



REDES INDUSTRIAIS

Disponibilidade de Redes Industriais



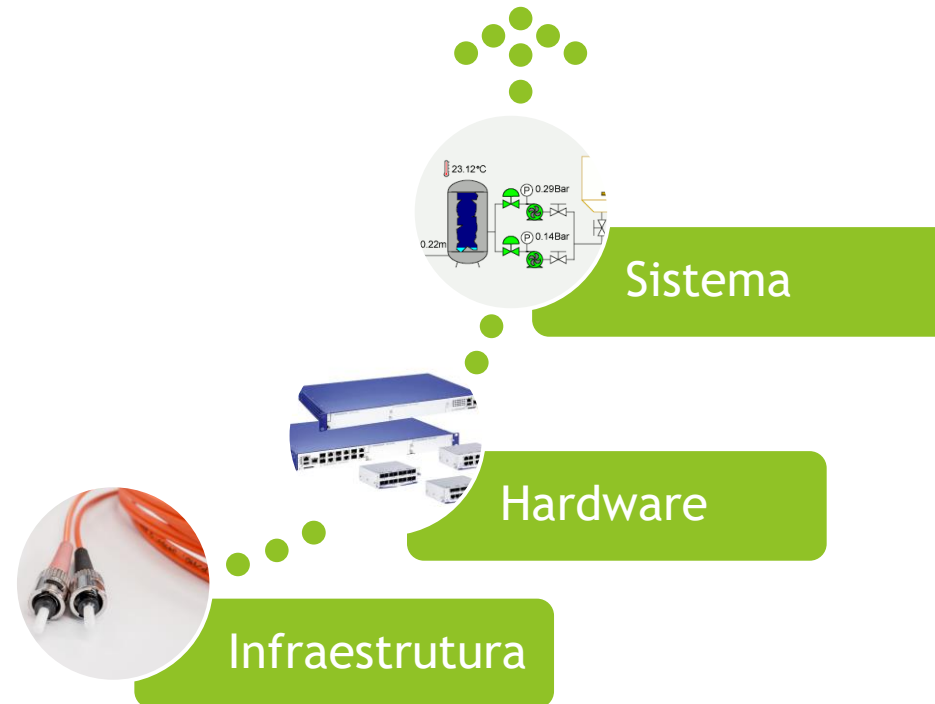
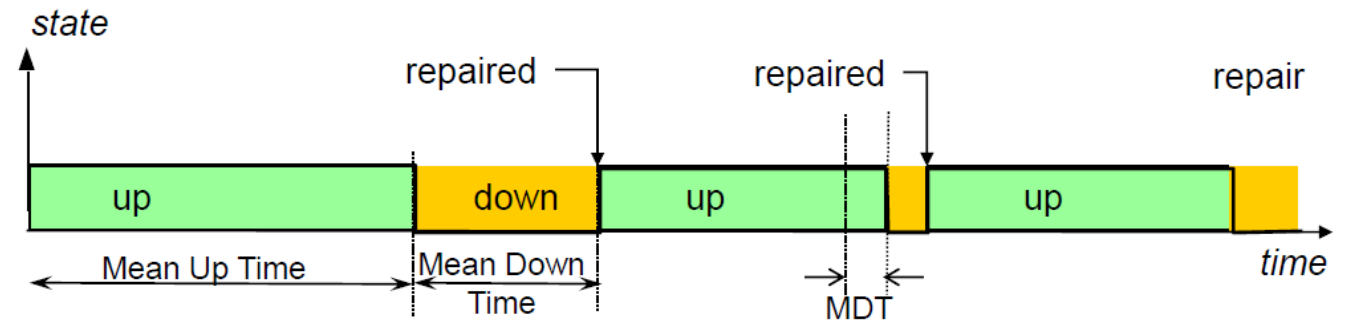
Divulgando as tecnologias a favor da vida.

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Sinopse

- ▶ A premissa fundamental da indústria é a **disponibilidade**, sendo esta, também aplicável às redes industriais. Nesta palestra, iremos abordar como uma infraestrutura de rede industrial pode adotar novos **conceitos e boas práticas** de forma a torná-la mais robusta, resiliente e segura. A **segurança cibernética** é intrínseca ao ambiente operacional, porém nem sempre temos a compreensão de como as soluções de segurança cibernética disponíveis no mercado podem auxiliar a garantir a continuidade dos processos. Nos acompanhe para uma breve jornada partindo dos problemas aos diferentes conceitos e soluções.

Disponibilidade



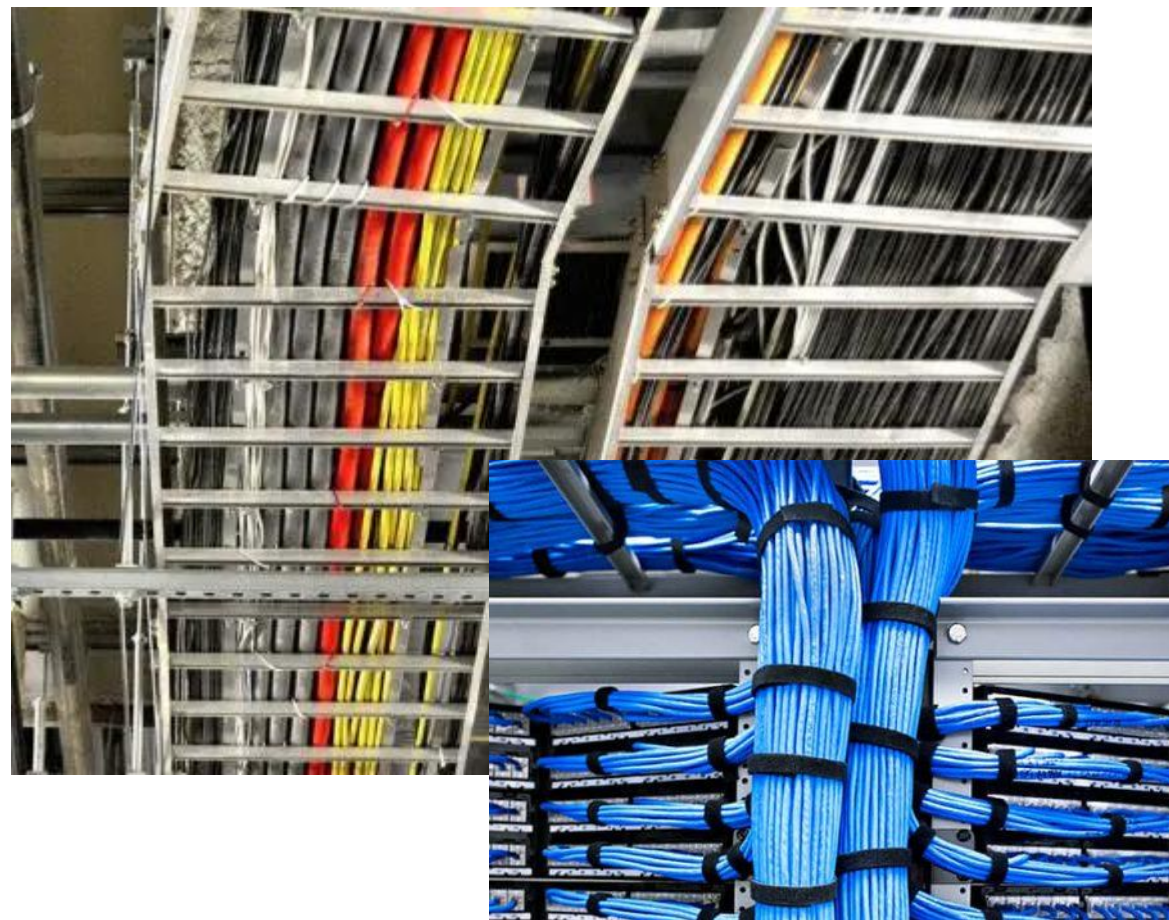
Disponibilidade Infraestrutura

- ▶ Eletrodutos
- ▶ Leitos
- ▶ Eletrocalhas

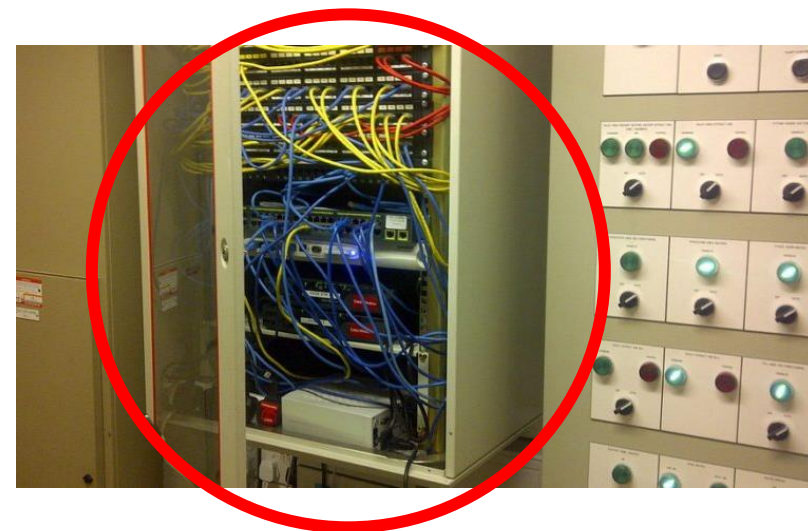
- ▶ Cabos par trançado UTP, STP, SFTP
- ▶ Cabos Fibra Óptica

- ▶ Lançamento subterrâneo
- ▶ Lançamento aéreo

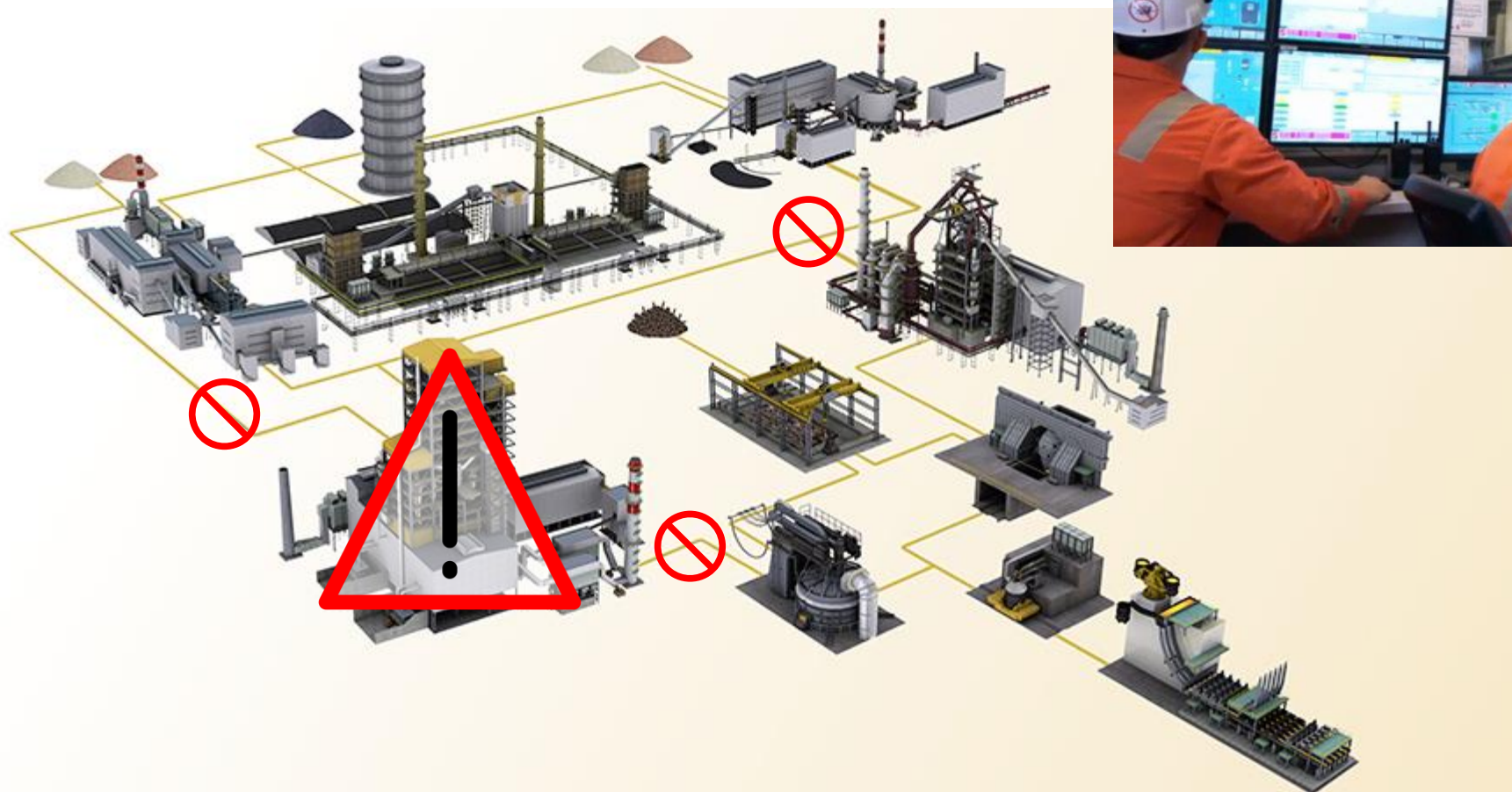
- ▶ Conectorização
- ▶ Limpeza, inspeção e certificação das fibras



Disponibilidade Infraestrutura

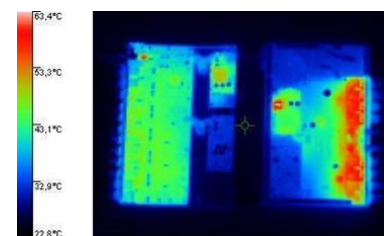


Disponibilidade Infraestrutura



Disponibilidade Hardware

- ▶ Premissas de hardware
 - ▶ Temperatura de operação
 - ▶ Compatibilidade Eletromagnética
 - ▶ MTBF
 - ▶ 'The Five Nines' 99,999%
- ▶ Redundância
 - ▶ Fontes de alimentação
 - ▶ Protocolos de alta disponibilidade



▶ Temperatura



▶ Choque



▶ Vibração

Disponibilidade Hardware

Vendor	Qtd.	MTBF [horas]	Taxa de falha [1/MTBF]	Operação [anos]	volume x %quebra [un.]
	10	1968468	5,08E-07	10	0
concorrente A	10	374052	2,67E-06	10	2
concorrente B	10	201480	4,96E-06	10	4

Vendor	Qtd.	MTBF [horas]	Taxa de falha [1/MTBF]	Operação [anos]	volume x %quebra [un.]
	10	1968468	5,08E-07	30	1
concorrente A	10	374052	2,67E-06	30	5
concorrente B	10	201480	4,96E-06	30	7

$$\text{CONFIABILIDADE} = R(t) = e^{-\lambda \cdot t}$$

λ = taxa de falhas

t = tempo

e = Número de Euler

$$\lambda(t) = \frac{1}{\text{MTBF}}$$

Precisa seguir a unidade do
MTBF (horas, dias...)

2,71

Disponibilidade

Hardware + Infraestrutura

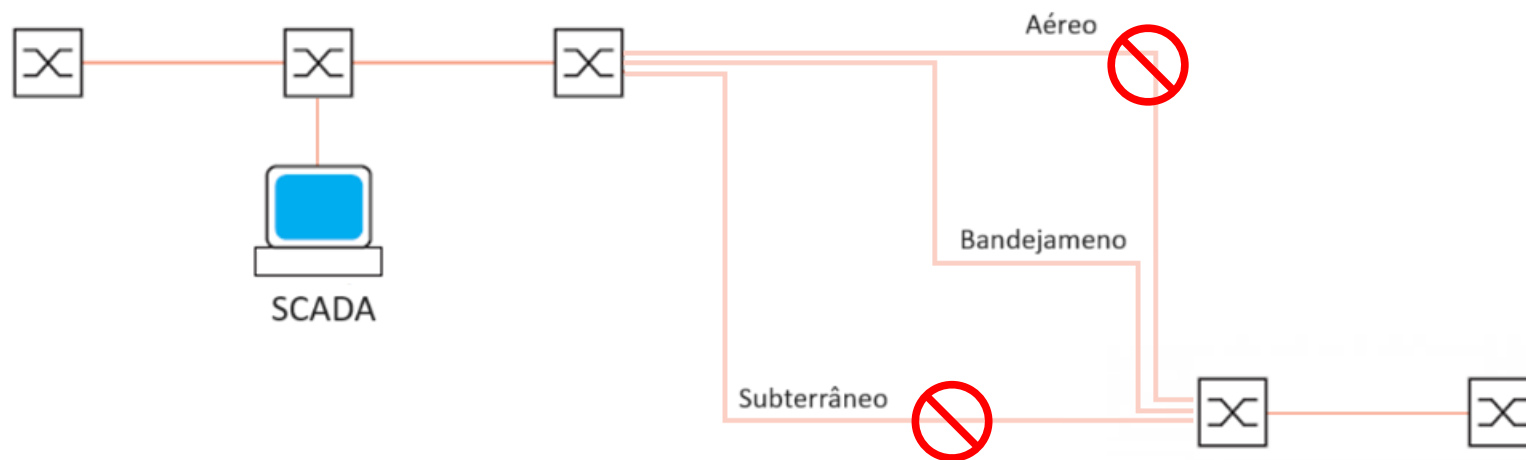
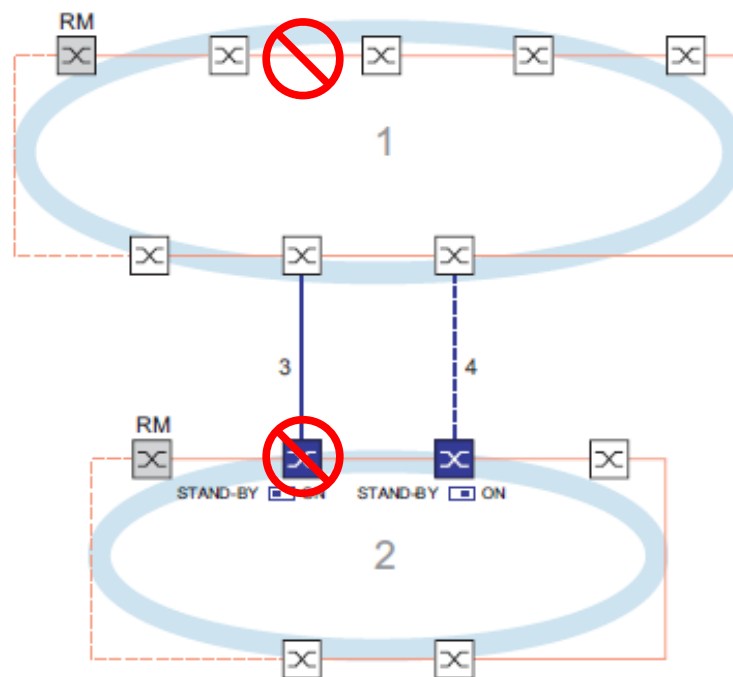


Figure 1: Example of link aggregation

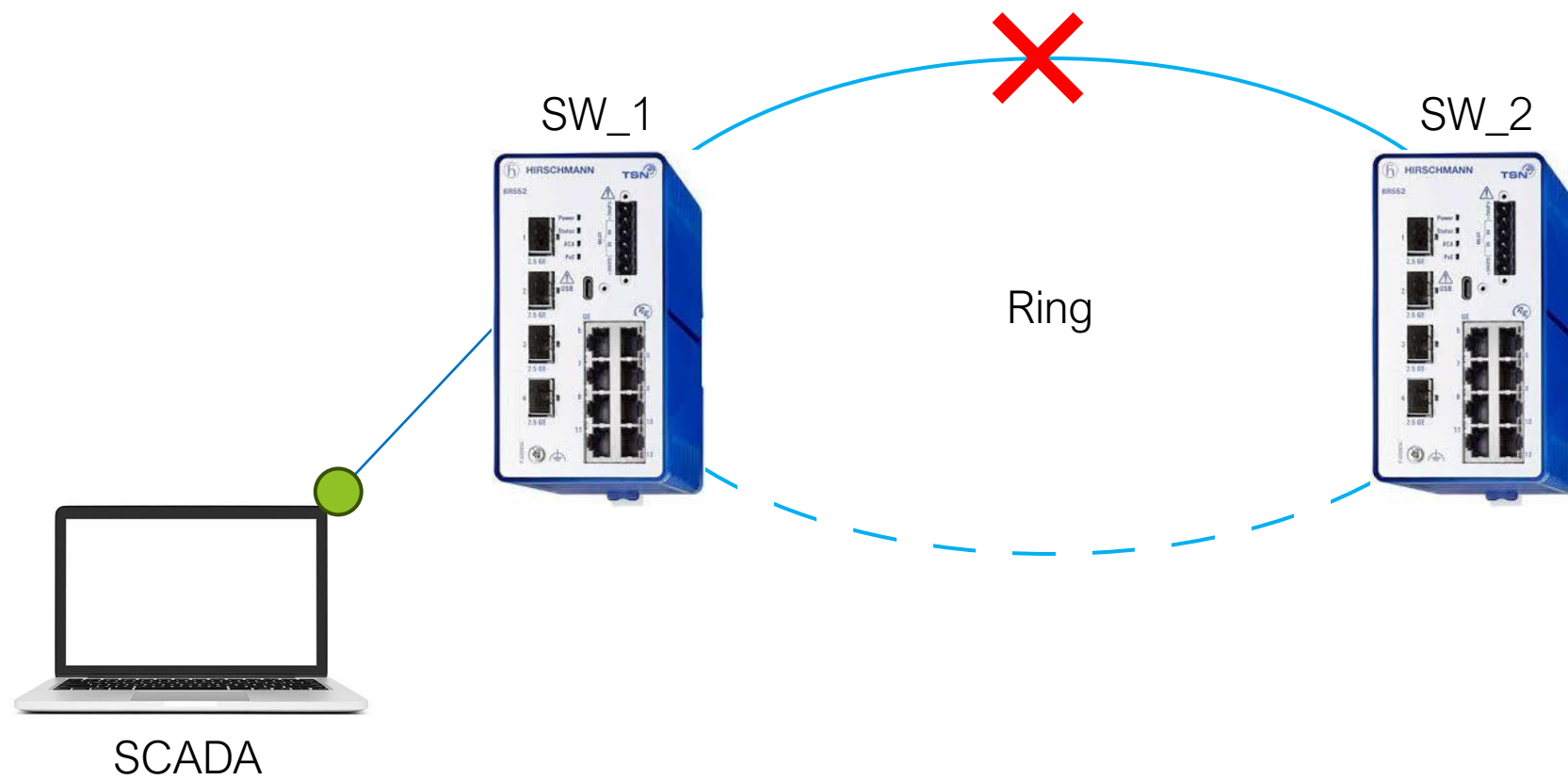


Disponibilidade

Hardware + Infraestrutura



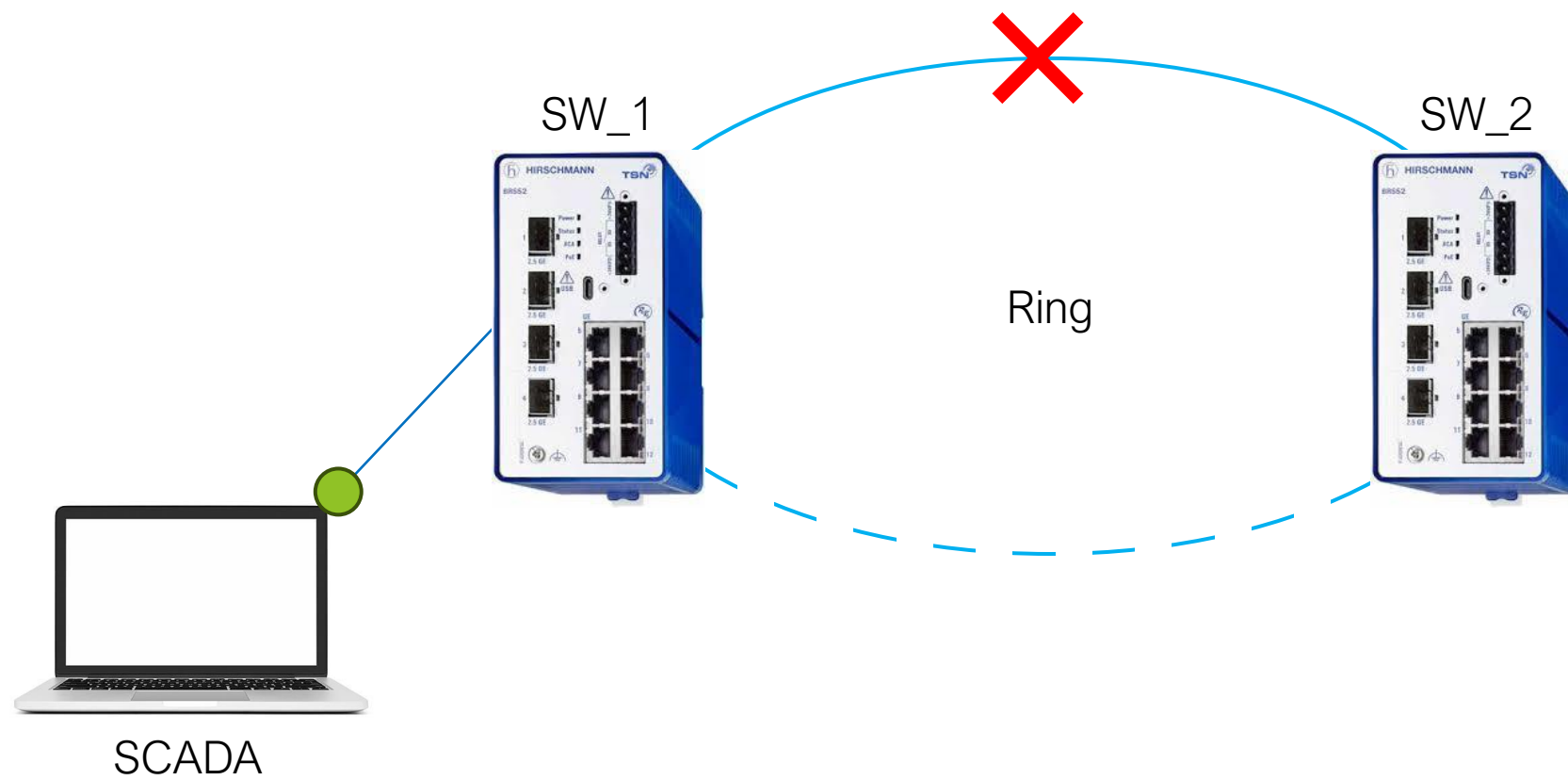
Disponibilidade Sistema



*RECOVERY TIME
sub 50ms*



Disponibilidade Sistema



*RECOVERY TIME
sub 50ms*



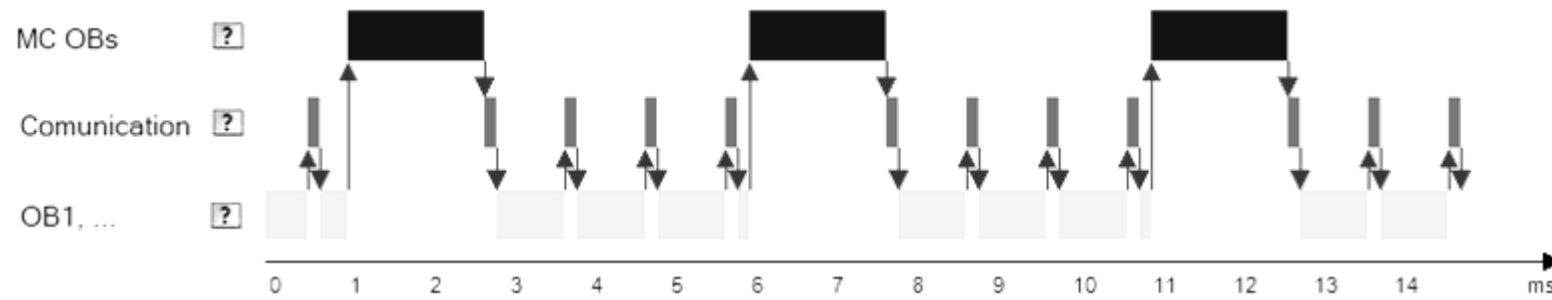
Conceitos e Boas Práticas

Rede Ethernet Industrial

“

O tempo de recuperação após uma falha de comunicação deve ser menor do que o tempo do ciclo operacional para passar despercebido pela aplicação.

“



Conceitos e Boas Práticas

Rede Ethernet Industrial

- ▶ Não crítico
 - < 10s (not real time)
 - ▶ Enterprise Resource Planning, Manufacturing Execution
- ▶ Automação em geral
 - < 1s (soft real-time)
 - ▶ Human Interface, SCADA, building automation, thermal
- ▶ Benignos
 - < 100ms (real-time)
 - ▶ process & manufacturing industry, power plants
- ▶ Críticos
 - < 10ms (hard real time)
 - ▶ synchronized drives, robot control, substations, X-by-wire

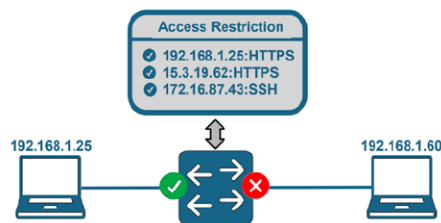


Conceitos e Boas Práticas

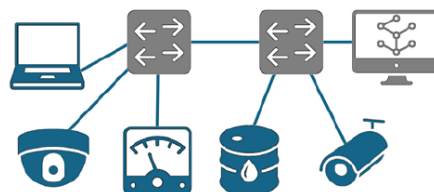
Segurança Cibernética



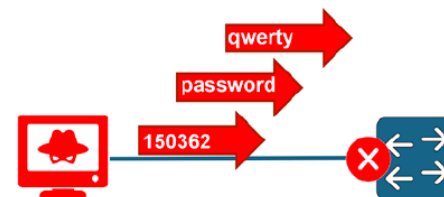
► Bloqueio de portas



► Restrição de acesso



► Segmentação de rede



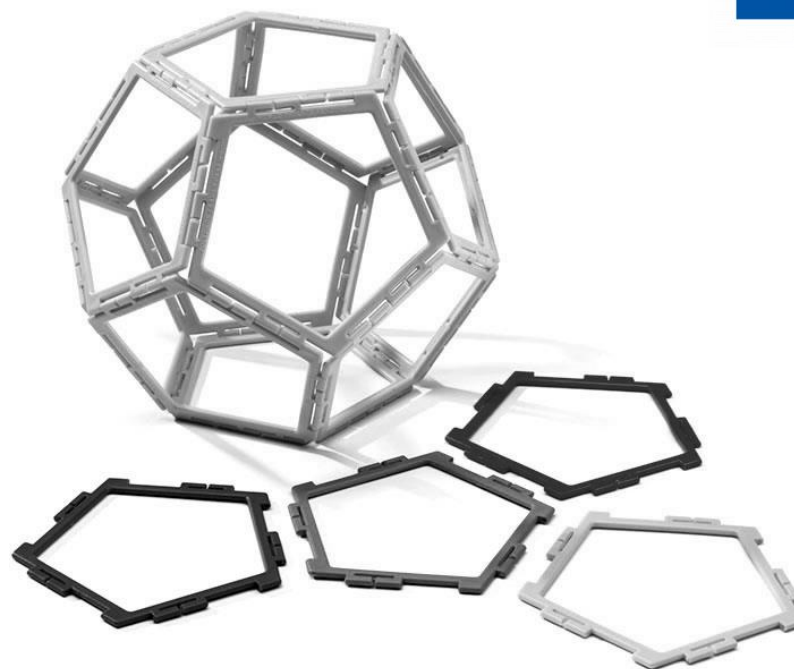
► Gerenciamento de senha



► Gerenciamento de configuração

Conceitos e Boas Práticas

Segurança Cibernética

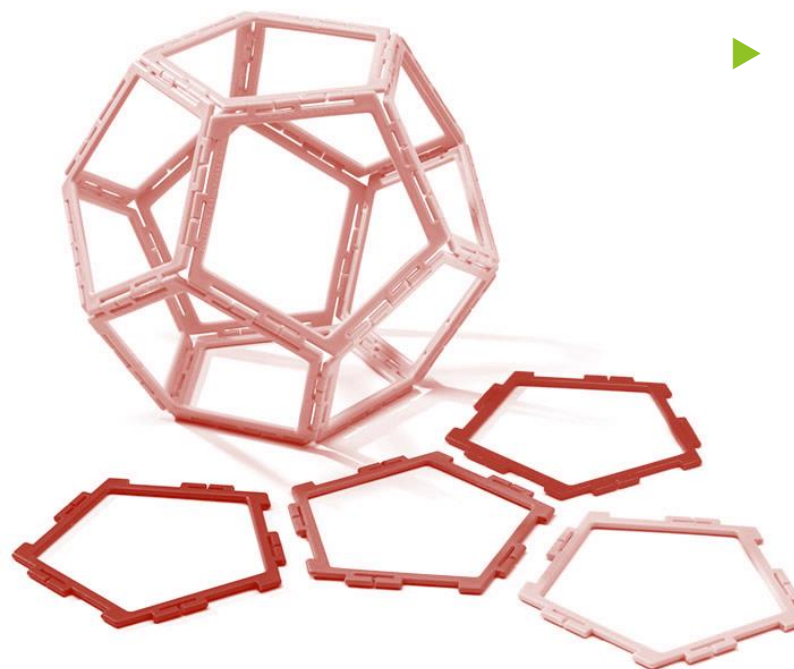


Conceitos e Boas Práticas

Segurança Cibernética

▶ Controle de acesso

▶ Análise de riscos



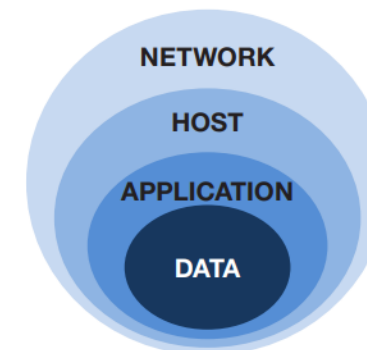
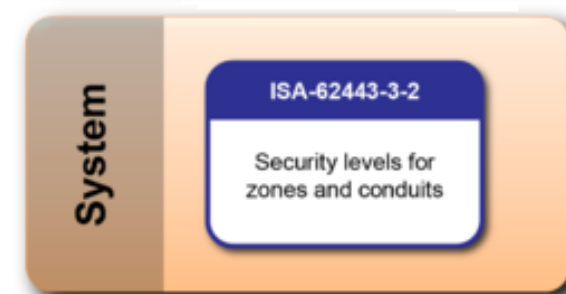
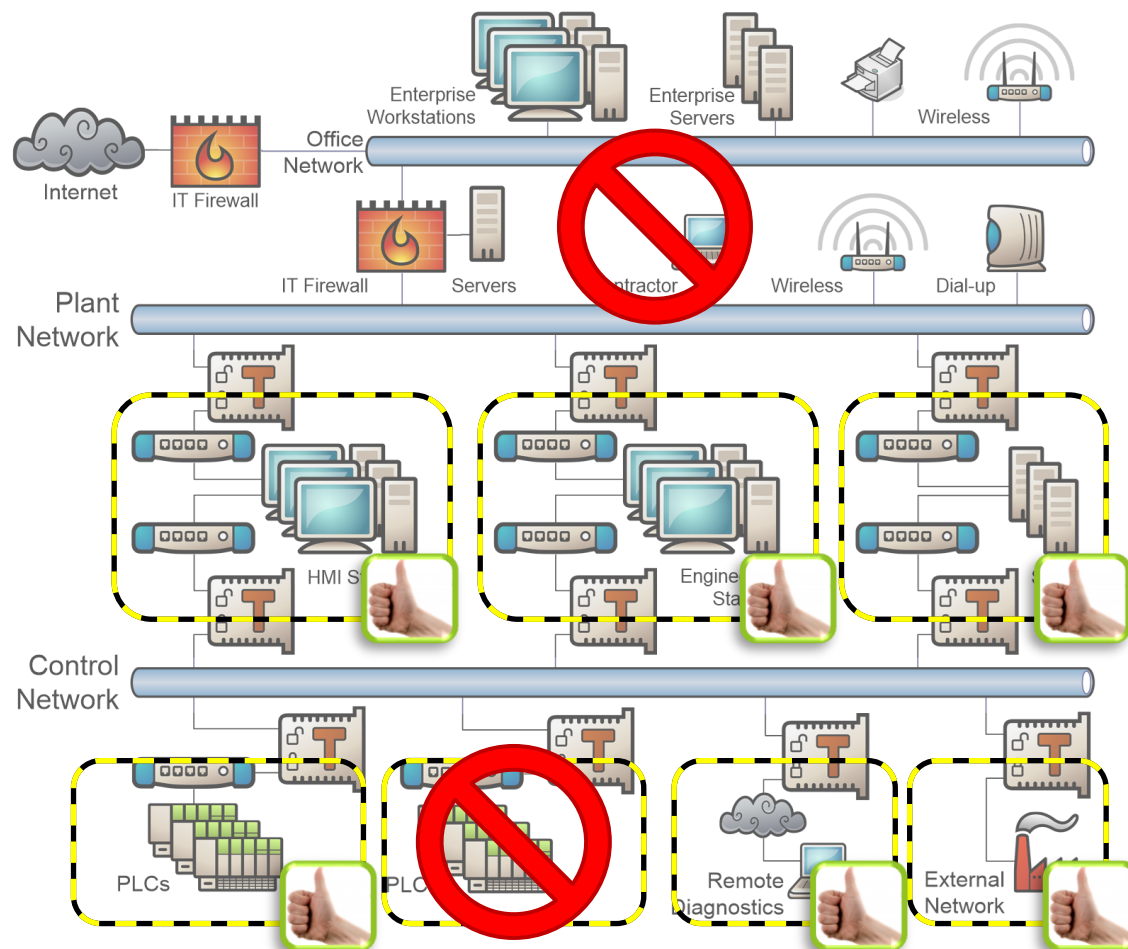
▶ Políticas corporativas

▶ Gestão de ativos

▶ Etc..

Conceitos e Boas Práticas

Segurança Cibernética



Estudo de Caso #1

Missão Crítica UFV

The screenshot shows the Hirschmann Industrial HiVision network management interface. The main window displays a network topology with several devices and their connections. A green arrow points to a specific connection between two devices. A small window titled 'mpingLCD' displays the number '0:000'. The bottom of the screen shows an event history table with columns for ID, Ack., Type, Category, Time, User, Source, Component, and Message.

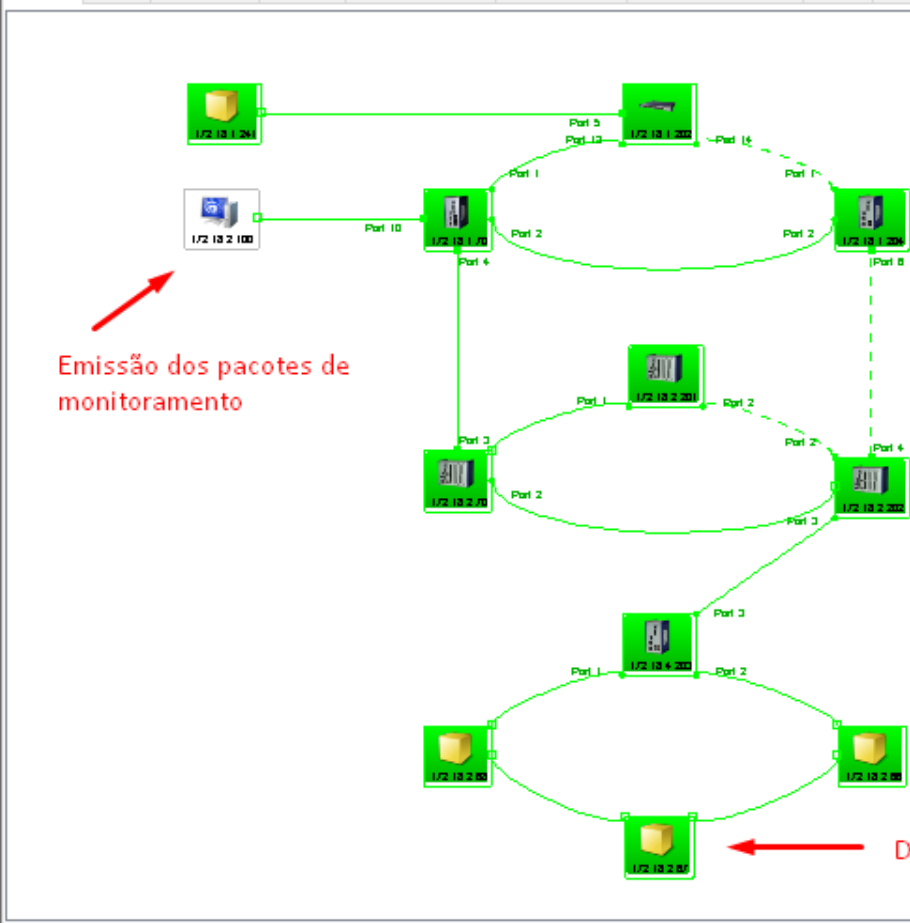
ID	Ack.	Type	Category	Time	User	Source	Component	Message
1093	<input type="checkbox"/>	Event Acknowledge		2023-05-09 11:36:15	Bruno Duarte	Industrial HiVision		Severe Events Acknowledged by User: 1087-1088,1090
1092	<input checked="" type="checkbox"/>	Status Better		2023-05-09 11:36:15	NBK_BMR_...	10.0.0.40	Protocols/Protocol Pin...	Status Improvement: OK (Reachability=Yes)
1091	<input checked="" type="checkbox"/>	Status Better		2023-05-09 11:36:07	NBK_BMR_...	10.0.0.30	Port 2/Link	Status Improvement: OK (Link=Up)
1090	<input checked="" type="checkbox"/>	Status Worse		2023-05-09 11:35:41	NBK_BMR_...	10.0.0.40	Protocols/Protocol Pin...	Status Impairment: Error (Reachability=No)
1089	<input checked="" type="checkbox"/>	Status Better		2023-05-09 11:35:15	NBK_BMR_...	10.0.0.10	Port 8/Link	Status Improvement: OK (Link=Up)
1088	<input checked="" type="checkbox"/>	Status Worse		2023-05-09 11:35:00	NBK_BMR_...	10.0.0.10	Port 8/Link	Status Impairment: Error (Link=Down)



VLAN: All

Project

- My Network
- New Devices
- Rogue Devices
- Unused Devices



mpingLCD

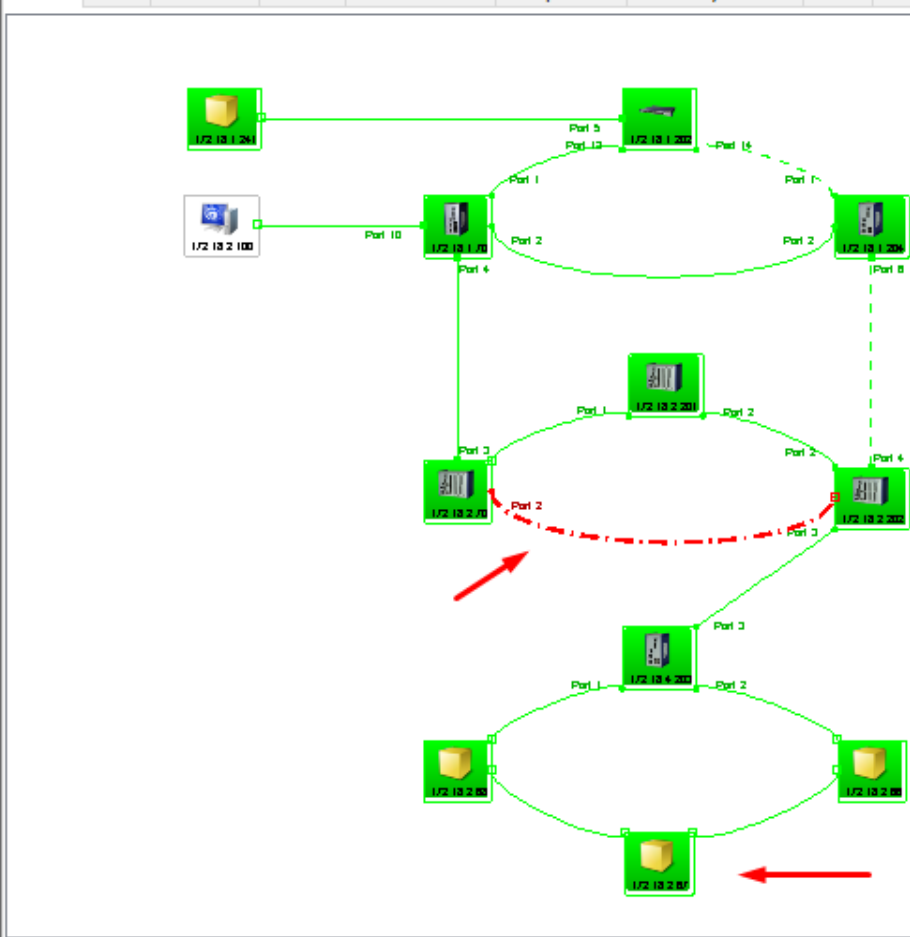
0 : 000

ID	Ack.	Type	Category	Time	User	Source	Component	Message
1227	<input type="checkbox"/>	Event Acknowledge	Industrial HiVision	2022-07-08 10:46:19	Bruno	Industrial HiVision		Severe Events Acknowledged by User: 1223
1226	<input checked="" type="checkbox"/>	Status Better		2022-07-08 10:46:16	NBK_BMR_...	172.18.2.201	Port 2/Link	Status Improvement: OK (Link=Up)
1225	<input checked="" type="checkbox"/>	Status Better		2022-07-08 10:46:14	NBK_BMR_...	172.18.2.202	Port 2/Link	Status Improvement: OK (Link=Up)
1224	<input checked="" type="checkbox"/>	Status Worse		2022-07-08 10:46:11	NBK_BMR_...	172.18.2.201	Port 2/Link	Status Impairment: Error (Link=Down)

VLAN: All

Project

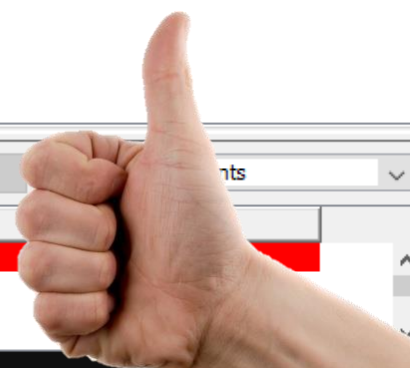
- My Network
- New Devices
- Rogue Devices
- Unused Devices



mpingLCD

0 : 0 15

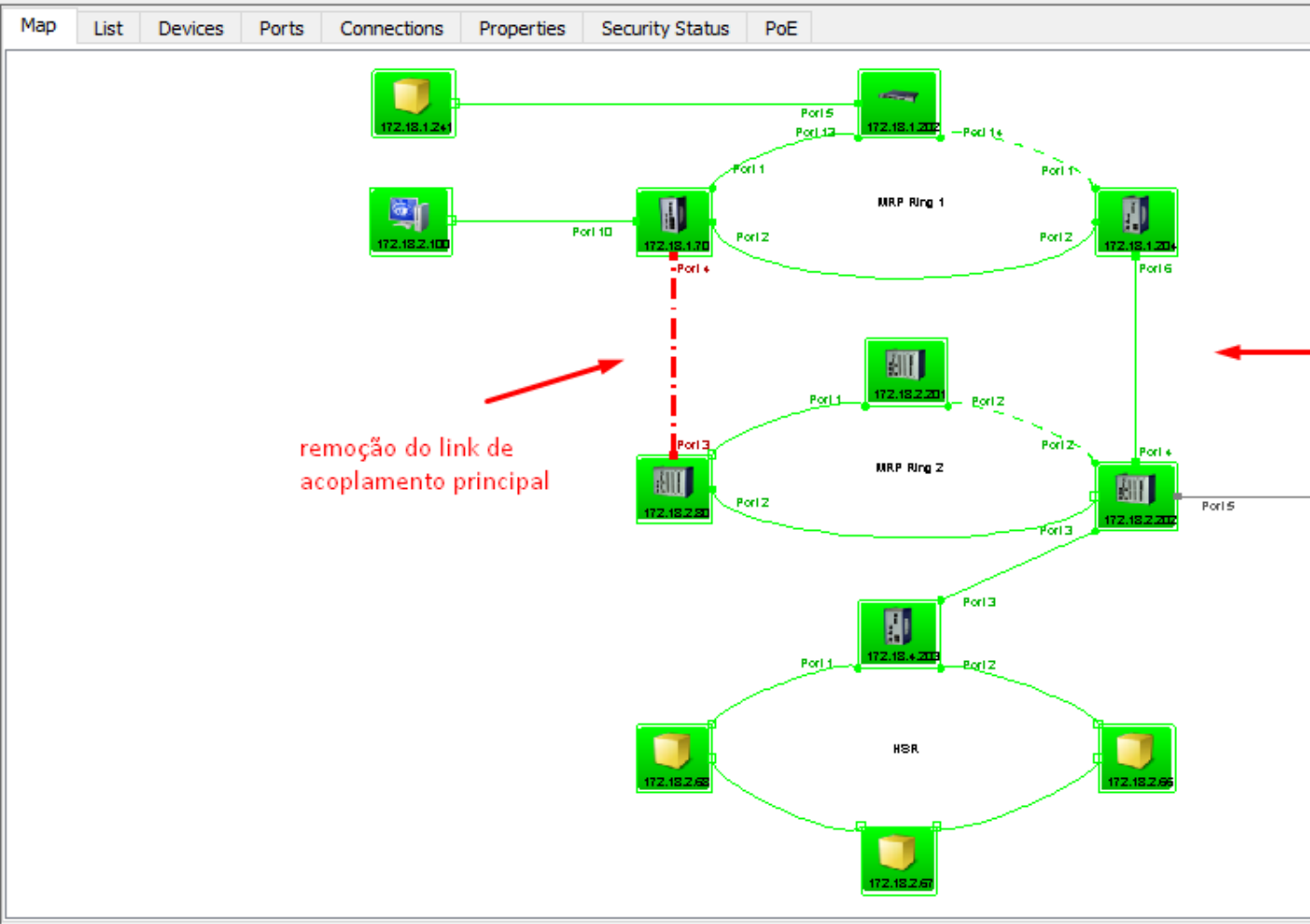
ID	Ack.	Type	Category	Time	User	Source	Component	Message
1228	<input type="checkbox"/>	✖	Status Worse	2022-07-08 10:48:42	NBK_BMR_...	172.18.2.70	Port 2/Link	Status Impairment: Error (Link=Down)
1227	<input type="checkbox"/>	ℹ	Event Acknowledge	2022-07-08 10:46:19	Bruno	Industrial HiVision		Severe Events Acknowledged by User: 1223
1226	<input checked="" type="checkbox"/>	ℹ	Status Better	2022-07-08 10:46:16	NBK_BMR_...	172.18.2.201	Port 2/Link	Status Improvement: OK (Link=Up)
1225	<input checked="" type="checkbox"/>	ℹ	Status Better	2022-07-08 10:46:14	NBK_BMR_...	172.18.2.202	Port 2/Link	Status Improvement: OK (Link=Up)



VLAN: All

Project

- My Network
- New Devices
- Rogue Devices
- Unused Devices

remoção do link de acoplamento principal

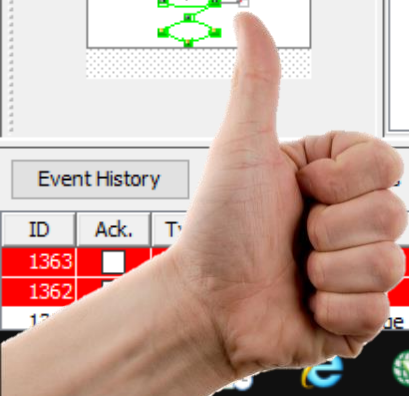
chaveamento do link de acoplamento backup

mpingLCD

0 : 035

Event History

ID	Ack.	T	Time	User	Source	Component	Message
1363			2022-07-08 12:06:02	NBK_BMR_...	172.18.2.80	Port 3/Link	Status Impairment: Error (Link=Down)
1362			2022-07-08 12:05:58	NBK_BMR_...	172.18.1.70	Port 4/Link	Status Impairment: Error (Link=Down)
1361			2022-07-08 12:05:36	Bruno	Industrial HiVision		Severe Events Acknowledged by User: 1356



Estudo de Caso #2

Missão Crítica SE



► RSTP (IEC 62439)

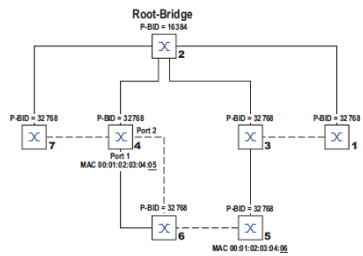
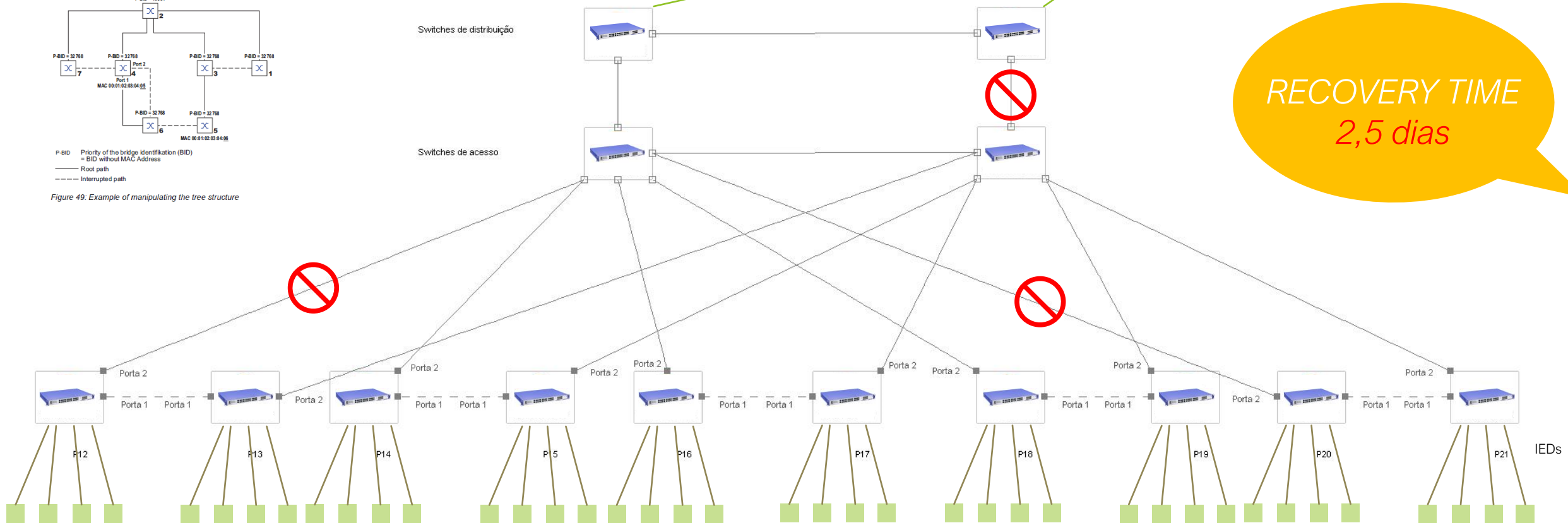


Figure 49: Example of manipulating the tree structure



ANTES

RECOVERY TIME
2,5 dias

Estudo de Caso #2

Missão Crítica SE



► RSTP (IEC 62439)

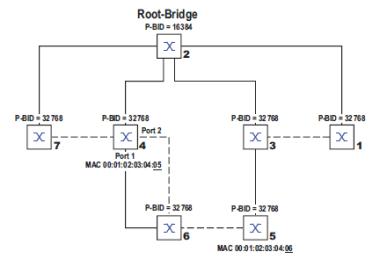
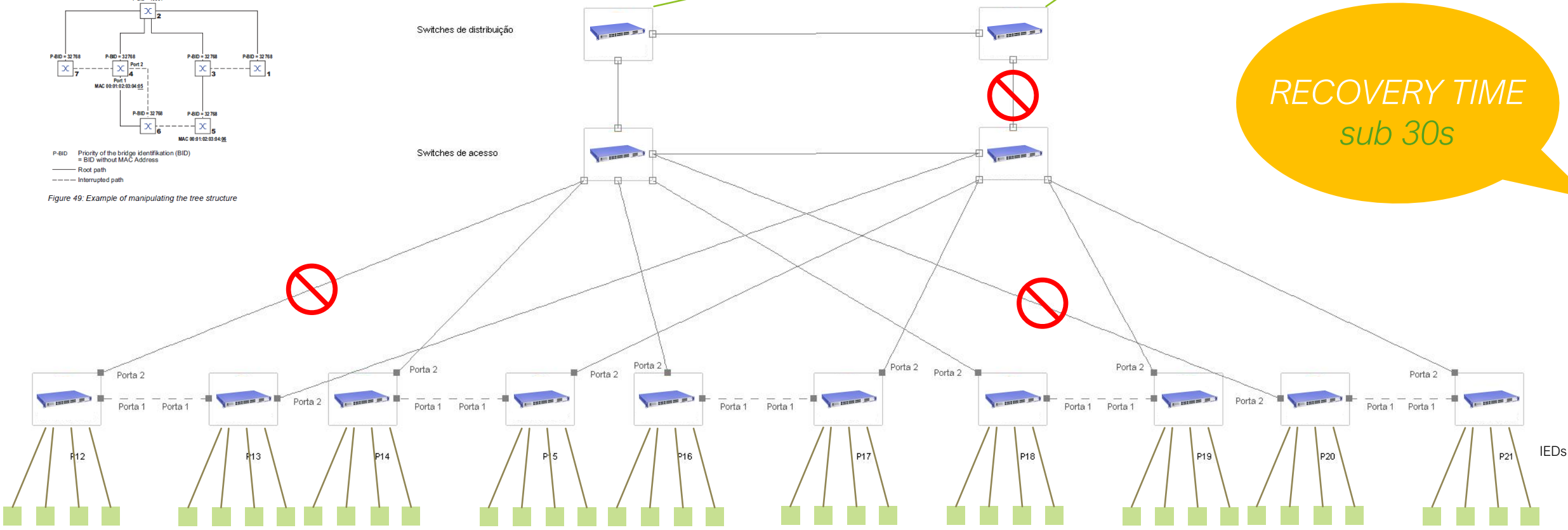


Figure 49: Example of manipulating the tree structure



DEPOIS

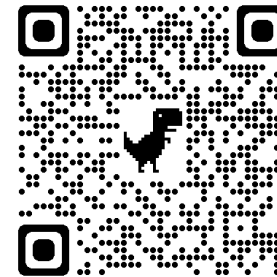
RECOVERY TIME
sub 30s

Overview

- ▶ Disponibilidade
 - ▶ Infraestrutura
 - ▶ Hardware
 - ▶ Sistema
- ▶ Convergência (recovery time)
- ▶ Boas práticas (segurança cibernética)
- ▶ Estudos de caso

Obrigado

BAUMIER
Autom@tion



Bruno Duarte

Ger. Engenharia de Aplicação

bruno.duarte@baumier.com.br