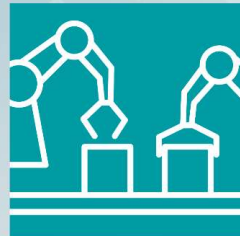
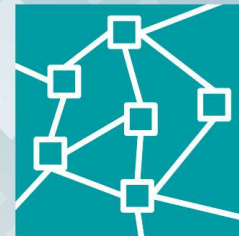
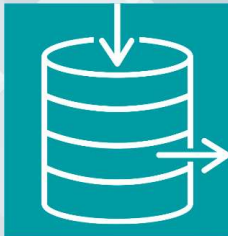




DIGITAL FACTORY

NOW



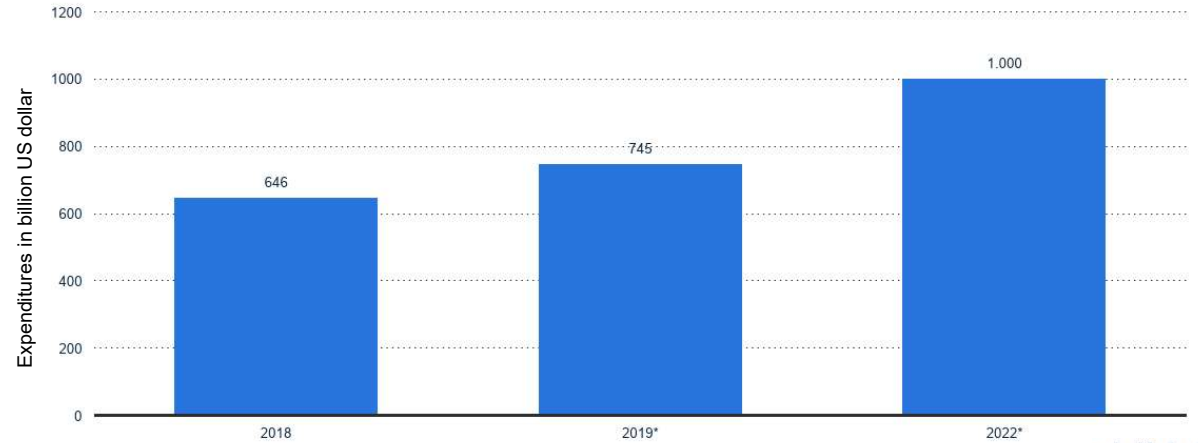
DIGITAL FACTORY NOW

The Power and Potential of Digitalization

Digital Factory | The power and potential of digitalization

Potential

Forecast for expenditure on the Internet of Things (IoT) worldwide in the years 2018 to 2022 (in billion US dollar)



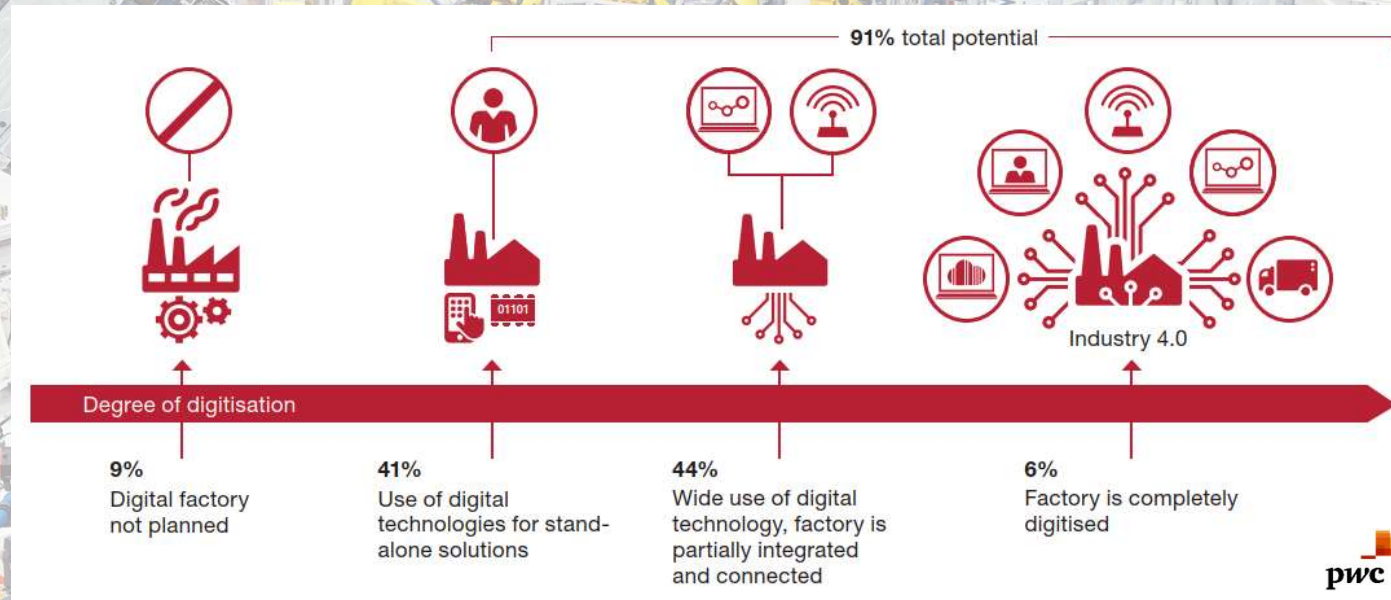
statista

Countries all over the world are investing into digitalization



Digital Factory | The power and potential of digitalization

Potential

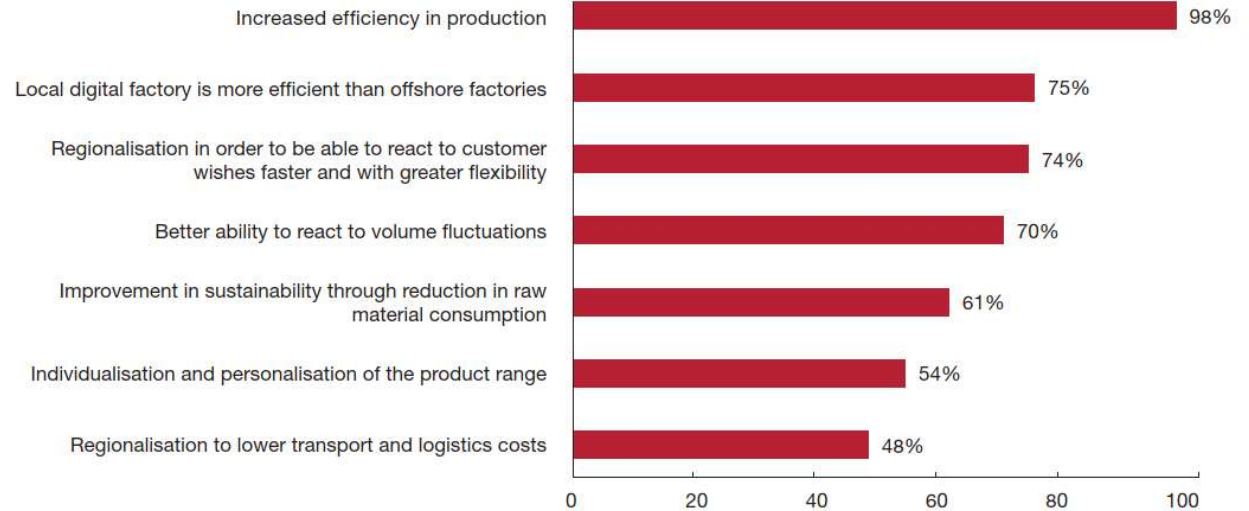


9 out of 10 companies are investing in Digital Factories



Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



Q: What are your significant reasons for setting up or expanding digital factories?

Base: Respondents planning to set up or expand digital factories

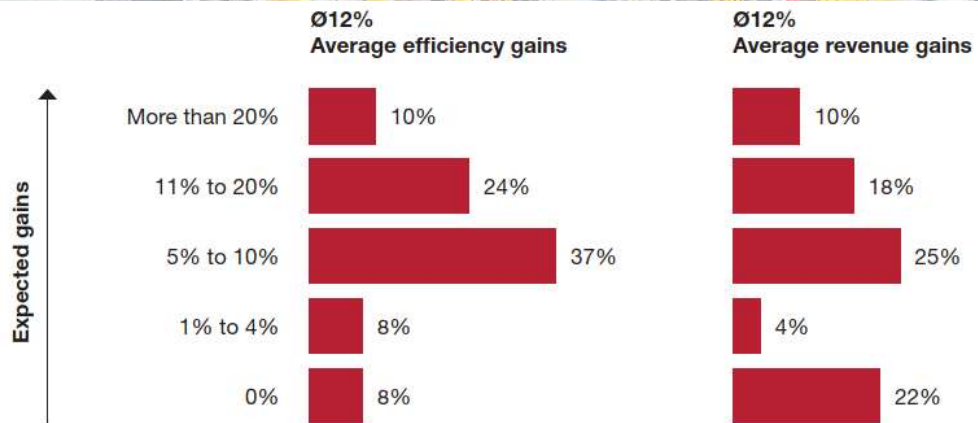


Efficiency and customer centricity are top reasons for expanding Digital Factories



Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



Q: An efficiency gain by how many percent in comparison to now do you expect for your company over the next five years from digital factories? A revenues gain by how many percent in comparison to now do you expect for your company over the next five years from digital factories?

Base: Respondents whose companies have or are planning a digital factory or the use of at least one digital concept

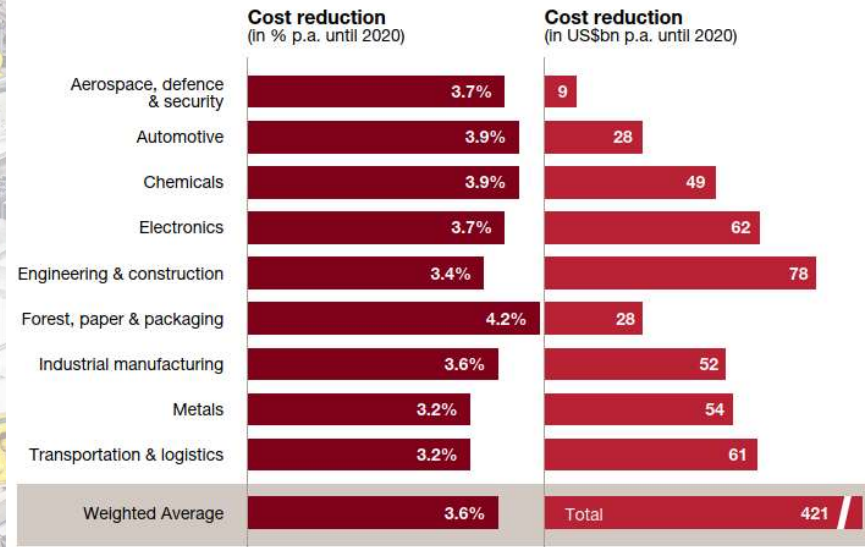


Respondents expect both efficiency and revenue gains of 12% on average over the next 5 years



Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



Q: What cumulative benefits from digitisation do you expect in the next 5 years? Lower costs.

pwc

Companies in every industry sector expect significant cost reductions



Digital Factory | The power and potential of digitalization

Digitalization and mankind

Digitalization does not replace people



Digitalization creates new jobs



DIGITAL FACTORY

NOW

From a Factory to a Digital Factory

Digital Factory | From a factory to a Digital Factory

Digitalization changes our world



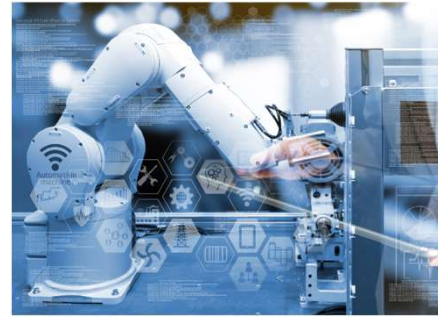
Flexible consumption

New, data centric
business models



Mass customization

Economic
production with batch
size one



Smart devices / IoT

Networked systems as
a basis



Knowledge sharing

Lack of skilled workers
and efficient
development processes

Digital Factory | From a factory to a Digital Factory

Goals of Digital Factory



1. Optimized production
2. Reduced costs
3. Idea-to-cash

Digital Factory | From a factory to a Digital Factory

Customer requirements and benefits



Enable new ideas

The Digital Factory transfers data into information. This information will be used to optimize processes and reduce costs.

- New business models
- Idea-to-cash



Flexible infrastructure

Our solutions are scalable to respond quickly to growth potentials. Independent on the factory and production size and amount of data – we are able to adapt a solution to every industry.

- Optimized production
- Update capability



Proof-of-concept

Everything was proven in our own production facility. From concept to maintenance, we provide finished and tested use cases.

- Reduced engineering costs
- Benefit from experience

Digital Factory | From a factory to a Digital Factory

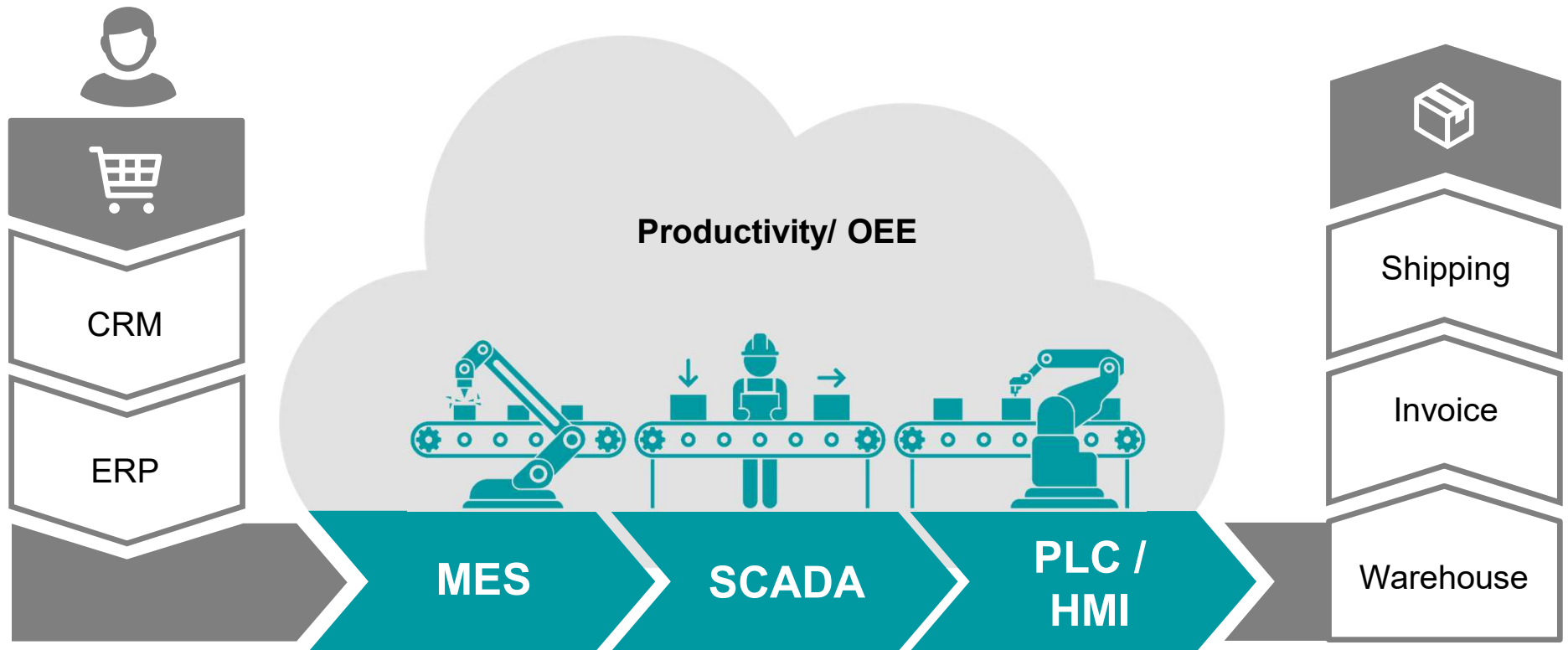
Challenges

- Extract relevant information from a huge amount of data automatically
- Get more information output with lower investment
- Reduced engineering costs by increasing automation and communication



Digital Factory | From a factory to a Digital Factory

Why do many digitalization strategies fail?



OEE = Overall equipment effectiveness

How to calculate OEE (overall equipment effectiveness)

1 Locate source of inefficiencies

2 Quantify the degree of inefficiency

OEE combines three factors:

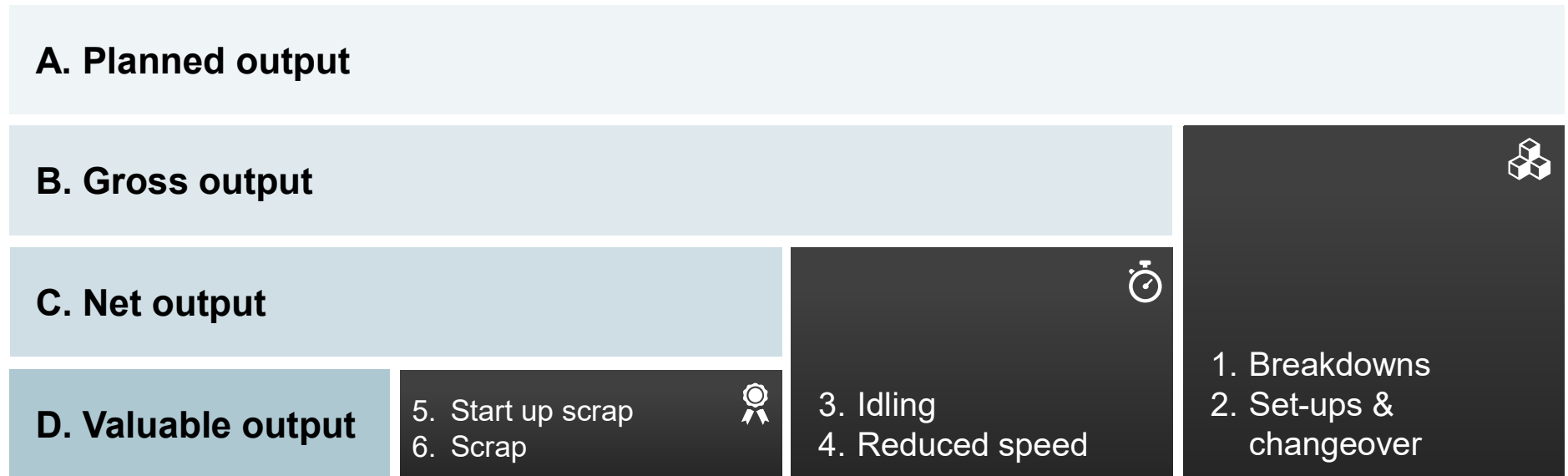
Availability (**A**) 100% machine is available at scheduled time

Performance (**P**) 100% performance at max. speed

Quality (**Q**) 100% of all parts are OK

$$OEE = A * P * Q$$

The six big losses of OEE



$$\frac{\text{Gross output}}{\text{Planned output}} \downarrow \text{Availability rate } A * \frac{\text{Net output}}{\text{Gross output}} \downarrow \text{Performance rate } P * \frac{\text{Valuable output}}{\text{Net output}} \downarrow \text{Quality rate } Q = OEE$$

How to move to a Digital Factory?



Digital Transformation

- Digitization of business
 - No paper
 - Unified data
- Gather information with actual data
- Use of digitalization to **inform and guide** people



Industry 4.0

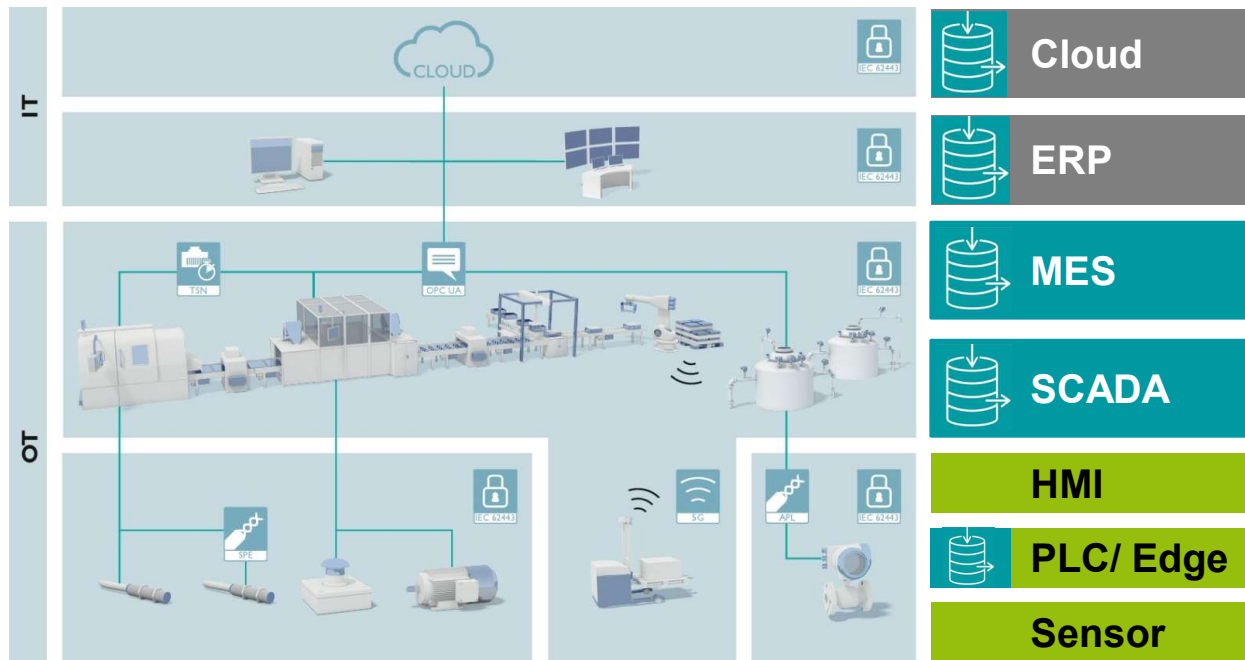
- 4th industrial revolution
 - Network/ technology
 - Standards/ protocols
- Smart production principles
 - Connection of all machines and systems
 - Open architecture



Digital Factory

- The result of Digital Transformation and Industry 4.0
- Information from each producer to each consumer
- Available data anytime, everywhere
- Translation of data into information

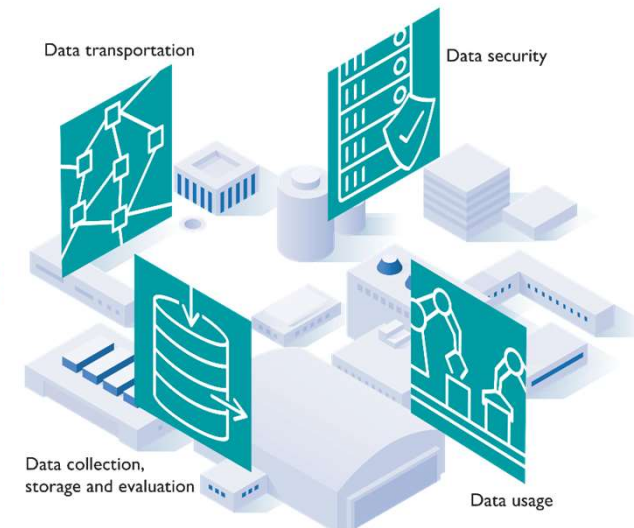
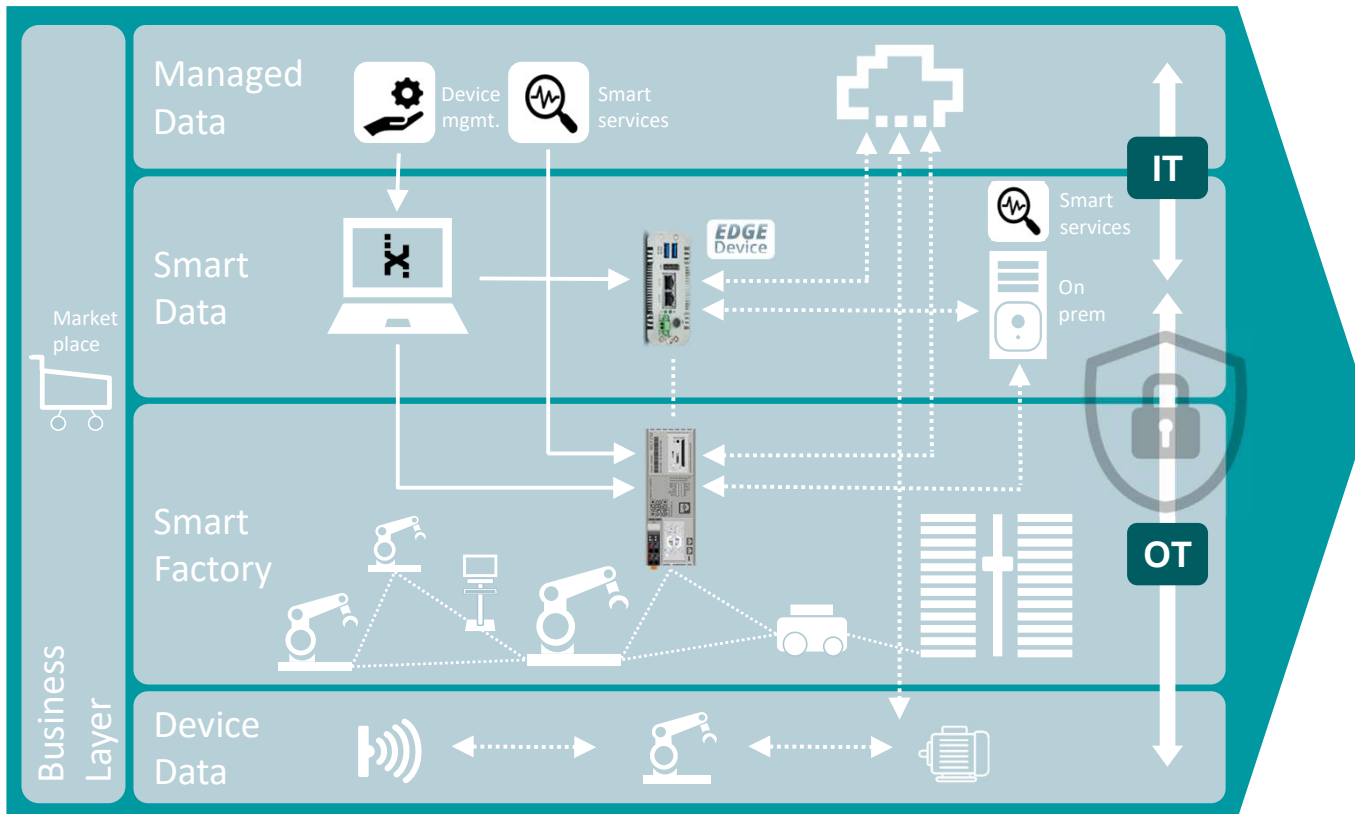
Why does the current architecture prevent innovation?



- Show stopper for optimization projects !**
- No normalization
 - No abstraction
 - No standard
 - Only high-value projects
 - Data silos

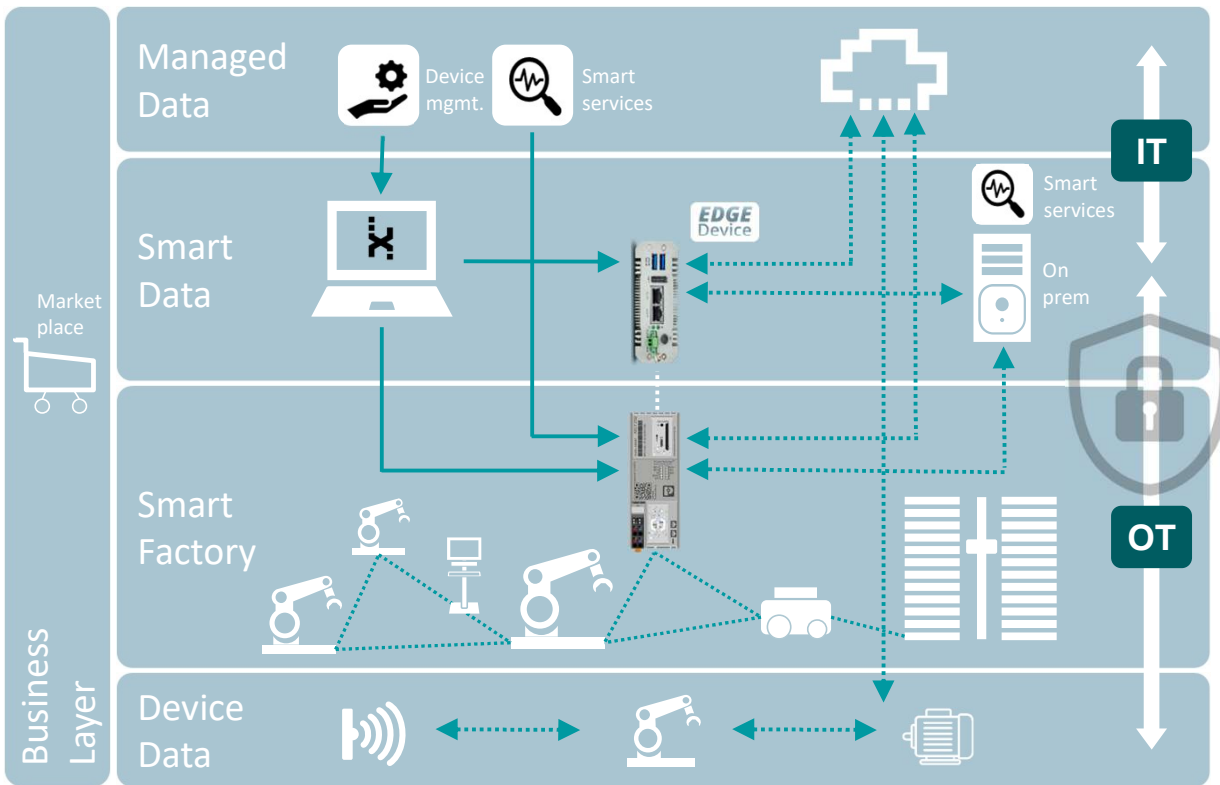
Digital Factory | From a factory to a Digital Factory

Create a solution to enable factory optimization

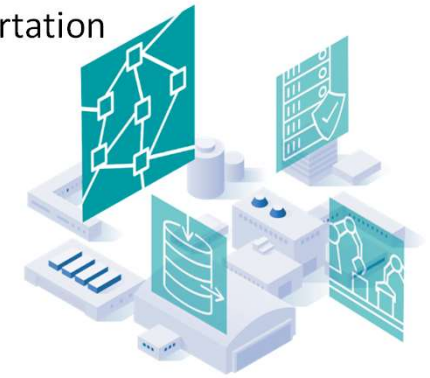


Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach



Data transportation



- Network structuring and management
- Ensure data quality and bandwidth
- Select the ideal digital infrastructure

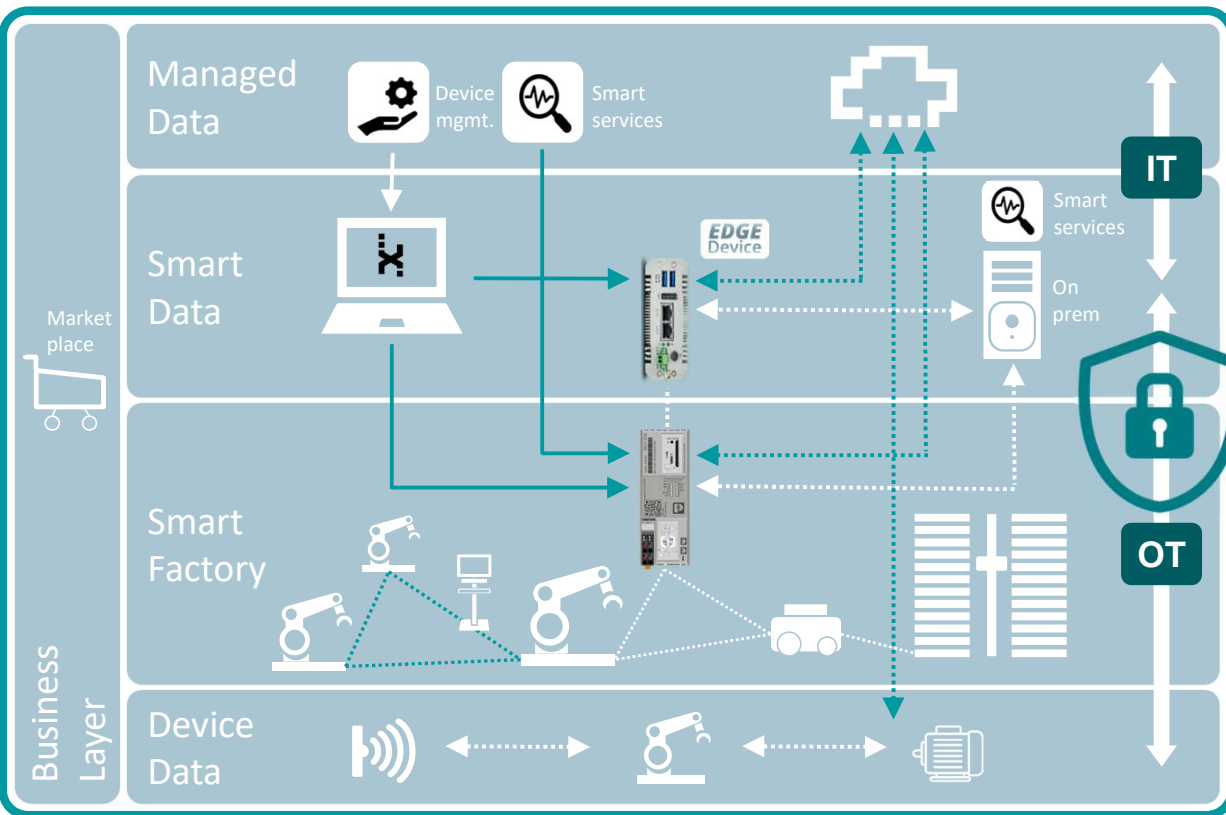
Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach

Data security

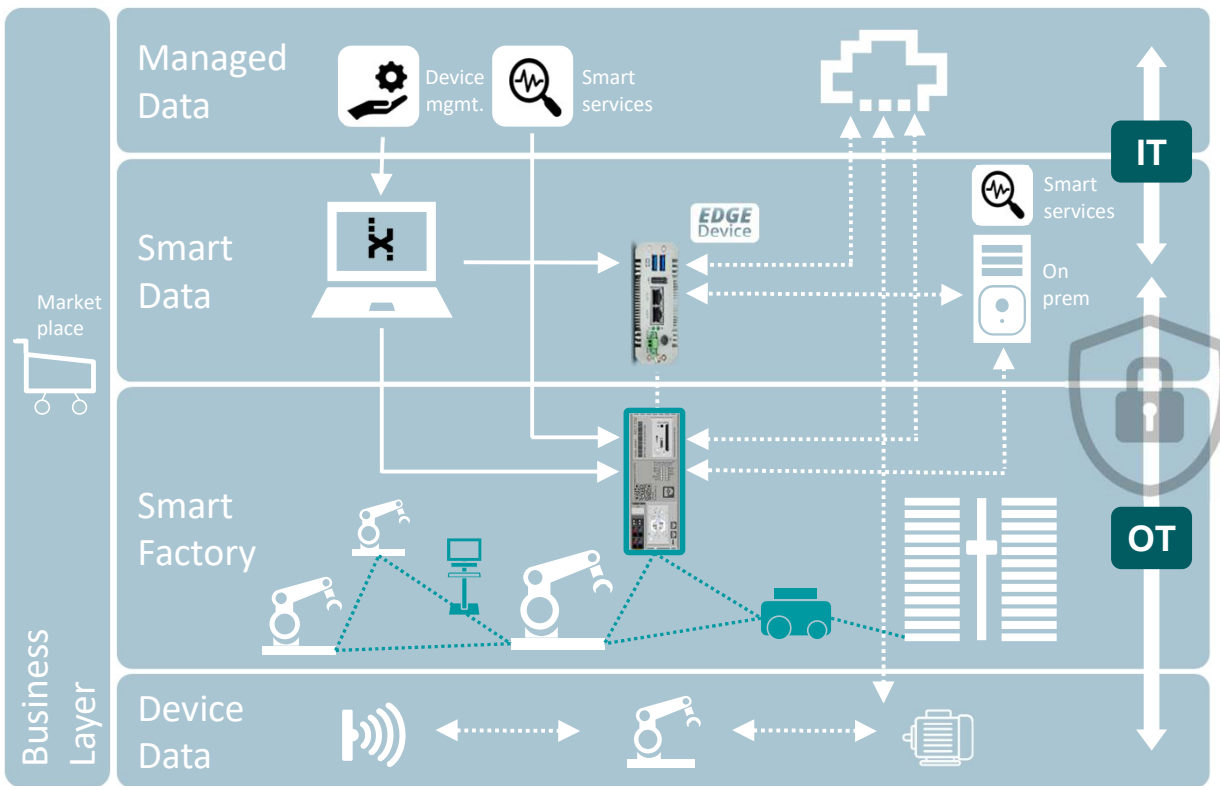


- Protect the factory against hacker attacks
- Ensure a state-of-the-art protection
- Worldwide support



Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach

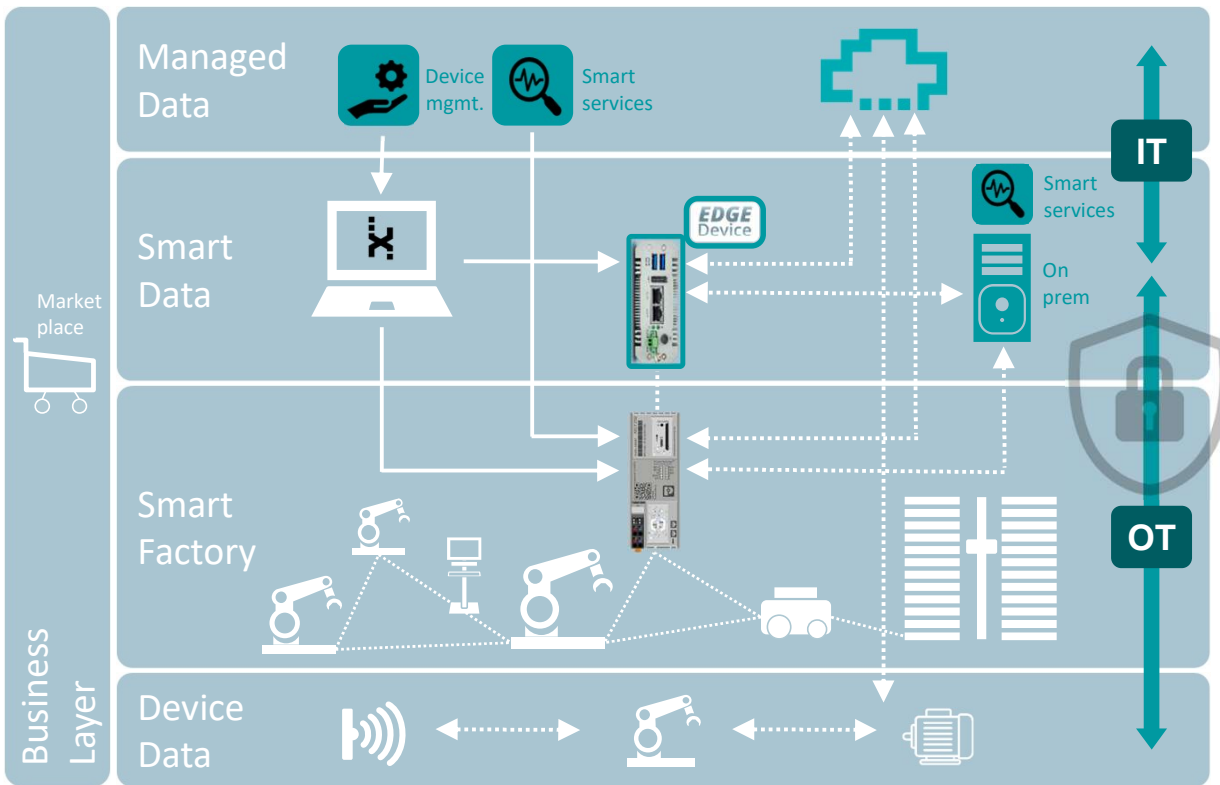


Data usage

- Smart production
- Horizontal and vertical integration – easy and fast
- Ensure openness to other systems

Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach

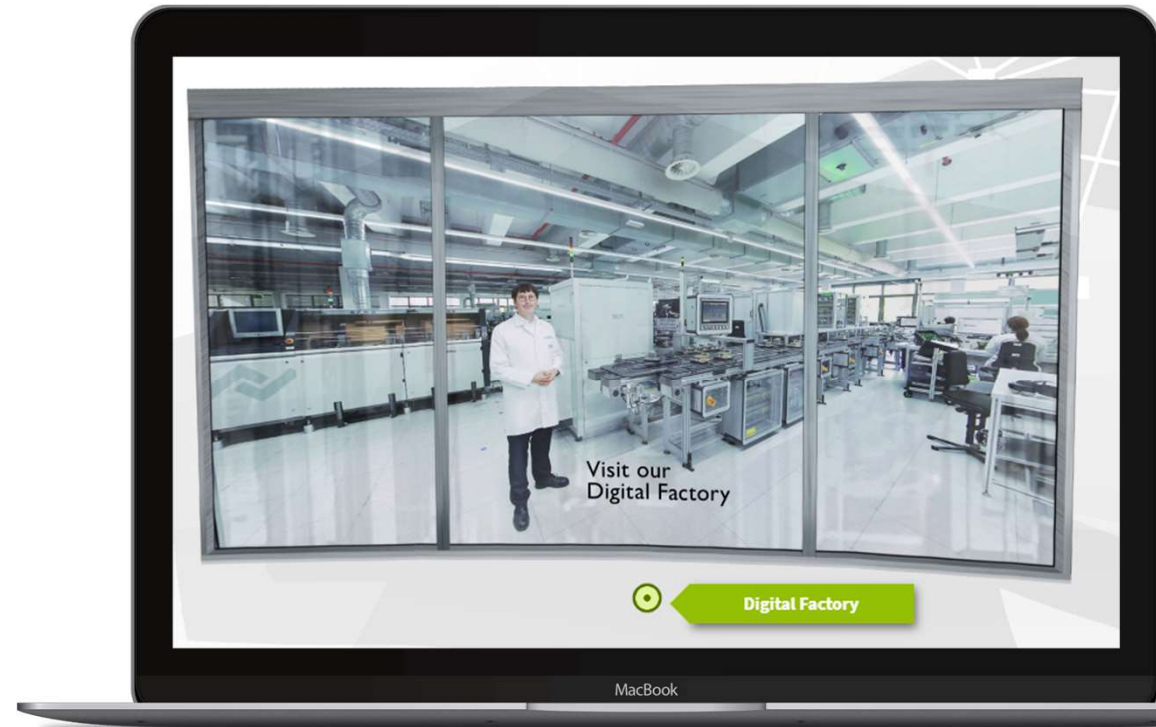


Data collection,
storage and evaluation

- Data acquisition with full connection from OT to IT
- Ensure normalized data
- Transform data into information

Digital Factory | From a factory to a Digital Factory

Proof-of-concept in our own Factory in Bad Pyrmont



DIGITAL FACTORY NOW

Our Uses Cases for your Productivity Increase

Digital Factory | Our use cases for your productivity increase

Segments of Digital Factory

Data transportation

Network structuring and management

Data security

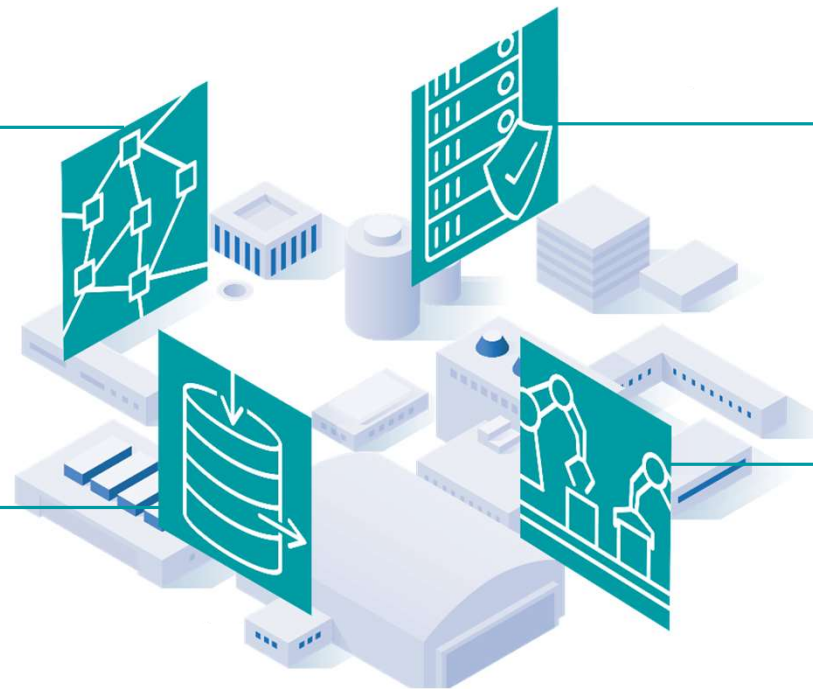
Investment protection against unwanted access

Data collection, storage and evaluation

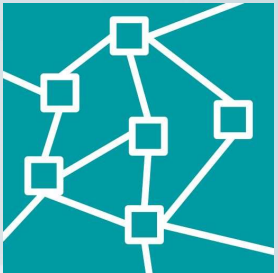
Data conversion into information

Data usage

Simple horizontal and vertical integration



DIGITAL FACTORY NOW



Data Transportation

Digital Factory

Data transportation

- Network structuring and management
- Ensure data quality and bandwidth
- Support the ideal digital infrastructure

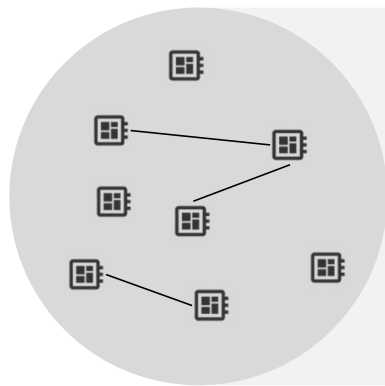
Connection of
smart devices

Smart automation
network

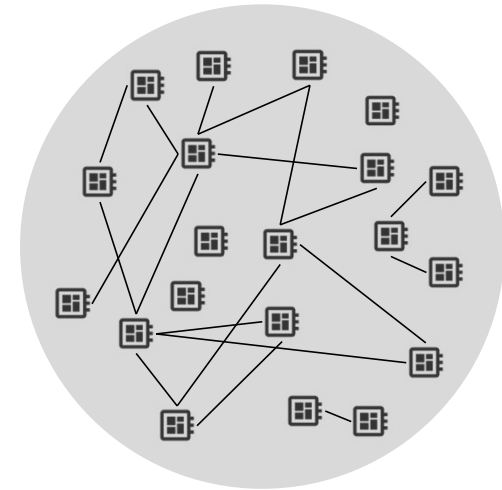


Digital Factory | Data transportation

Digital Transformation



Increasing network demand



30 billion
connected devices

75 billion
connected devices

2020

2030



Digital Transformation – the amount of data changes dramatically

By 2025 **30%**

of the global data sphere will be

 **realtime****

By 2025 **49%**

of the worldwide data is stored in

 **public clouds**

**Companies overtake consumers
as largest data producers**



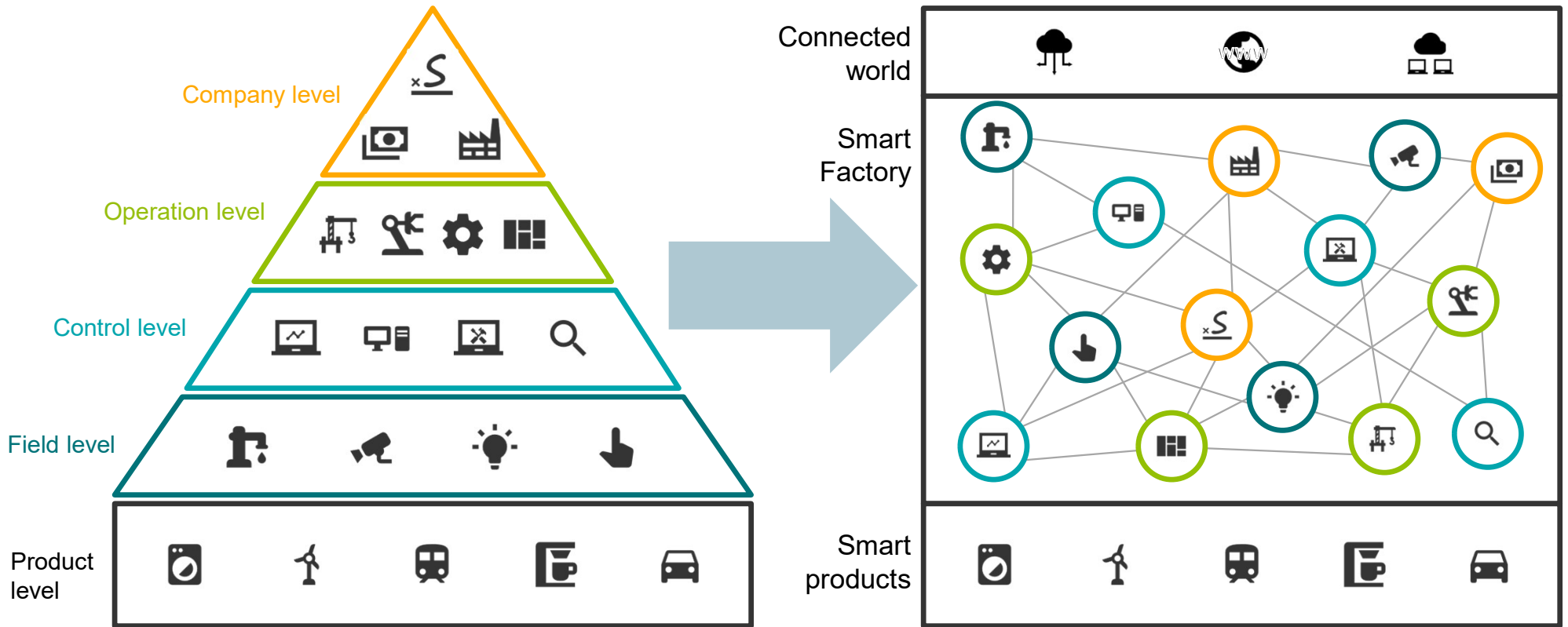
The amount of bytes produced by
companies grows to

13.6 ZB in 2025

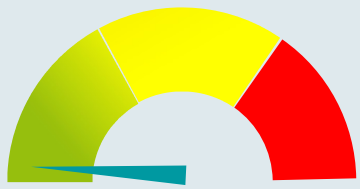
and accounts for **OVER 80 %**
of the bytes stored worldwide

Digital Factory | Data transportation

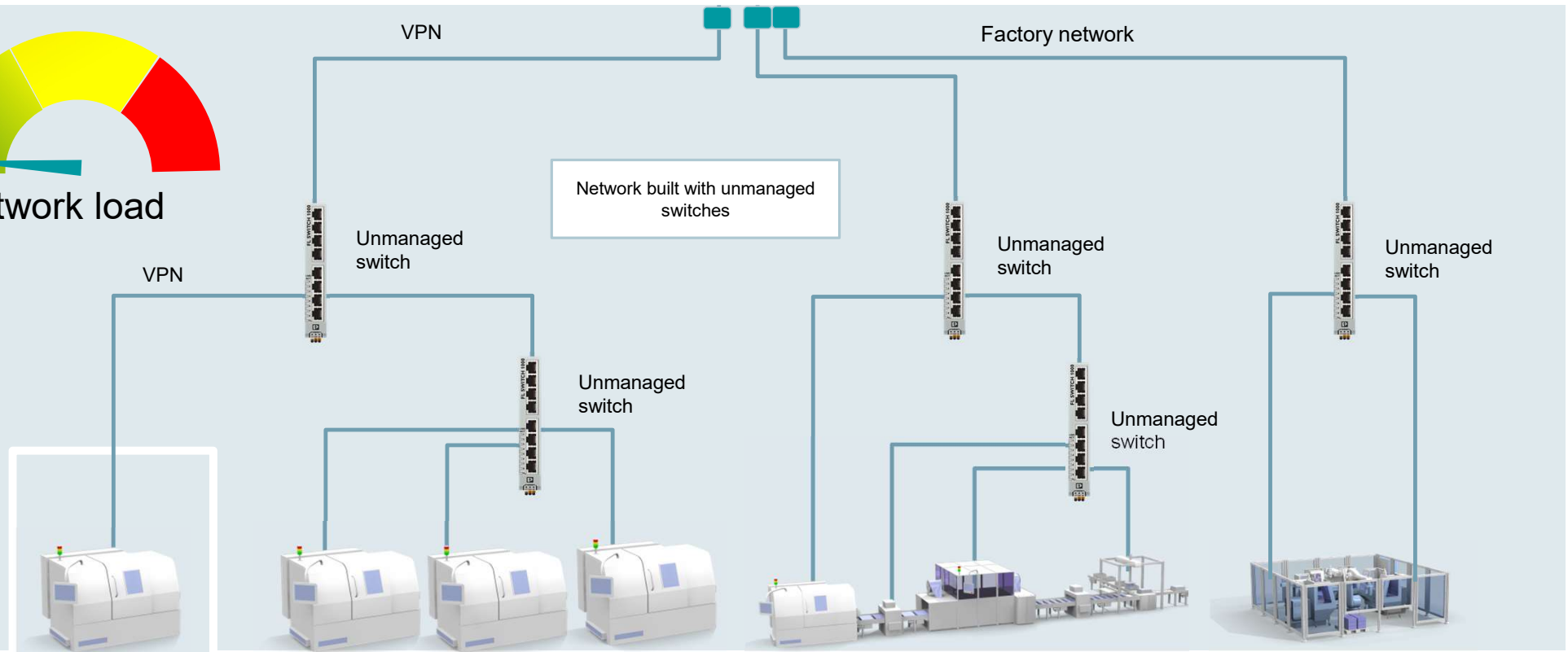
Digital Transformation – the network structure has to change



What is the problem with many industrial networks?

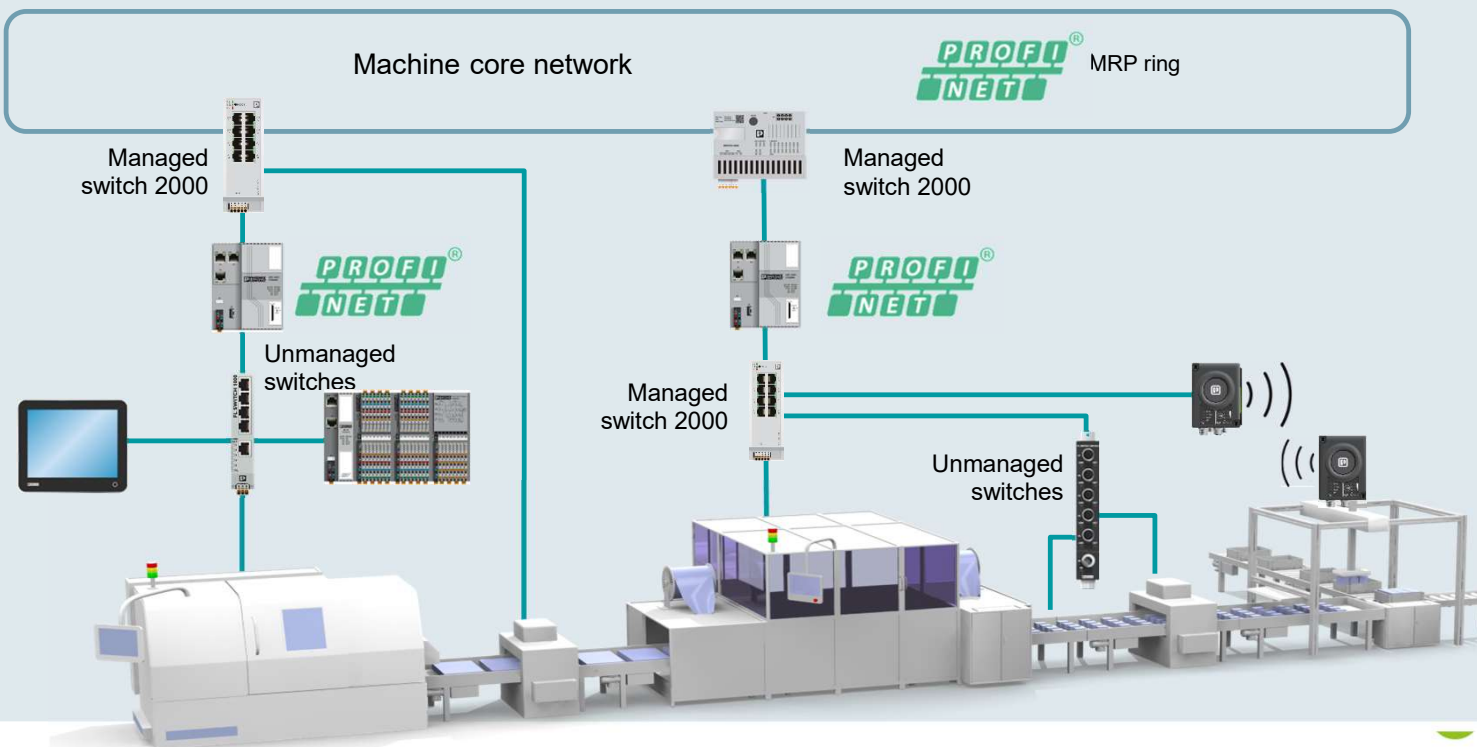


Network load



How can we increase availability of the network?

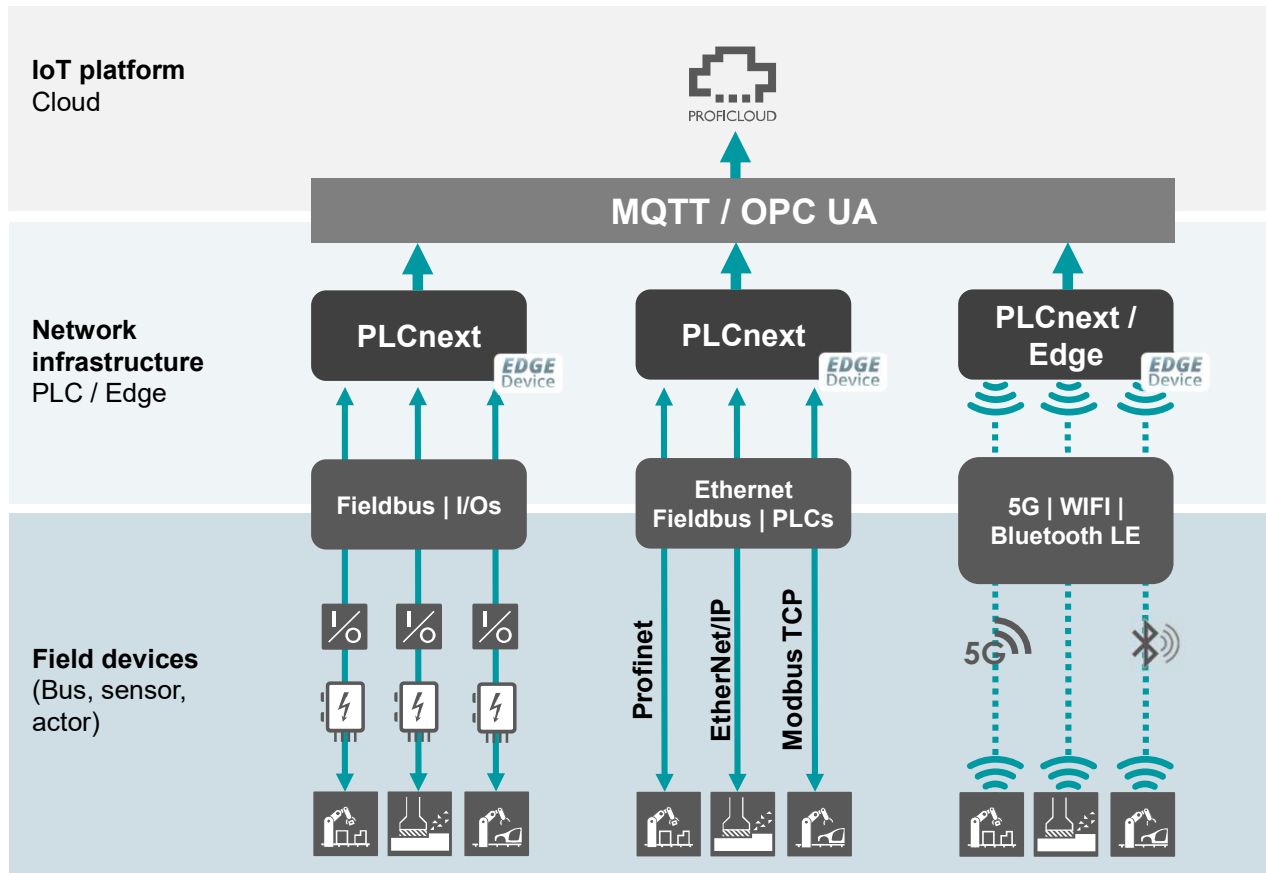
Machine network



Diagnostic is key

- Network load
- Device failures
- Protocol – discards
- Can be integrated into PLC diagnostic

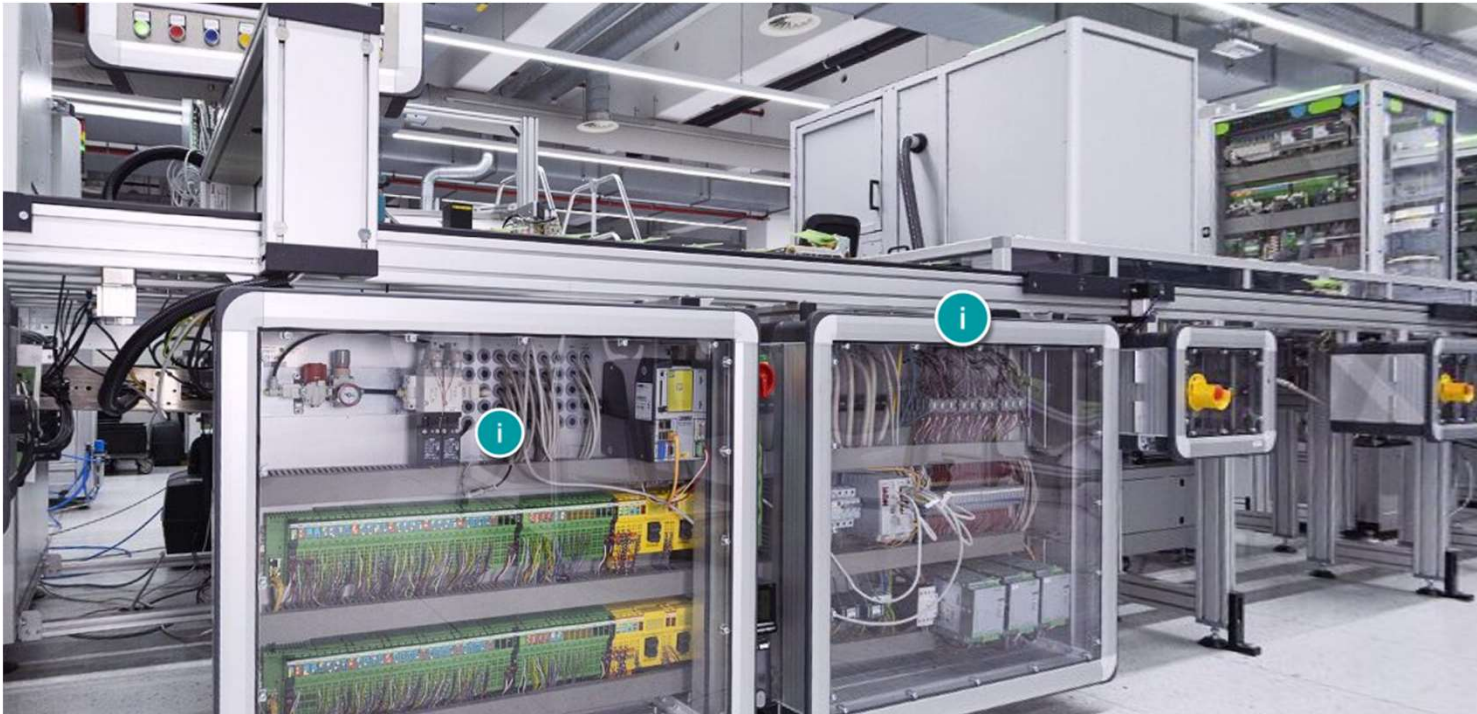
Connectivity: flexible and easy



- No matter what – we build a connection
 - Cable/ Fiber optics
 - Radio/ Bluetooth LE/ WIFI/ 5G
 - Bandwidth
 - 10/100 Mbit
 - 1/10 Gbit
 - Topology
 - Priority-based
 - Redundant

Data transportation | Smart automation network

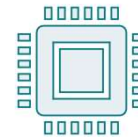
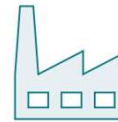
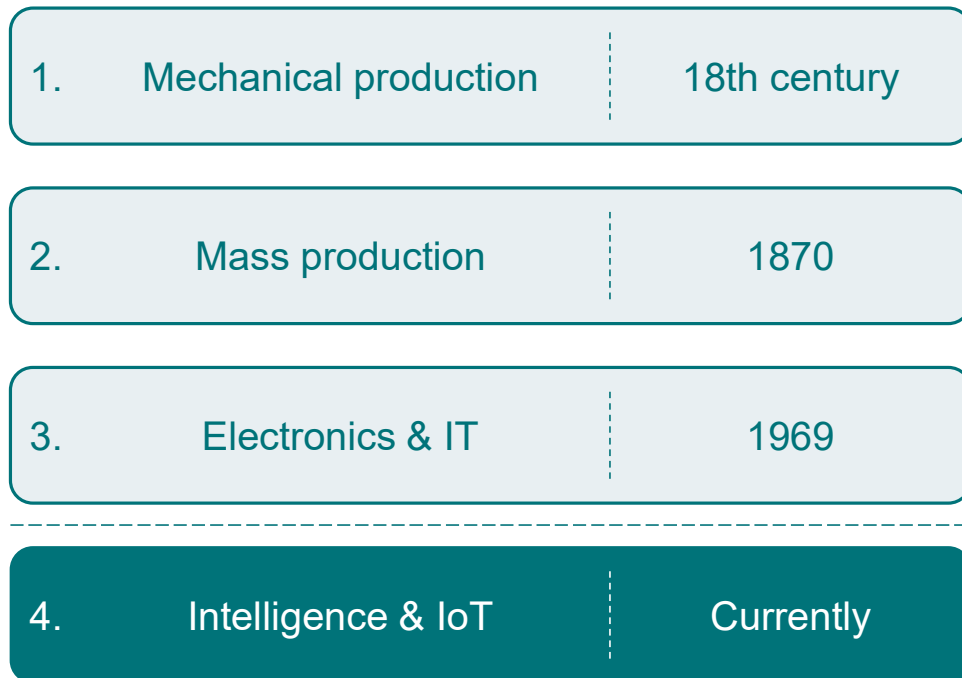
Implementation into our own factory



Introduction – Importance of data transportation

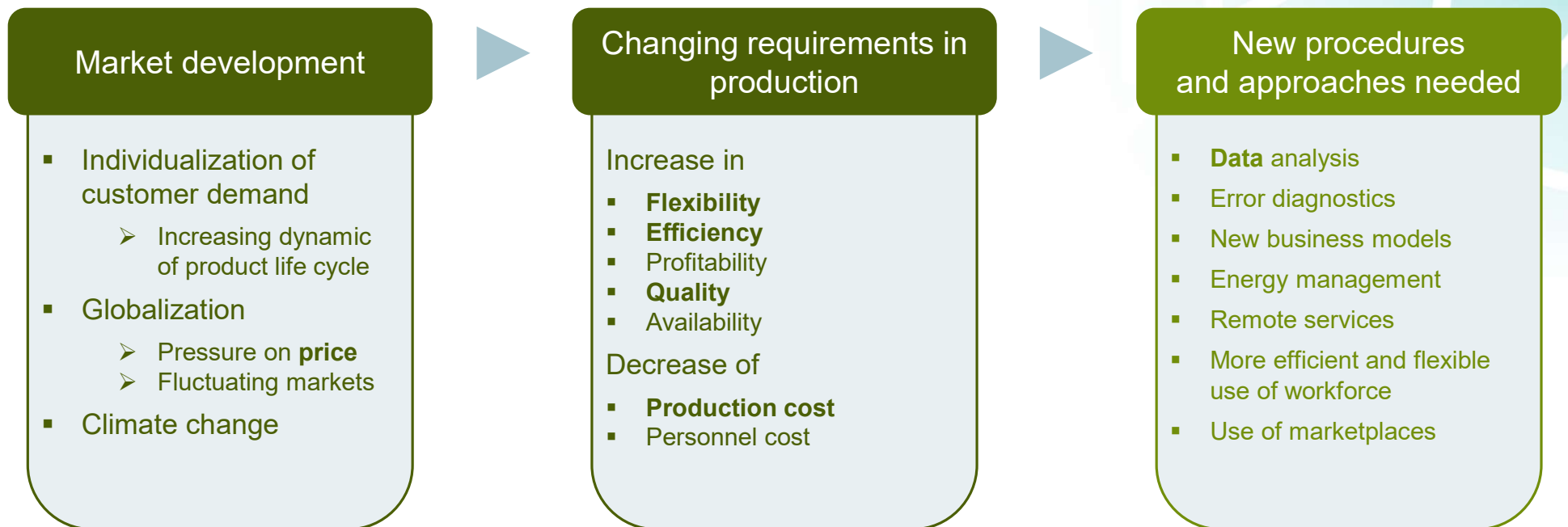
Technological aspects (technology push)

Industrial revolutions



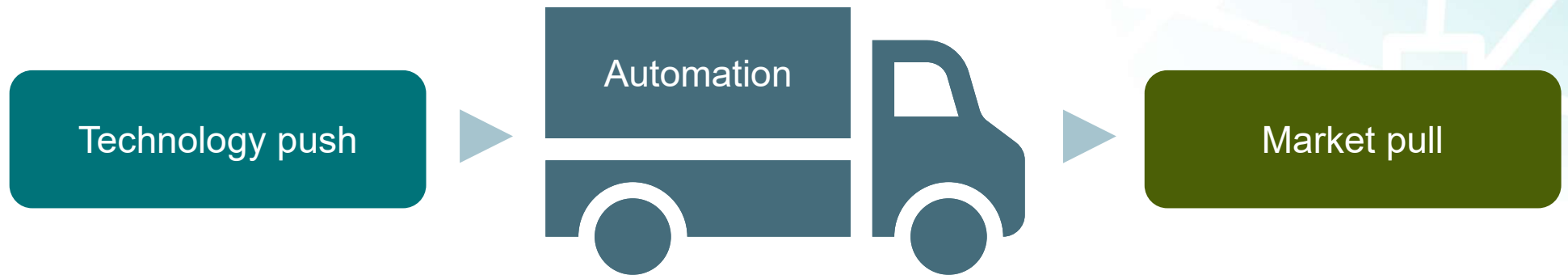
- Machines instead of Hands
- Increasing production rate
- From mechanics to electronics
- Connecting devices
- Global data availability

Economic aspects (market pull)

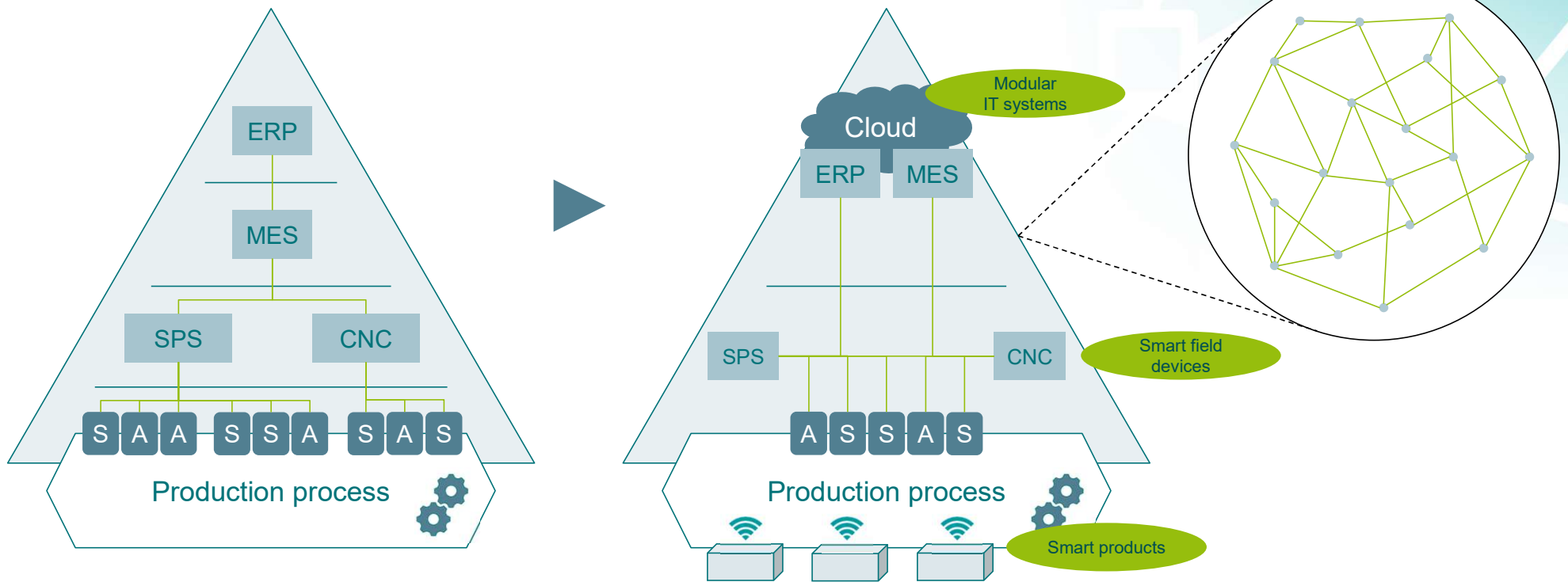


Introduction | Driving factors for automation

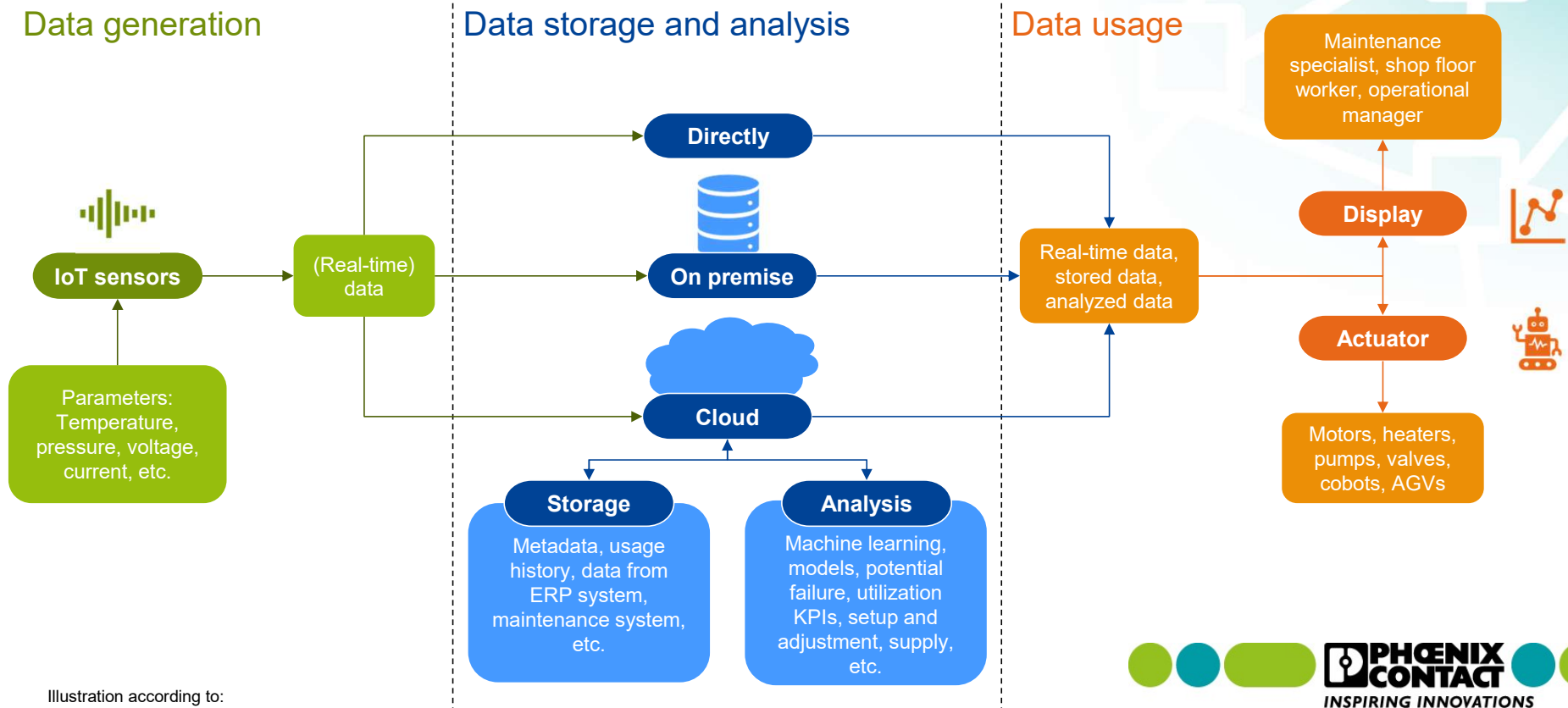
New automation thinking



1. Connected infrastructure through cyber-physical systems



2. Data exchange within company borders



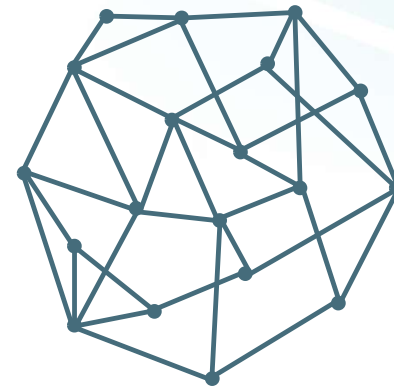
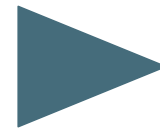
3. Data exchange across company borders

Goal: Automate value chains



Introduction | New automation thinking

Data transportation is essential for the Digital Factory and its economical success

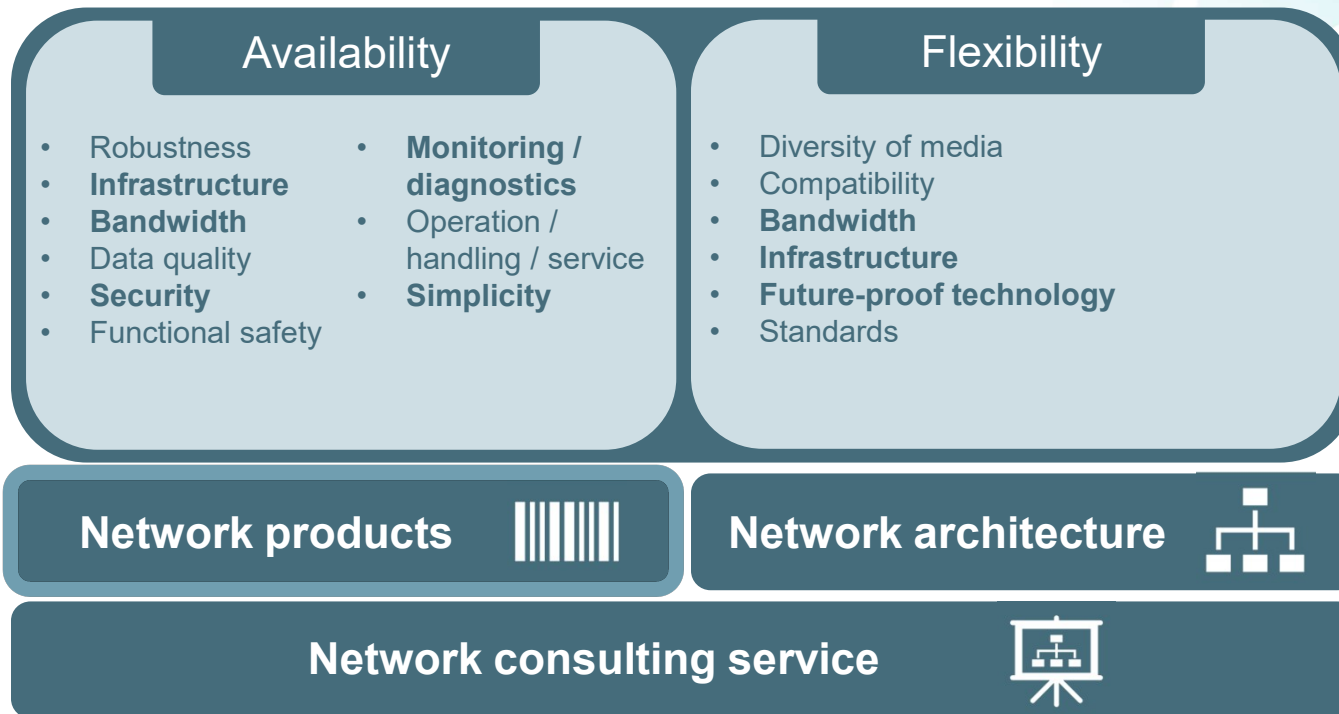


Network

The
powerful and sustainable
industrial network

Powerful and sustainable network

Maximize industrial communication for available and flexible production



Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



Software



Future
technologies

Powerful and sustainable network | Network products

Network installation



Copper

- EMC shielded
- Easy assembly
- Protection class IP20 to IP69K



Fibre optic

- Broad range of connectors
- Up to 40 Gbit/s
- Integrated locking
- Easy assembly



Patch panels

- Connection between field and cabinet
- Surge protection
- PoE injectors



PRP redundancy modules

- Parallel redundancy protocol
- No switching time in case of an error



SFP modules

- „Small Form-Factor Pluggable“
- Small, standardized modules for network connections
- FO and Ethernet



➤ Wide range of connectors



➤ Bandwidth (40 Gbit/s with FO)



➤ Surge protection



➤ Support of PRP



➤ Support of SFP

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



Software



Future
technologies

Powerful and sustainable network | Network products

Unmanaged switches



**Switch
1000**

- Fibre optic support
- Power-over-Ethernet
- Flexible installation
- High data rates
- Data prioritization  EtherNet/IP™



**Switch
SFNT**

- Specialized for harsh environments
- Light error diagnostics



**Switch
1800/1900**

- 19" rack design
- High port density



**Switch
1605**

- Protection class IP67
- Flexible mounting



➤ Small and simple networks



➤ Different media



➤ New technologies supported



➤ Different automation protocols



➤ Robustness

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



Software



Future
technologies

Powerful and sustainable network | Network products

Managed switches



**Switch
2000**

-  **EtherNet/IP™**
- Redundancy (RSTP, MRP)
- Easy configuration



**Switch
3000/4000**

- Special IT functionality



**Switch
7000**

- Focus on **EtherNet/IP™**
- High performance
- Redundancy (Device Level Ring)



**Profinet
IRT**

- Focus on Profinet IRT
- Time synchronous
- Redundancy (MRP)



**Modular
managed**

- High-end layer 3 (routing switch)
- Also layer 2
- Modularity



➤ Diagnostics



➤ Every network layer covered



➤ Easy to handle



➤ Redundancy



➤ Different automation protocols

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



Software



Future
technologies

Power-over-Ethernet



PoE injectors

- Injecting electricity into the network



PoE switches

- Connect PoE devices



PoE splitter

- Separates data from energy to connect non-PoE devices



- Cost saving (Cables, power supply)



- Cameras, WLAN access points



- Standardized: IEEE 802.3



- Managed features

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



Software



Future
technologies

Powerful and sustainable network | Network products

Secure communication



Mounting devices, PCI Cards

- Cyber security
- Remote access
- Protection against viruses and malware



mGuard 1100

- Cyber security
- Remote access
- Firewall assistant



Industrial VPN Gateway

- Secure remote access over 3G, 4G/LTE



Ethernet Extender

- Secure extension of complex IP networks
- Managed and unmanaged versions



- Protection from viruses and malware



- Standardized remote access solution



- Secure access to remote locations



- Secure Ethernet extension

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



Software



Future
technologies

Powerful and sustainable network | Network products

Wireless



WLAN

- Flexible installation
- Cost-efficient
- REST-API
- Smart devices
- AGVs



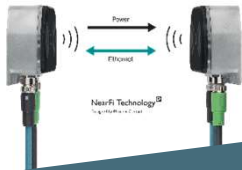
Bluetooth

- Inteferece-free with WLAN
- Optimized for **PROFI NET**
- Point-to-point connection (cranes, robots, etc.)



Bluetooth LE

- Low energy IoT sensors
- Precision machining



NearFi

- Wireless Ethernet and power (≤ 10 mm)
- Application
 - Rotating tools
 - High amount of tool exchanges
- No abrasion

Highlight 2021



➤ Smart devices



➤ AGVs



➤ IoT sensors



➤ Abrasion reduction

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



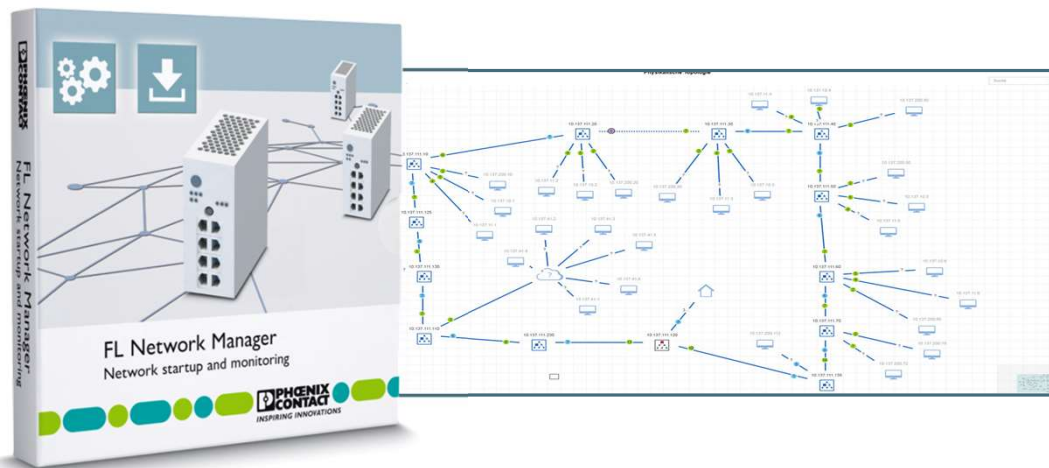
Software



Future
technologies

Powerful and sustainable network | Network products

Software



FL Network Manager

- Topology overview
- Multi device firmware update
- Multi device configuration
- Configuration file handling



➤ Tool for local network management



➤ Monitoring and configuration



➤ Support of network and security devices

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network
installation



Unmanaged
switches



Managed
switches



Power over
Ethernet



Secure
communication



Wireless



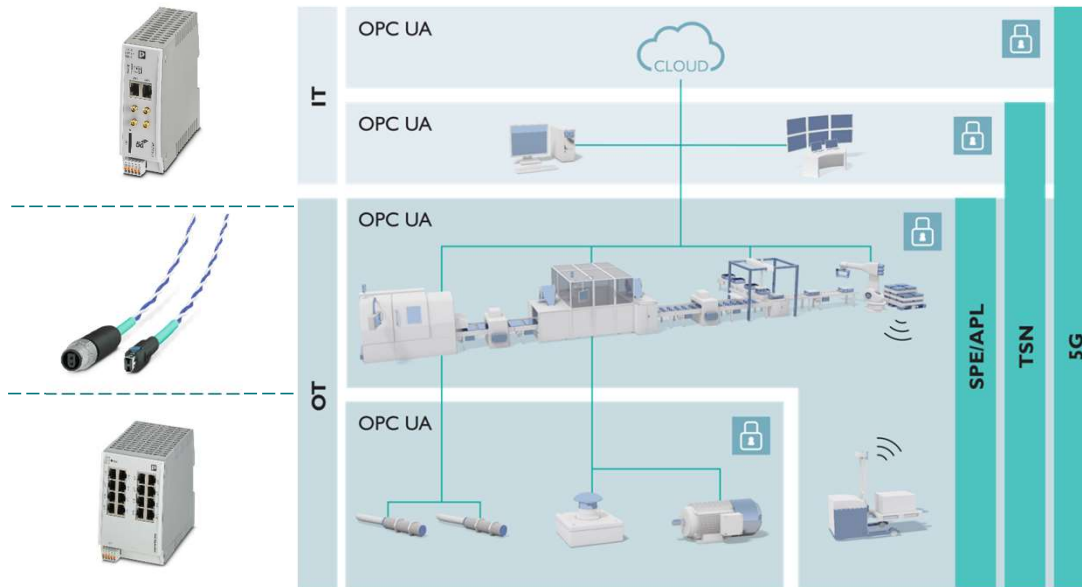
Software



Future
technologies

Powerful and sustainable network | Network products

Future technologies in sight



➤ Manufacturer independent communication over all layers with OPC UA



➤ High performance communication for mobile applications with 5G



➤ Real time applications possible for Ethernet networks with TSN



➤ Ethernet for sensors with SPE

✓ Availability & Flexibility

Powerful and sustainable network | Network products

Portfolio for flexible productions and smart machines



Network installation



Unmanaged switches



Managed switches



Power over Ethernet



Secure communication



Wireless



Software



Future technologies

Powerful and sustainable network | Network products

... and more

FL SWITCH 2600/2700 Portfolio overview



	FL SWITCH 26xx	FL SWITCH 27xx
Transmission speed	Fast Ethernet (100 Mbit/s)	Gigabit Ethernet (1000 Mbit/s)
Operating temperature	-40°C - 70°C	
Supply voltage	9-57 V DC, redundant	
Alarm output	-	
Degree of protection	IP65/IP66/IP67	
Approvals		

Note: Not all approvals will be available at market launch



FL SWITCH 2600/2700 Portfolio overview



	FL SWITCH 26xx	FL SWITCH 27xx
Transmission speed	Fast Ethernet (100 Mbit/s)	Gigabit Ethernet (1000 Mbit/s)
Operating temperature	-40°C - 70°C	
Supply voltage	9-57 V DC, redundant	
Alarm output	-	
Degree of protection	IP65/IP66/IP67	
Approvals		

Note: Not all approvals will be available at market launch



FL SWITCH 2000F Portfolio overview



	FL SWITCH 20xxF
Transmission speed	Fast Ethernet (100 Mbit/s)
Operating temperature	0°C - 60°C
Supply voltage	18-32 V DC
Approvals	

New - Q1 2021

L SWITCH 2000F Portfolio overview



	FL SWITCH 20xxF
Transmission speed	Fast Ethernet (100 Mbit/s)
Operating temperature	0°C - 60°C
Supply voltage	18-32 V DC
Approvals	

New - Q4 2020



Same feature set as standard FL SWITCH 20xx models



New - Q4 2020



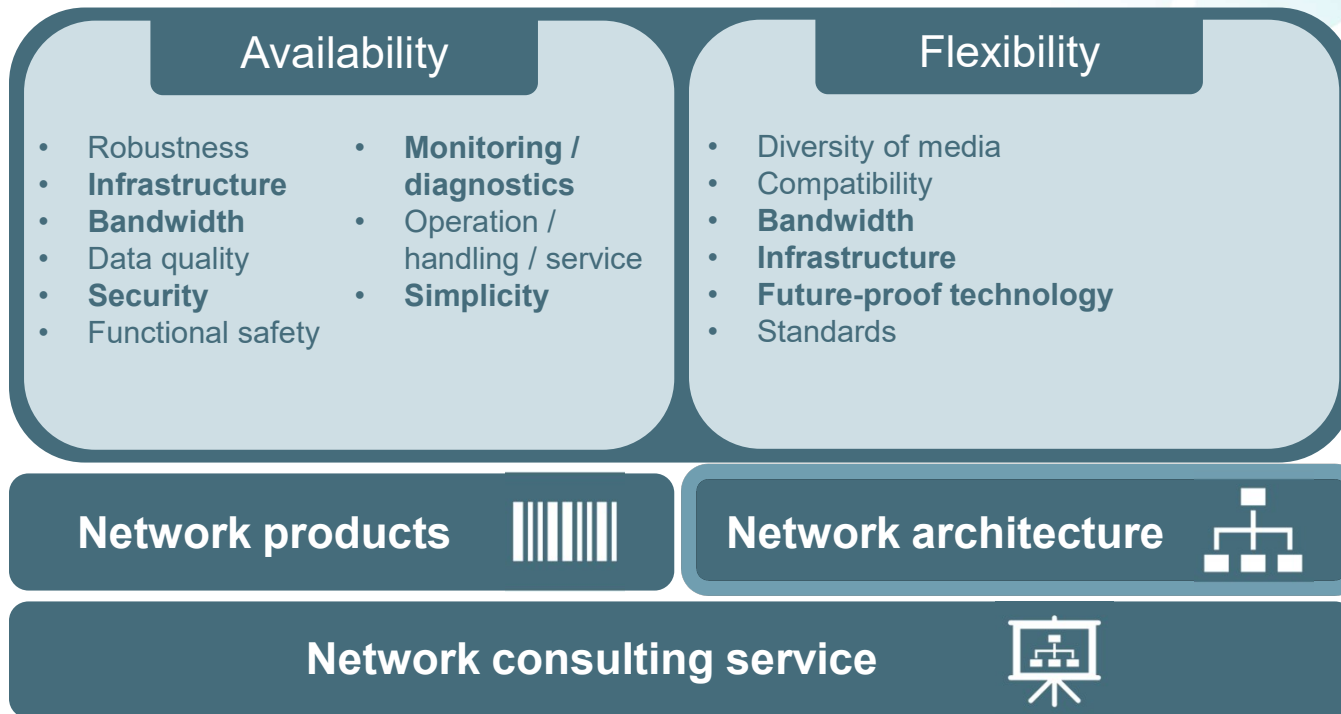
Same feature set as standard FL SWITCH 20xx models



- Slim housing ✓
- Unmanaged Gigabit ✓
- Managed Gigabit ✓
- Power In/Power Out ✓
- Configuration Memory ✓
- Automation protocols ✓

Powerful and sustainable network

Maximize industrial communication for available and flexible production

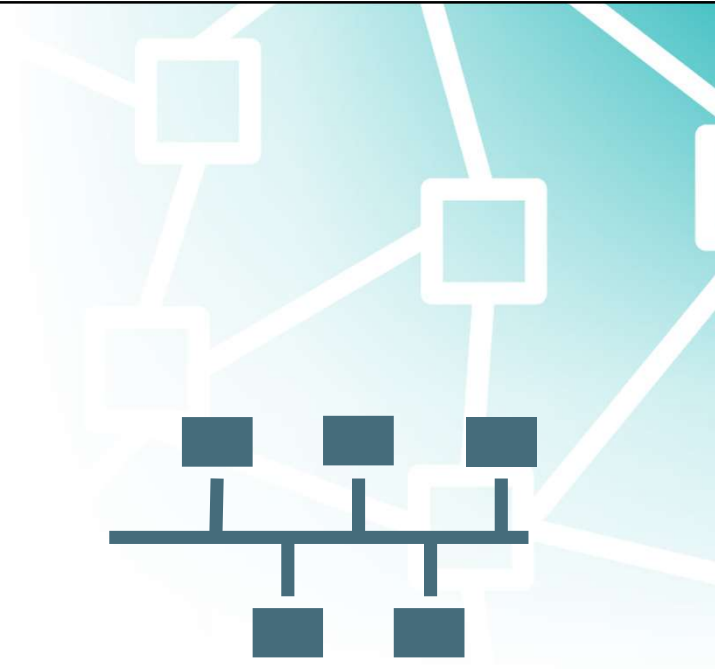


Basics – Topologies

Characteristics

- ✓ Easy to implement
- ✓ Low costs
- ✓ Fast error detection

- ! Maintenance and redundancy – Device failure causes partial network downtime
- ! High network load for the devices



Bus

Basics – Topologies

Characteristics

- ✓ Easy to implement / manage / diagnose
- ✓ End device failure does not affect network
- ✓ Short latencies (Star)
- ! Single point of failure (Star)
- ! A lot of wiring effort needed
- ! High latencies for long cascades (Tree)



Basics – Topologies

Characteristics

- ✓ Easy to manage and diagnose with managed switches
- ✓ **Redundancy** – High protection from downtimes
- ! Increased implementation effort and costs
- ! Devices need to support redundancy mechanisms



Ring

Powerful and sustainable network | Network architecture

Basics – Topologies

Characteristics

- ✓ **Redundancy** – Very high protection from downtimes
- ✓ Low latencies
- ! Very high implementation effort and costs



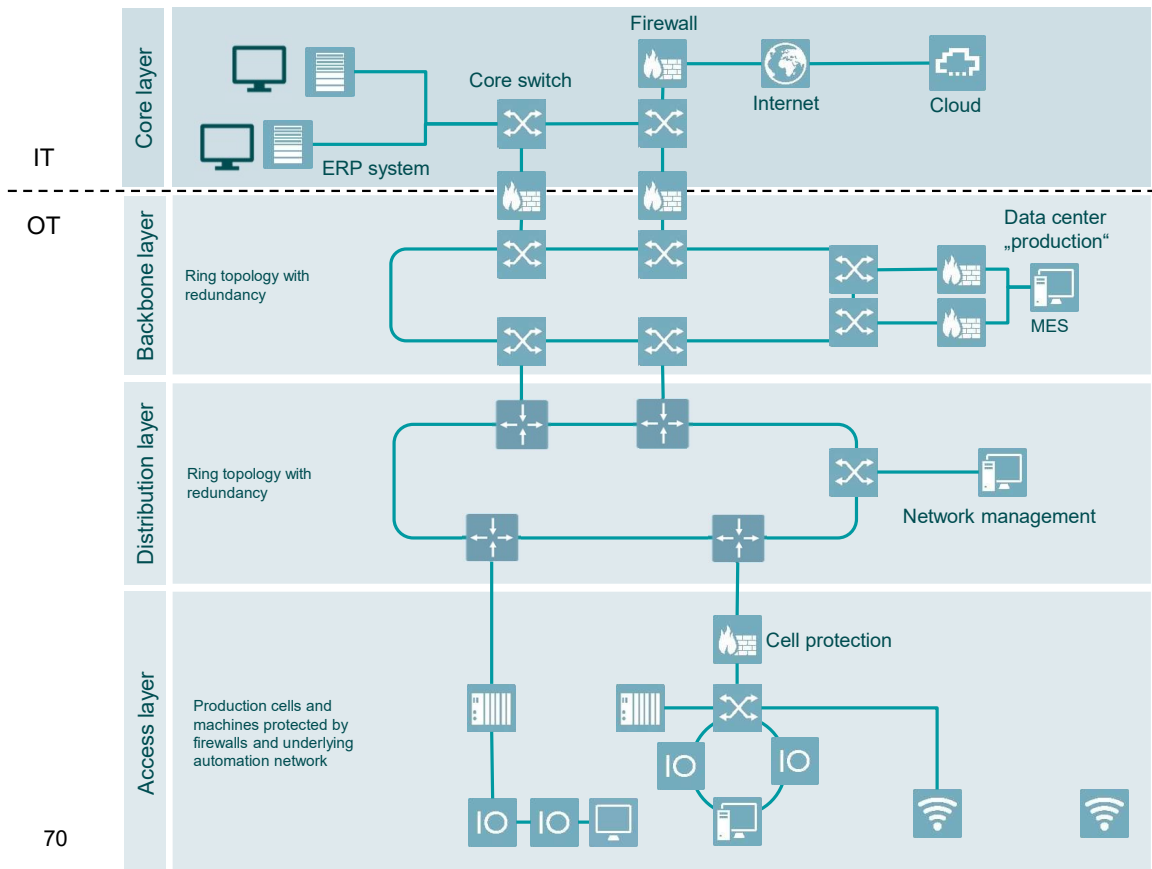
Mesh

Powerful and sustainable network | Network architecture

Redundancy protocols

Standard	Reconfiguration time	Topologies	Applications
RSTP/STP Rapid Spanning Tree Protocol	Up to several seconds	Ring, meshed structures, star, tree	IT and automation networks
RSTP + FRD Fast ring detection + Large Tree Support	100 to 500 ms	Ring, meshed structures, star, tree	Automation networks
MRP Media Redundancy Protocol	200 ms	Ring	PROFINET automation networks
VRRP Virtual Router Redundancy Protocol	Up to several seconds	Double and multiple routers	Connection to the office network

Basics - Layers



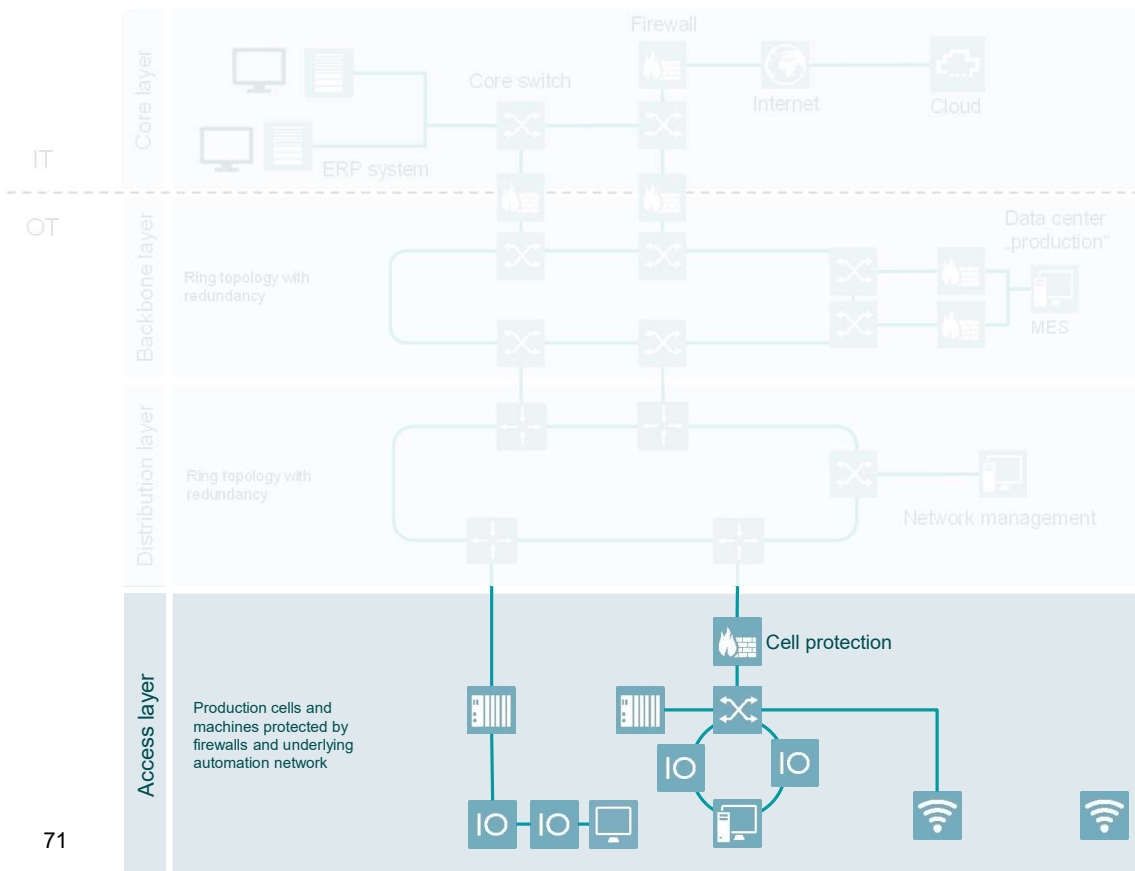
- Enterprise IT
- Internet, cloud technologies
- Secured through firewalls

- Data transportation of different production halls
- Connection to office IT

- Factory network - Merging of machines, production lines and production cells in production hall

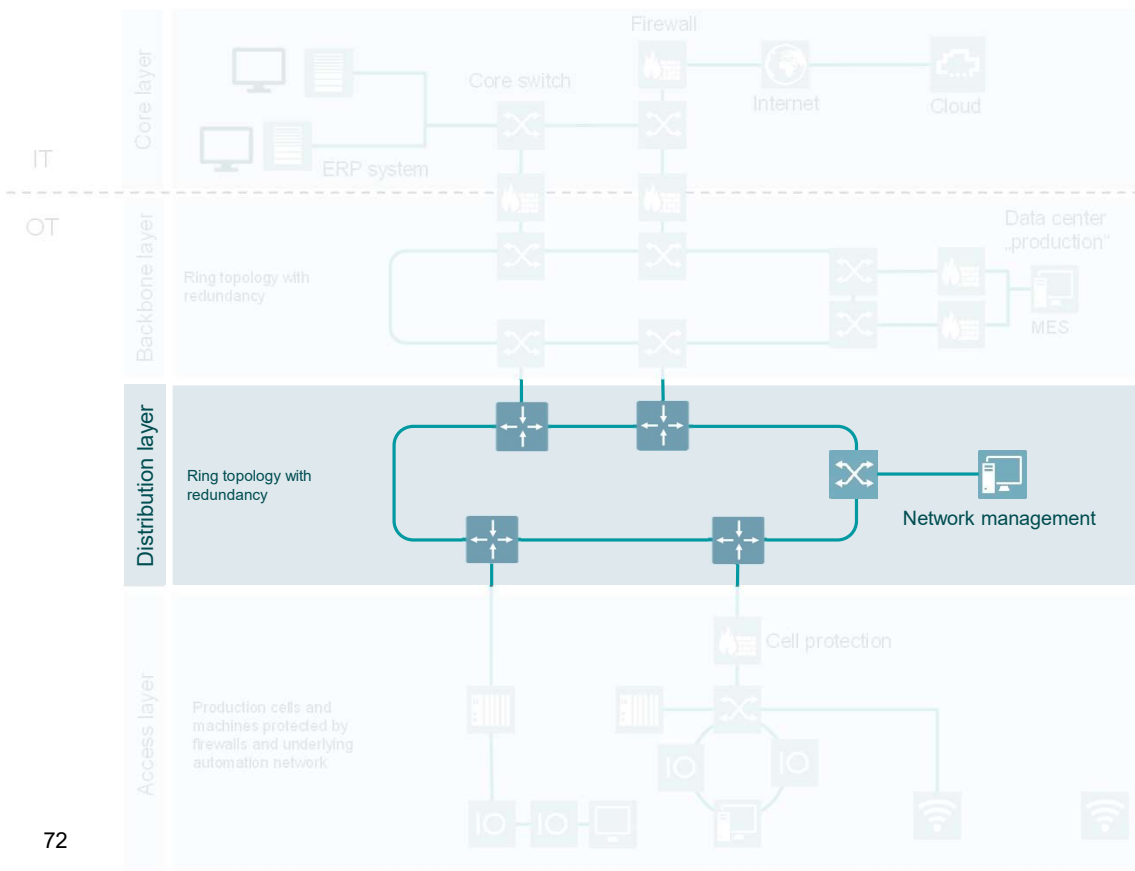
- Production cells and machine networks

Basics – Access layer



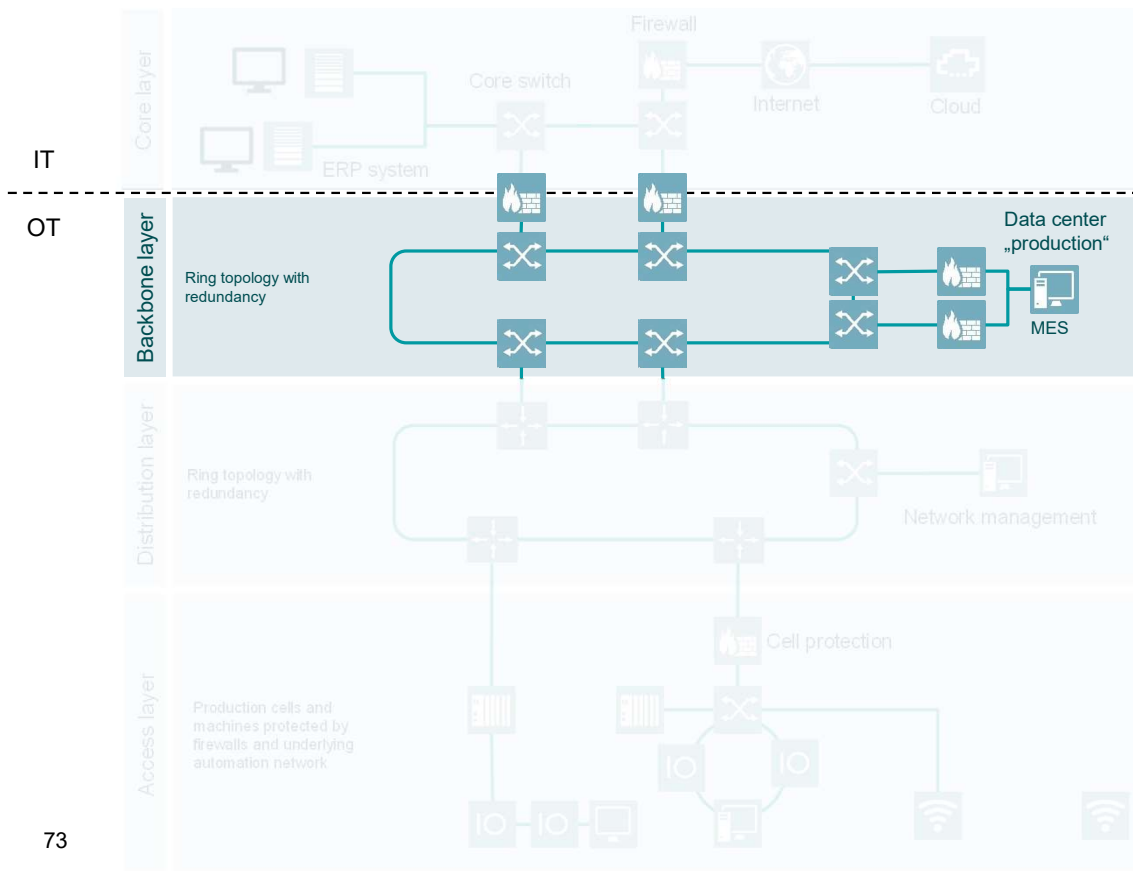
- **Usage:** Network devices, horizontal communication (M2M)
- **Characteristics:** Small to medium-sized data packages, communication → deterministic, error-proof, high availability necessary, special real-time requirements, managed switches (L2)
- **Transmission distance:** $\leq 100\text{m}$
- **Medium:** Copper, WLAN, Bluetooth
- **Bandwidth:** Typ. $\leq 100\text{ Mbit/s}$ (1 Gbit also used)
- **Protocols:** TCP/IP, Profinet, Ethernet/IP, Modbus/TCP, OPC-UA, MQTT, ..., connection to fieldbus systems
- **Topologies:** Bus, star, ring

Basics – Distribution layer



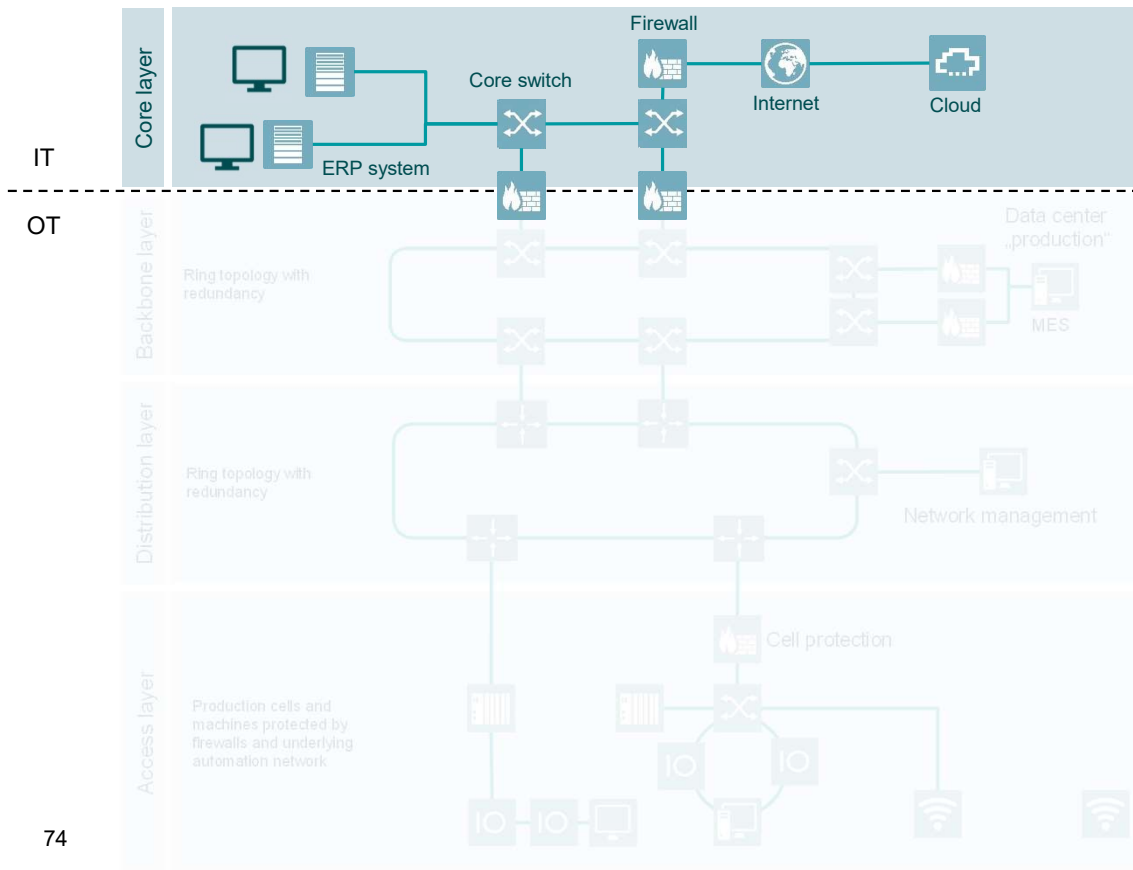
- **Usage:** Factory network – merge of machines, production lines and production cells in production hall
- **Characteristics:** Local network management, high flexibility through modularity necessary, integration of subnets, managed switches (L3),
- **Transmission distance:** Typ. less than 100 m
- **Medium:** Copper, fiber optic
- **Bandwidth:** 100 Mbit/s up to 1 Gbit/s
- **Protocols:** VPN, SNMP, ICMP, OPC UA, MQTT, TCP/IP
- **Topologies:** Star, ring

Basics – Backbone layer



- **Usage:** Transportation of data of different production halls, connection to office IT
- **Characteristics:** Redundant (rack) switches, production data center, high flexibility through modularity necessary, security functions (firewalling, authentication),
- **Transmission distance:** Up to 80 km
- **Medium:** Fiber Optic, copper
- **Bandwidth:** 100 Mbit/s up to 10 Gbit/s (Industrial Ethernet)
- **Protocols:** VRRP, CARP, OSPF, routing
- **Topologies:** Ring, star

Basics – Core layer



- **Usage:** Enterprise IT, connection to backbone layer secured through firewalls
- **Characteristics:** (Rack) switches, cloud technologies, Internet, servers, management systems, update servers, intranet, DHCP servers, DNS
- **Transmission distance:** Up to 100m
- **Medium:** Copper
- **Bandwidth:** 100 Mbit/s up to 10 Gbit/s
- **Protocols:** TCP/IP, SNMP, DHCP, DNS
- **Topologies:** Star, tree

Powerful and sustainable network | Network architecture

Production network vs. office network

	Production	Office
Priorities	<p><u>Availability</u> Integrity Confidentiality</p>	<p><u>Confidentiality</u> Integrity Availability</p>
Installation	<ul style="list-style-type: none"> ▪ Wiring dependent on machine / production plant ▪ Assembling in the field ▪ Industrial components ▪ Lifespan: 10 to 20 years ▪ Star and ring topology 	<ul style="list-style-type: none"> ▪ Fixed installation in the building ▪ Preassembled wiring ▪ Office components ▪ Lifespan: max. 5 years ▪ Star and tree topology
Data	<ul style="list-style-type: none"> ▪ Small data packages ▪ Cyclic deterministic data communication ▪ Real time ▪ Very high network availability 	<ul style="list-style-type: none"> ▪ Big data packages ▪ Acyclic data communication ▪ No real time ▪ Medium network availability
Environment	<ul style="list-style-type: none"> ▪ High temperatures ▪ Dust, moisture, vibration ▪ High load of electromagnetic effects 	<ul style="list-style-type: none"> ▪ Normal temperatures ▪ Application in normal environments ▪ Low load of electromagnetic effects

Powerful and sustainable network | Network architecture

Basics – Bandwidth

Bandwidth (medium)	Typ. application area
100 Mbit/s (CU)	Access layer, production cells, machines
1 Gbit/s (CU)	Production cells, distribution- backbone- and core layer,
1 Gbit/s (FO)	Distribution- to backbone layer
10 Gbit/s (CU, FO)	distribution- backbone- and core layer,

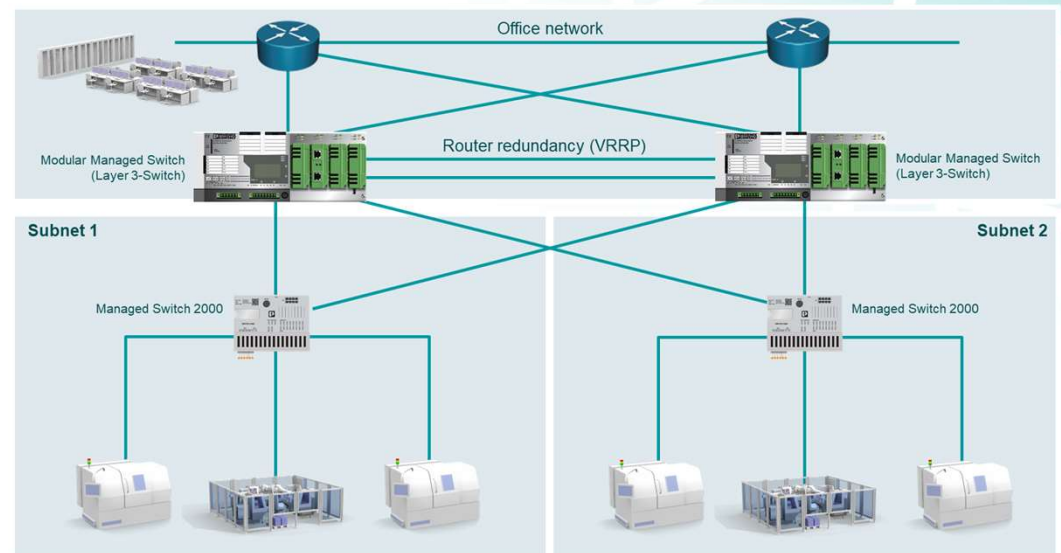
Digital Factory | Commercial advanced training

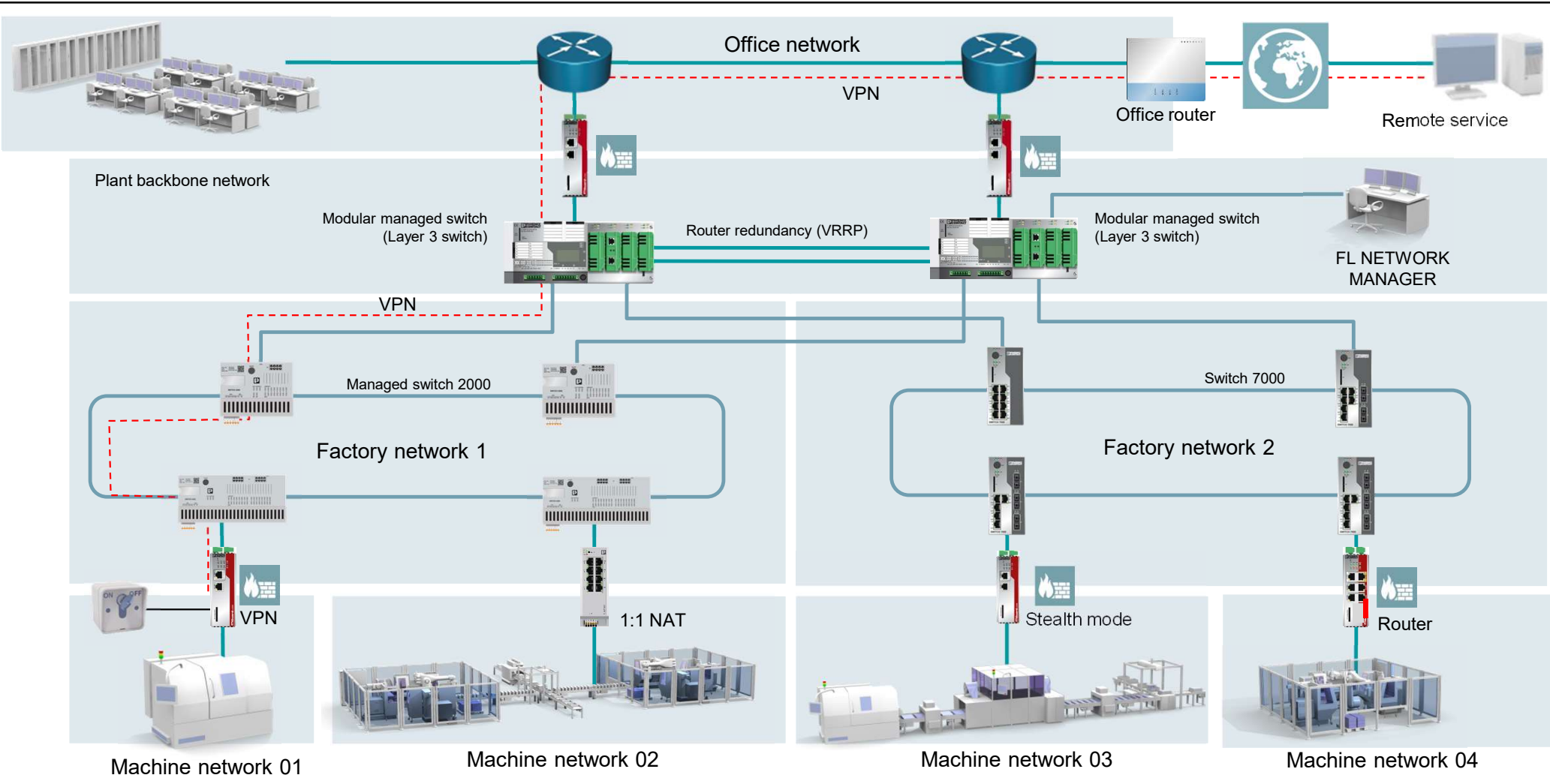
Digital Data from our production



Basics – Subnets

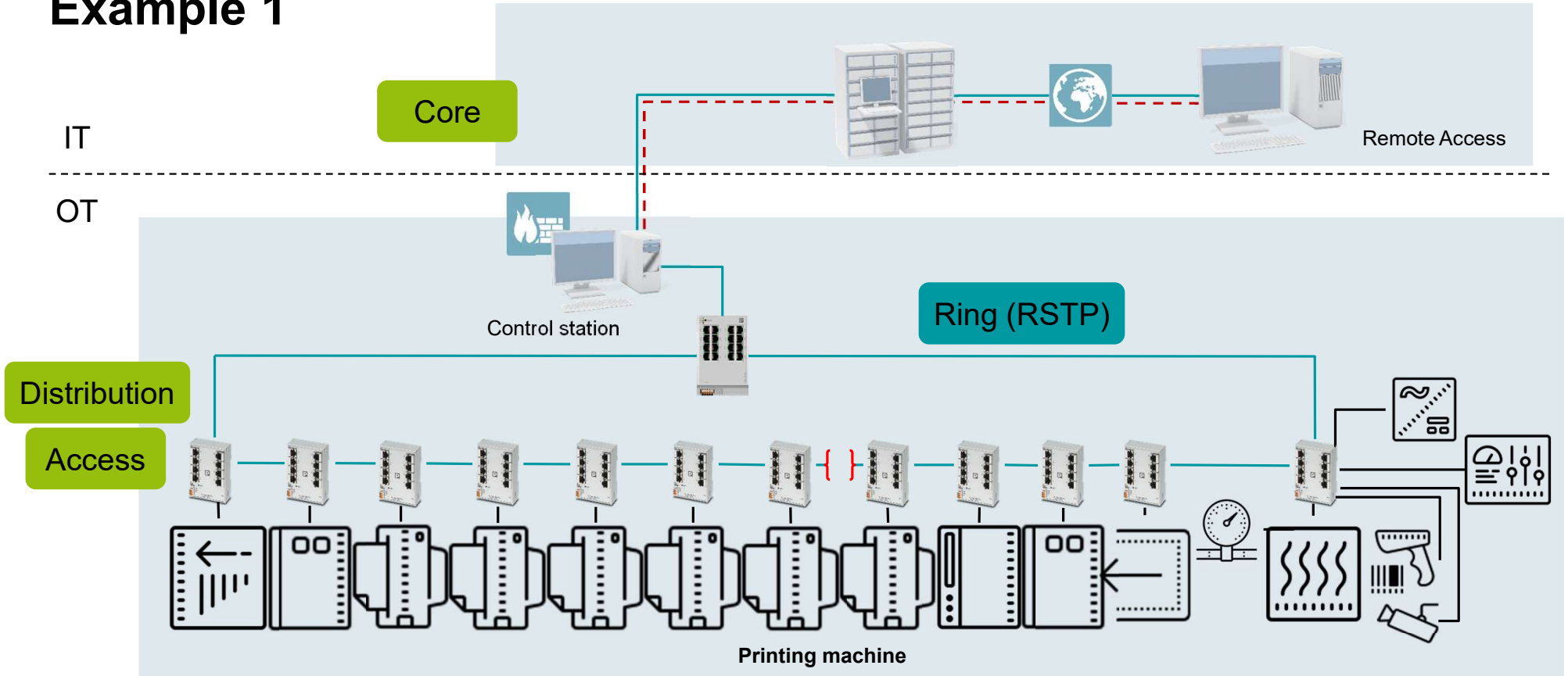
- Expansion of the **IP address range**
- **Easy network extension** possible
- Limiting of broadcast and multicast load
- **Simplified error location**
- Logical organization of network participants
- **Increase of security**





Powerful and sustainable network | Real customer network architecture

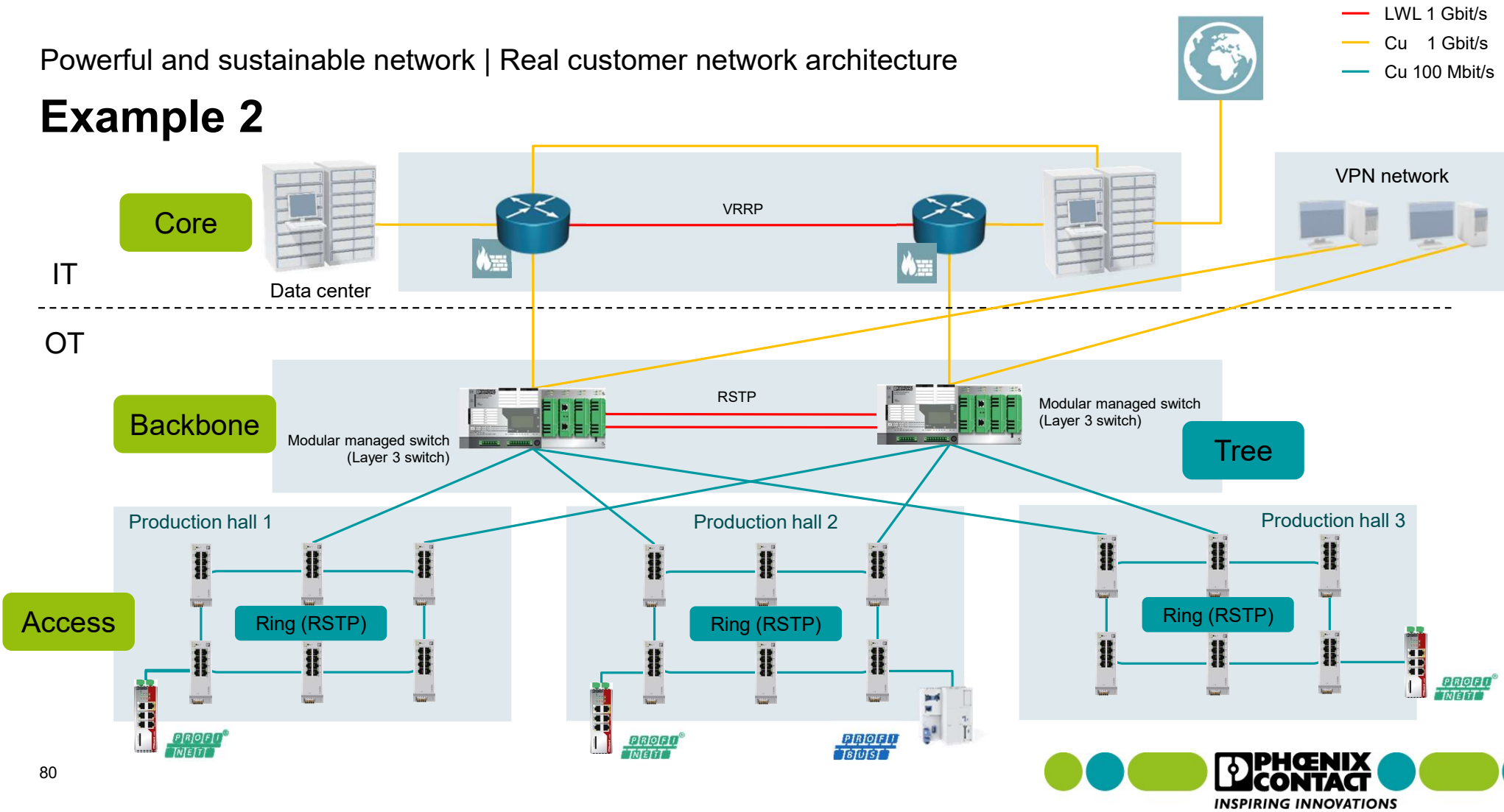
Example 1



Powerful and sustainable network | Real customer network architecture

Example 2

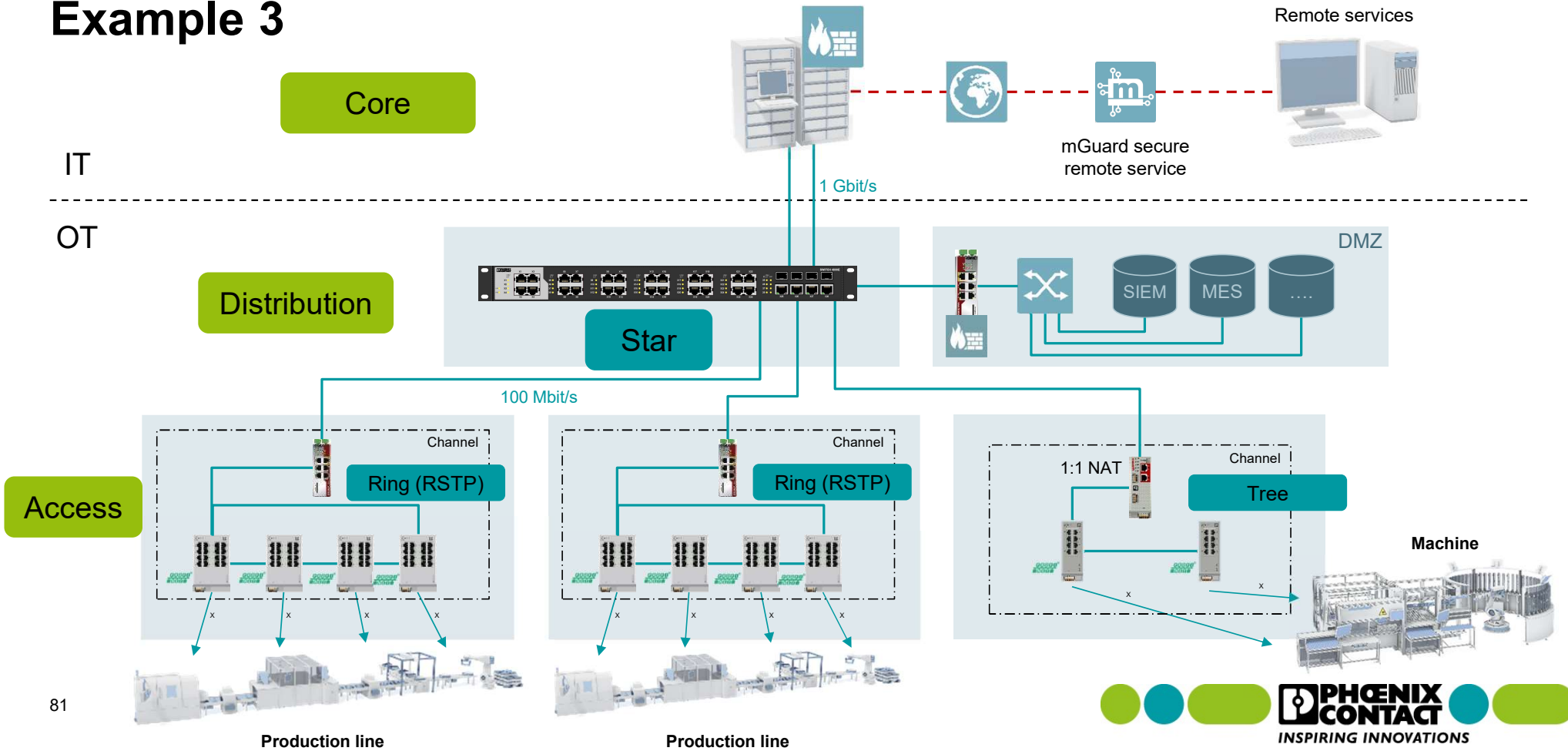
- LWL 1 Gbit/s
- Cu 1 Gbit/s
- Cu 100 Mbit/s



Powerful and sustainable network | Real customer network architecture

Example 3

— Ethernet
- - - VPN connection



Customer pains

Customer pains | Find the right arguments

Clients status quo

Industrial networks are

- Historically grown (step by step)
- Not structured
- Not sustainable (not digital factory-ready)

Reason

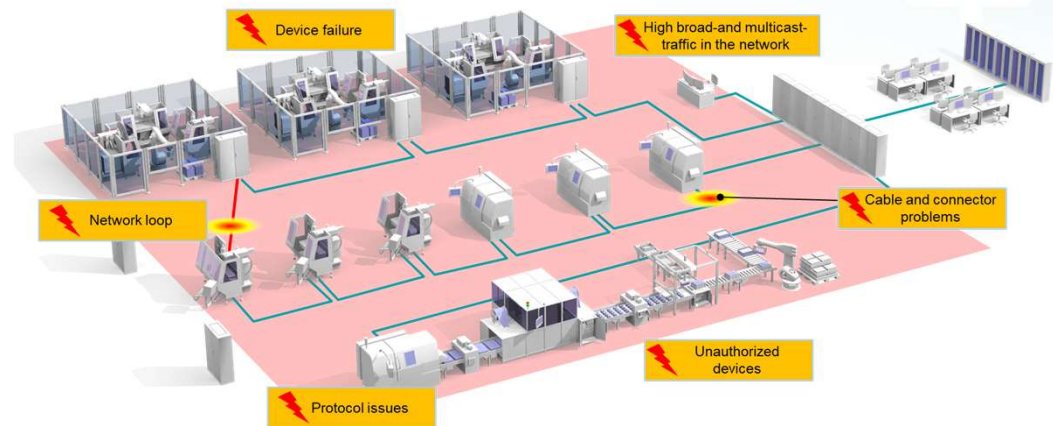
- Fast technological evolution
- Time pressure
- Costs

Future Technical Evolution

- ↑ Amount of network nodes
- ↑ Data traffic

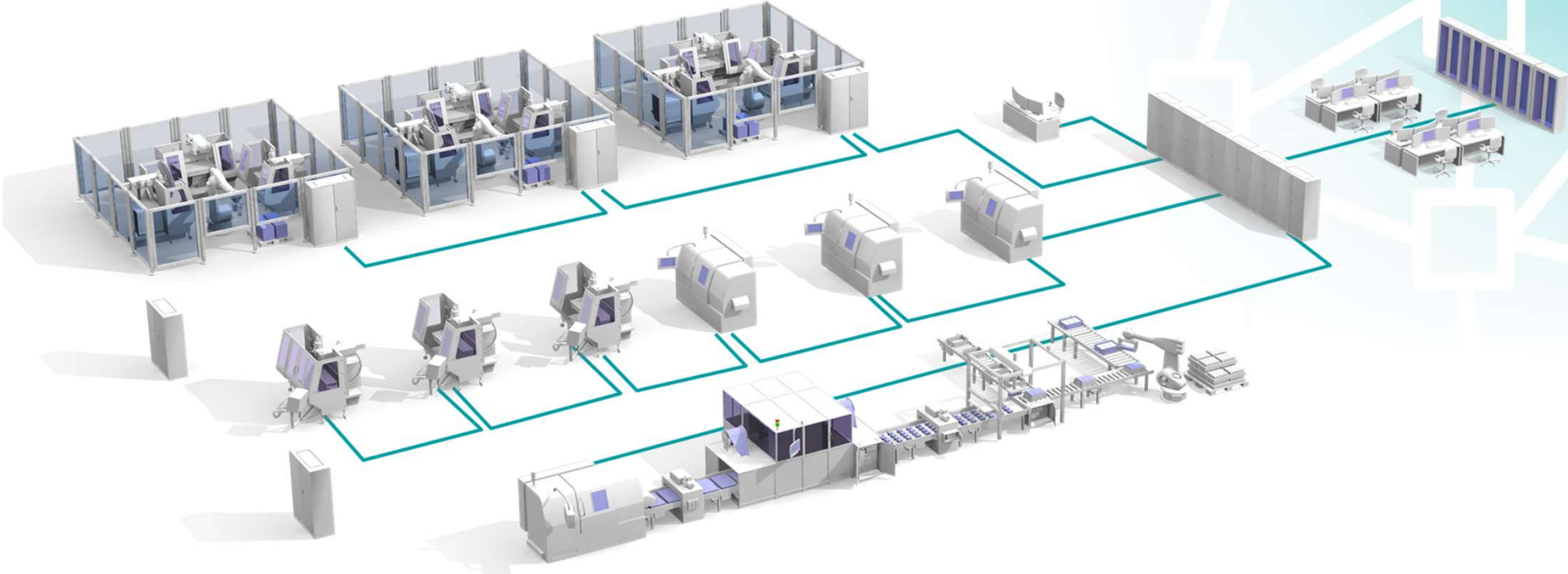
Consequences

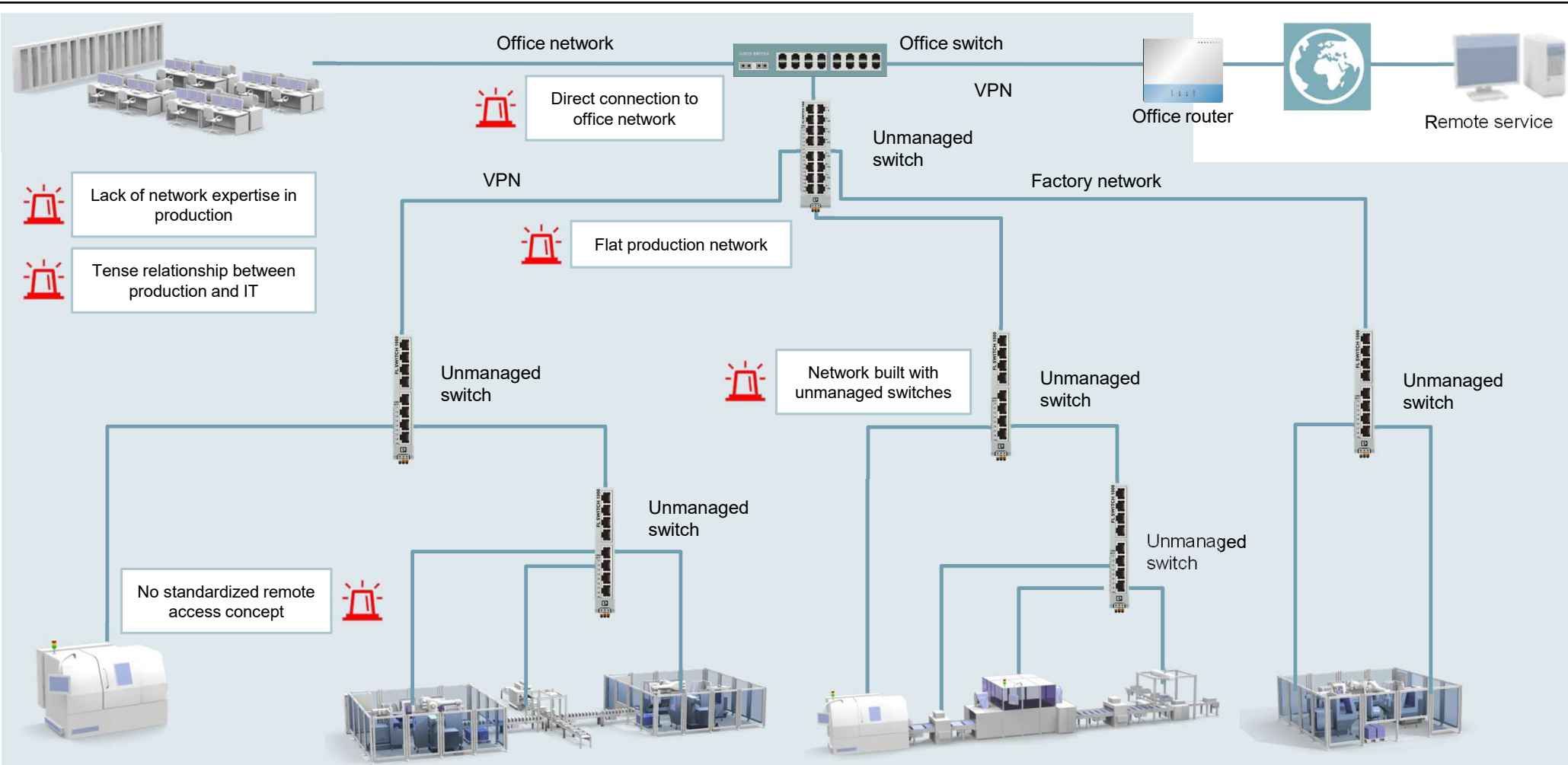
- ❖ High risk of system failures
- ❖ Longer downtimes
- Lower availability
- Higher costs



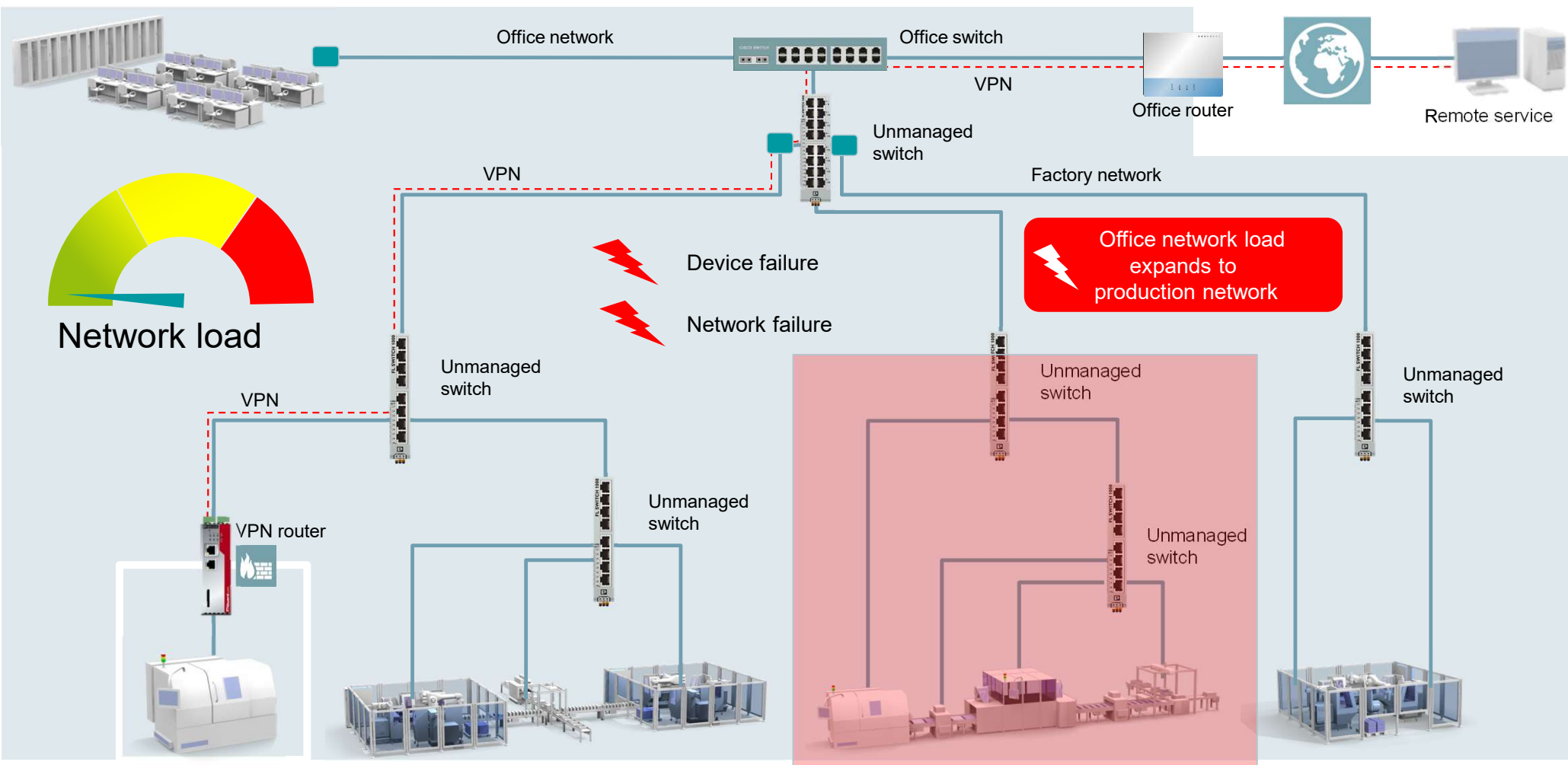
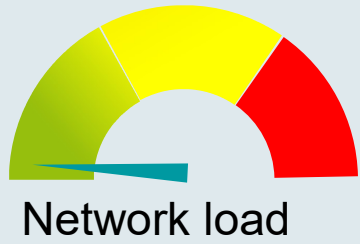
Customer pains | Find the right arguments

Production network





Critical situations in the network



Direct connection to office network

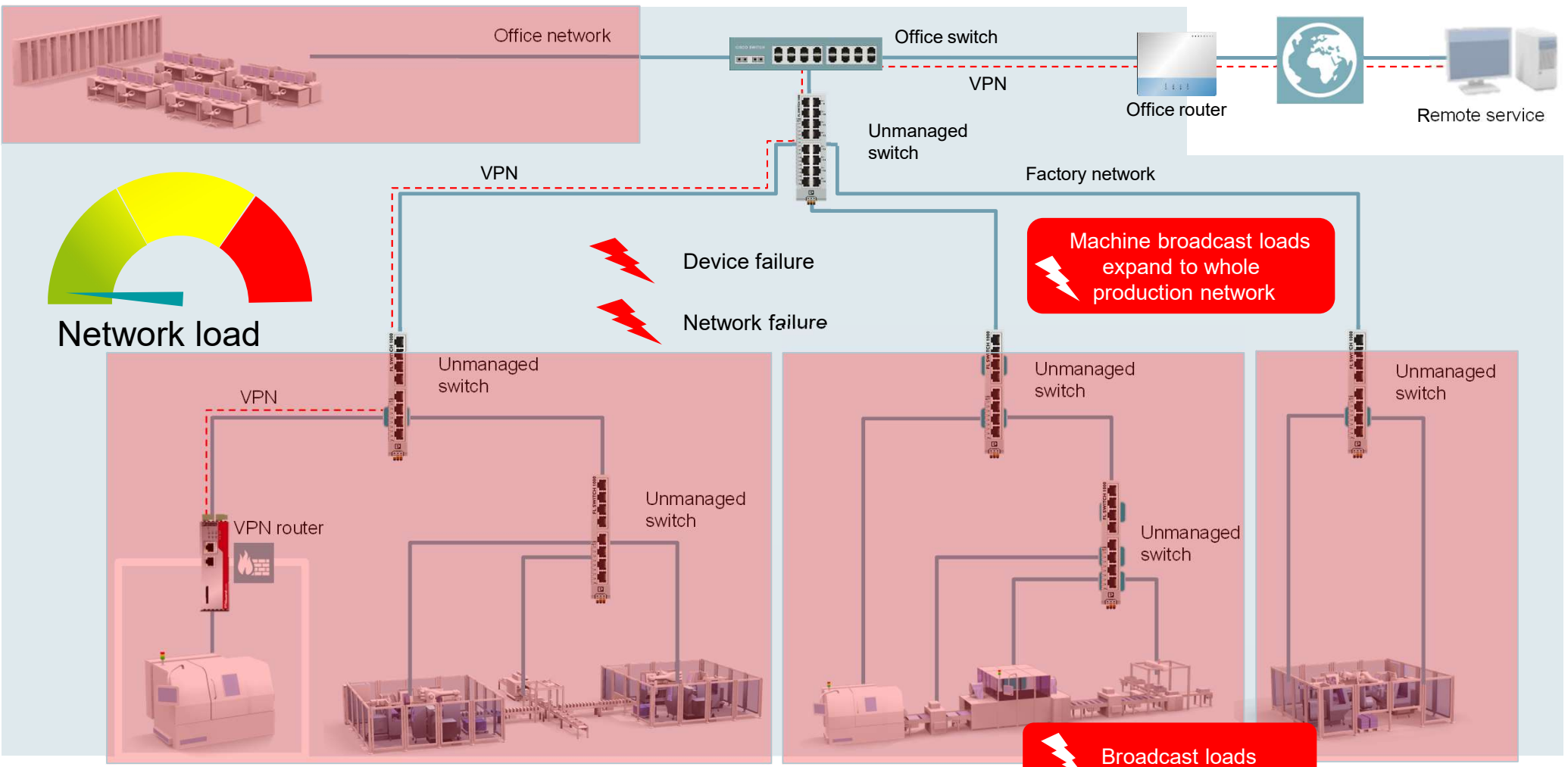


Network built with unmanaged switches



Flat production network





Direct connection to office network

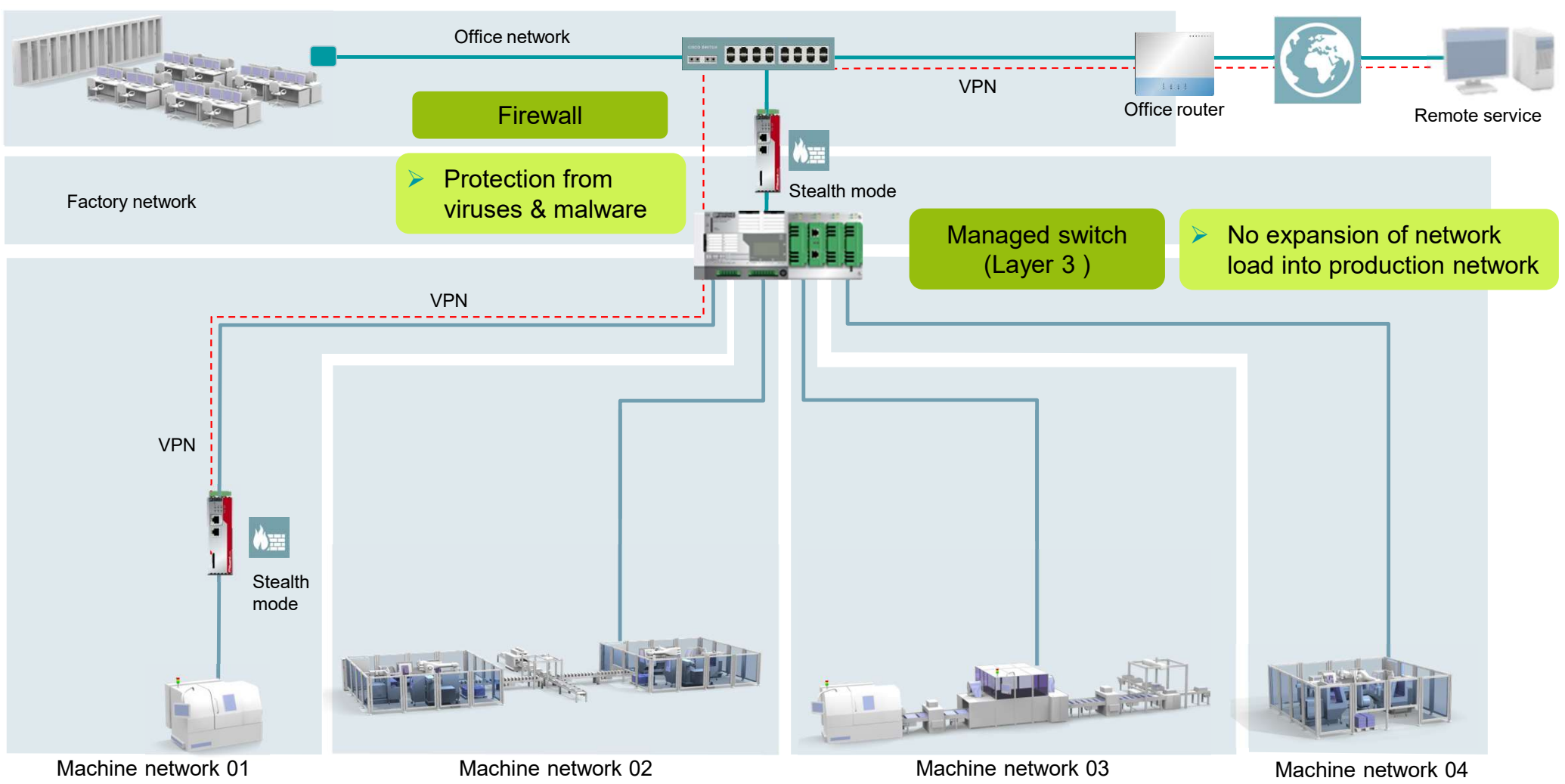


Network built with unmanaged switches

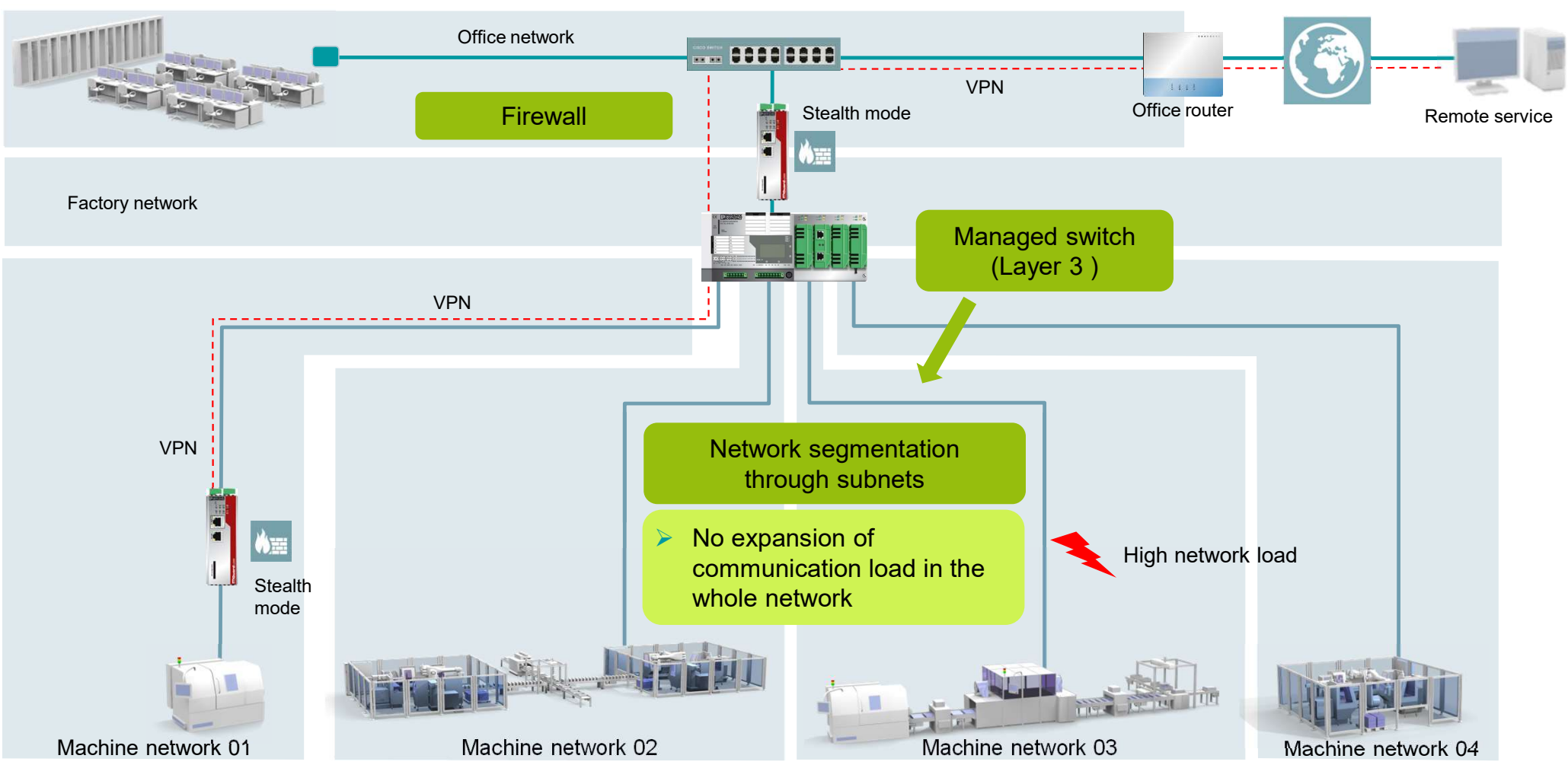


Flat production network

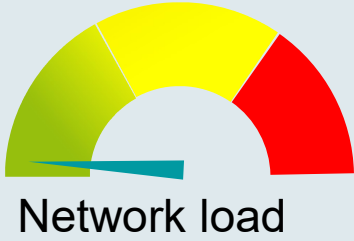
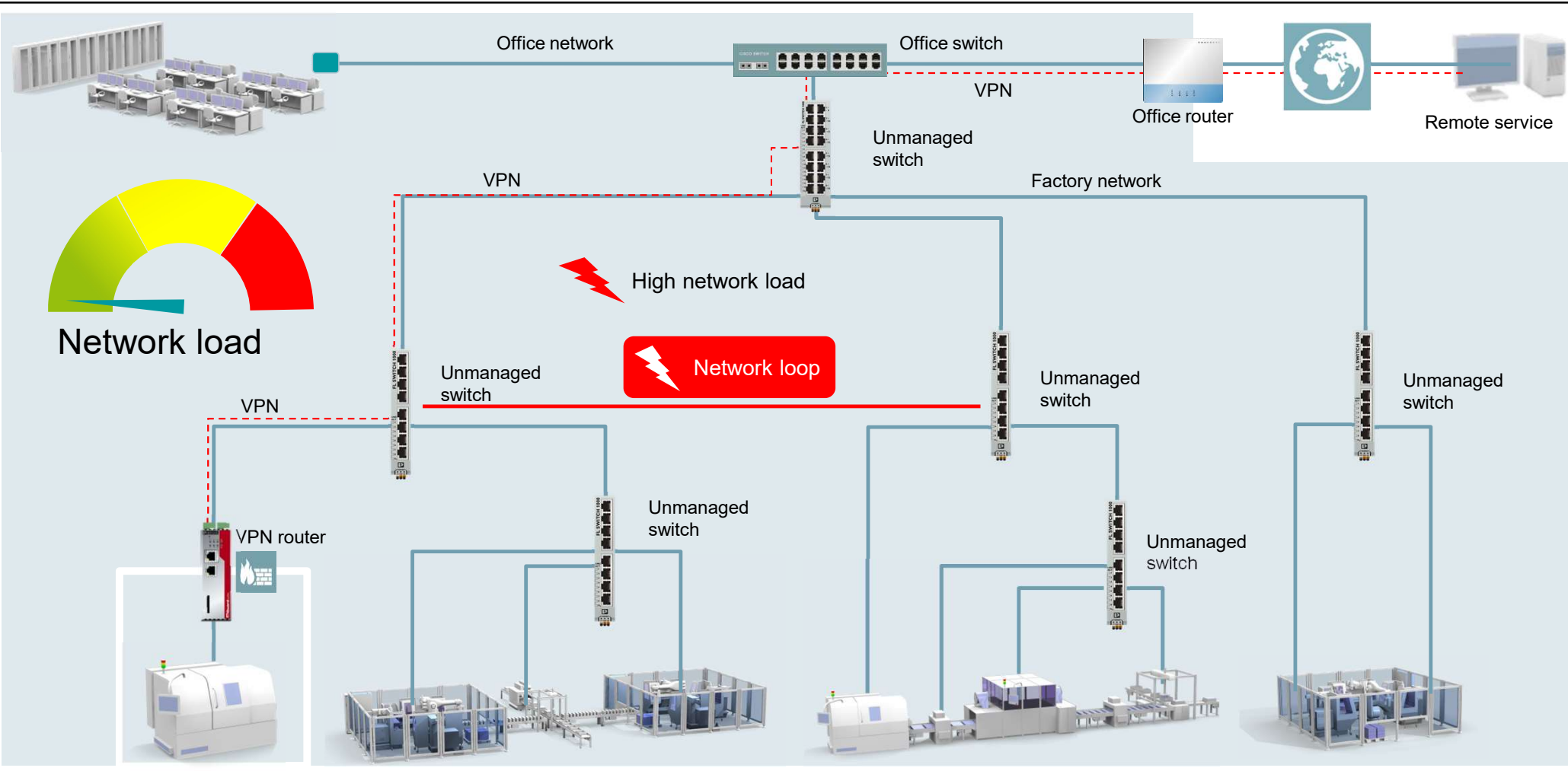




↑ Availability



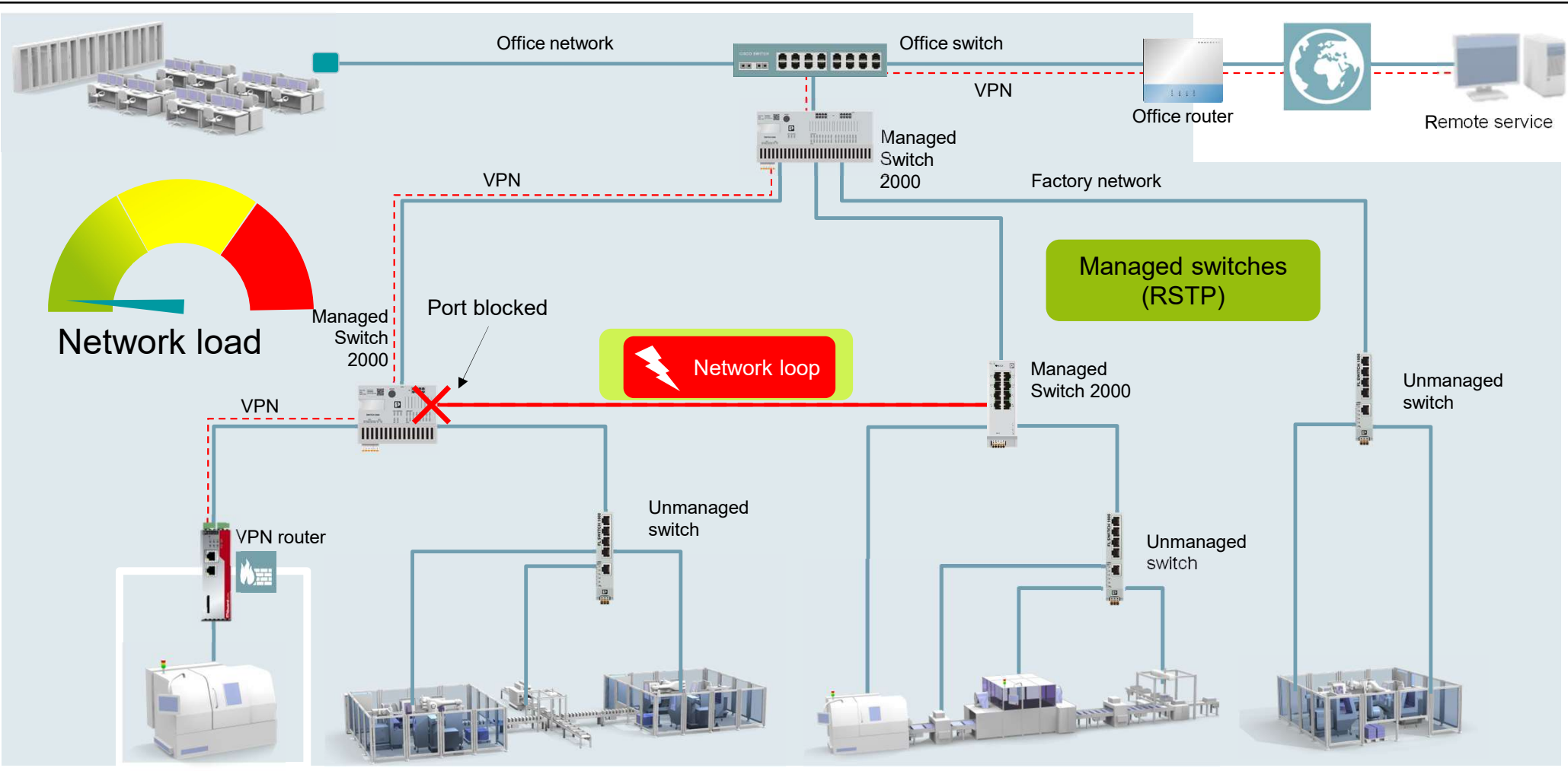
↑ **Availability** ↑ **Flexibility**

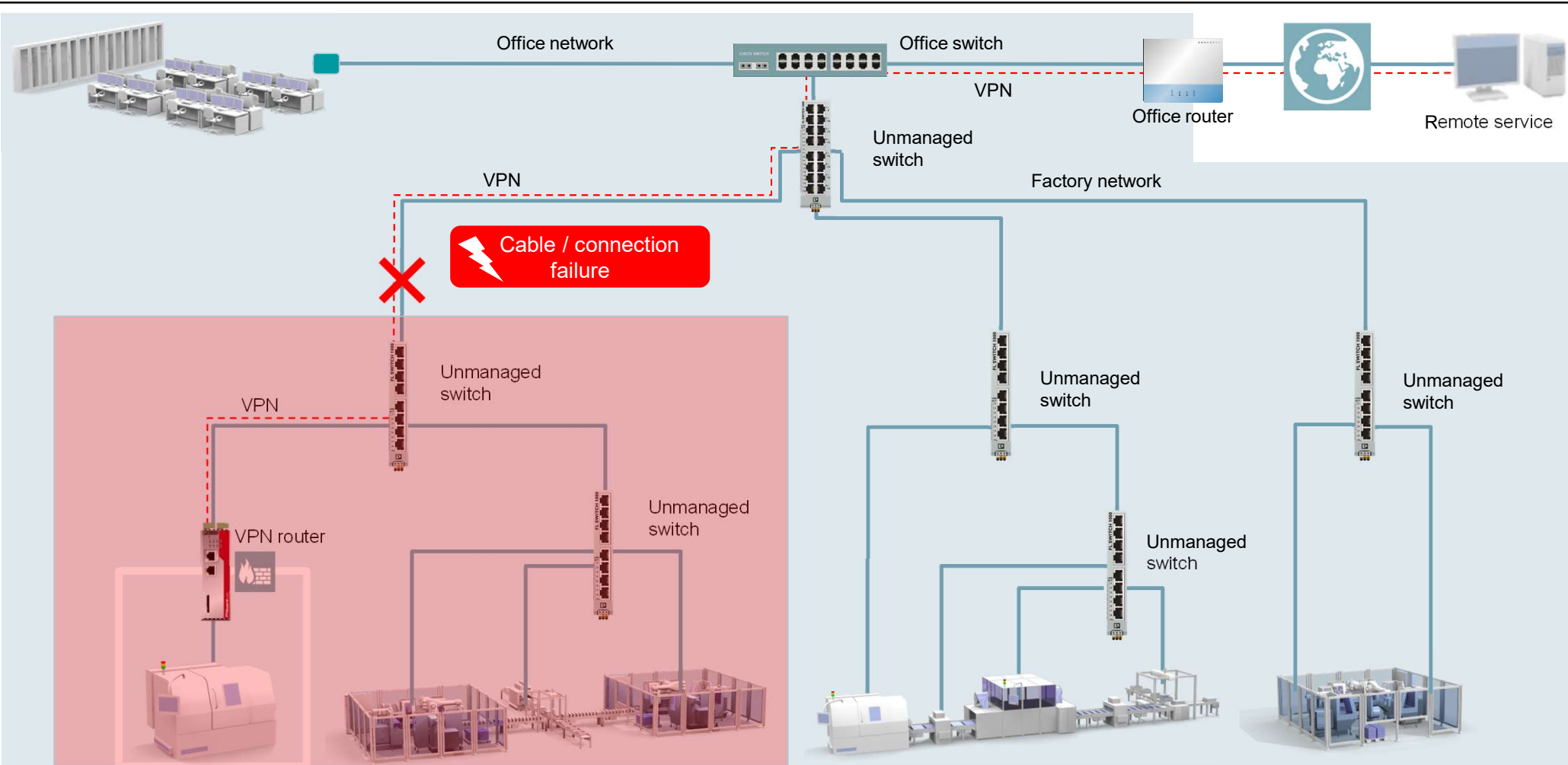


Network built with unmanaged switches



Flat production network

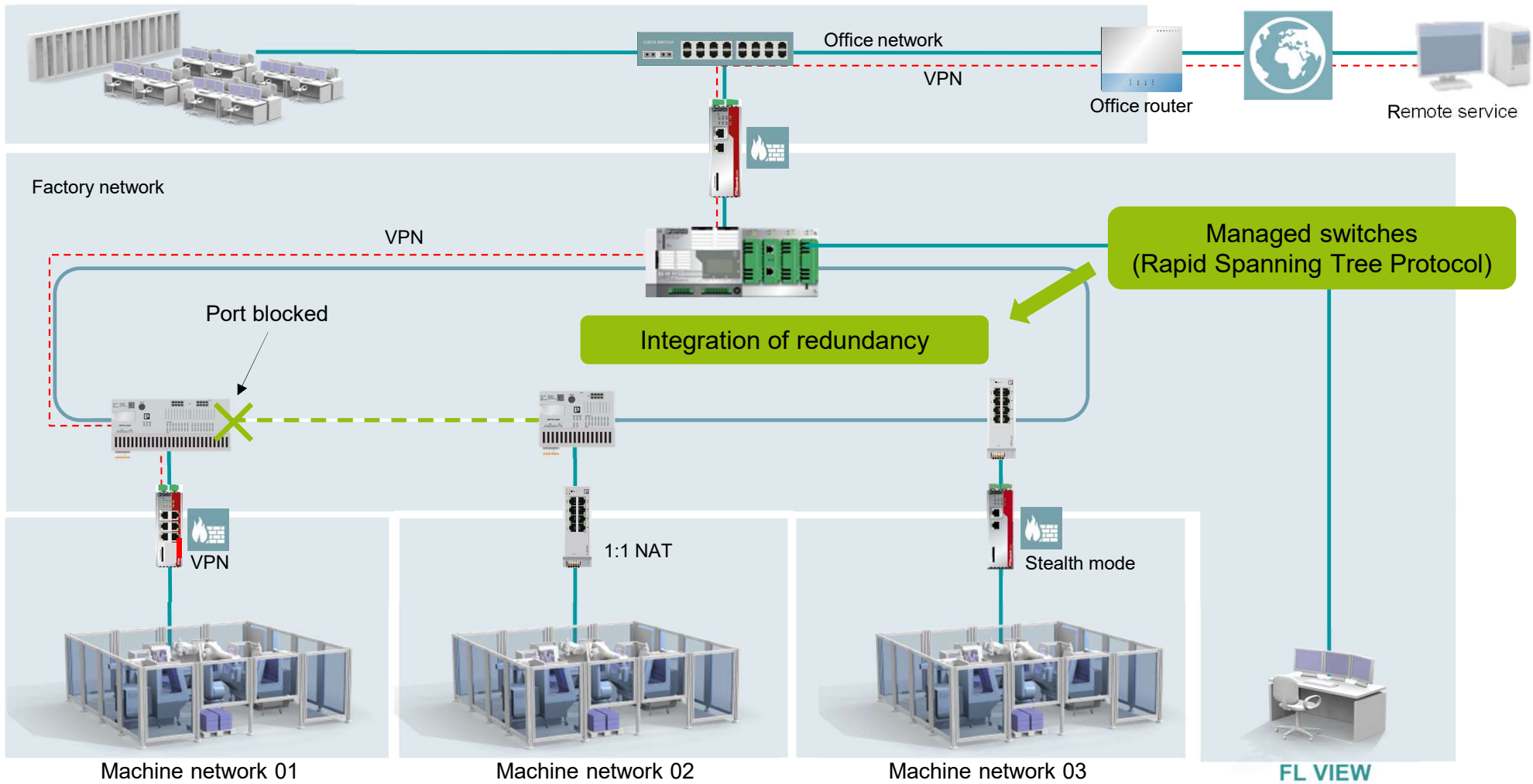


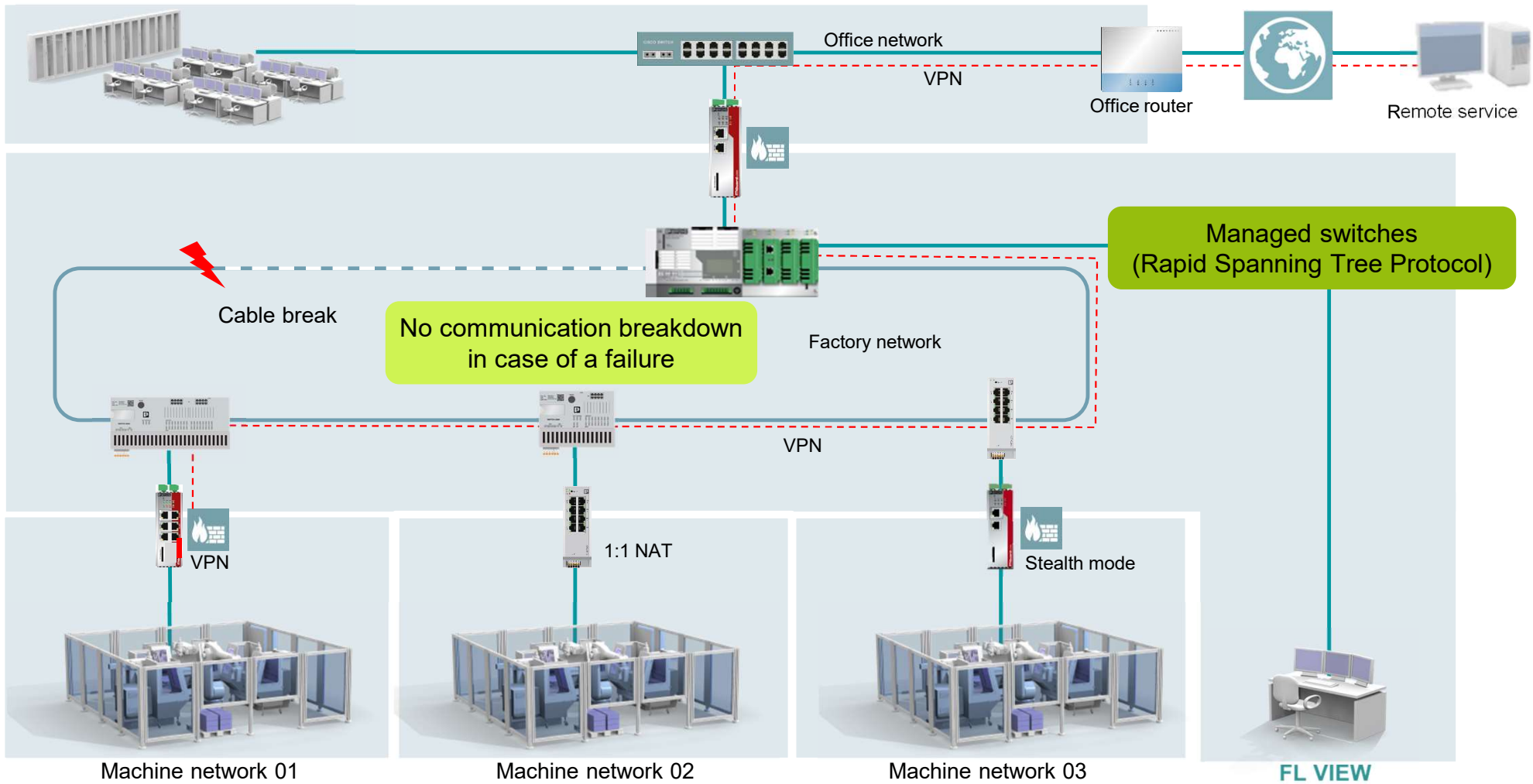


Partial failure of the network!

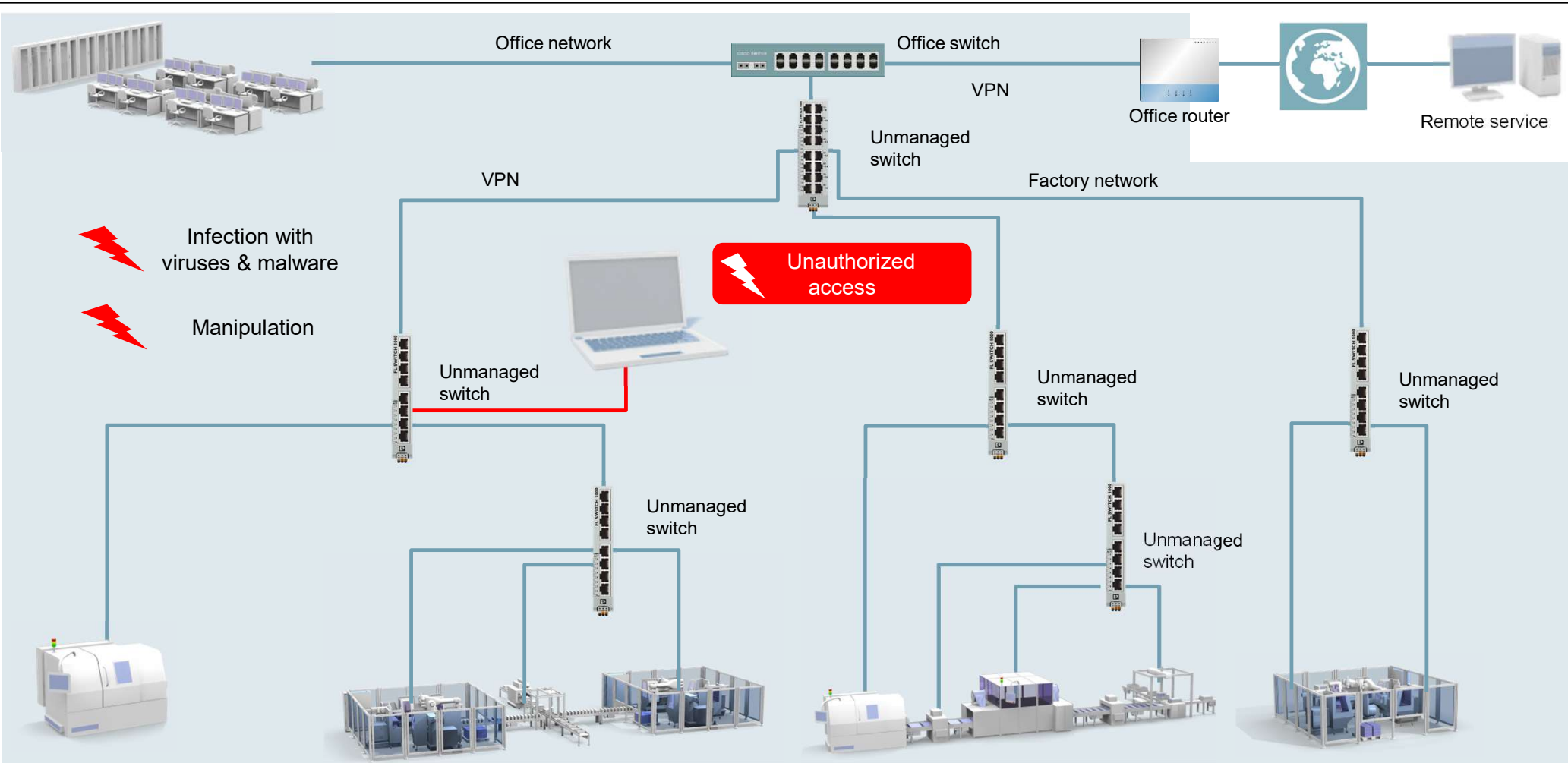


Network built with unmanaged switches

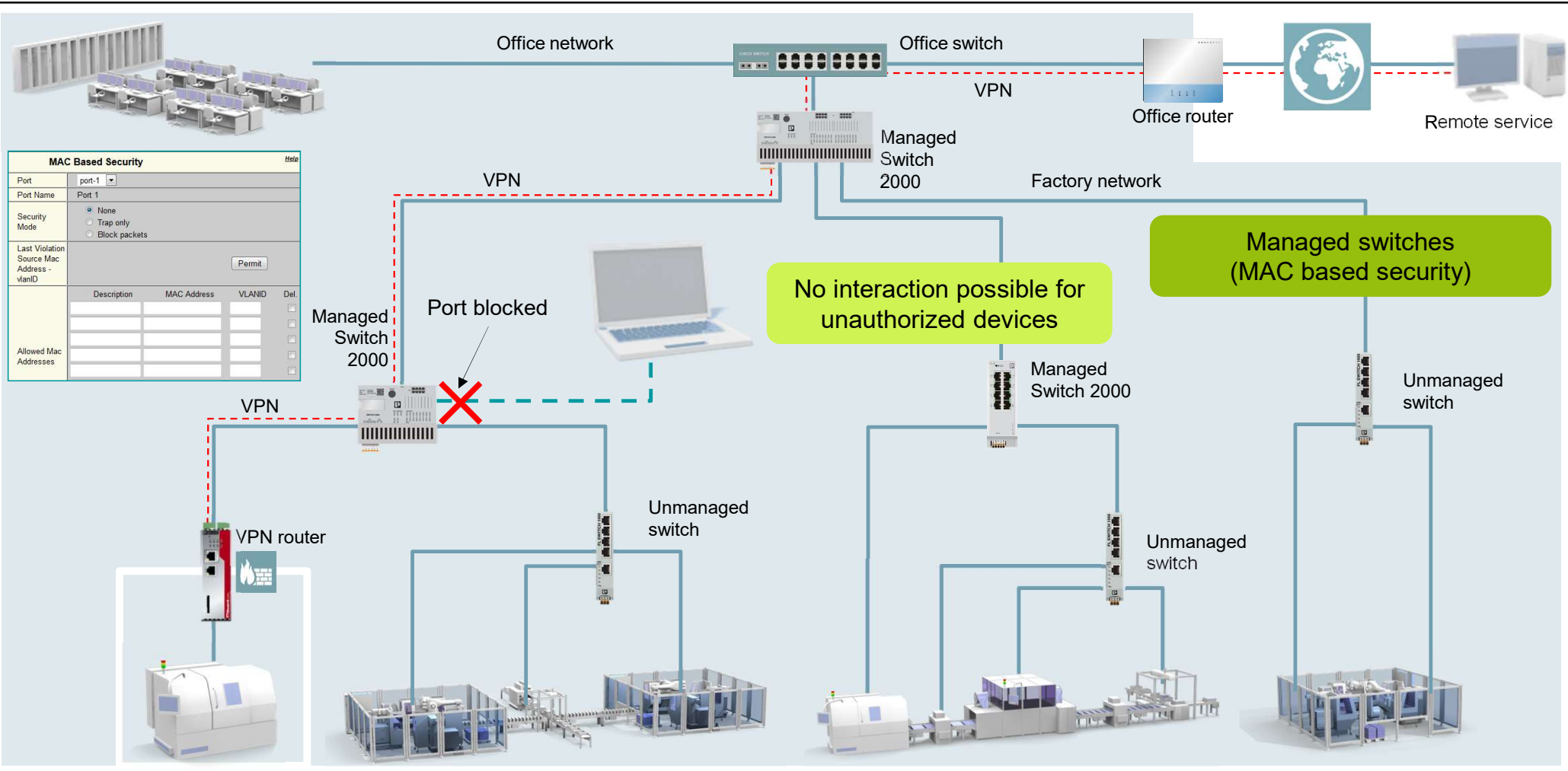


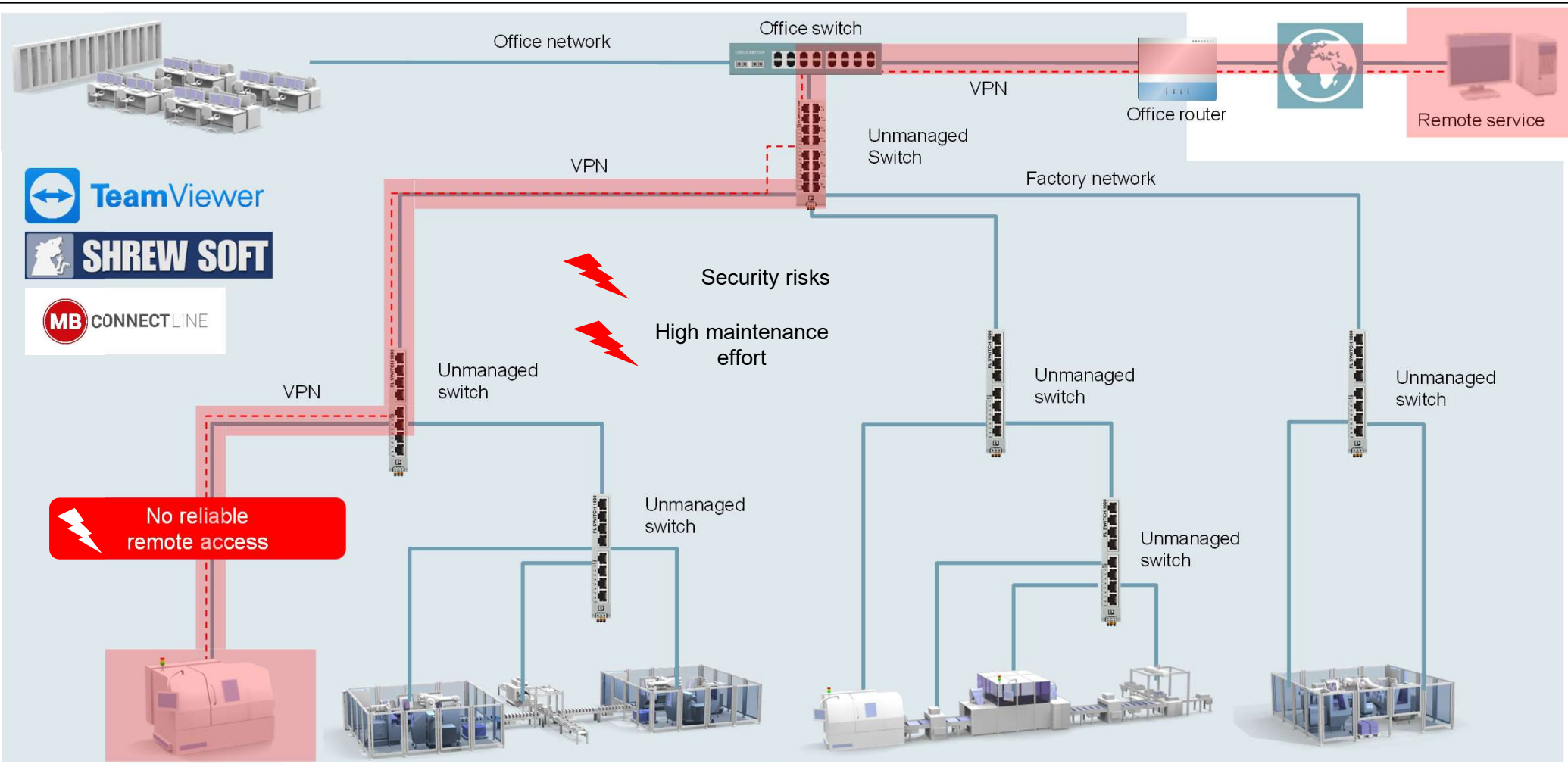



↑ **Availability**



Network built with unmanaged switches

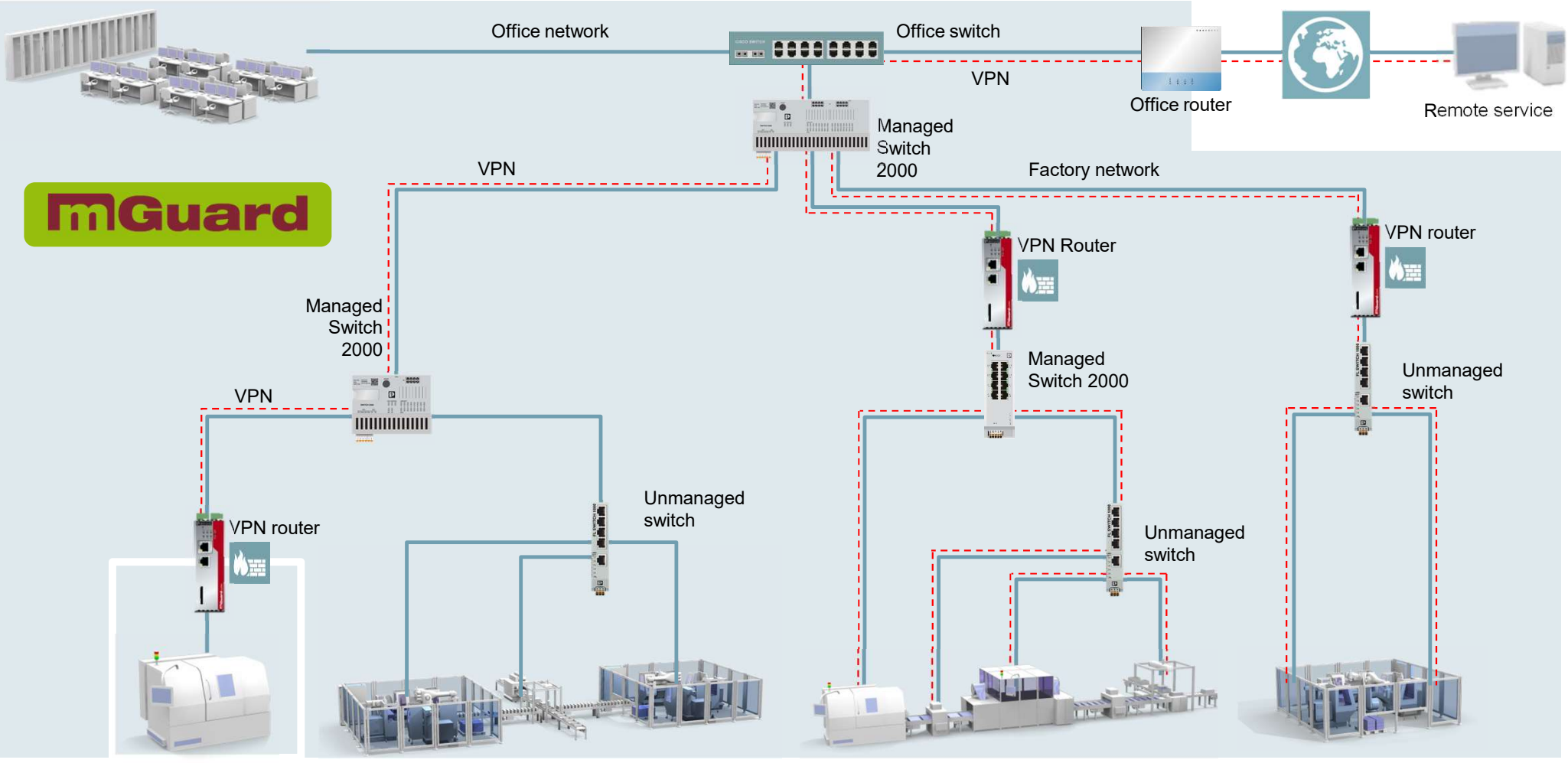




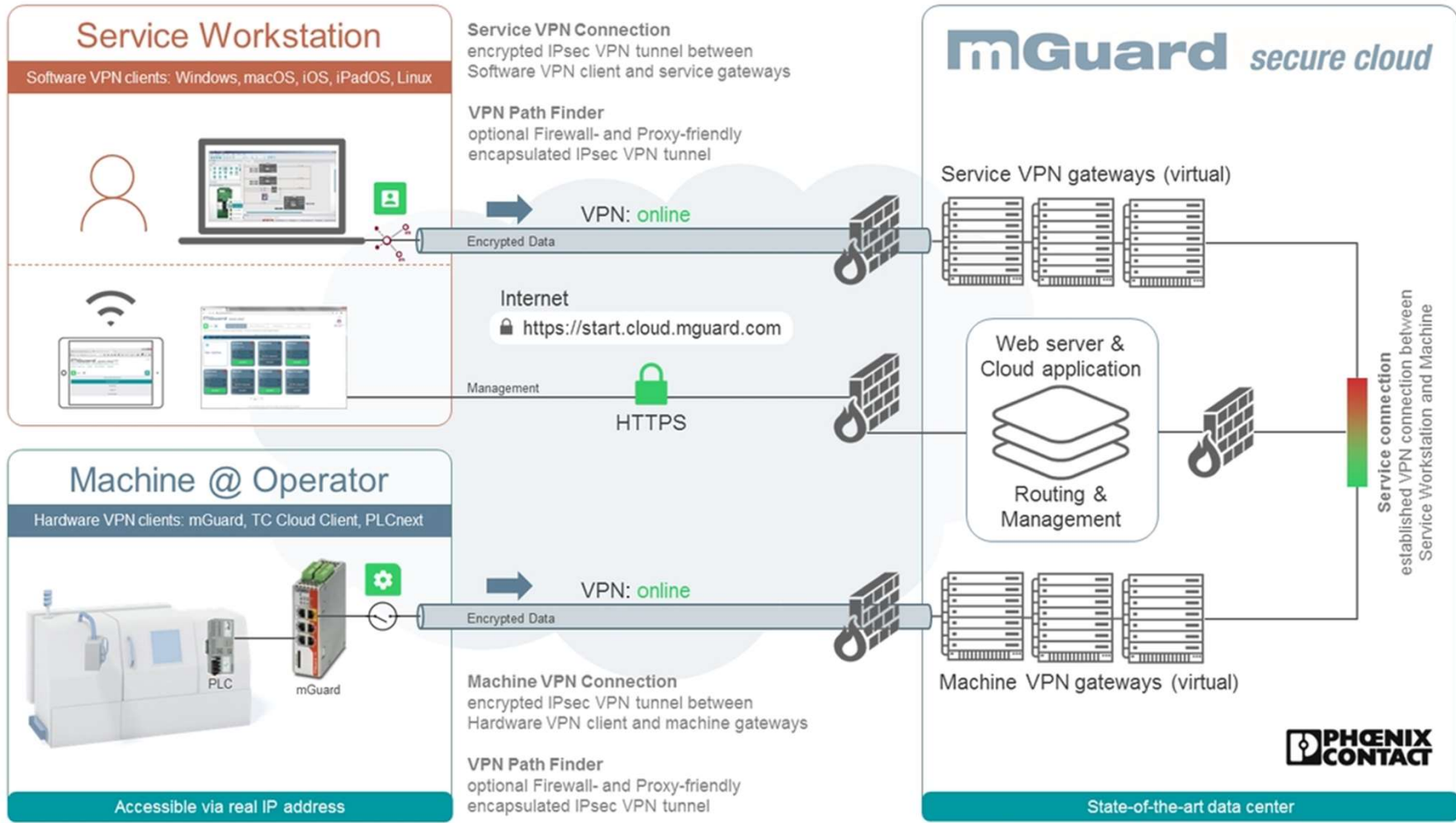
 **No remote service available in necessary situations!**

No standardized remote access concept





mGuard



Remote service



VPN

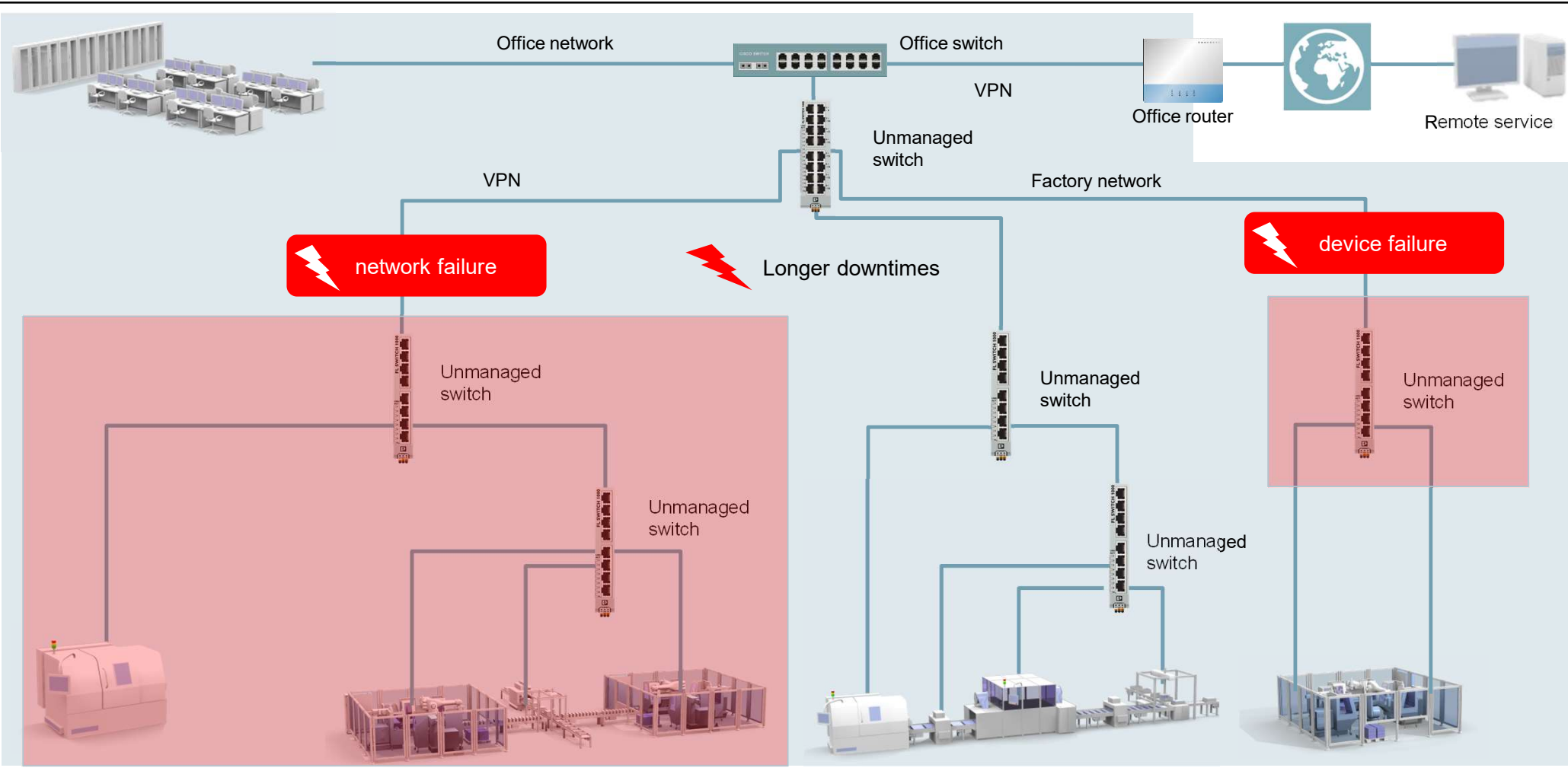
VPN

VPN

https

VPN

VPN



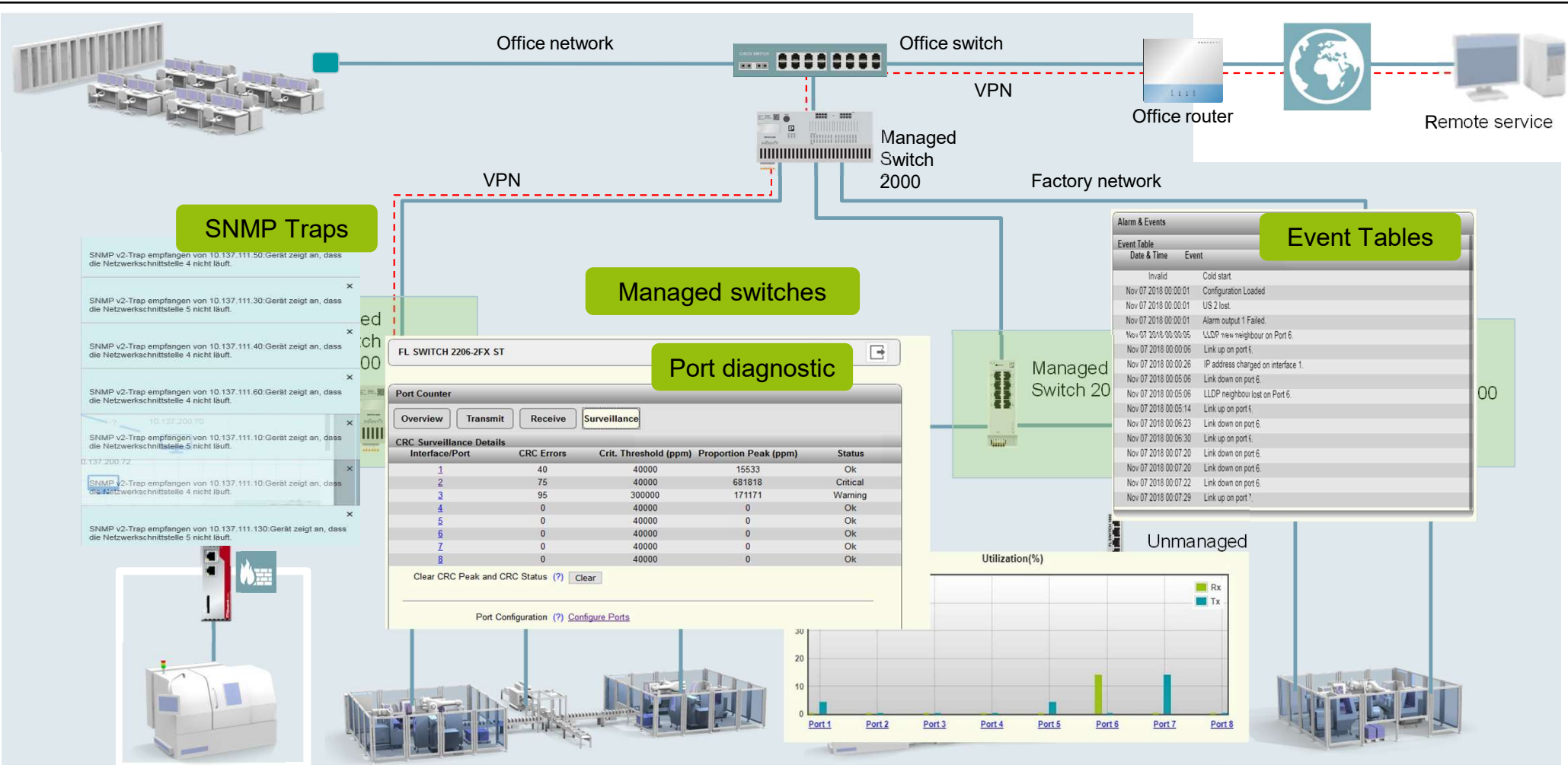
Lack of network expertise in production



Tense relationship between production and IT



Network built with unmanaged switches

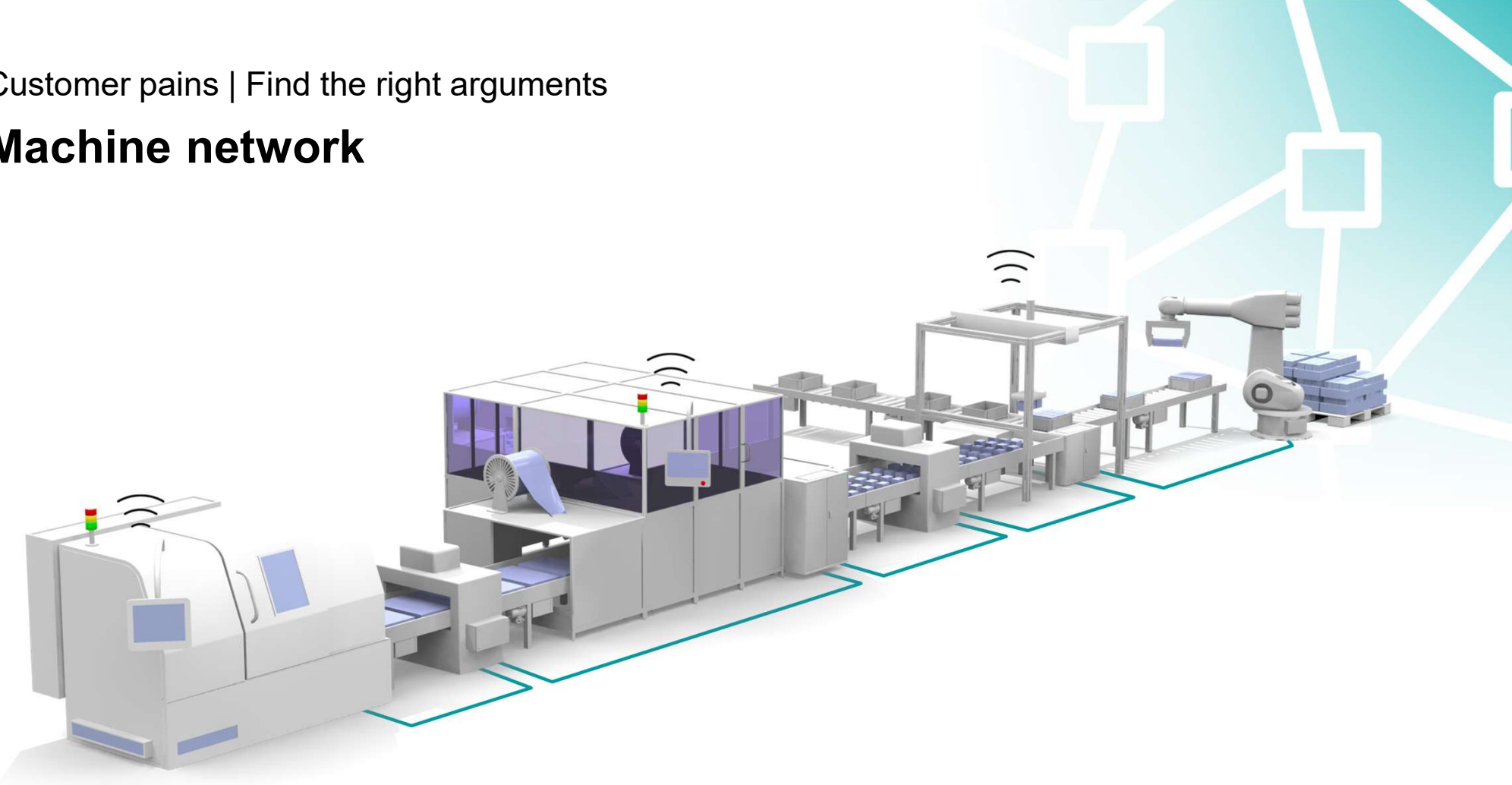


↑ Availability

↑ Flexibility

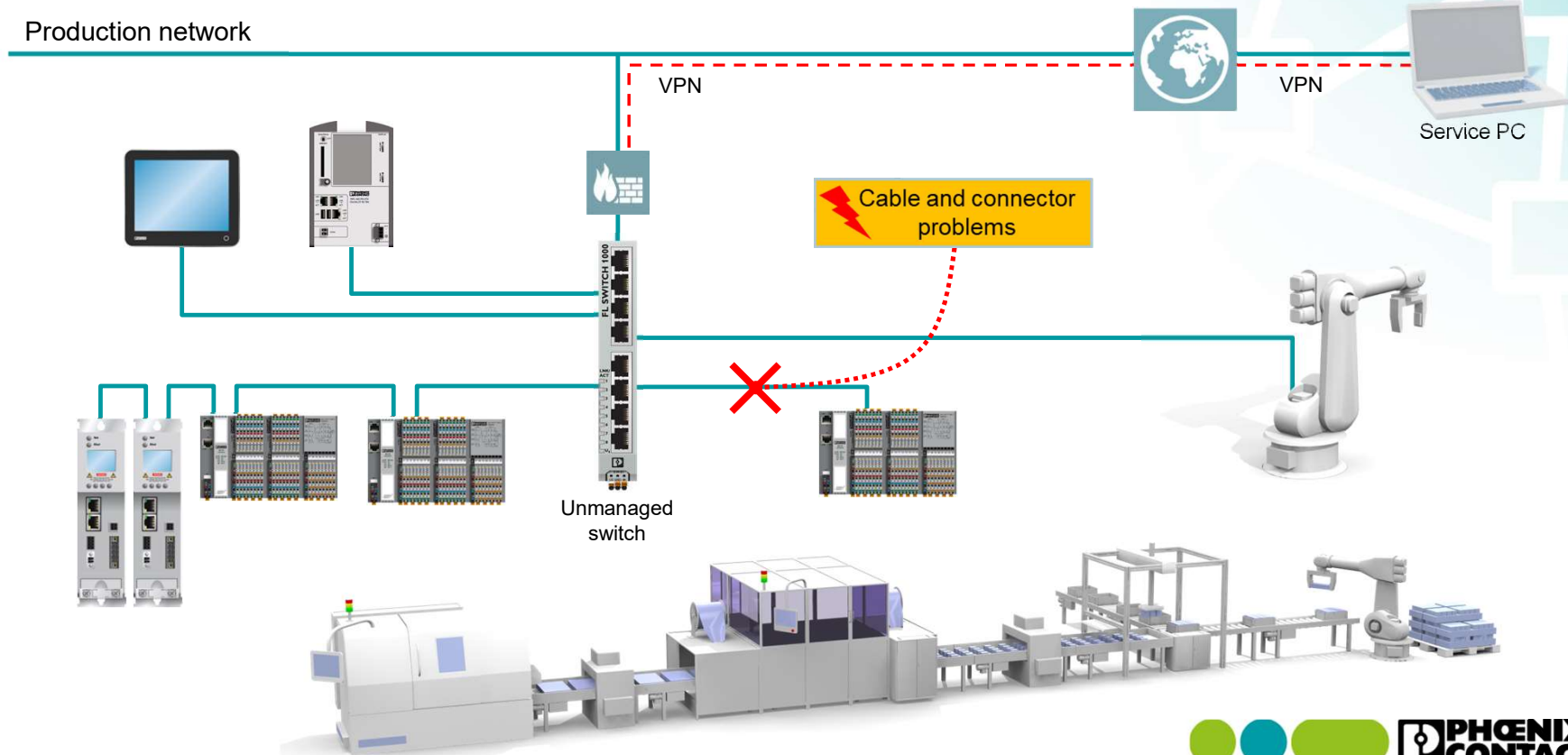
Customer pains | Find the right arguments

Machine network



Customer pains | Machine network

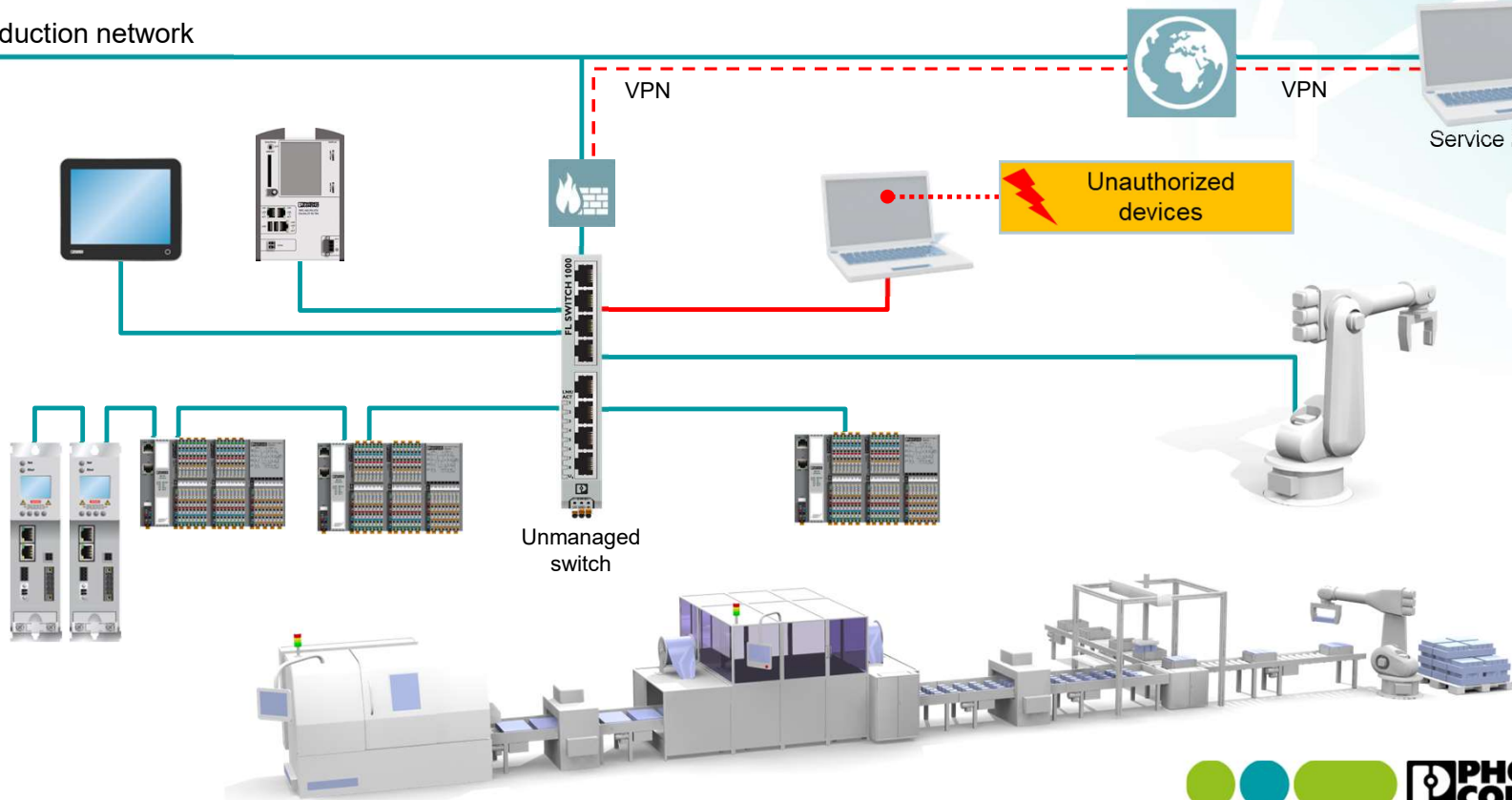
Network issue 1 – Cable and connector problems



Customer pains | Machine network

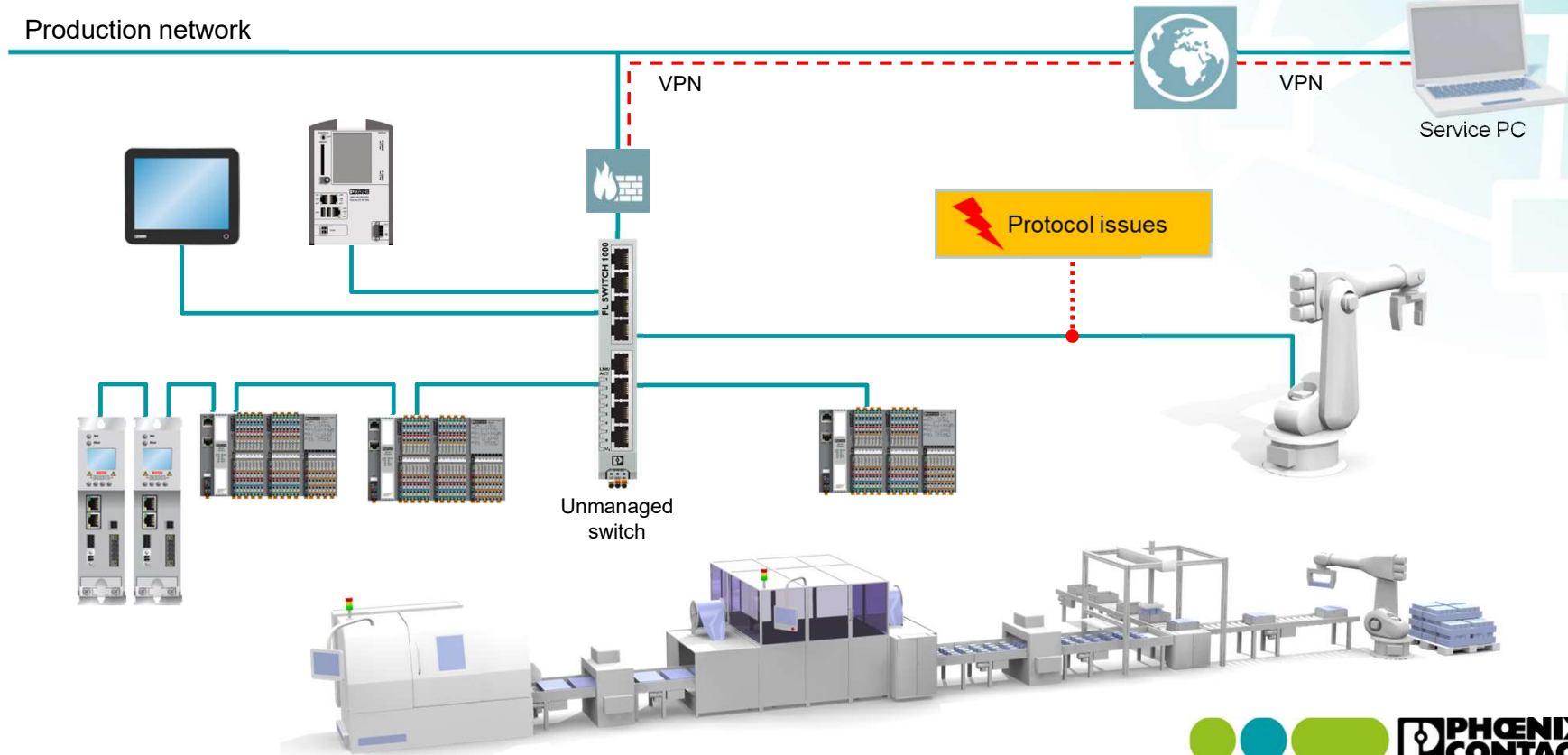
Network issue 2 – Unauthorized devices

Production network



Customer pains | Machine network

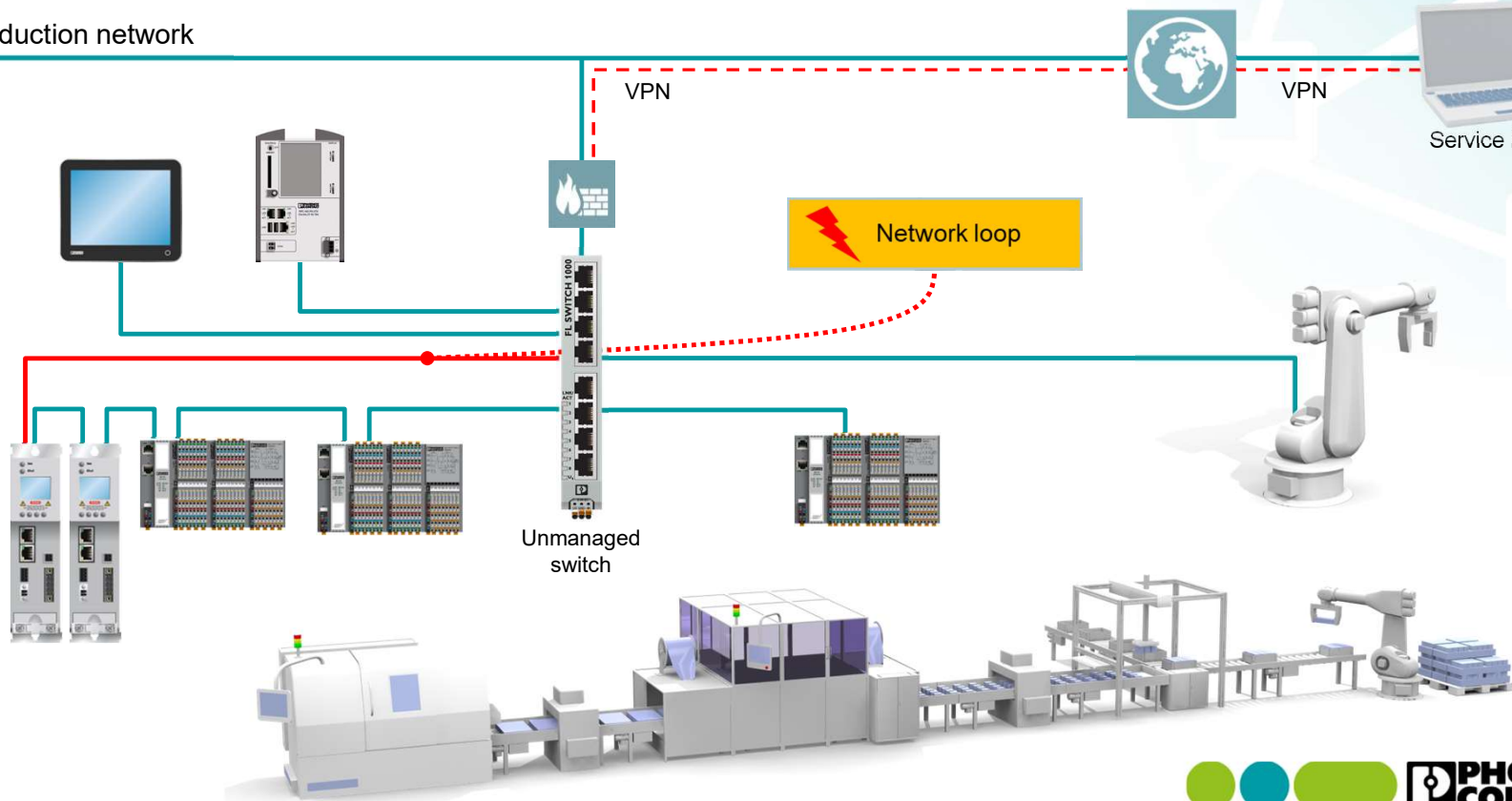
Network issue 3 – Protocol issues



Customer pains | Machine network

Network issue 4 – Network loops

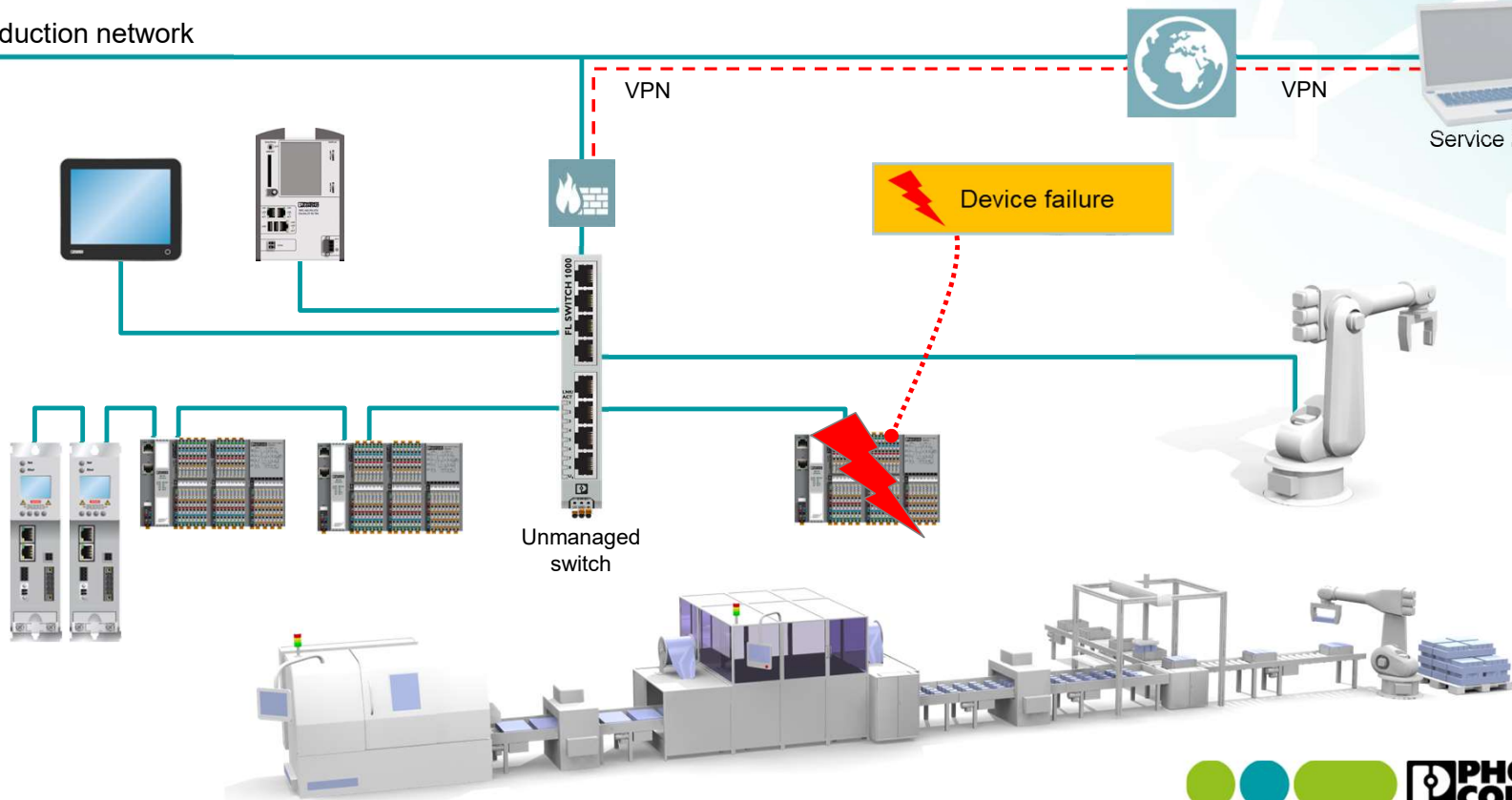
Production network



Customer pains | Machine network

Network issue 5 – Device failure

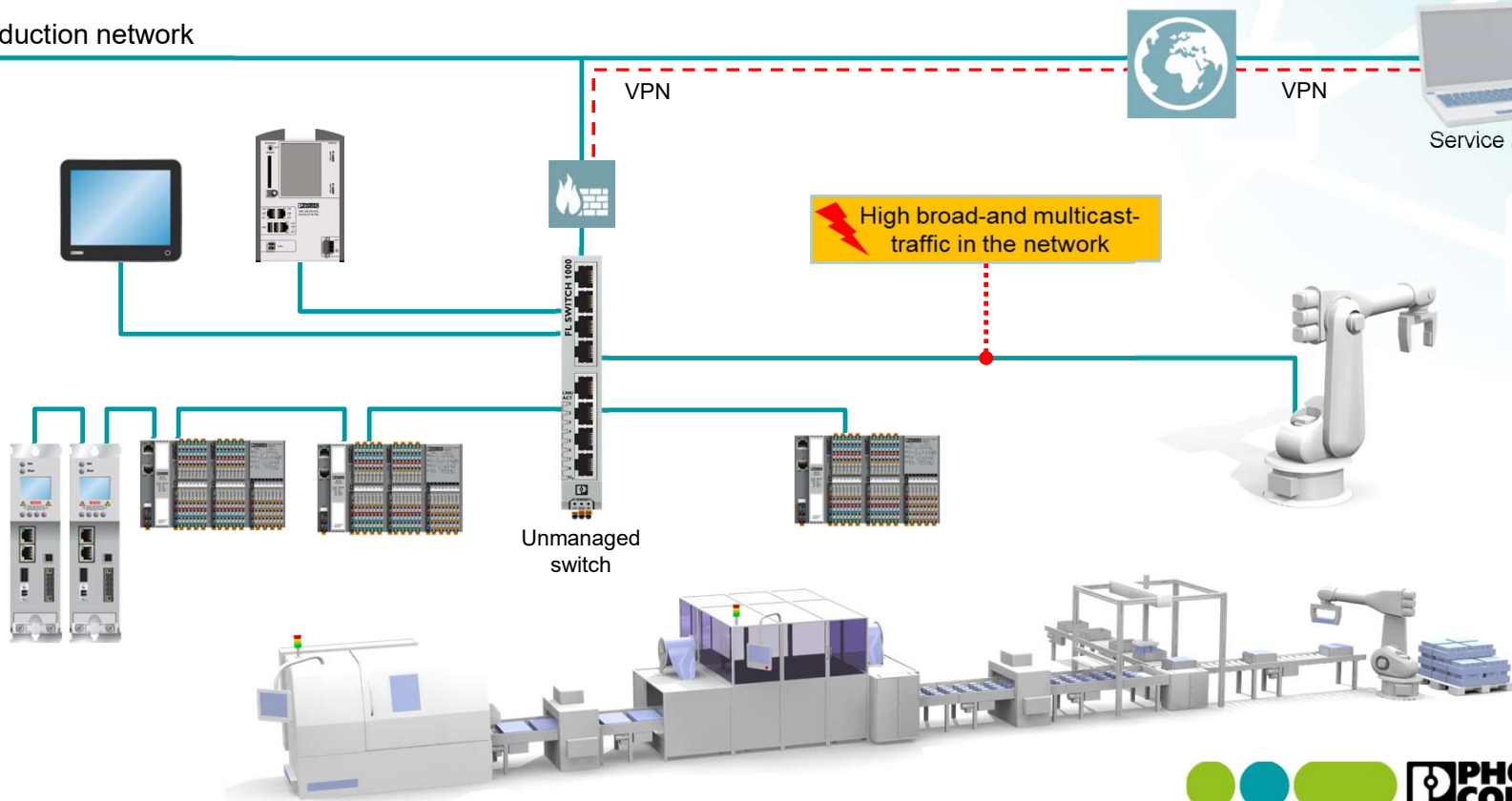
Production network



Customer pains | Machine network

Network issue 6 – High broadcast and multicast load

Production network



Customer pains | Machine network

Network issue 6 – Solution

Port diagnostic

FL SWITCH Z206-2FX ST

Port Counter

Overview Transmit Receive Surveillance

CRC Surveillance Details

Interface/Port	CRC Errors	Crit. Threshold (ppm)	Proportion Peak (ppm)	Status
1	40	40000	15533	Ok
2	75	40000	681818	Critical
3	95	300000	171171	Warning
4	0	40000	0	Ok
5	0	40000	0	Ok
6	0	40000	0	Ok
7	0	40000	0	Ok
8	0	40000	0	Ok

Clear CRC Peak and CRC Status (?)

Port Configuration (?) [Configure Ports](#)

Utilization(%)

VPN

SNMP Traps

SNMP v2-Trap empfangen von 10.137.111.50:Gerät zeigt an, dass die Netzwerkschnittstelle 4 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.30:Gerät zeigt an, dass die Netzwerkschnittstelle 5 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.40:Gerät zeigt an, dass die Netzwerkschnittstelle 4 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.60:Gerät zeigt an, dass die Netzwerkschnittstelle 4 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.10:Gerät zeigt an, dass die Netzwerkschnittstelle 5 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.10:Gerät zeigt an, dass die Netzwerkschnittstelle 4 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.10:Gerät zeigt an, dass die Netzwerkschnittstelle 4 nicht läuft.

SNMP v2-Trap empfangen von 10.137.111.10:Gerät zeigt an, dass die Netzwerkschnittstelle 4 nicht läuft.

Event Tables

Alarm & Events

Date & Time	Event
Invalid	Cold start.
Nov 07 2018 00:00:01	Configuration Loaded
Nov 07 2018 00:00:01	US 2 lost.
Nov 07 2018 00:00:01	Alarm output 1 Failed
Nov 07 2018 00:00:05	LLDP new neighbour on Port 6.
Nov 07 2018 00:00:06	Link up on port 6.
Nov 07 2018 00:00:26	IP address changed on interface 1.
Nov 07 2018 00:05:06	Link down on port 6.
Nov 07 2018 00:05:06	LLDP neighbour lost on Port 6.
Nov 07 2018 00:05:14	Link up on port 6.
Nov 07 2018 00:06:23	Link down on port 6.
Nov 07 2018 00:06:30	Link up on port 6.
Nov 07 2018 00:07:20	Link down on port 6.
Nov 07 2018 00:07:20	Link down on port 6.
Nov 07 2018 00:07:22	Link up on port 6.
Nov 07 2018 00:07:29	Link up on port 7.

Syslog

Activate syslog (?) Enable

Syslog server 1 (?) 0.0.0.0

Syslog server 1 port (?) 514

Syslog server 2 (?) 0.0.0.0

Syslog server 2 port (?) 514

Syslog test message (?)

Index	Message group	Status
1	Connectivity	<input checked="" type="checkbox"/>
2	Diagnosis	<input checked="" type="checkbox"/>
3	Automation protocol	<input checked="" type="checkbox"/>
4	System information	<input checked="" type="checkbox"/>
5	Redundancy	<input checked="" type="checkbox"/>
6	Security	<input checked="" type="checkbox"/>

Snapshots

Take snapshot (?)

Current snapshot state (?) Present

Timestamp of last snapshot (?) 2019/05/10 00:33:52 UTC

Download of snapshot file (?) [File transfer](#)

Switch FL 2000

111

Factory / backbone network



Remote service

Firewall, 1:1 NAT router

Machine network

Machine core network

PROFI[®]
NET MRP ring

Managed
Switch 2000

Managed
Switch 2000

IRT switches

PROFI[®]
NET

PROFI[®]
NET

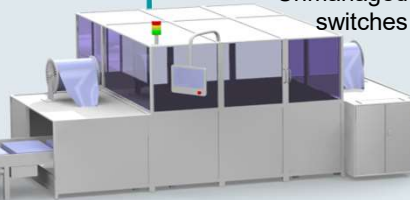
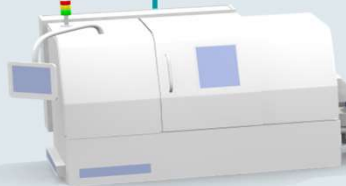
PROFI[®]
NET

Unmanaged
switches

Managed
Switch 2000

Unmanaged
switches

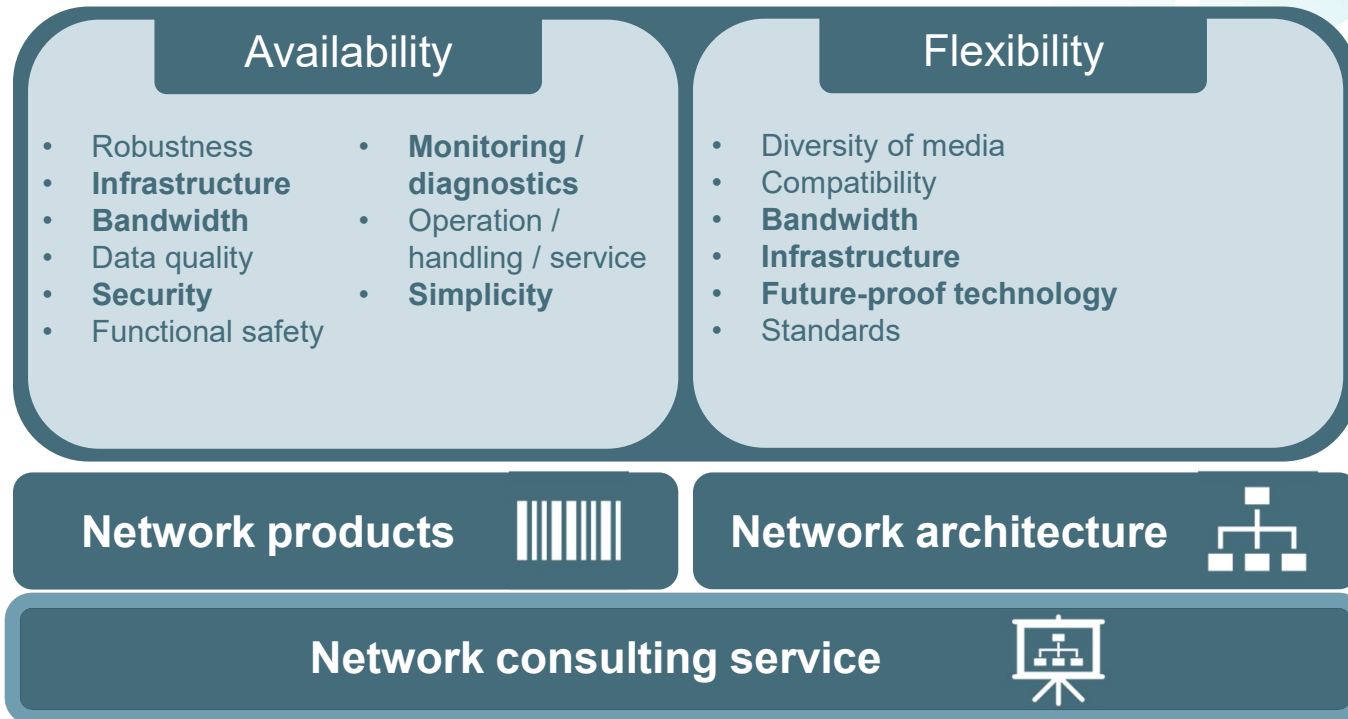
IRT switches



Network consulting service

Network consulting service

Maximize industrial communication for available and flexible production



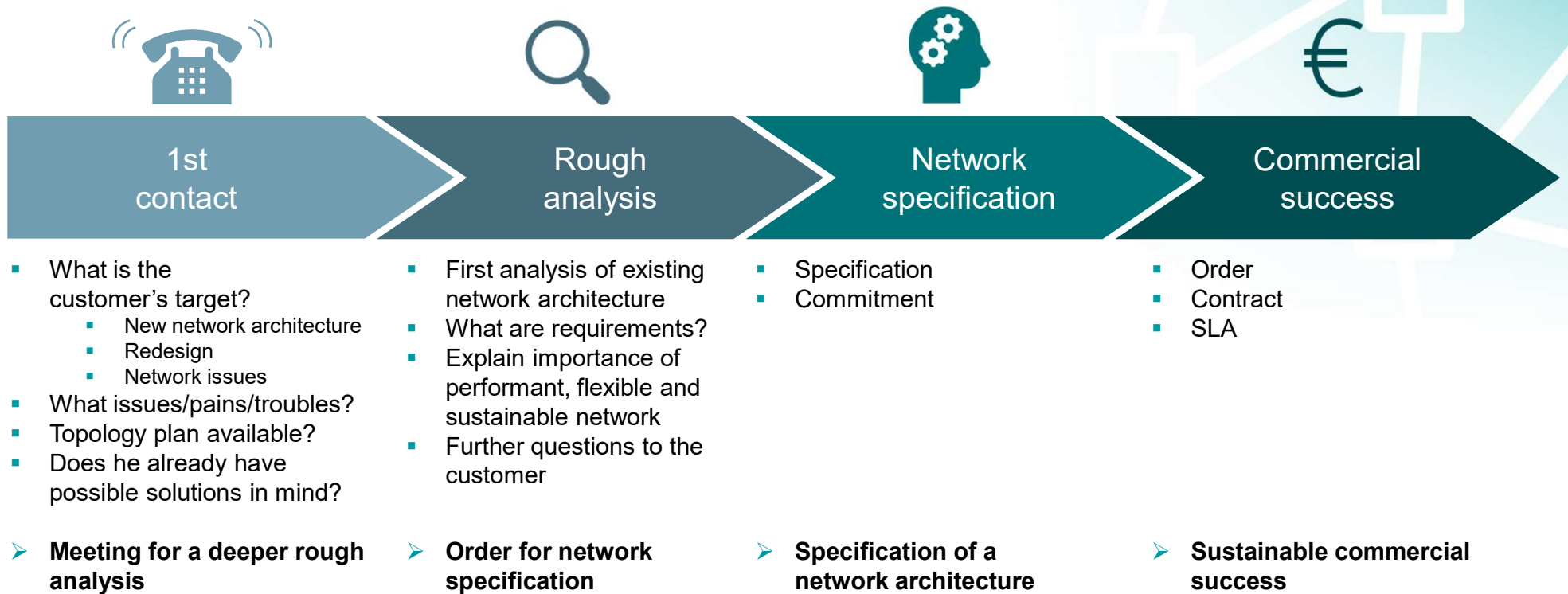


„Don't sell - help buy!“

- Unknown

Network consulting service

Example



The six big losses of OEE

A. Planned output

B. Gross output

C. Net output

D. Valuable output

5. Start up scrap
6. Scrap



3. Idling
4. Reduced speed



1. Breakdowns
2. Set-ups & changeover



$$\frac{\text{Gross output}}{\text{Planned output}} \downarrow \text{Availability rate } A * \frac{\text{Net output}}{\text{Gross output}} \downarrow \text{Performance rate } P * \frac{\text{Valuable output}}{\text{Net output}} \downarrow \text{Quality rate } Q = OEE$$

Network consulting service

User Economics

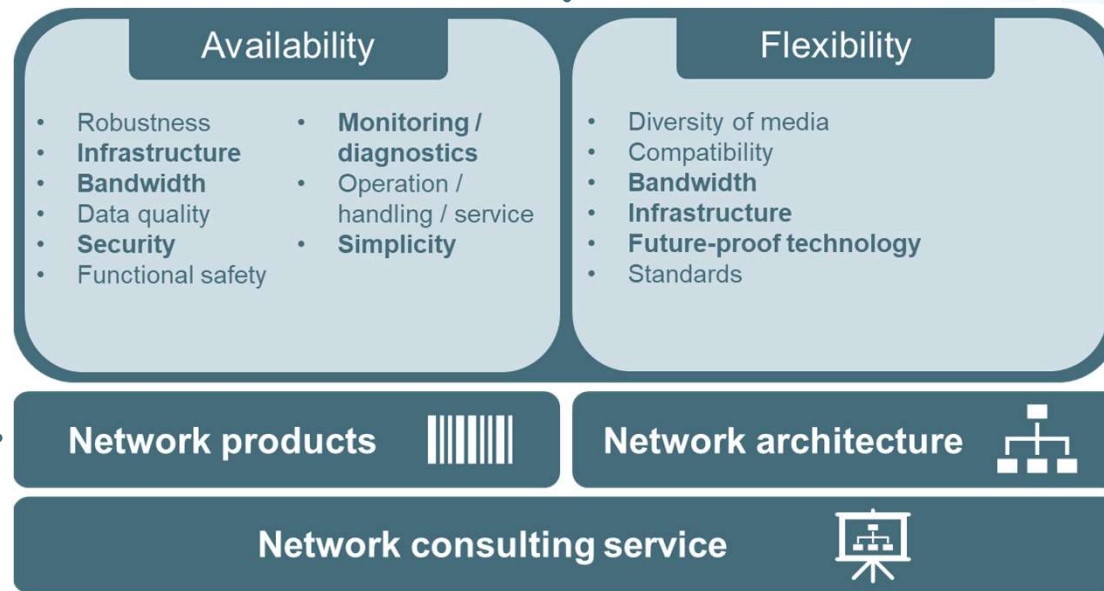
Invest calculation							
Downtimes p. month	Cost p. minute	100 €	INVEST	price p. piece			
Lost telegrams because of network load	0,5	h	3.000 €	Managed Switches	200	600,00 €	120.000,00 €
Machine broadcast	2	h	12.000 €	Firewalls	67	450,00 €	30.150,00 €
Network loops	0,5	h	3.000 €	Installation			75.075,00 €
Defect switches	2	h	12.000 €	Training			20.000,00 €
Unauthorized devices	0,5	h	3.000 €				
Network failure	2	h	12.000 €				
Complex machine failure	2	h	12.000 €				
Sum	9,5	h	57.000 €	Still existing problems		40%	22.800 €
Risk fee for ransome attack 5%	800.000 €		40.000 €				
	Sum		97.000 €				268.025,00 €
Cost p. Year			1.164.000 €				23%
Break even			2,76	Month			

Smart automation network

Key takeaways

Availability and flexibility are the key parameters for a reliable and sustainable production network in the Digital Factory

We provide all the products we need for „Digital Factory ready“ production network

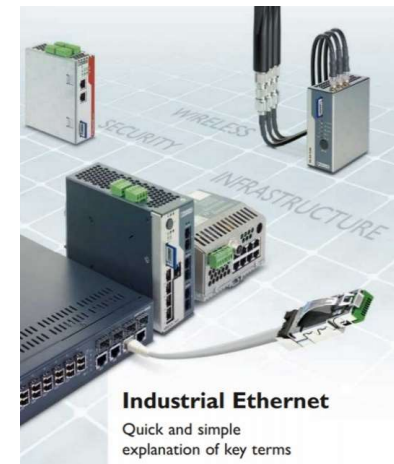


The right network architecture in combination with powerful network products is the key to solve the customer's pains

With our products, knowledge and experience in network technology we want to be a strong partner for our customers when it comes to providing a powerful data transportation infrastructure

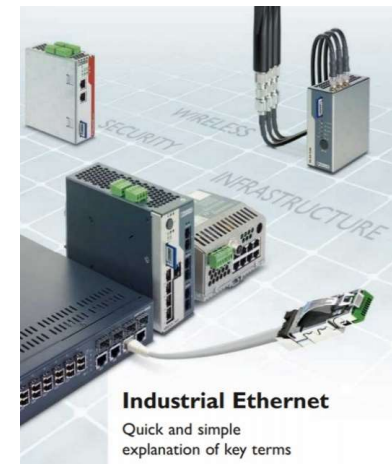
Glossary

KPI	Key performance indicators are values, which explain the effectiveness of a reached business objective
Modbus	Modbus is a communication protocol developed by Modicon in 1979 (see modbus.org)
BooTP	Bootstrap protocol assigns IP address and parameter to a device of a network
CARP	Common address redundancy protocol is used to increase the availability of IP systems via virtual IP and MAC addresses
CIFS	Common Internet File System is a protocol for printer files and servers in computer networks. A special mGuard FW monitors the integrity of this protocol. CIM (CIFS Integrity monitoring)
DCP	Discovery and configuration protocol to configure station names and IP addresses within Profinet
DHCP	Dynamic host configuration protocol assigns network configurations to clients
DMZ	Demilitarized zone: secure access to server systems by special rule sets of the firewall
DNS	Domain name system: translating service of understandable domain names into IP addresses
Firewall	Security system to protect against unwanted access



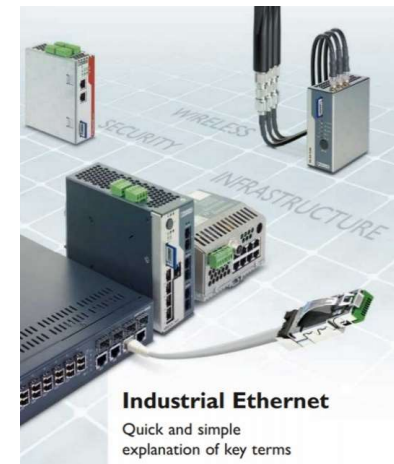
Glossary

FRD	Fast ring detection is an extension of the RSTP (Rapid Spanning Tree Protocol) from Phoenix Contact where switch-over times of 100 to 500 ms can be achieved in the ring with up to 56 devices. The protocol can only be used on a 10/100 Mbit basis.
IEC62443	International norm about the IT security of industrial communication systems (ICS)
VPN client	Virtual protocol network client executes the VPN connection on a device
mGuard cloud	Security cloud for the administration of global VPN connections and part of the vpn router parameters
MRP	The Media Redundancy Protocol (MRP) is a redundancy protocol that is part of PROFineT standard IEC 61158, which ensures switch-over times of 200 ms in a ring topology.
NAT	Network Address Translation (NAT) is also referred to as IP masquerading. The NAT router establishes the connection between the internet (external) and entire networks (internal). Only the NAT router and its IP address are visible externally, all connections from within the system to the internet and vice versa are made via the NAT router, which manipulates the relevant entries in the data telegrams. NAT routers can be used to provide a certain degree of protection for the internal network.
NTP	Network time protocol is a standard to synchronize the time in a network
OPC	OLE for Process Control is the most widely used standard-based data connectivity method in the world. It enables communication between devices and applications from different manufacturers.
Port-based security	Function which prevents unauthorized access to the network. With this function it is possible to specify MAC addresses that are permitted to access the network. All other addresses are denied access.



Glossary

Profinet	Ethernet communication model from field level to control level.
PSIRT	Product Security Incident Response act similar to CERT (Computer Emergency Respond Team) which publish and solve IT security incidents
QoS	Quality of Service (QoS) is a collective term for quality classes for network services. it takes speed, bandwidth, delay, security, and priority into consideration.
Radius authentication	The Remote Authentication Dial-in User Service (RADIUS) is used to protect authentication in wireless networks.
Router	Routers are connecting elements which act on layer 3 of the iSo/oSi reference model between different networks. The destination IP address is used to determine which network the packet should be forwarded to.
SD card	Secure digital memory
SIEM	Security information and event management: realtime analysis of security alarms from applications and network devices
SYSLOG	Syslog is a standard to communicate log messages in an IP network
VPN	A virtual private network connects several separate networks via a public network, e.g., the internet. Cryptographic protocols are used to ensure confidentiality and authenticity.





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Summary

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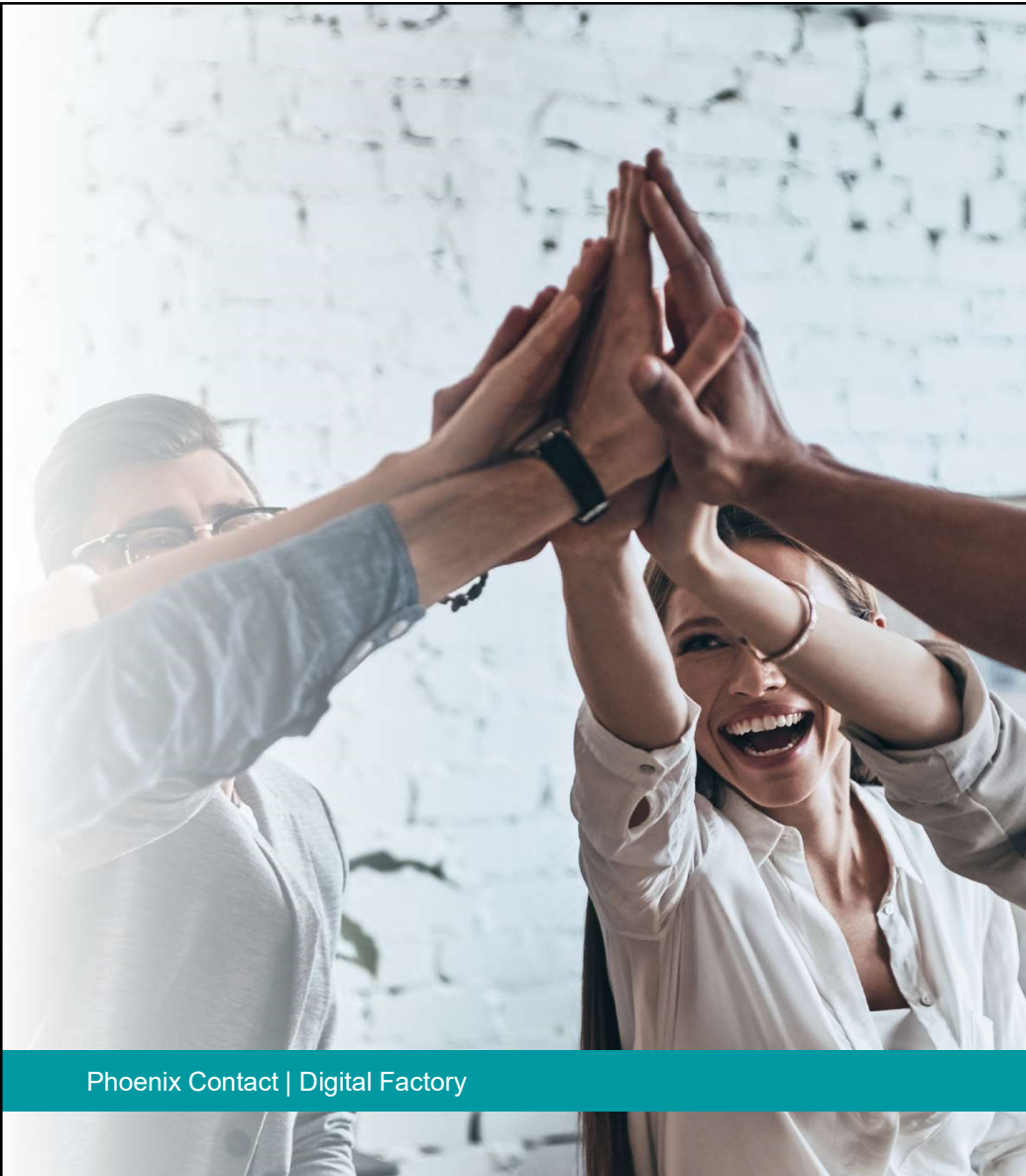
Our value proposition for your Digital Factory

In order to meet **today's digitalization requirements** and **profitably realize opportunities**, our solutions offer you the following added values:

- **Scalable** – individually tailored your requirements
- **Tested** and **validated** – in our own production
- **Ready-to-use** – benefit from the Digital Transformation today

With **goal-oriented consulting**, we find together the right solution for your Digital Factory. Let's tackle the **challenges of digitalization** together and seize the **opportunities**.





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