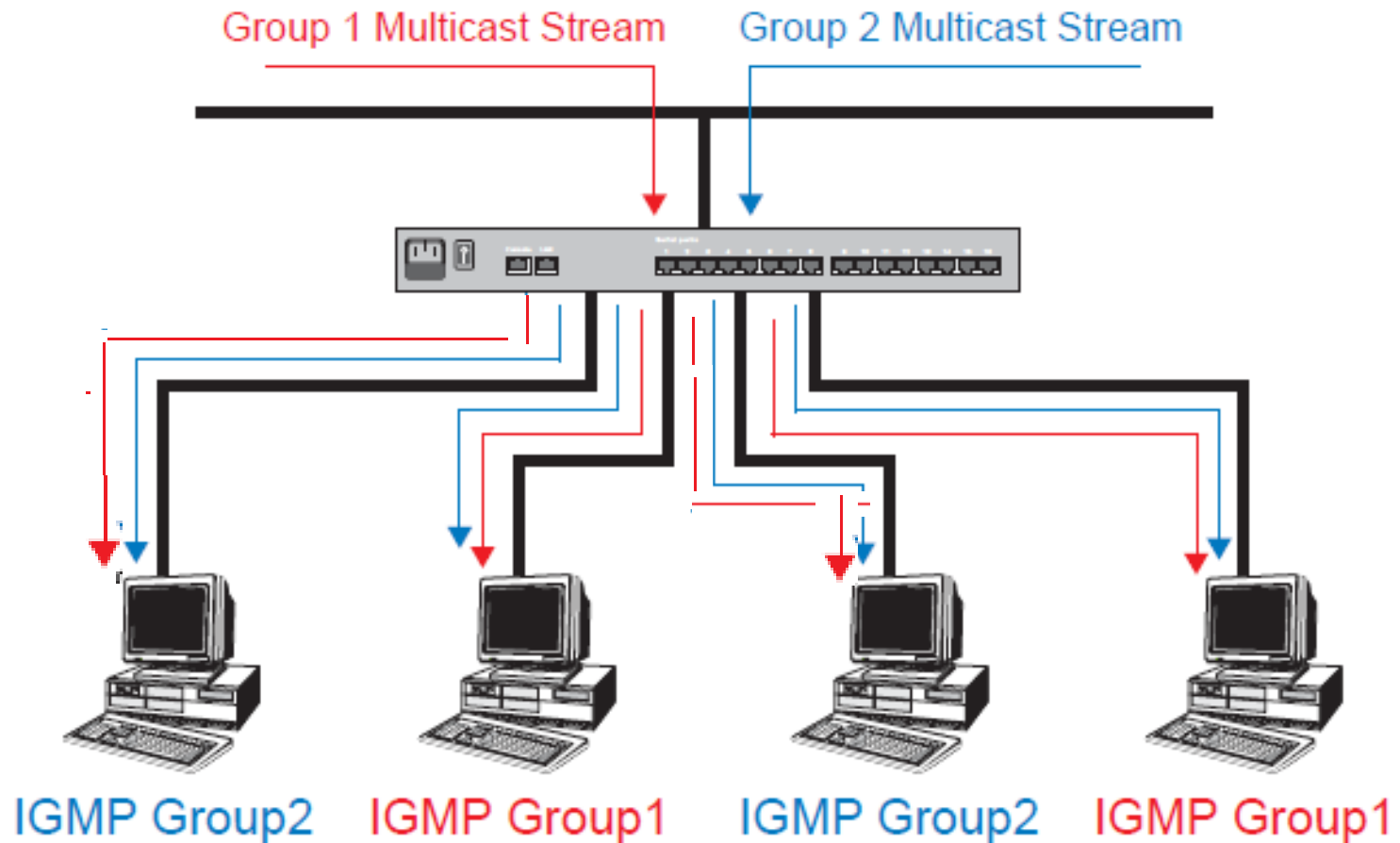
REDUNDANCIAS(EJEMPLO RED CON CHAIN)

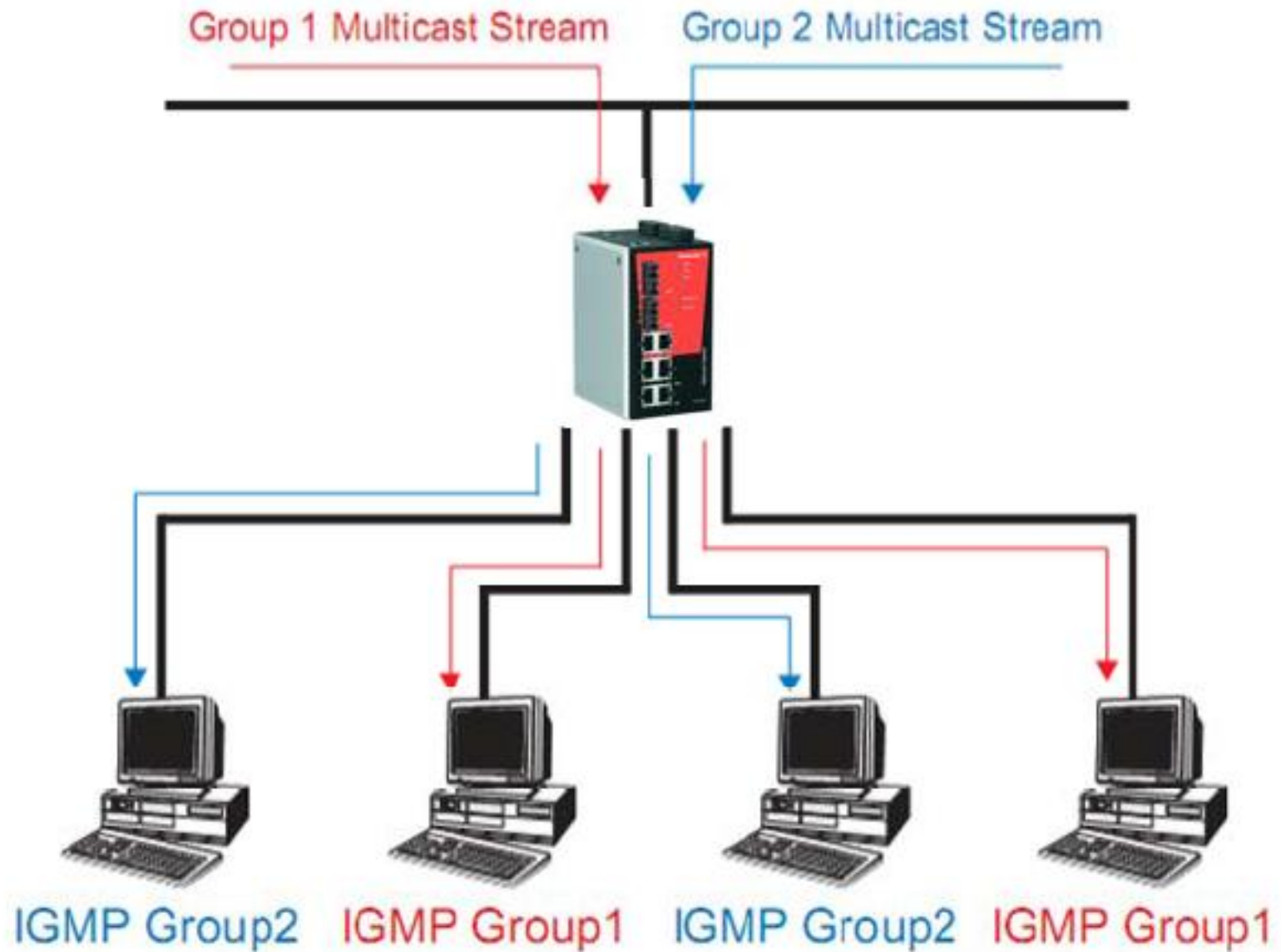


REDUNDANCIAS(EJEMPLO RED CON RING + COUPLING)



Network without multicast filtering





☐ Asignar prioridad a los datos

☐ Standards:

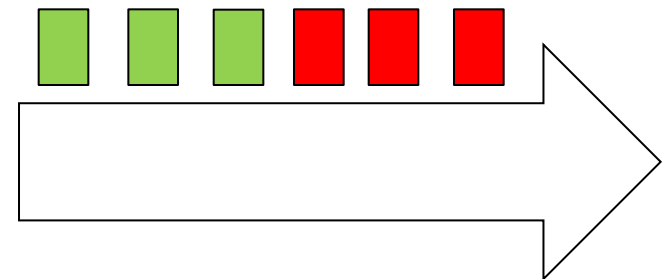
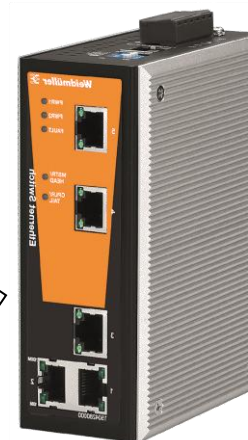
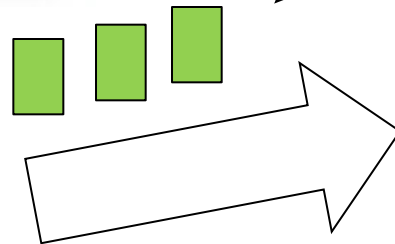
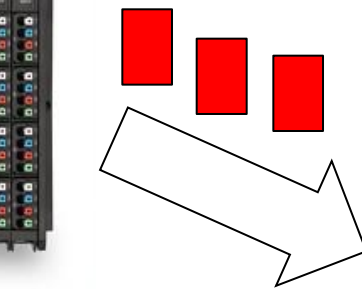
- ☐ 802.11D → Layer2 (CoS)
- ☐ DIFFSERV → Layer3 (ToS)
- ☐ Port Based

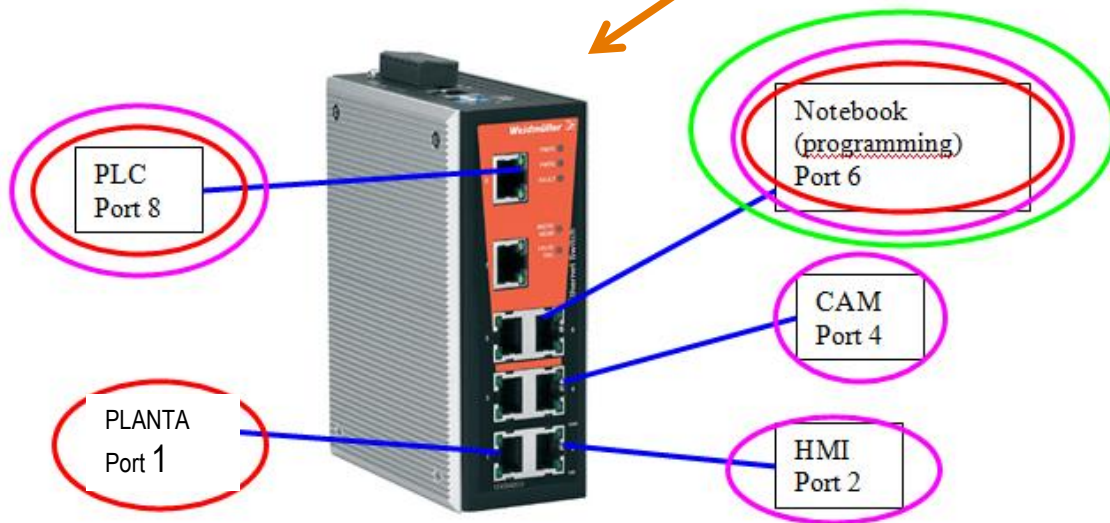
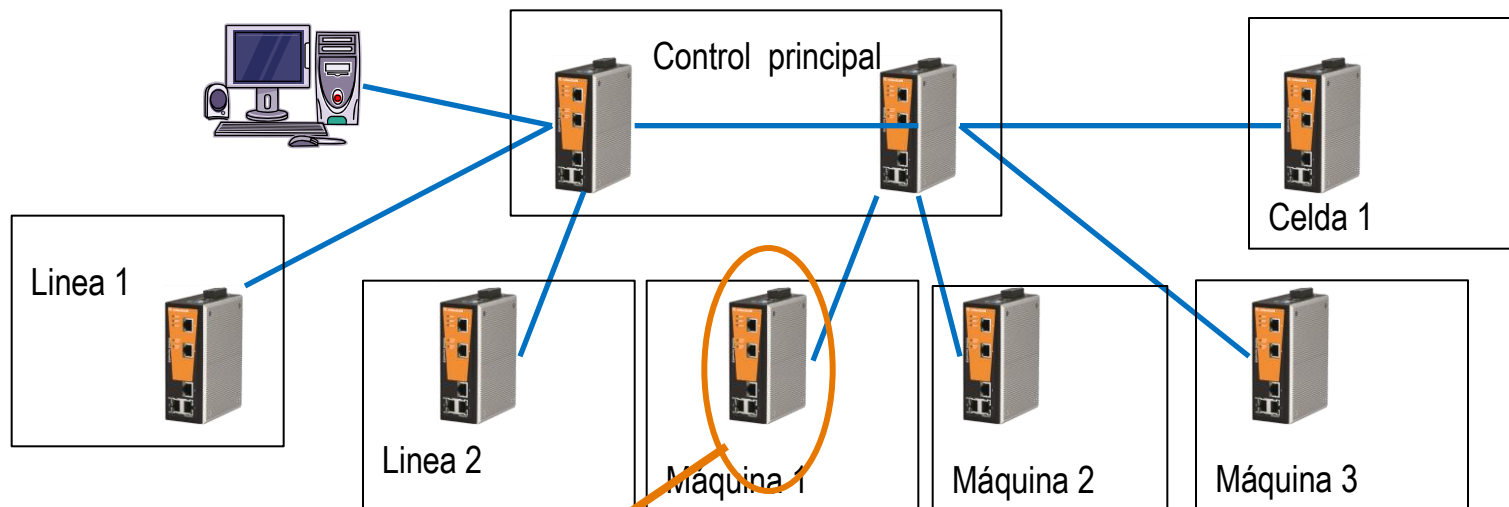
QoS Classification

Queuing Mechanism

Weight Fair(8:4:2:1)

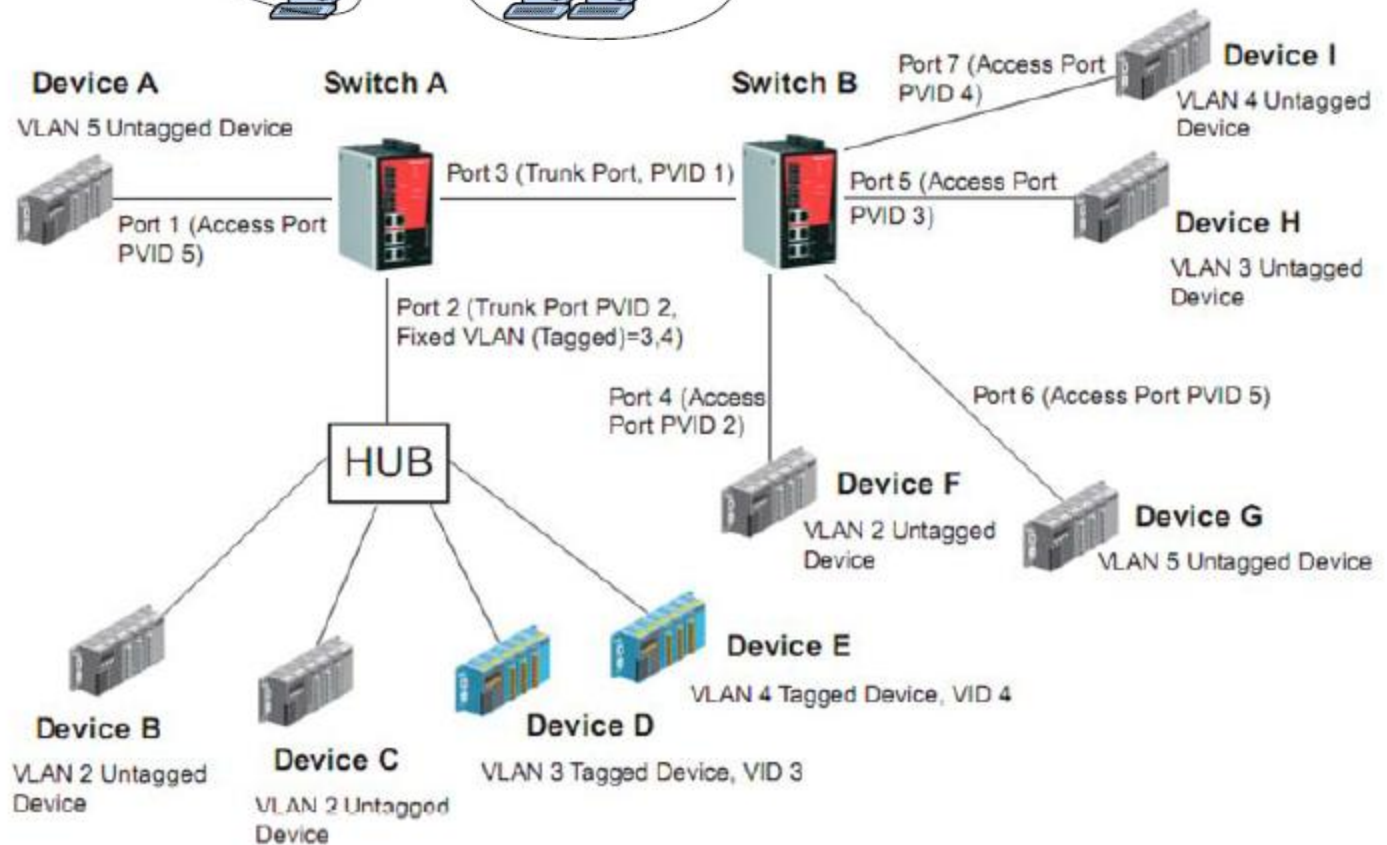
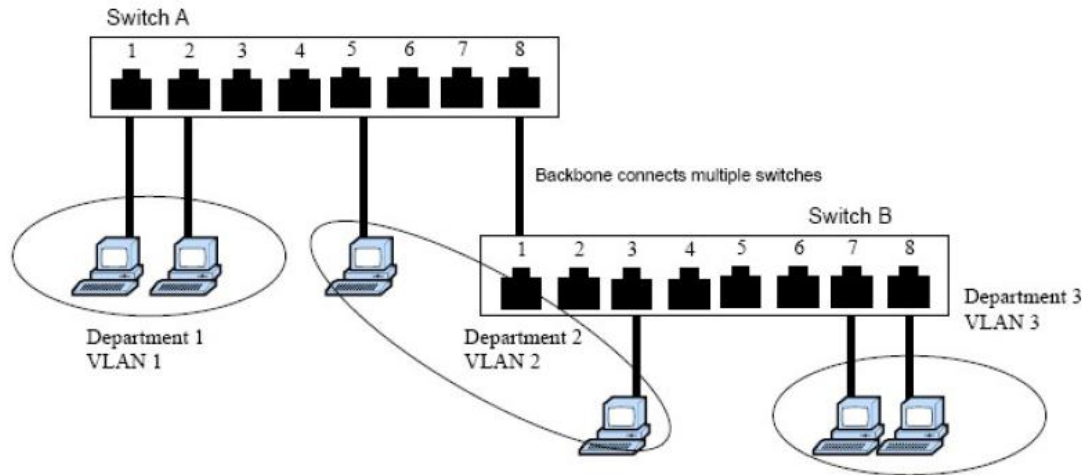
Port	Inspect ToS	Inspect CoS	Port Priority
1	☒	☒	3(Normal) ▾
2	☒	☒	3(Normal) ▾
3	☒	☒	3(Normal) ▾
4	☒	☒	3(Normal) ▾
5	☒	☒	3(Normal) ▾
6	☒	☒	3(Normal) ▾
7	☒	☒	3(Normal) ▾
8	☒	☒	3(Normal) ▾





VLAN port setting

- ❑ VLAN 2 RED DE MÁQUINA:
 - ❑ CAM + HMI+ PLC (VIOLETA)
- ❑ VLAN 3 RED DE FÁBRICA:
 - ❑ PLC + PLANTA (ROJA)
- ❑ VLAN 4 PROGRAMACIÓN:
 - ❑ TODOS LOS PUERTOS (VERDE)



Relay Warning Events Settings

System Events

☐ Override Relay 1 Warning Settings

Power Input 1 failure(On->Off)

DI 1 (Off)

DI 1 (On)

Turbo Ring Break

☐ Override Relay 2 Warning Settings

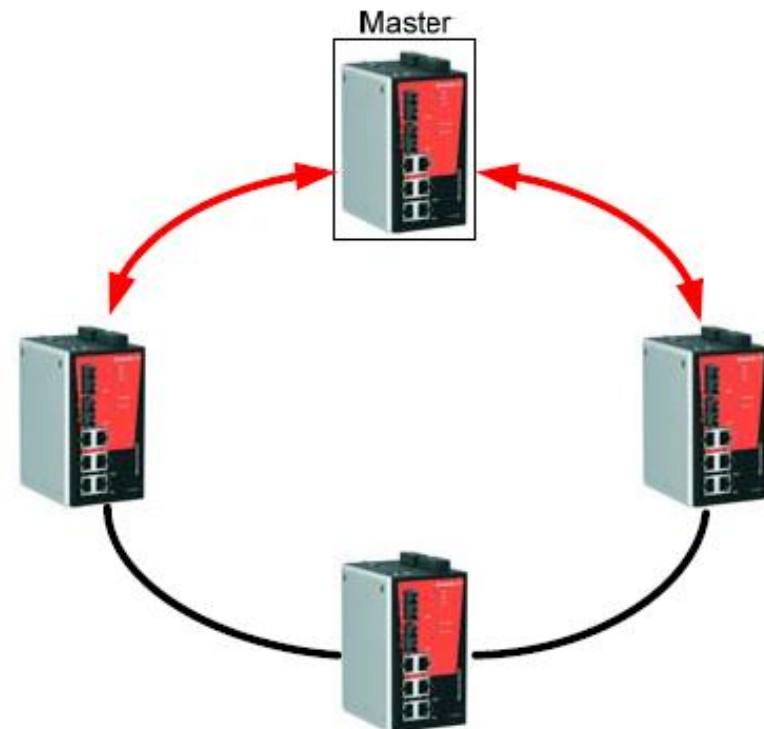
Power Input 2 failure(On->Off)

DI 2 (Off)

DI 2 (On)

Port Events

Port	Link	Traffic-Overload	Rx-Threshold(%)	Traffic-Duration(s)
1	Ignore	Disable	1	1
2	Ignore	Disable	1	1
3	Ignore	Disable	1	1
4	Ignore	Disable	1	1
5	Ignore	Disable	1	1
6	Ignore	Disable	1	1
7	Ignore	Disable	1	1
8	Ignore	Disable	1	1



Email Warning Events Settings

System Events

- ☐ Switch Cold Start ☐ Switch Warm Start ☐ Power Transition(On->Off) ☐ Power Transition(Off->On)
☐ DI 1(Off) ☐ DI 1(On) ☐ DI 2(Off) ☐ DI 2(On)
☐ Config. Change ☐ Auth. Failure ☐ Comm. Redundancy Topology Changed

Port Events

Port	Link-ON	Link-OFF	Traffic-Overload	Rx-Threshold(%)	Traffic-Duration(s)
1	☐	☐	☐	0	1
2	☐	☐	☐	0	1
3	☐	☐	☐	0	1
4	☐	☐	☐	0	1
5	☐	☐	☐	0	1
6	☐	☐	☐	0	1
7	☐	☐	☐	0	1
8	☐	☐	☐	0	1

Activate

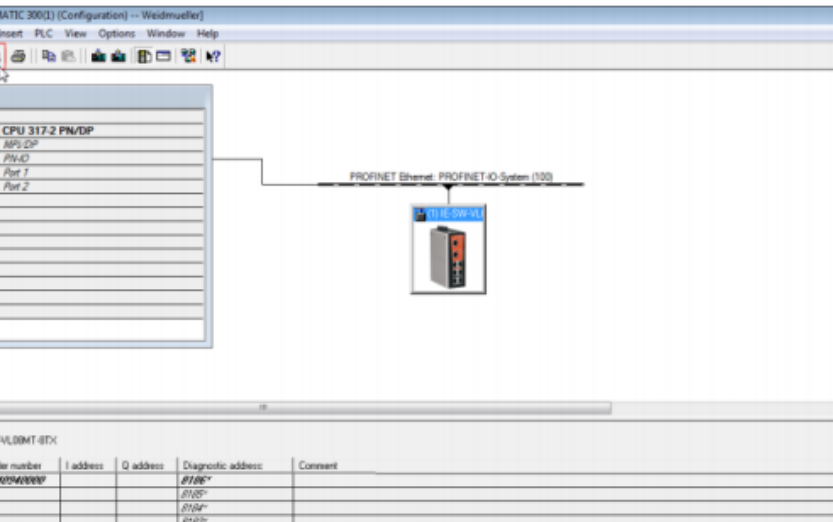
Email Warning Events Settings

Mail Server IP/Name:
SMTP Port:
Account Name:
Account Password:
☐ Change Account Password
Old Password:
New Password:
Retype Password:

1st email address:
2nd email address:
3rd email address:
4th email address:

Send Test E-mail

Activate



PROFINET Cyclic I/O Data Table

Category	Direction	Byte	Bit	Name	Description
Device	Input	0	0	Device status	0 is failed status, 1 is OK.
			1	Power 1	0 is unavailable, 1 is OK
			2	Power 2	0 is unavailable, 1 is OK
			3	RSTP status	0 is disabled, 1 is enabled
			4	Turbo Ring v1	0 is disabled, 1 is enabled
			5	Turbo Ring v2	0 is disabled, 1 is enabled
			6	Turbo Chain	0 is disabled, 1 is enabled
			7	Turbo Ring v2 status	0 is broken, 1 is healthy
Port	Input	1	0	Port 1 Connection	0 is not connected, 1 is connected
			1	Port 2 Connection	0 is not connected, 1 is connected
			2	Port 3 Connection	0 is not connected, 1 is connected
			3	Port 4 Connection	0 is not connected, 1 is connected

- Profinet Design:
- <http://www.profibus.com/download/installation-guide/>
- ODVA ETHERNET/IP Infrastructure Guide:
- http://www.odva.org/Portals/0/Library/Publications_Numbered/PUB00035R0_Infrastructure_Guide.pdf

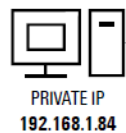


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APLICACIONES ROUTING

End Customer 1

PRODUCTION NETWORK



PRIVATE IP
192.168.1.84



PRIVATE IP
192.168.1.120

ROUTER
PRIVATE WAN IP
192.168.1.22

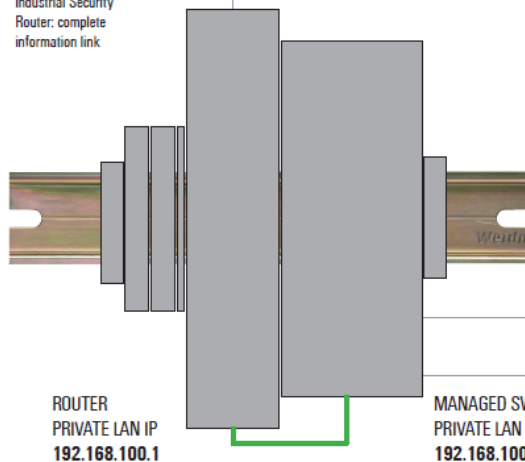


ROUTER
PRIVATE LAN IP

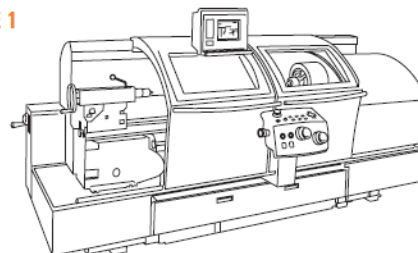
ROUTER
PRIVATE WAN IP
192.168.1.26



Industrial Security
Router: complete
information link



MACHINE 1



MACHINE
PRIVATE LAN IP
192.168.100.105

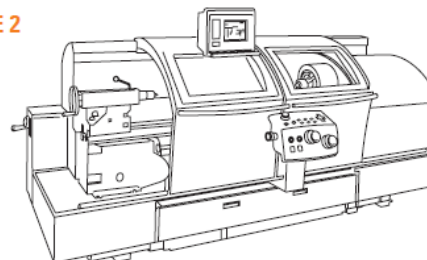


MACHINE
PRIVATE LAN IP
192.168.100.101



MACHINE
MANAGED SWITCH
PRIVATE LAN IP

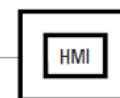
MACHINE 2



MACHINE
PRIVATE LAN IP
192.168.100.105



MACHINE
PRIVATE LAN IP
192.168.100.101



Router forwarding **MACHINE 1**

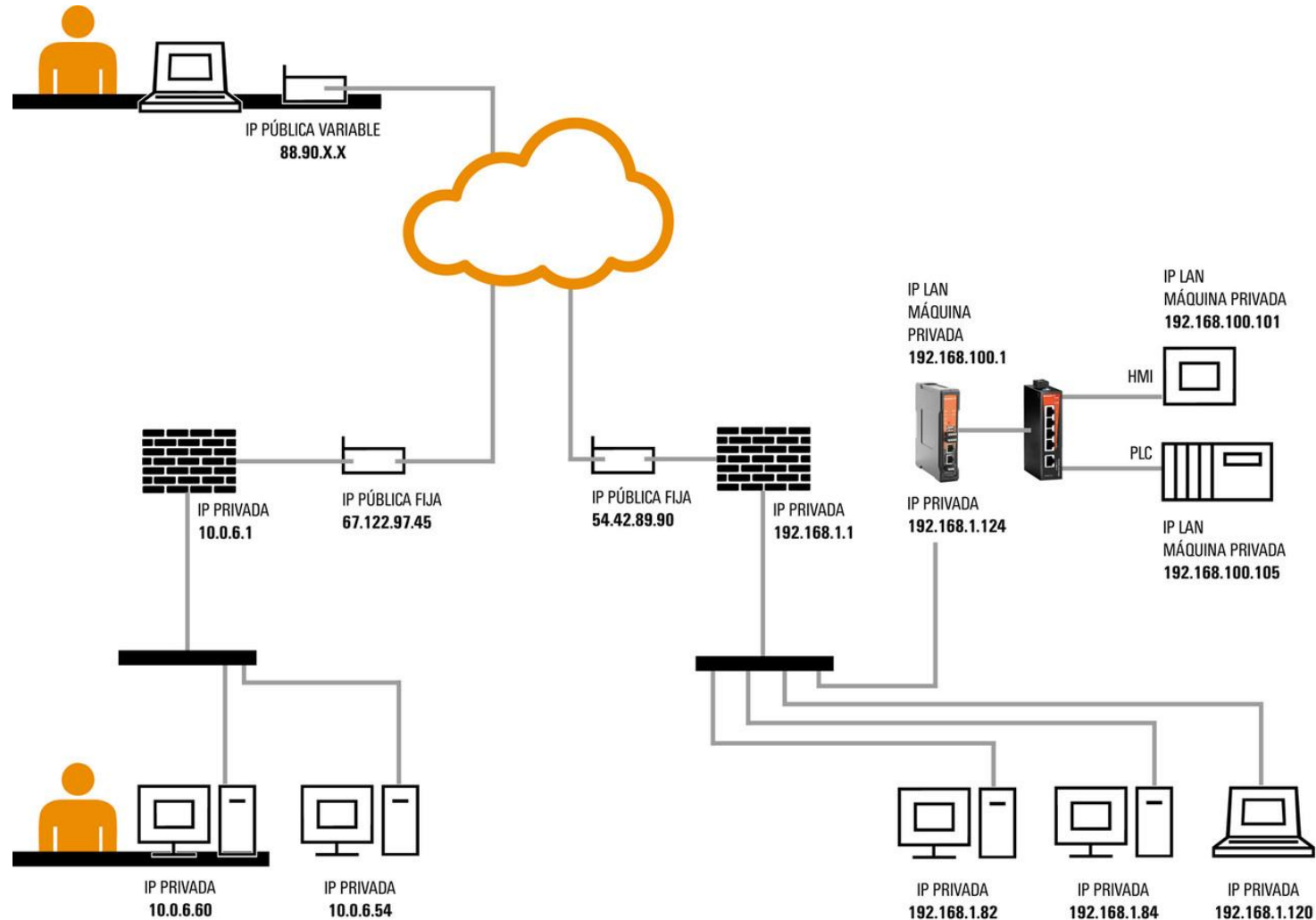
EQUIPMENT	WAN	LAN
ROUTER	192.168.1.22	192.168.100.1
SWITCH	192.168.1.23	192.168.100.102
PLC	192.168.1.24	192.168.100.105
HMI	192.168.1.25	192.168.100.101

Router forwarding **MACHINE 2**

EQUIPMENT	WAN	LAN
ROUTER	192.168.1.26	192.168.100.1
SWITCH	192.168.1.27	192.168.100.102
PLC	192.168.1.28	192.168.100.105
HMI	192.168.1.29	192.168.100.101

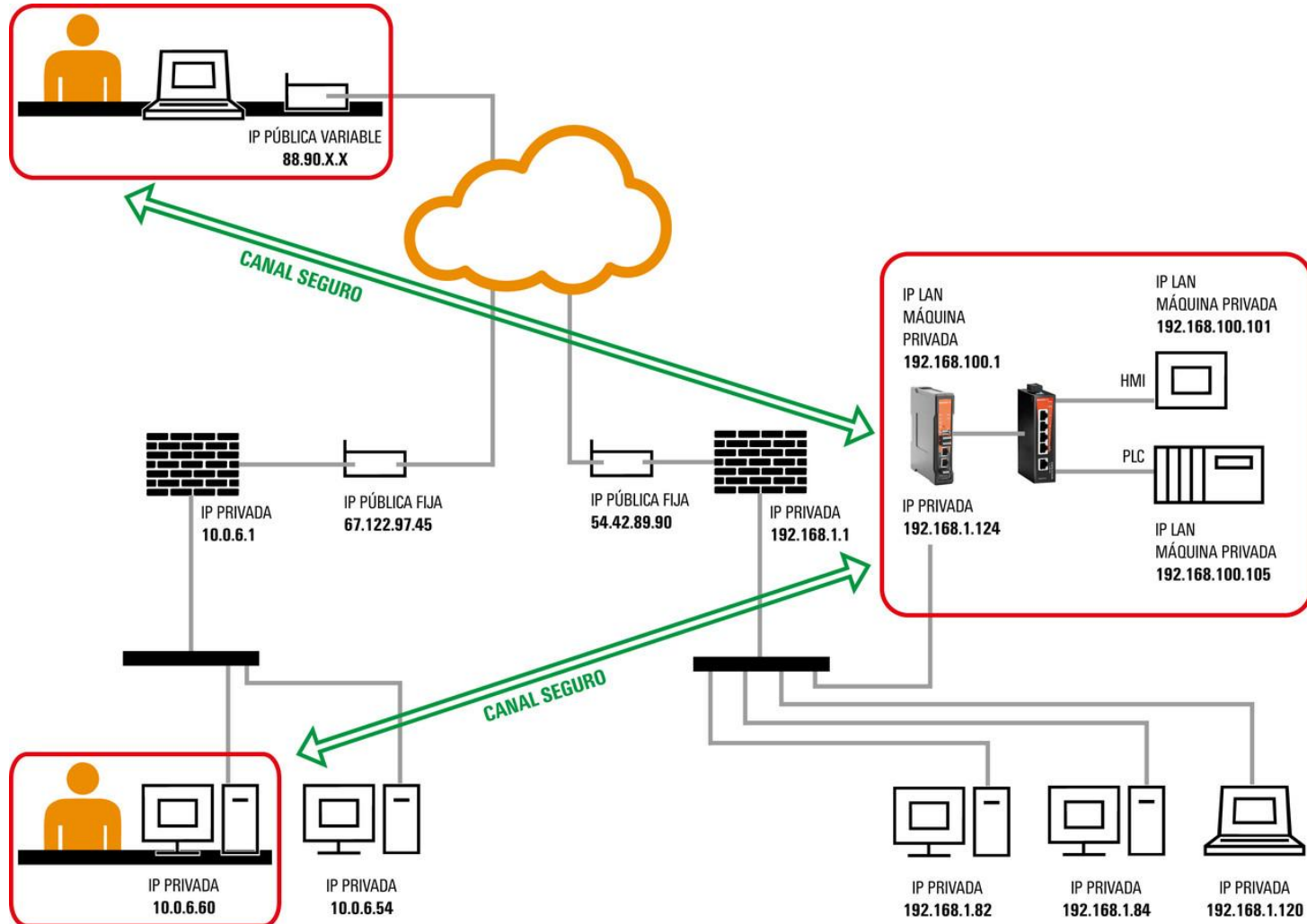
Situación inicial

- IP pública vs. IP privadas.
- Red Máquina
- Red Interna
- Usuarios acceso remoto.



Objetivo

- Canal seguro
- Usuario final dentro LAN remota.





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RUEGOS Y PREGUNTAS



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