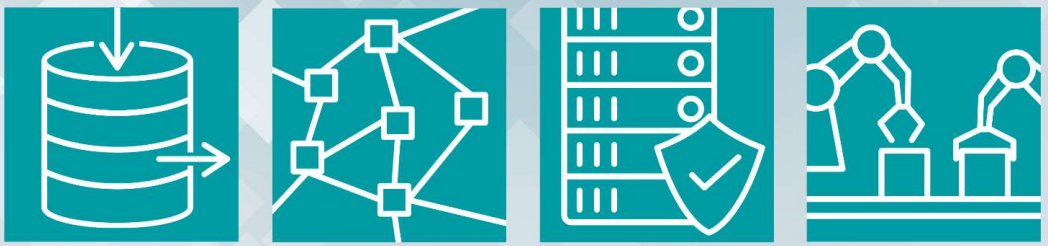
Phoenix Contact | Digital Factory

DIGITAL FACTORY

NOW



DIGITAL FACTORY

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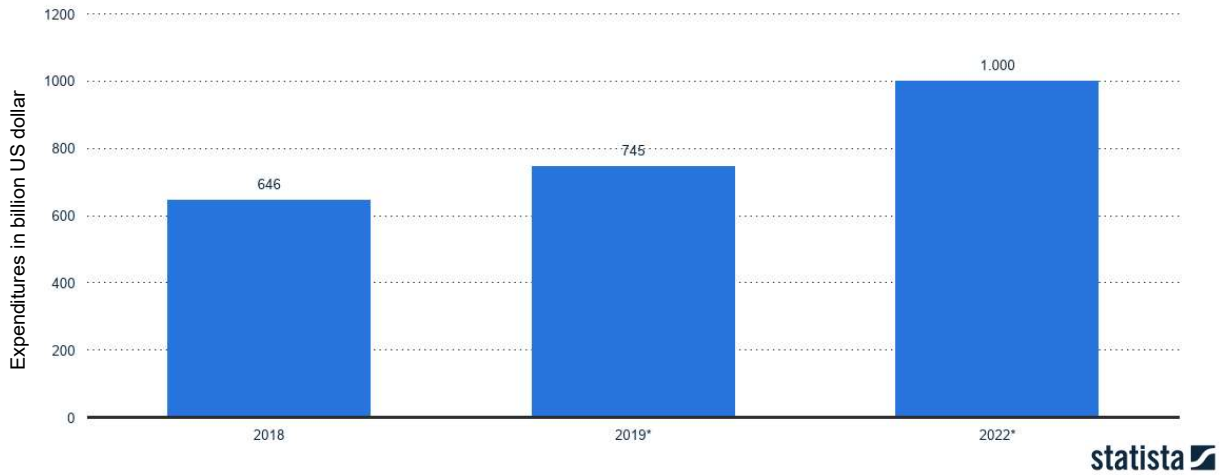
The Power and Potential of Digitalization

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)



Countries all over the world are investing into digitalization

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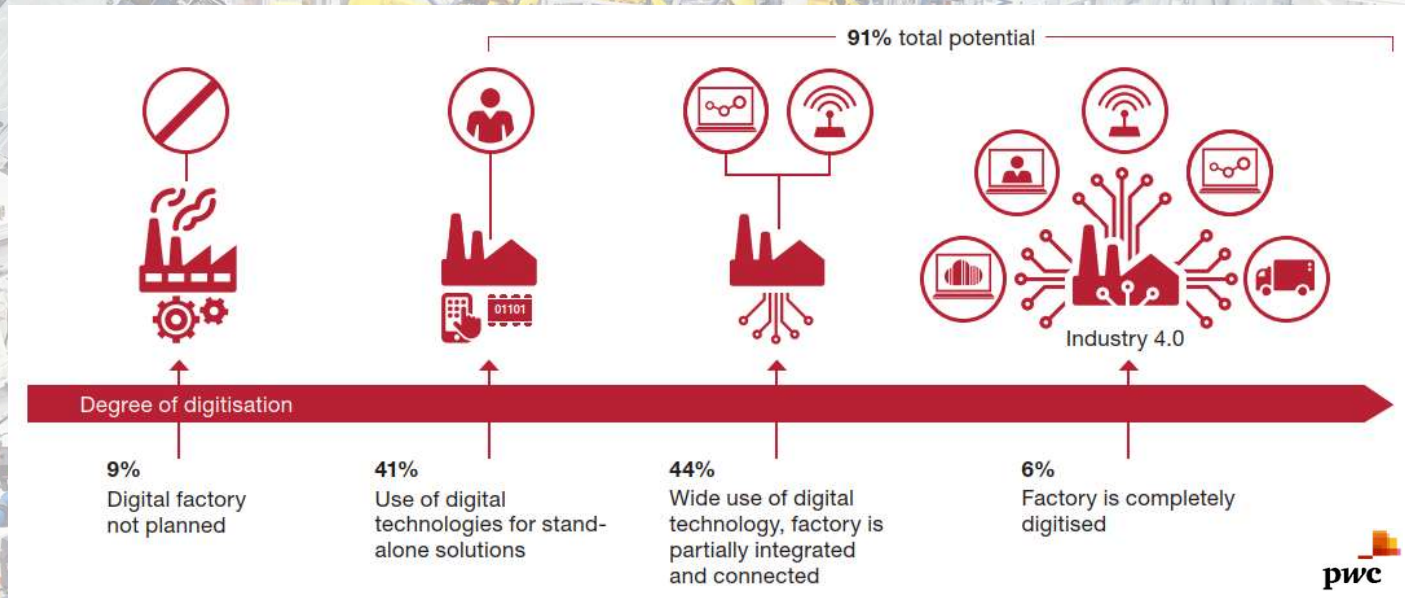
Source: Statista: ID537226 (https://de.statista.com/)

Digital Factory | The power and potential of digitalization

Potential



9 out of 10 companies are investing in Digital Factories

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Source: pwc: Digital factories 2020 - Shaping the future of manufacturing: (https://www.pwc.com/gx/en/industries/industrial-manufacturing/publications/digital-factories-2020.html)

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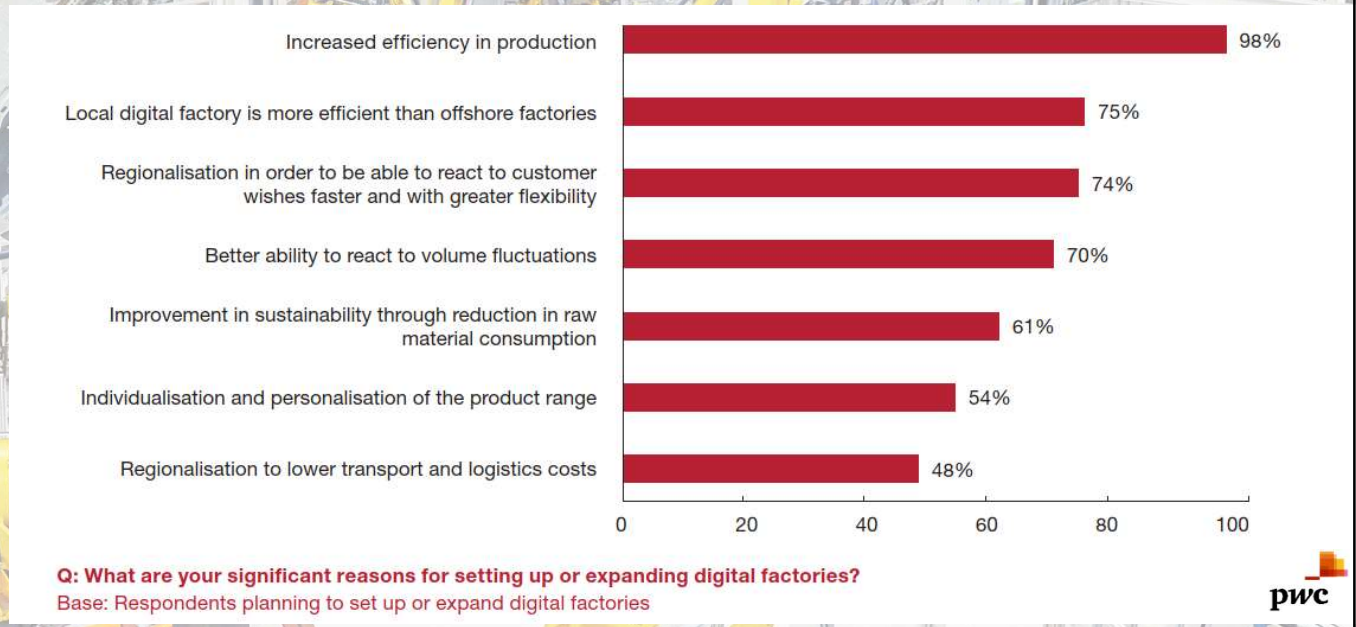
Why invest in Digital Factories?



Q: What are your significant reasons for setting up or expanding digital factories?
Base: Respondents planning to set up or expand digital factories

pwc

Efficiency and customer centricity are top reasons for expanding Digital Factories

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Source: pwc: Digital factories 2020 - Shaping the future of manufacturing: (https://www.pwc.com/gx/en/industries/industrial-manufacturing/publications/digital-factories-2020.html)

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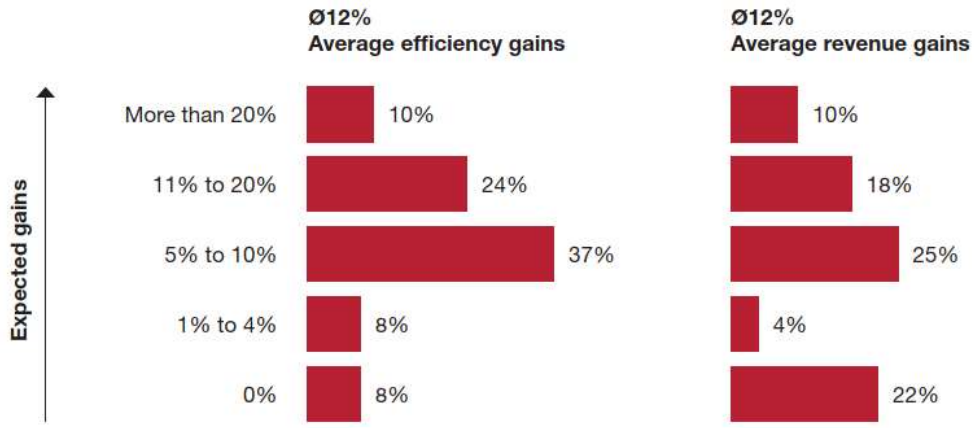
Why invest in Digital Factories?



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

pwc

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

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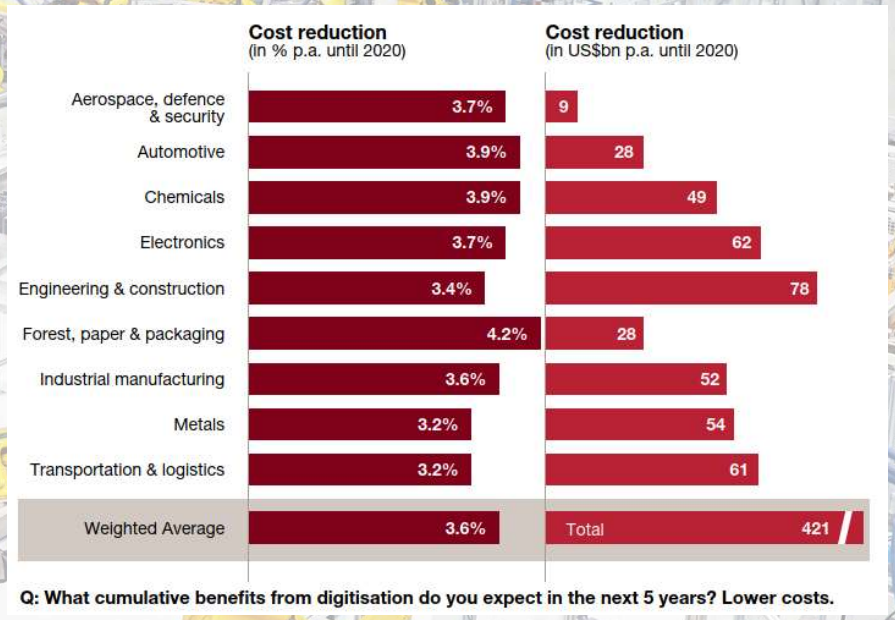
Source: pwc: Digital factories 2020 - Shaping the future of manufacturing: (https://www.pwc.com/gx/en/industries/industrial-manufacturing/publications/digital-factories-2020.html)

Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



pwc

Companies in every industry sector expect significant cost reductions

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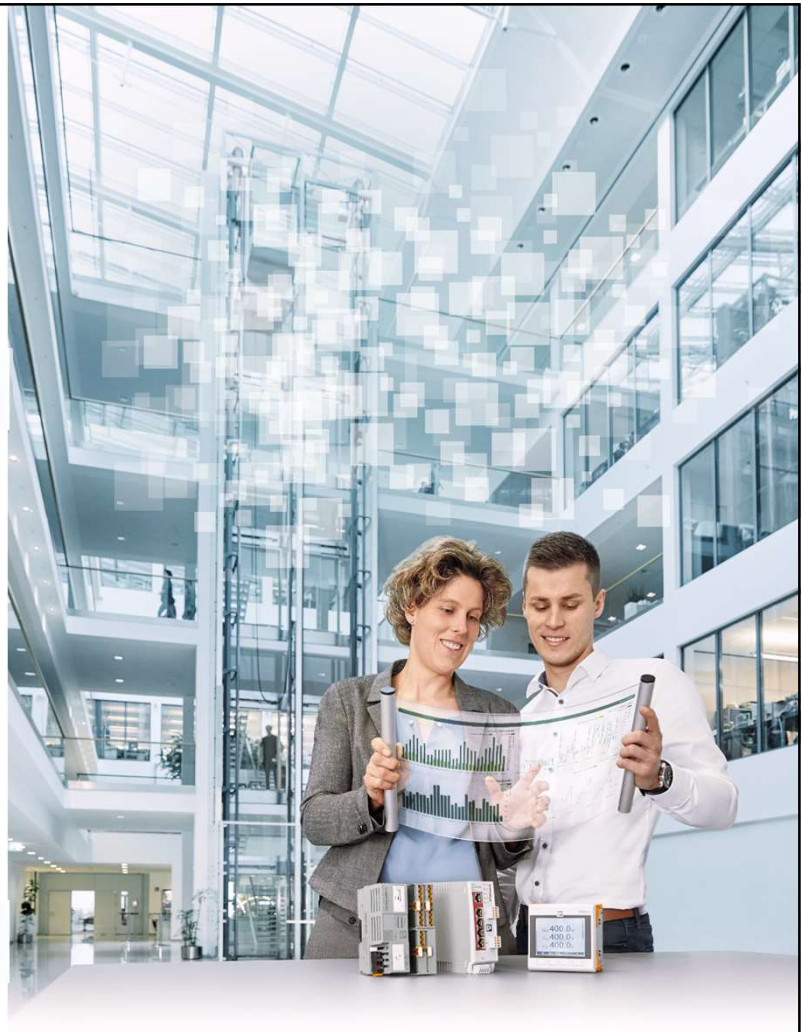
Source: pwc: Industry 4.0 - Building the digital enterprise (https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf)

Digital Factory | The power and potential of digitalization

Digitalization and mankind

Digitalization does not replace people

Digitalization creates new jobs



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DIGITAL FACTORY

NOW

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

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Goals of Digital Factory

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

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INSPIRING INNOVATIONS

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

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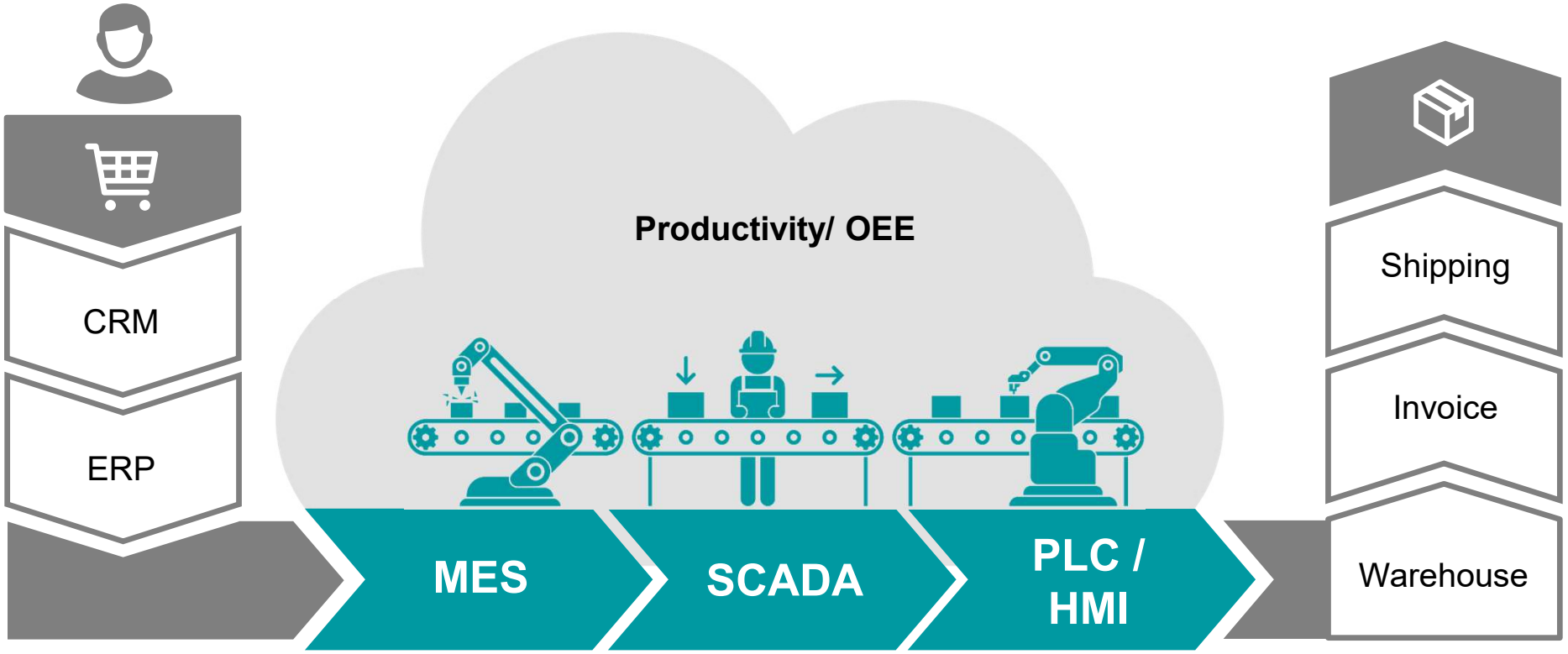
Challenges

- 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

Why do many digitalization strategies fail?



OEE = Overall equipment effectiveness

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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

$$OEE = A * P * Q$$

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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

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

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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

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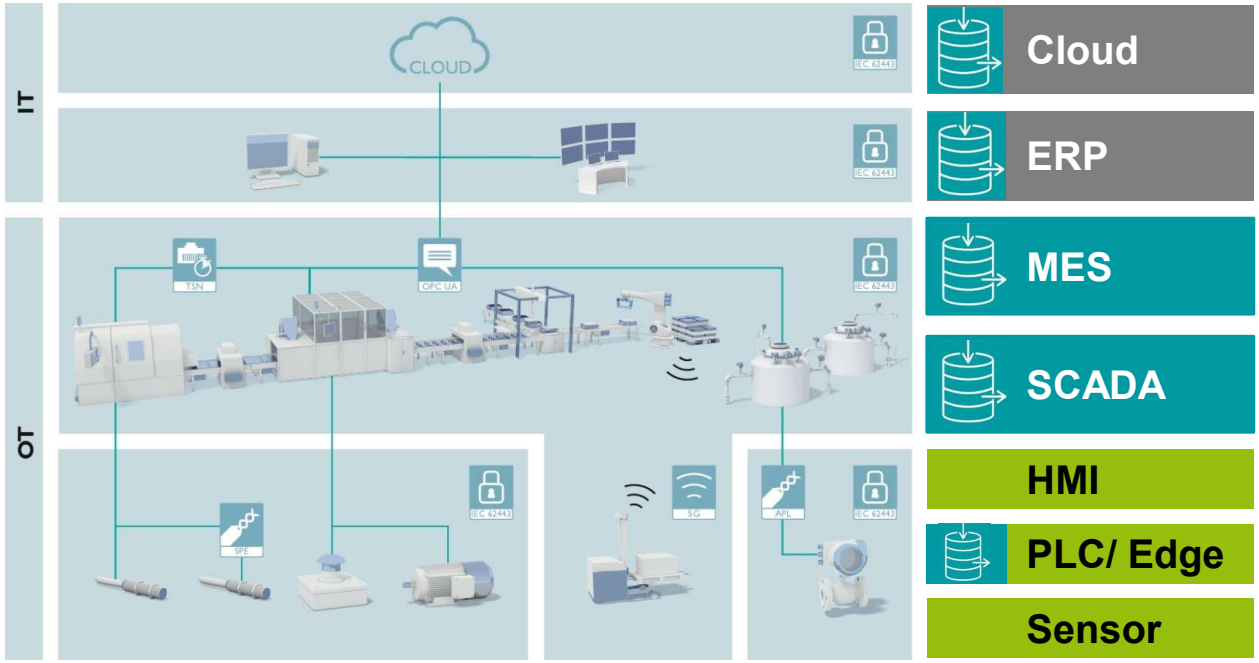
Why does the current architecture prevent innovation?



Cloud

ERP

MES

SCADA

HMI

PLC/ Edge

Sensor

Solut ntered

- No normalization
- No abstraction
- No standard
- Only high-value projects
- Data silos

Show stopper for optimization projects !

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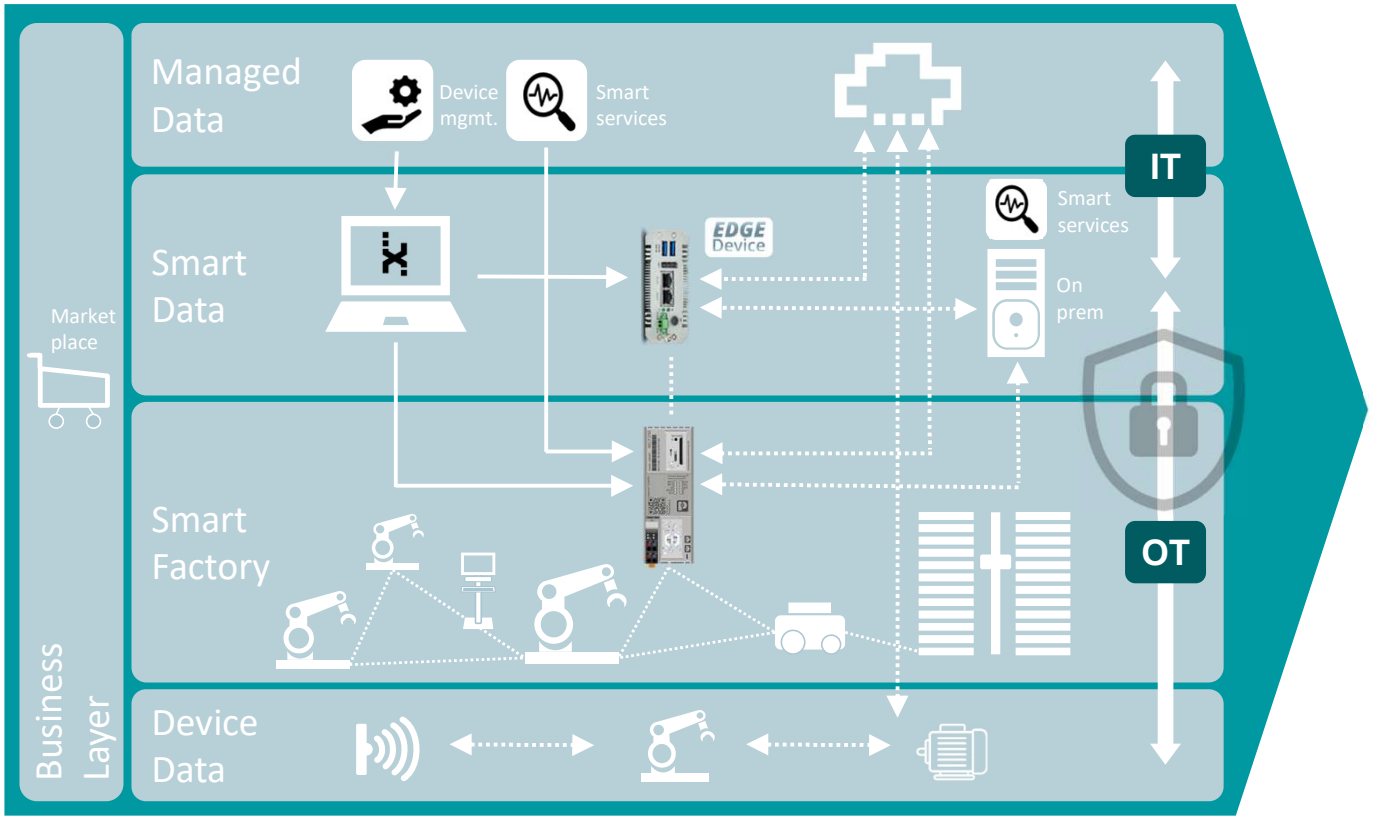
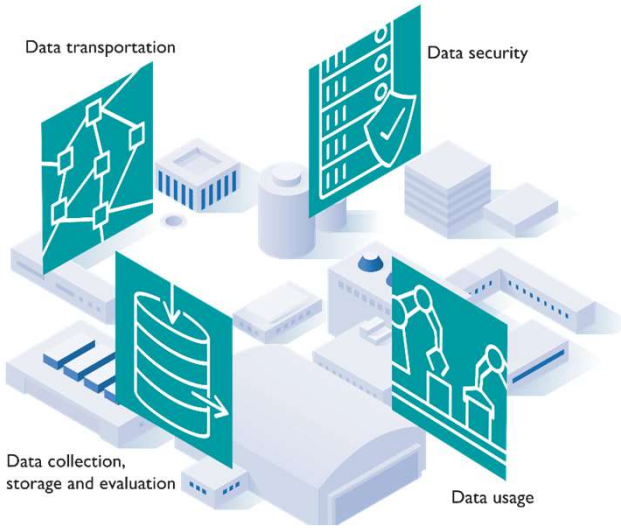
Digital Factory | From a factory to a Digital Factory

Create a solution to enable factory optimization





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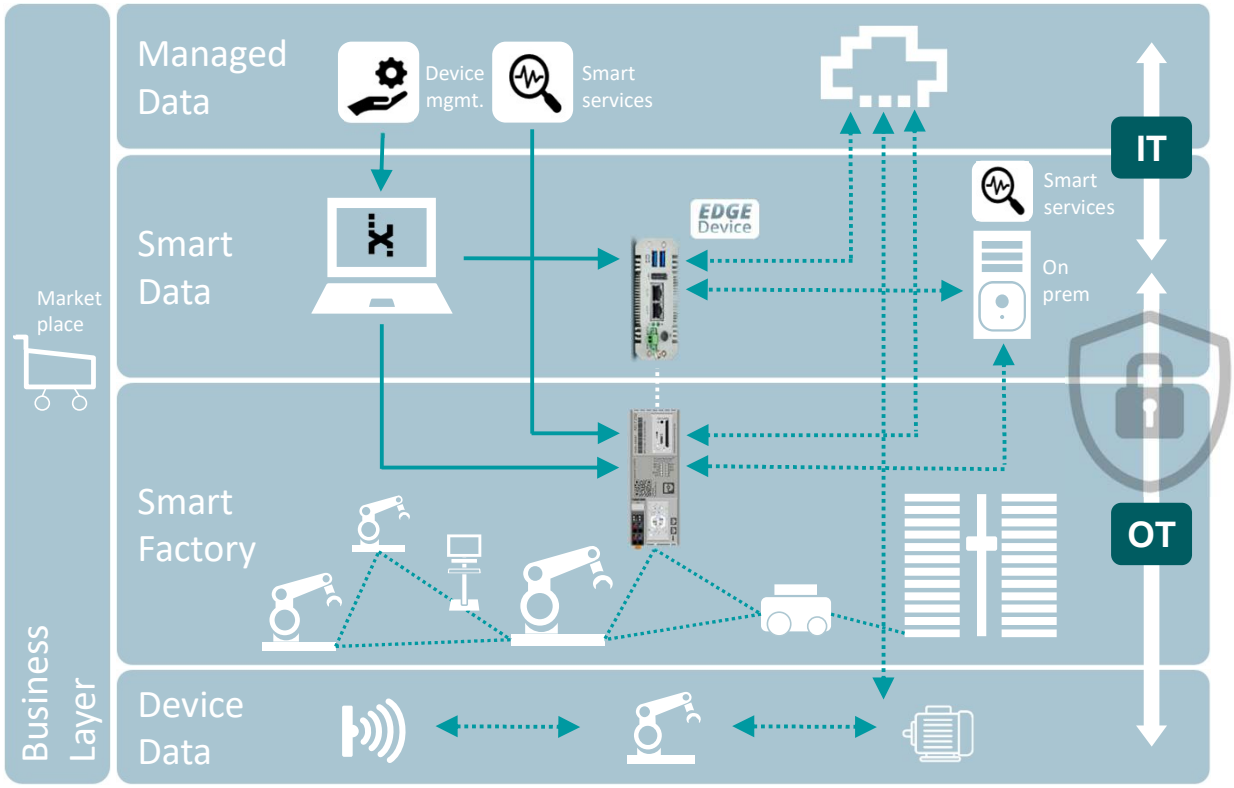
Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach



Data transportation

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

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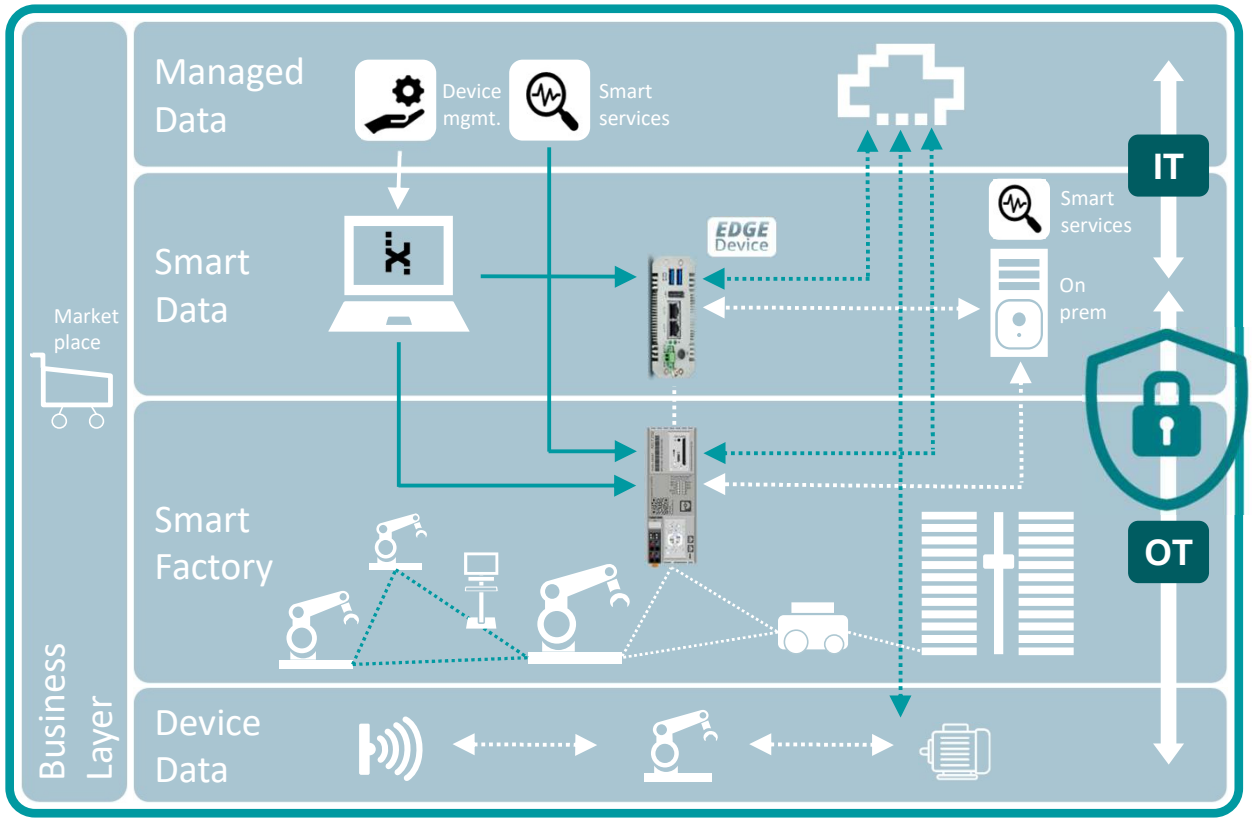
Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach



Data security

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

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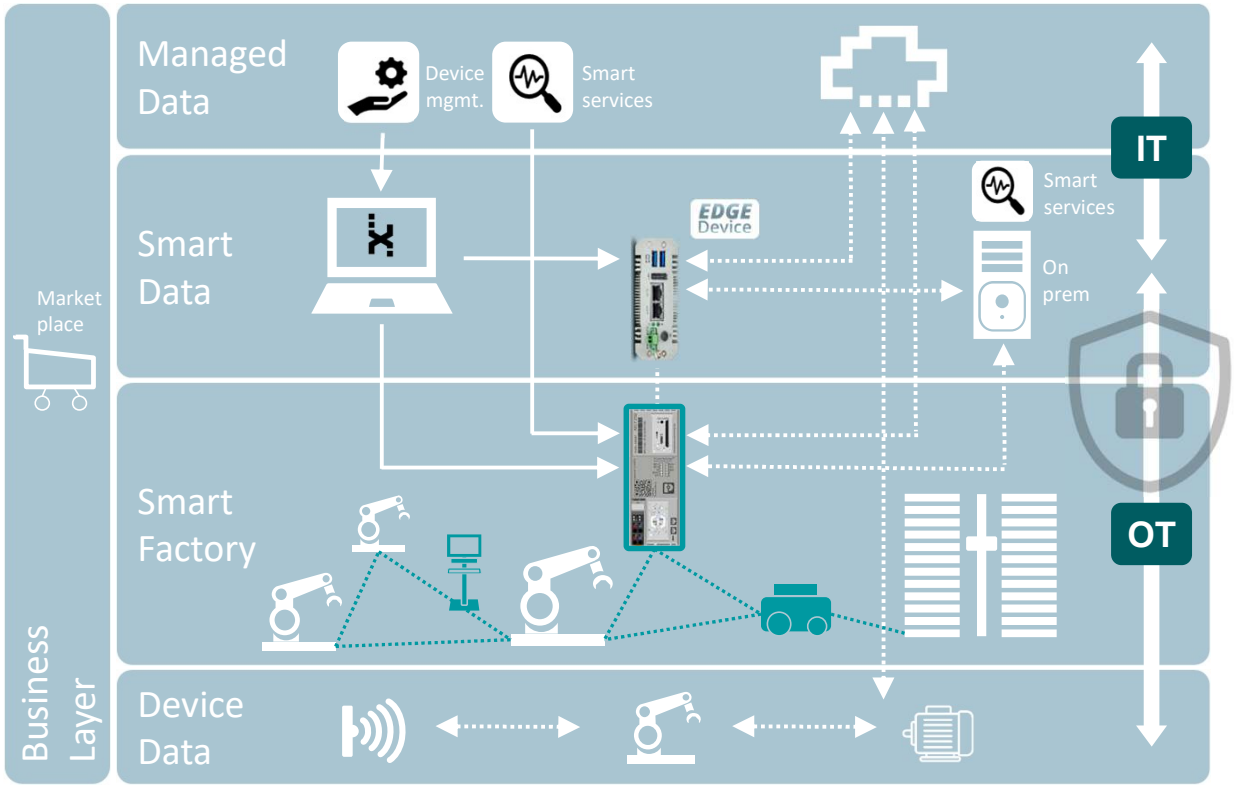
Application-oriented customer approach



Data usage

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

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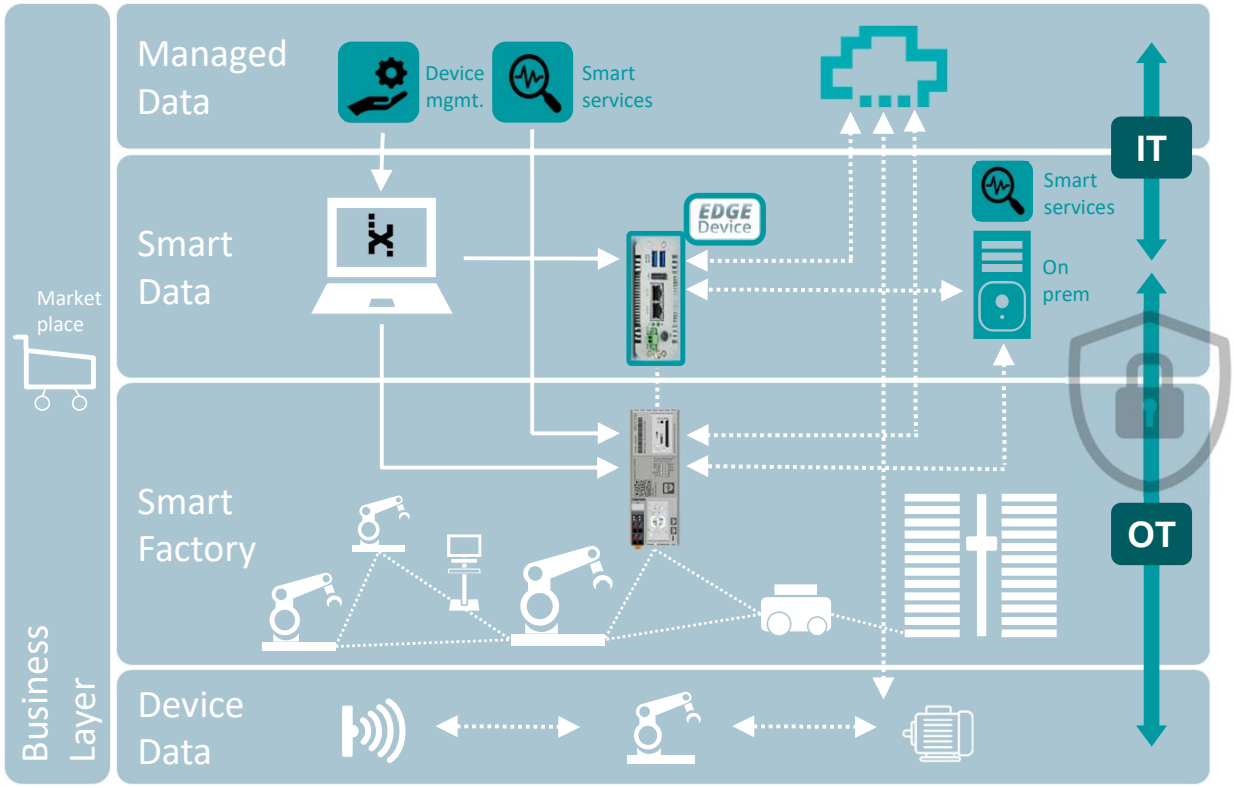
Application-oriented customer approach



Data collection, storage and evaluation

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

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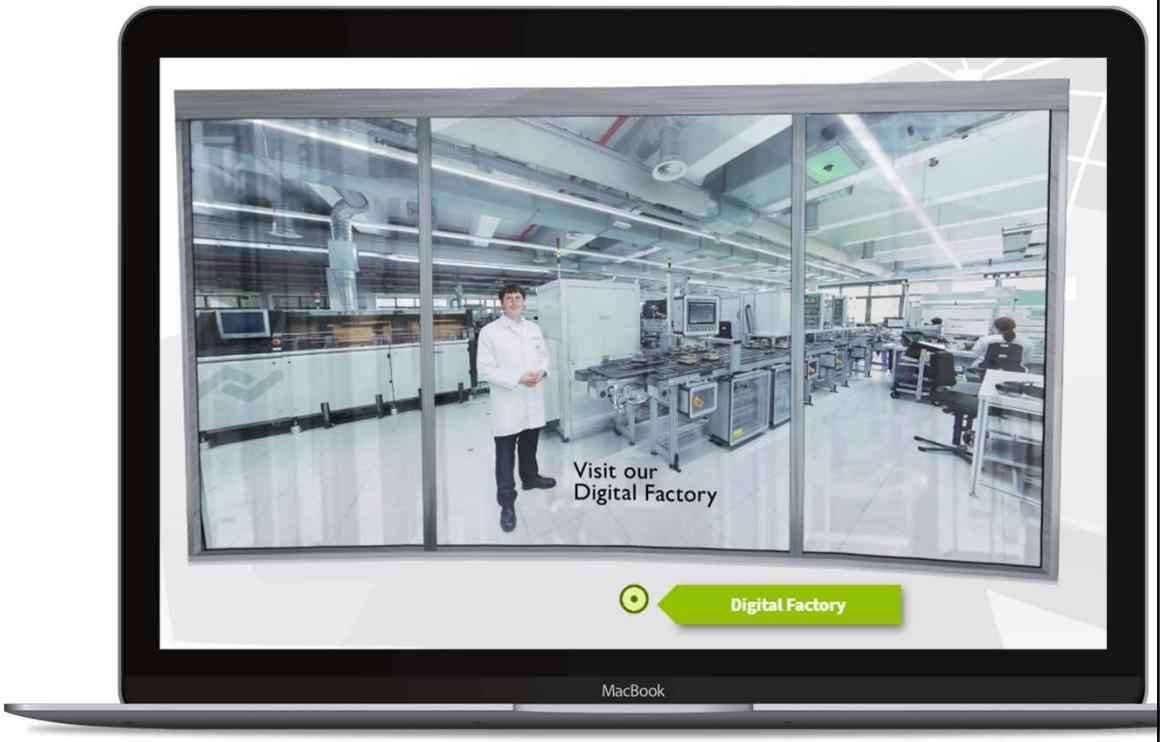
Digital Factory | From a factory to a Digital Factory

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



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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 collection, storage and evaluation

Data conversion into information

Data security

Investment protection against unwanted access

Data usage

Simple horizontal and vertical integration

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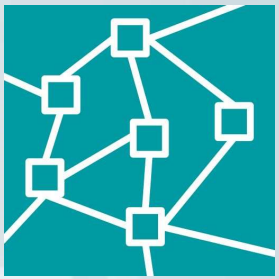
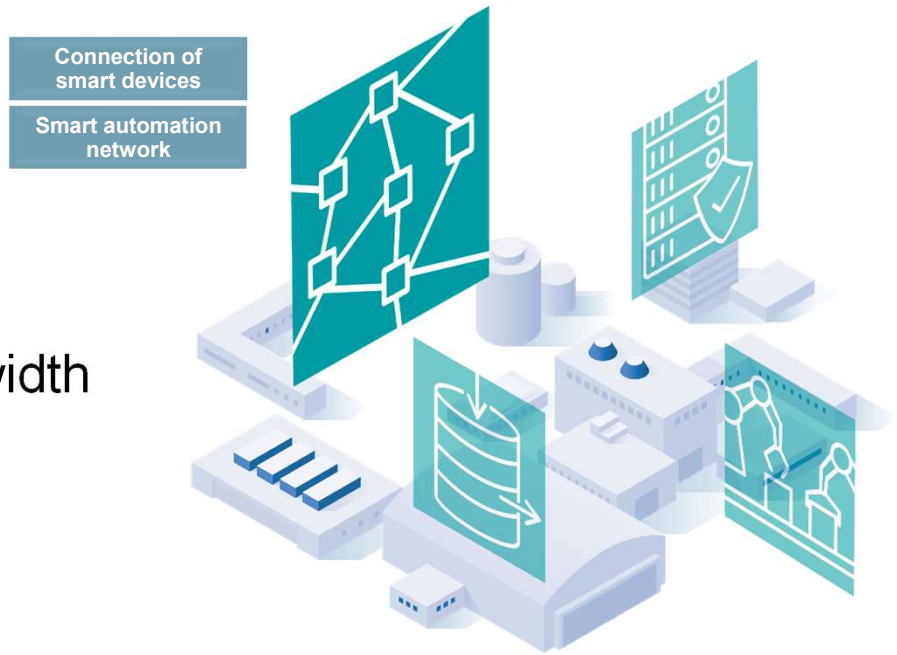


Data Transportation

Digital Factory

Data transportation

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



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Digital Factory | Data transportation

Digital Transformation

Source: CRISP Research, Feb 2019

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

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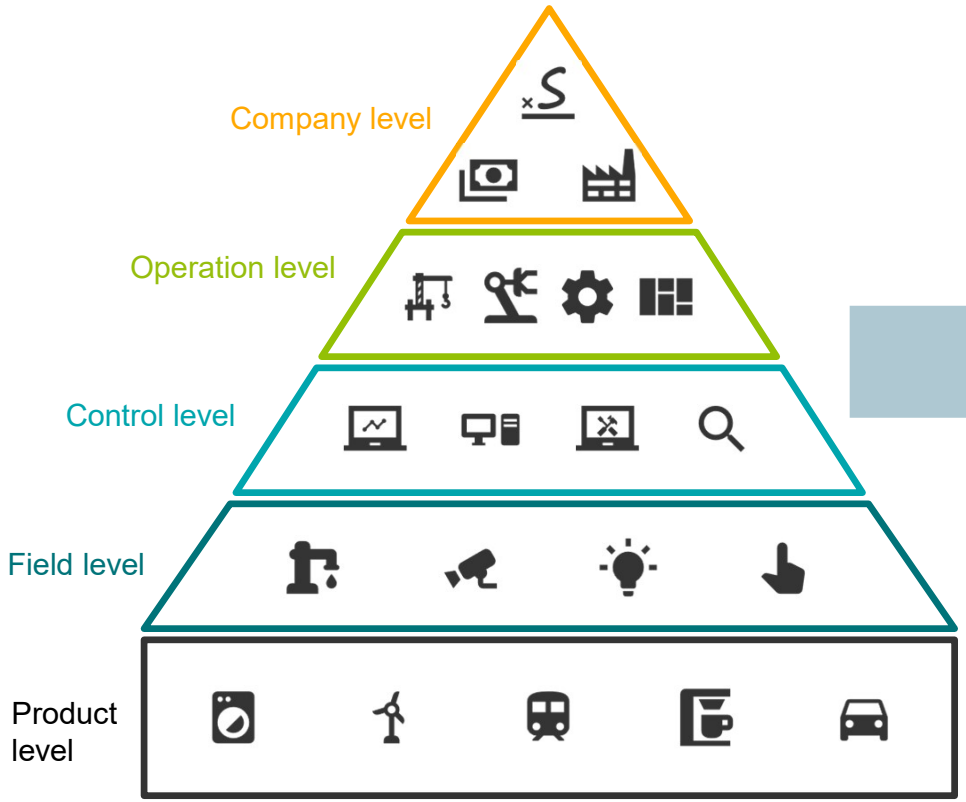
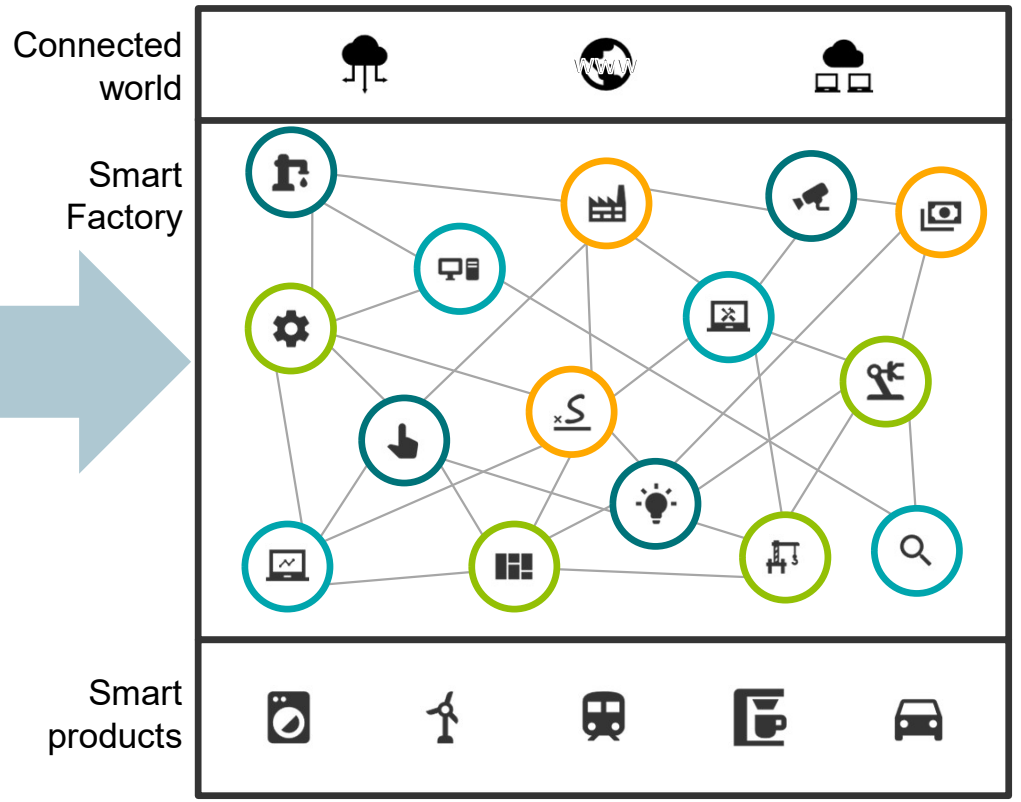
Source: CRISP Research, Feb 2019

Digital Factory | Data transportation

Digital Transformation – the network structure has to change





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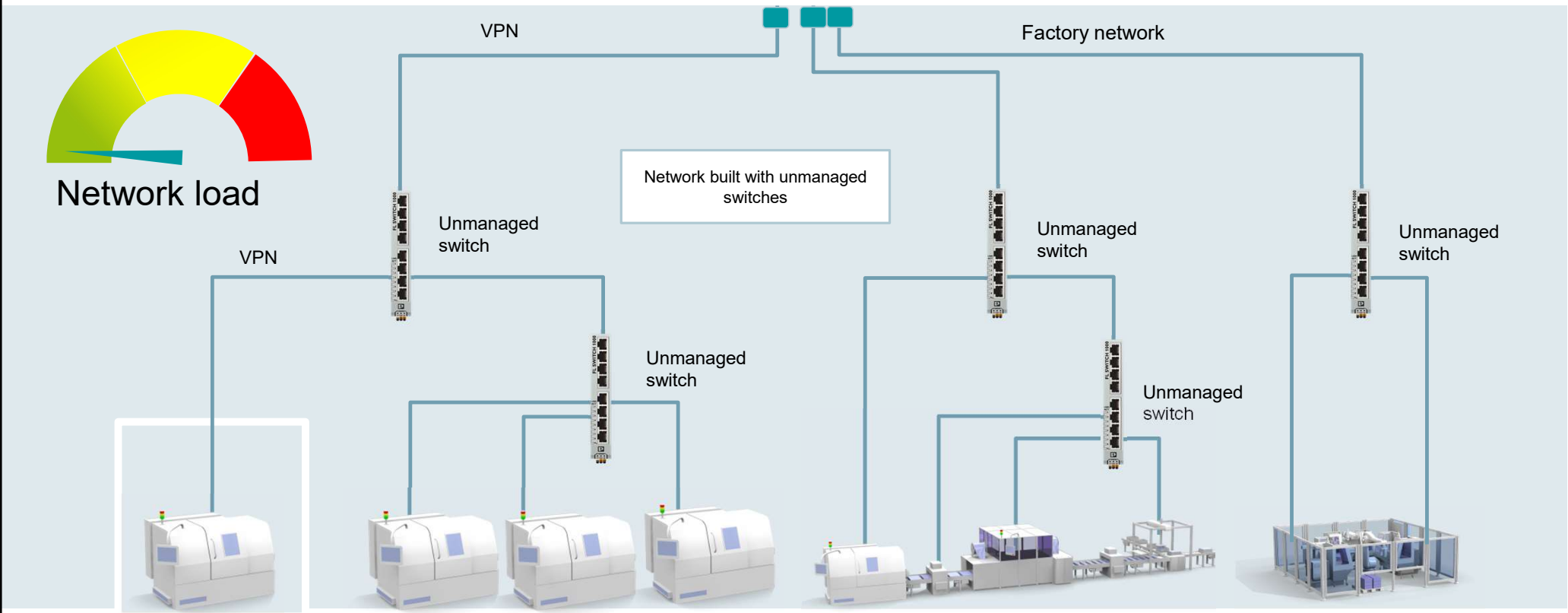
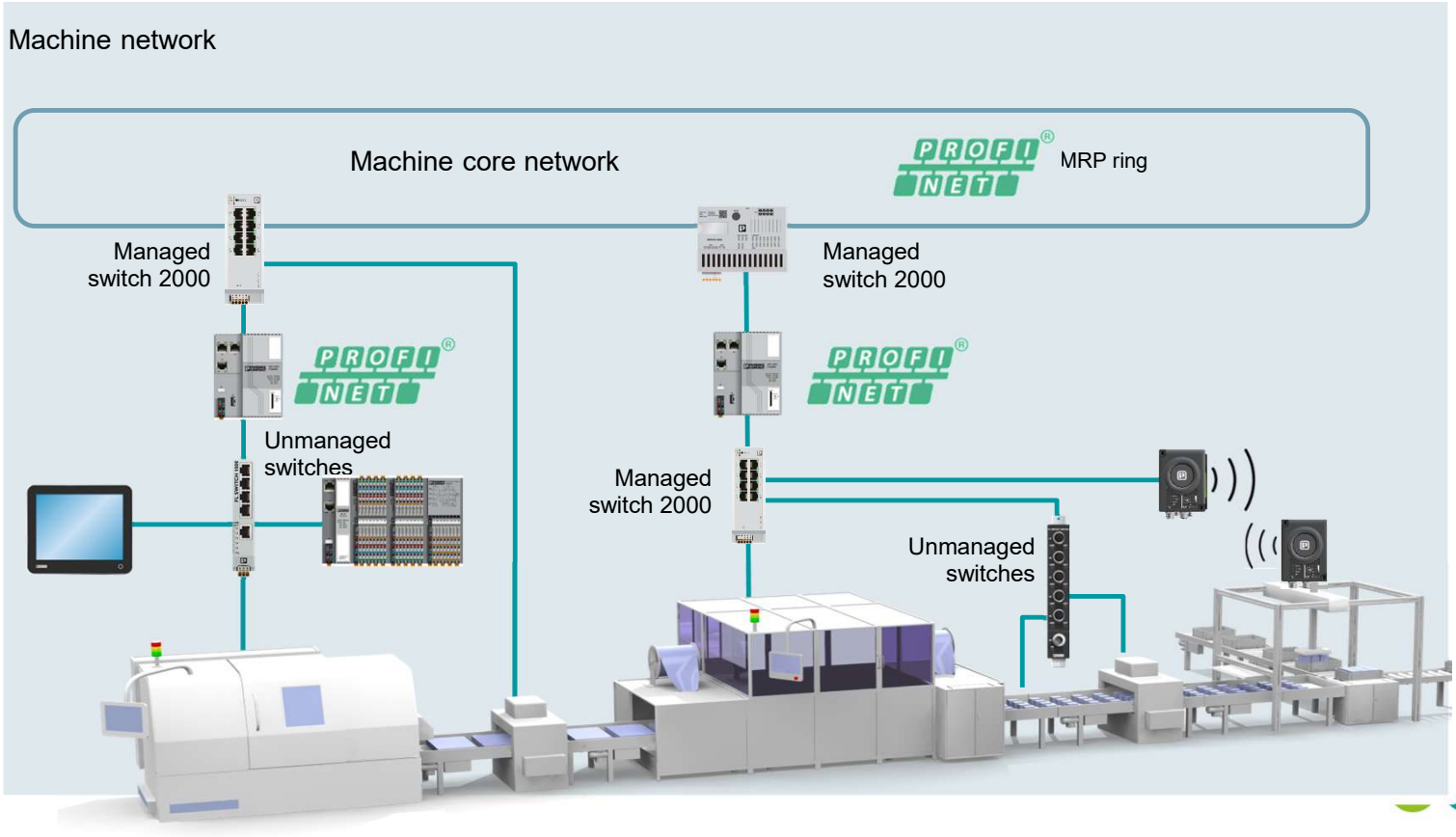
Digital Factory | Data transportation

What is the problem with many industrial networks?



How can we increase availability of the network?



Diagnostic is key

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

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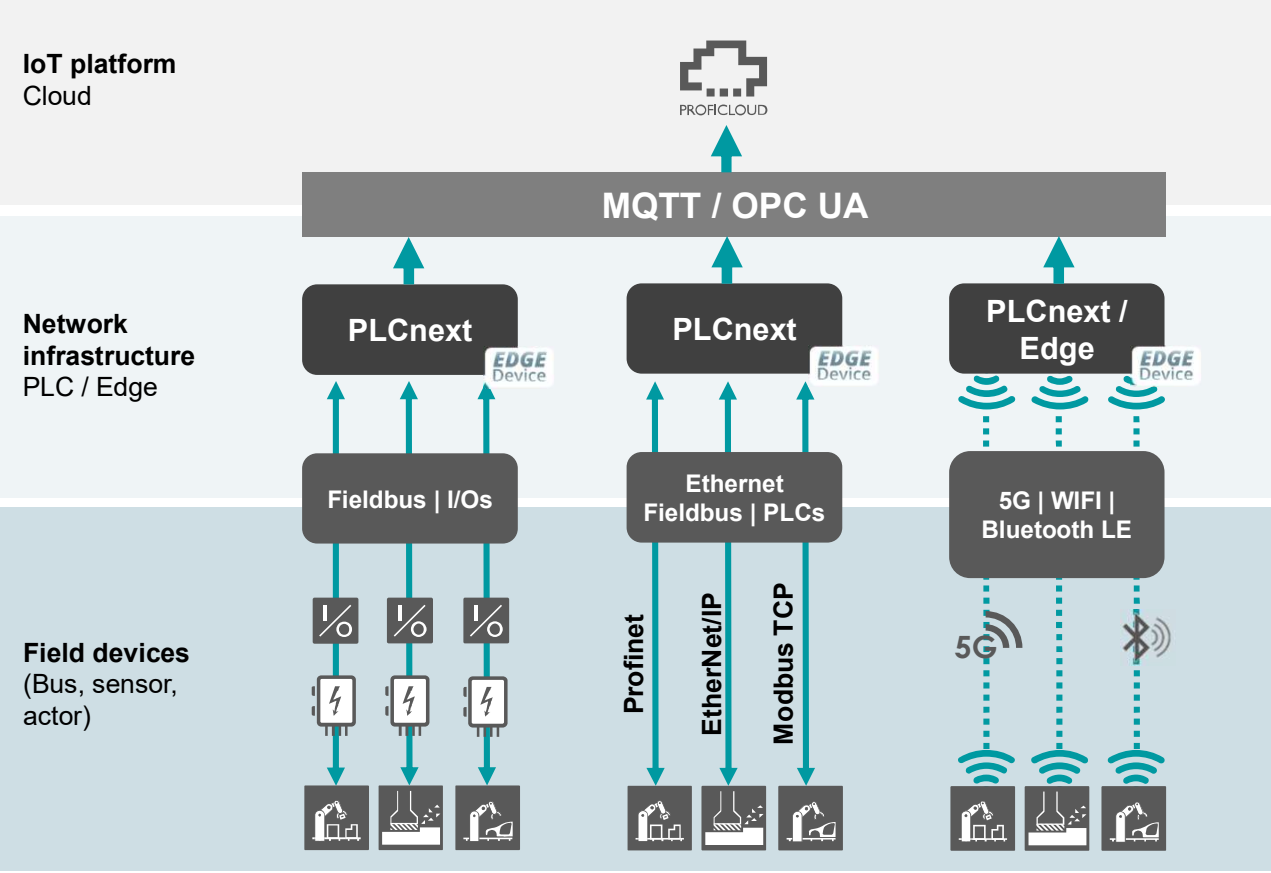
Digital Factory | Data transportation

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

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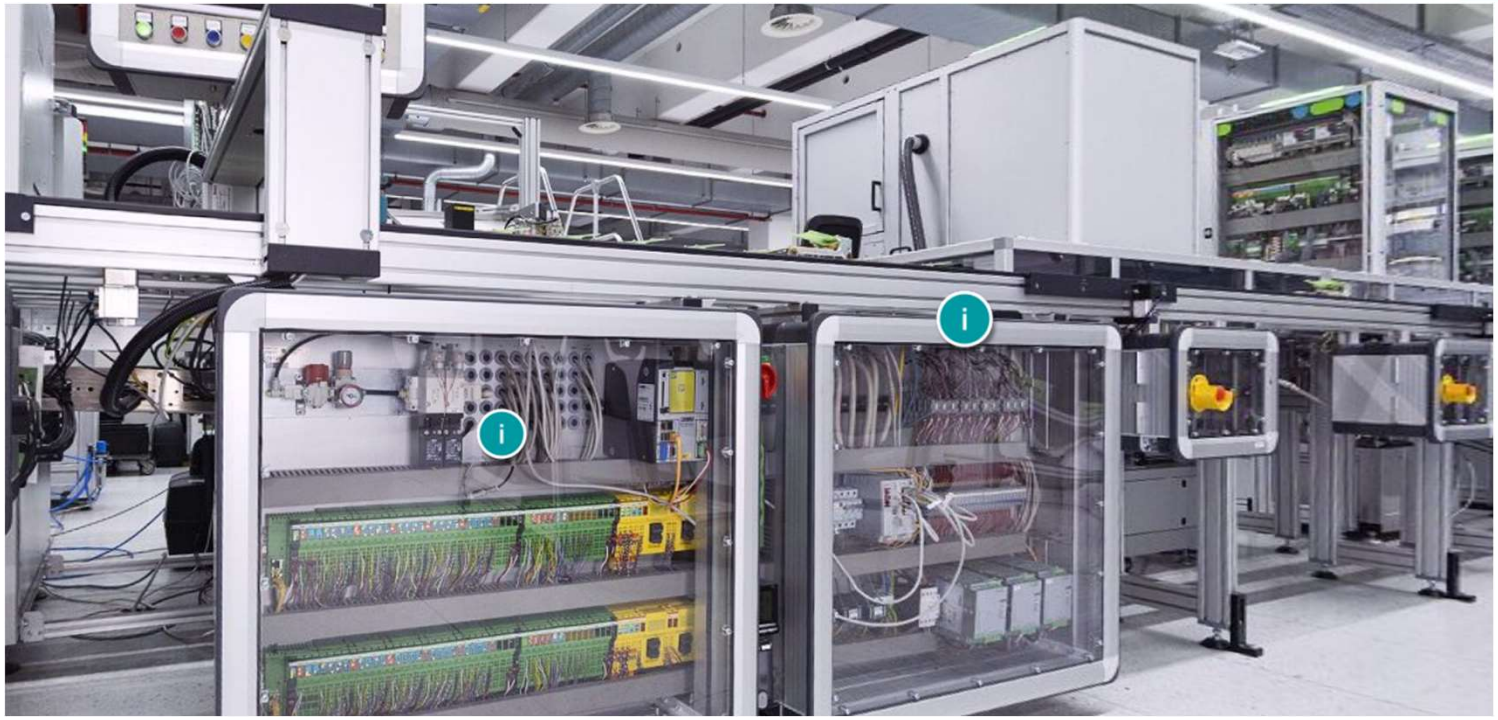
Data transportation | Smart automation network

Implementation into our own factory



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Introduction –
Importance of data transportation

Technological aspects (technology push)

Industrial revolutions

1.	Mechanical production	18th century	➢ Machines instead of Hands
2.	Mass production	1870	➢ Increasing production rate
3.	Electronics & IT	1969	➢ From mechanics to electronics
4.	Intelligence & IoT	Currently	➢ **Connecting devices** ➢ **Global data availability**

Illustration according to:
G. Reinhart, Handbuch Industrie 4.0, S.XXXI

Economic aspects (market pull)

Market development

- Individualization of customer demand
  - ➢ Increasing dynamic of product life cycle
- Globalization
  - ➢ Pressure on **price**
  - ➢ Fluctuating markets
- Climate change

Changing requirements in production

Increase in

- **Flexibility**
- **Efficiency**
- Profitability
- **Quality**
- Availability

Decrease of

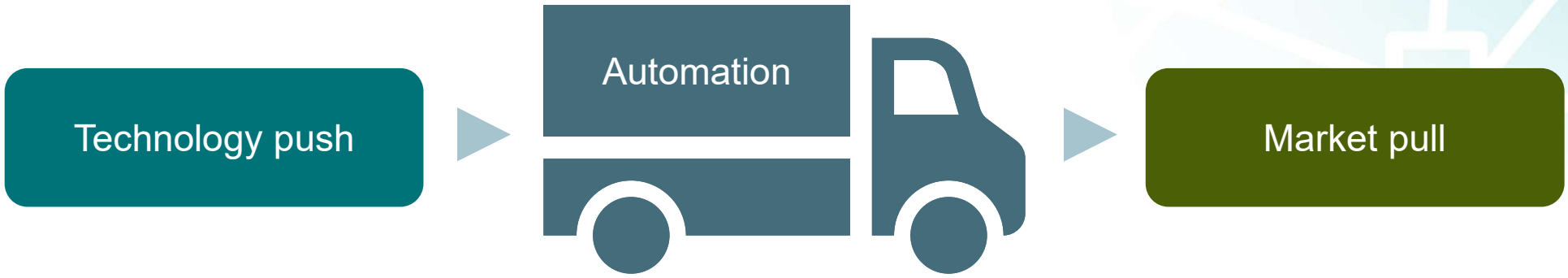
- **Production cost**
- Personnel cost

New procedures and approaches needed

- **Data** analysis
- Error diagnostics
- New business models
- Energy management
- Remote services
- More efficient and flexible use of workforce
- Use of marketplaces

Source:
G. Reinhart, Handbuch Industrie 4.0, S.XXXV - XXXVIII

New automation thinking



1. Connected infrastructure through cyber-physical systems

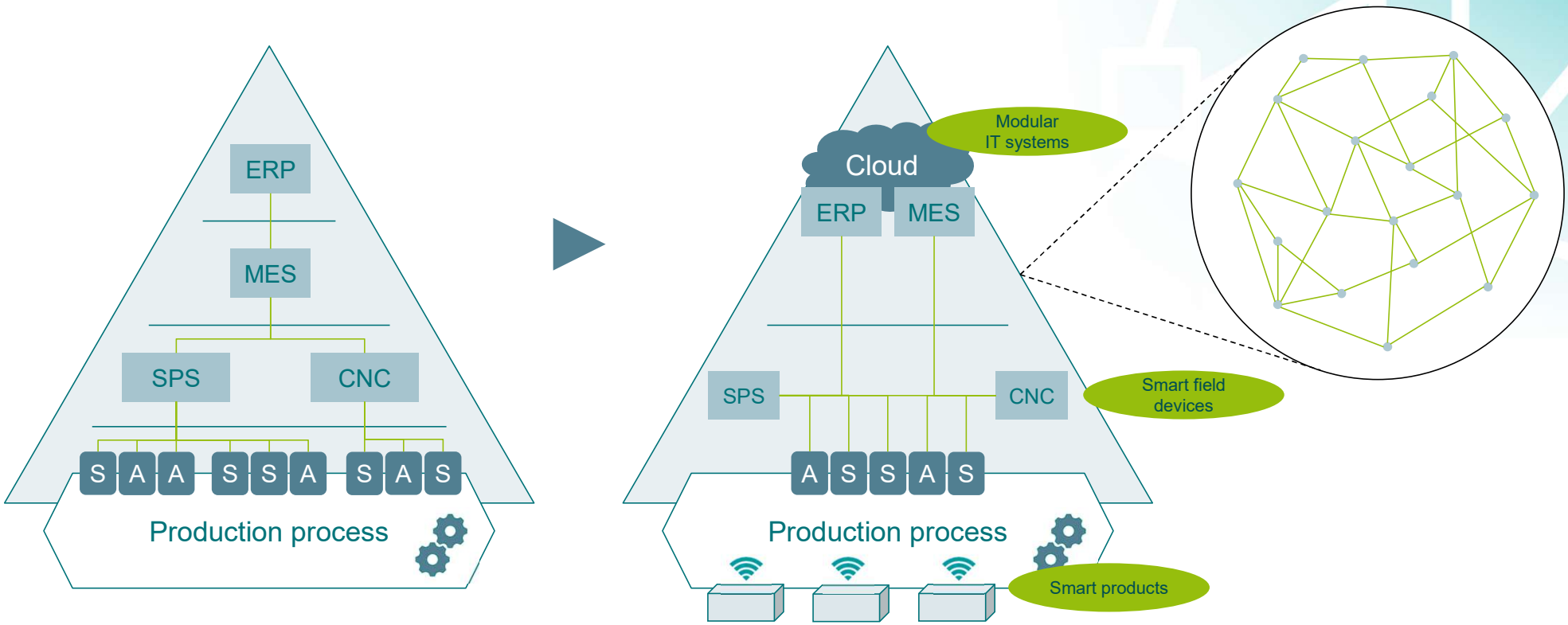


Illustration according to:
G. Reinhart, Handbuch Industrie 4.0, S.556

2. Data exchange within company borders

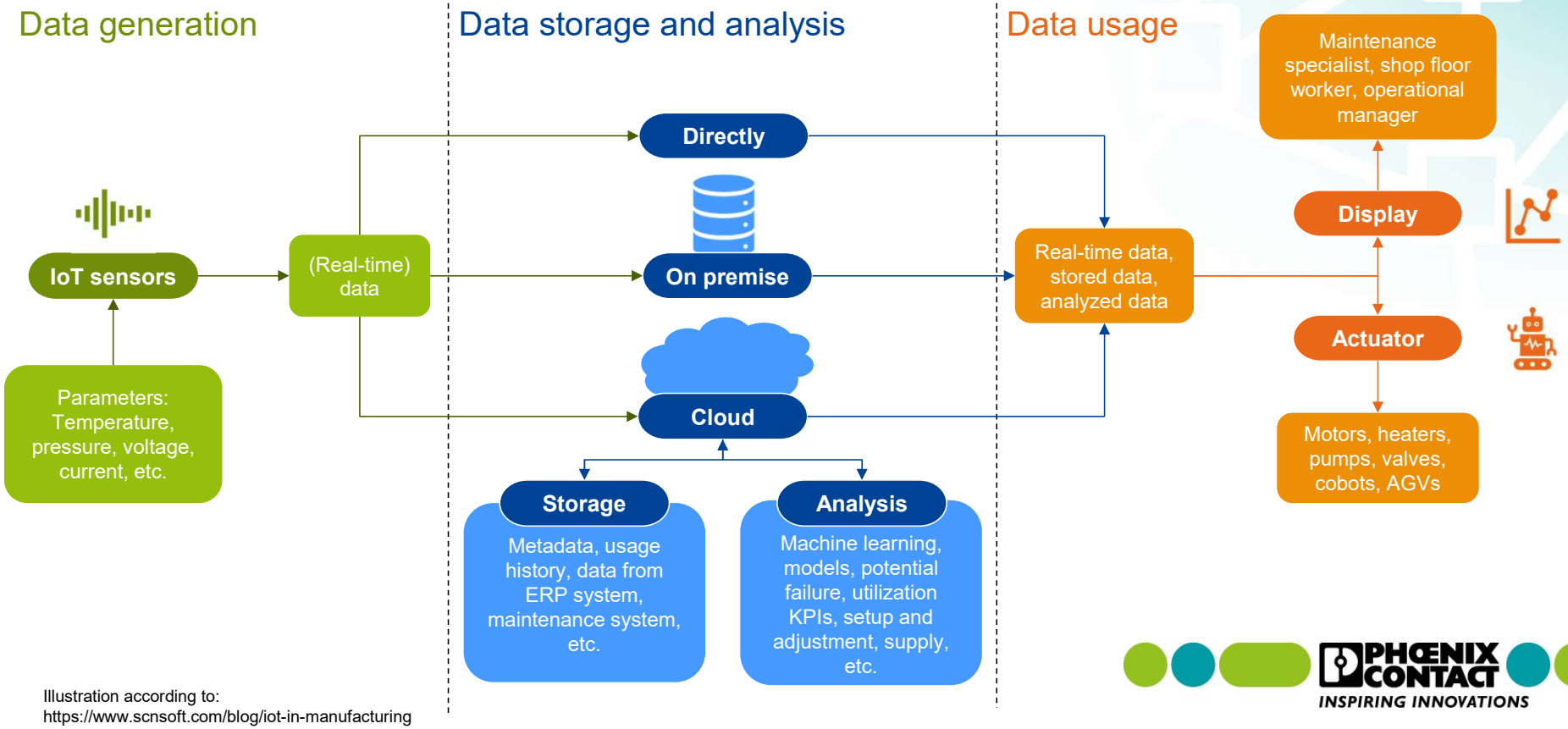


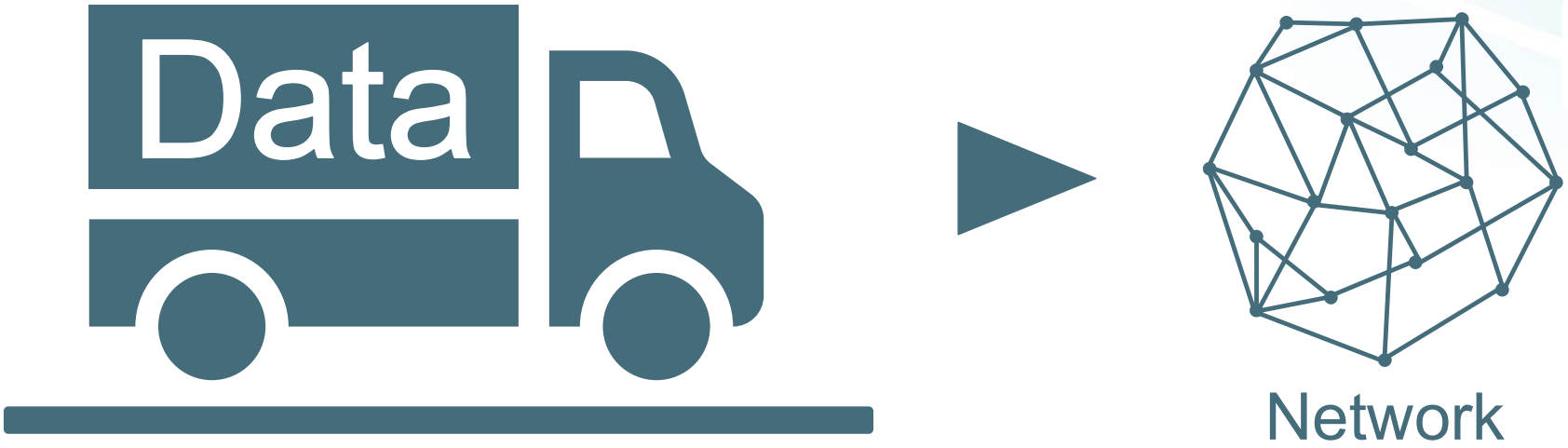
Illustration according to:
https://www.scnsoft.com/blog/iot-in-manufacturing

3. Data exchange across company borders

Goal: Automate value chains

Illustration according to:
G. Reinhart, Handbuch Industrie 4.0, S.38

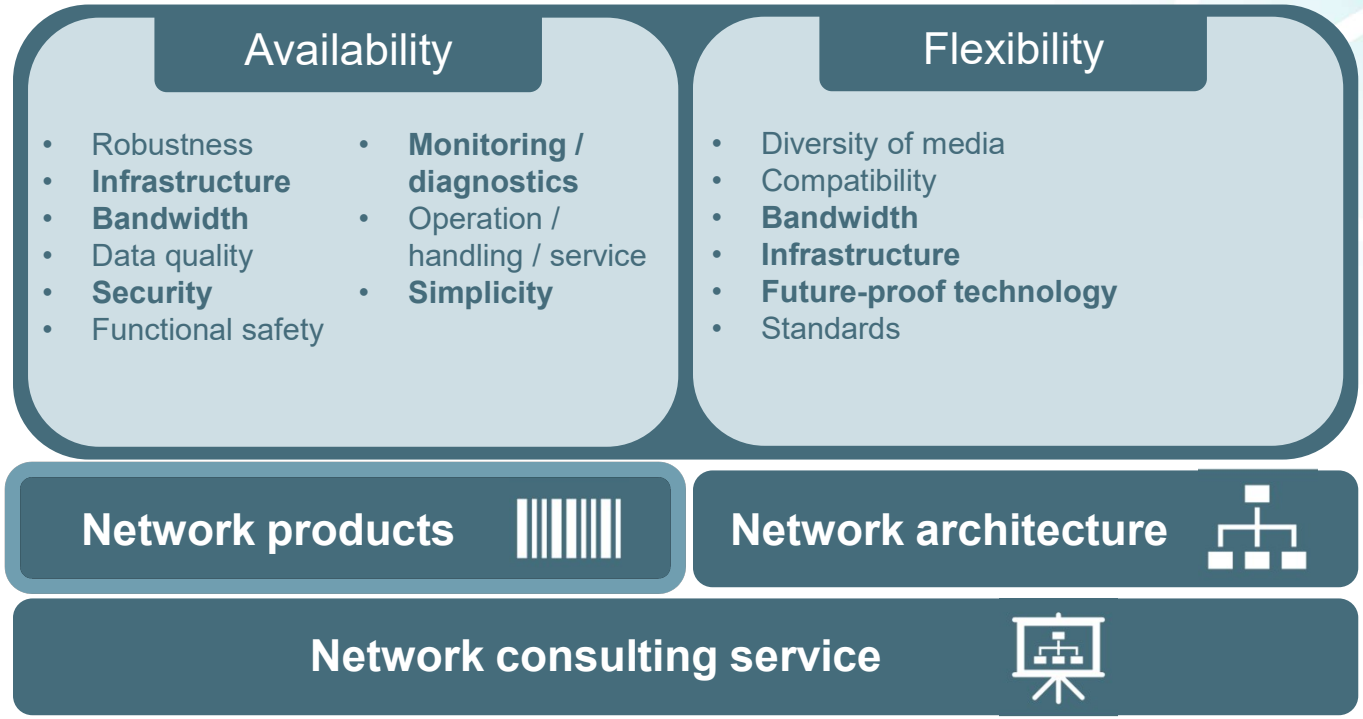
Data transportation is essential for the Digital Factory and its economical success



The
powerful and sustainable
industrial network

Powerful and sustainable network

Maximize industrial communication for available and flexible production



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Portfolio for flexible productions and smart machines

Network installation

Unmanaged switches

Managed switches

Power over Ethernet

Secure communication

Wireless

Software

Future technologies

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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

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Portfolio for flexible productions and smart machines

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Powerful and sustainable network | Network products

Unmanaged switches

Switch 1000

- Fibre optic support
- Power-over-Ethernet
- Flexible installation
- High data rates
- Data prioritization PROFINET 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

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Portfolio for flexible productions and smart machines

Network installation

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Powerful and sustainable network | Network products

Managed switches

Switch 2000

- PROFINET 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 sychronous
- 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

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Portfolio for flexible productions and smart machines

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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

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Portfolio for flexible productions and smart machines

Network installation

Unmanaged switches

Managed switches

Power over Ethernet

Secure communication

Wireless

Software

Future technologies

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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

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INSPIRING INNOVATIONS

Portfolio for flexible productions and smart machines

Network installation

Unmanaged switches

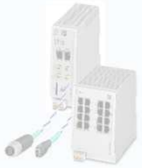
Managed switches

Power over Ethernet

Secure communication

Wireless

Software



Future technologies

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INSPIRING INNOVATIONS

Powerful and sustainable network | Network products

Wireless

WLAN

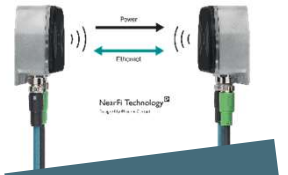
- Flexible installation
- Cost-efficient
- REST-API
- Smart devices
- AGVs

Bluetooth

- Inteference-free with WLAN
- Optimized for PROFINET
- Point-to-point connection (cranes, robots, etc.)

Bluetooth LE

- Low energy IoT sensors
- Precision machining



Highlight 2021

NearFi

- Wireless Ethernet and power (≤10 mm)
- Application
  - Rotating tools
  - High amount of tool exchanges

➢ No abrasion

➢ Smart devices

➢ AGVs

➢ IoT sensors

➢ Abrasion reduction

✓ Availability & Flexibility

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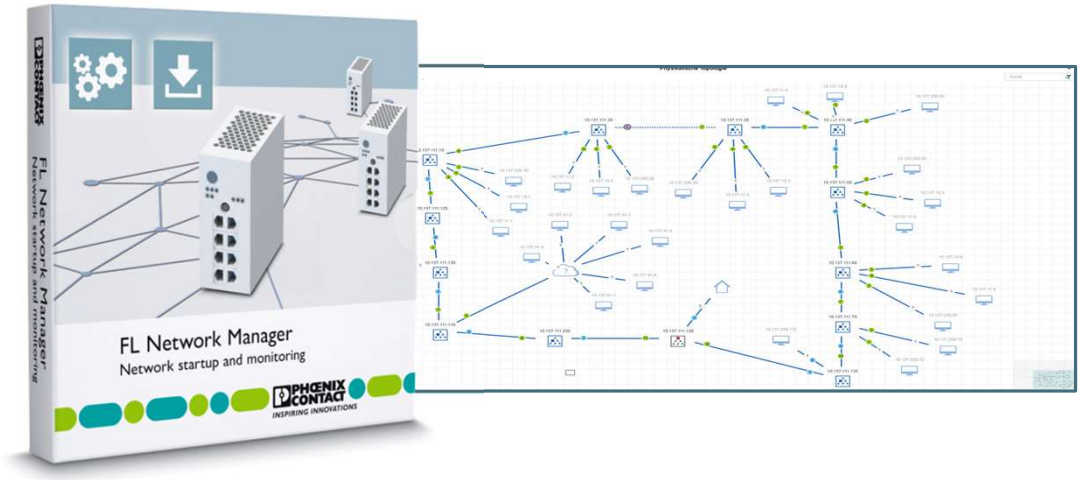
Software



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

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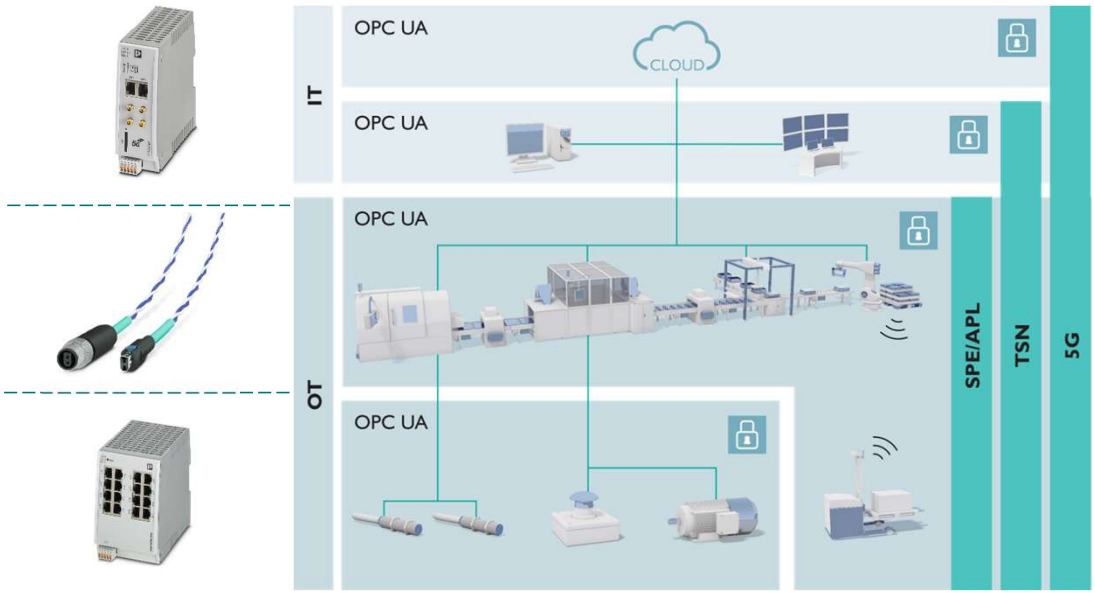
Future technologies in sight



- 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

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Portfolio for flexible productions and smart machines

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… 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	CE, cULus, DNV GL	

Note: Not all approvals will be available at market launch

New – Q1 2021

FL SWITCH 2600/2700

Portfolio overview

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Approvals	CE, cULus, DNV GL	

Note: Not all approvals will be available at market launch

New –

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

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	CE, cULus

New – Q4 2020

Same feature set as standard FL SWITCH 20xx models

L SWITCH 2000F

'ortfolio overview

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

New – Q4 2020

Same feature set as standard FL SWITCH 20xx models

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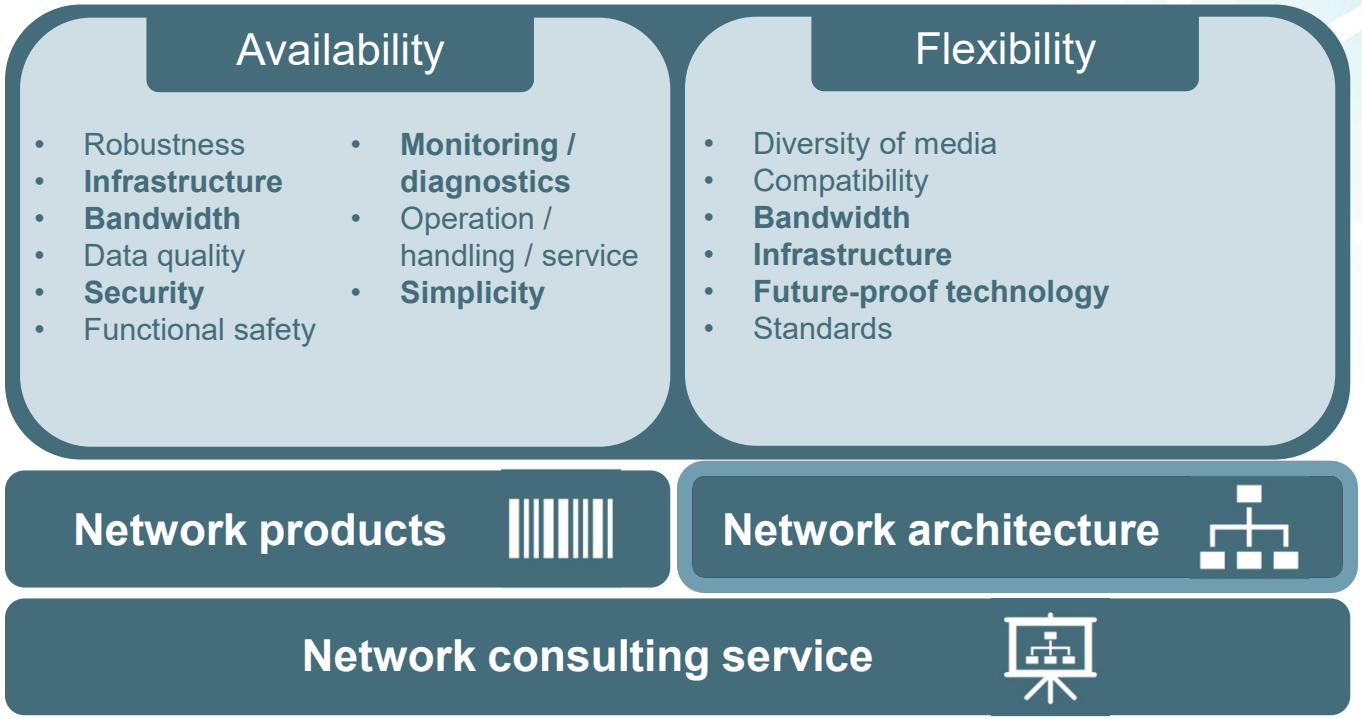
Powerful and sustainable network

Maximize industrial communication for available and flexible production



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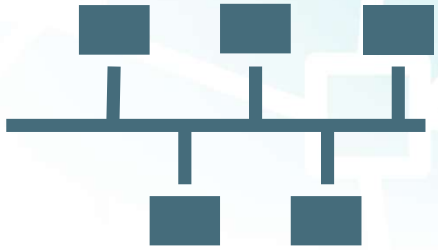
Basics – Topologies

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

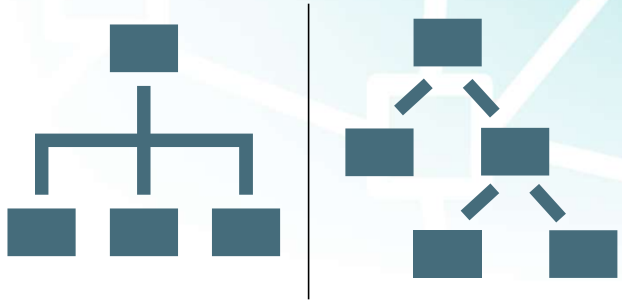
Source: www.giga.de

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)



Star | Tree

Source: www.giga.de

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

Source: www.giga.de

Basics – Topologies

Characteristics

- ✓ **Redundancy** – Very high protection from downtimes
- ✓ Low latencies

- ! Very high implementation effort and costs

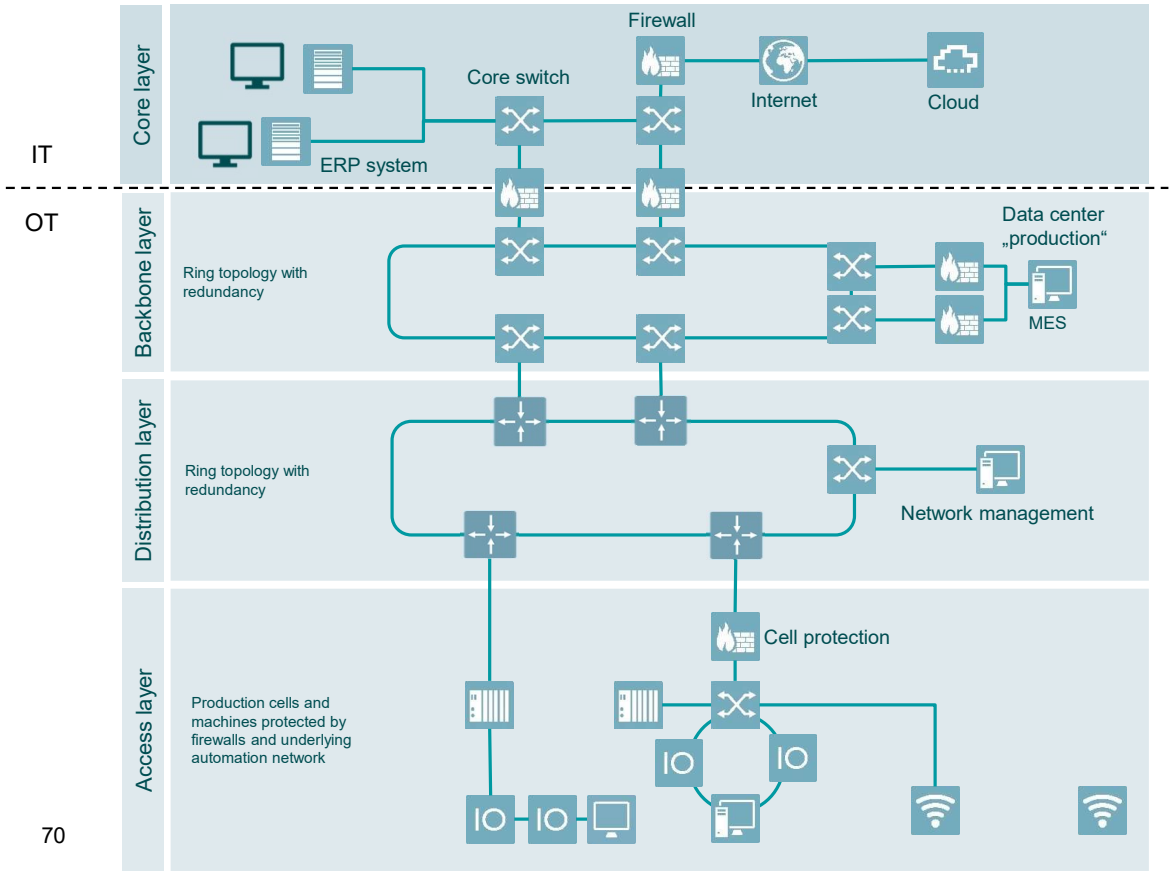
Mesh

Source: www.giga.de

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

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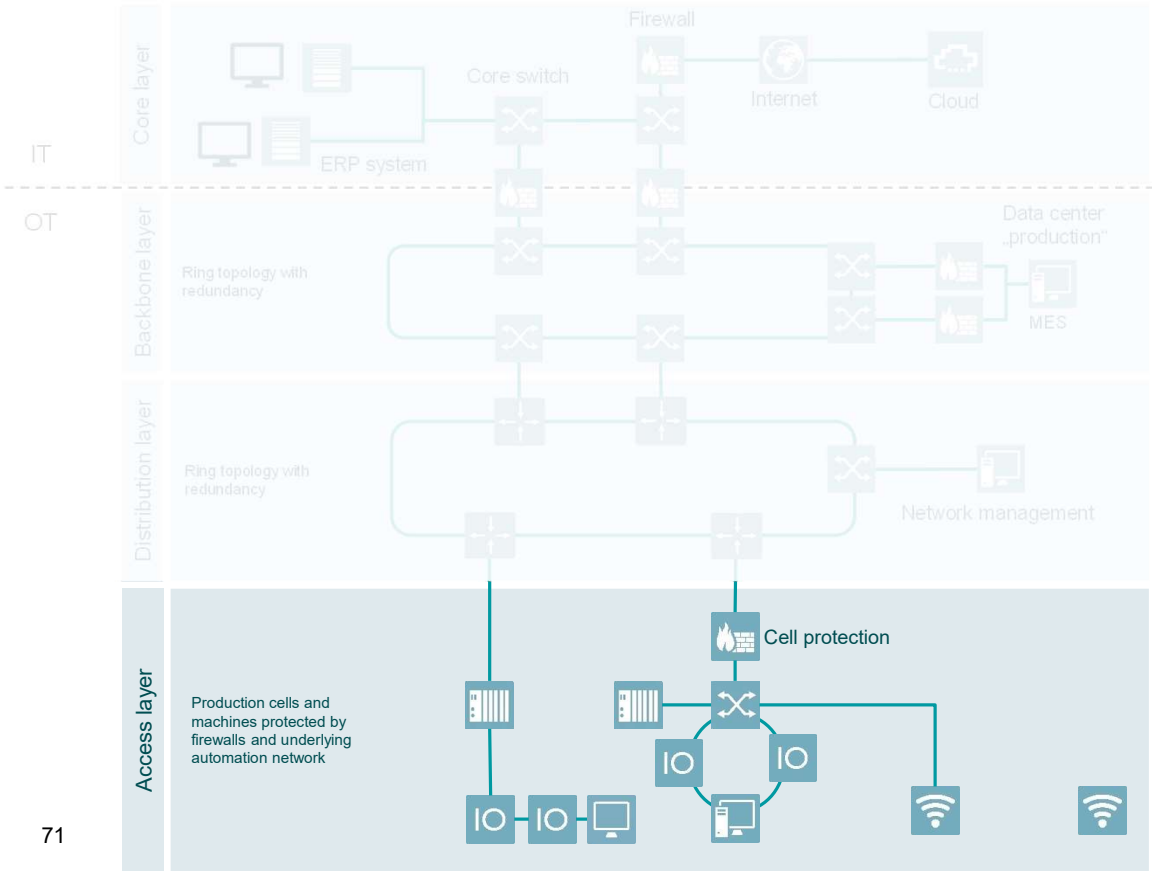
Basics – Access layer



- **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:** </= 100m
- **Medium:** Copper, WLAN, Bluetooth
- **Bandwidth:** Typ. </= 100 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

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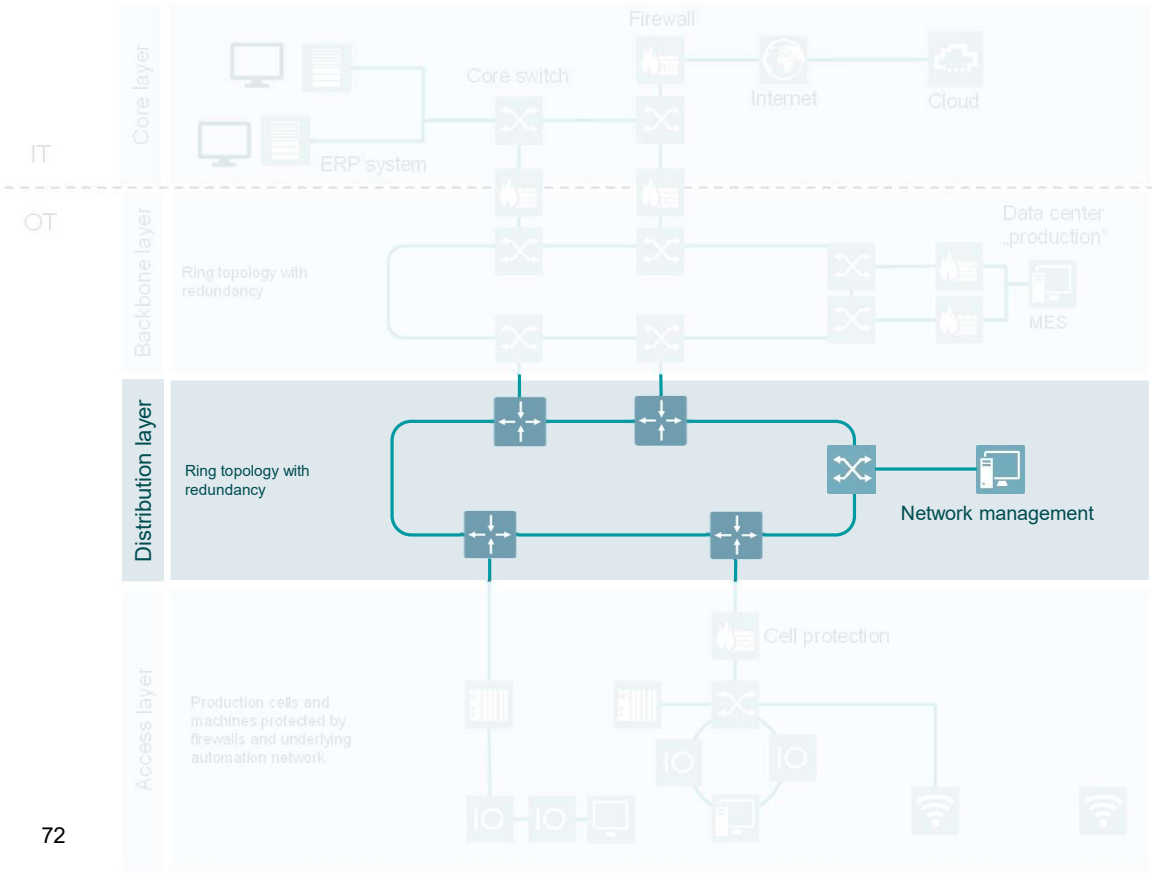
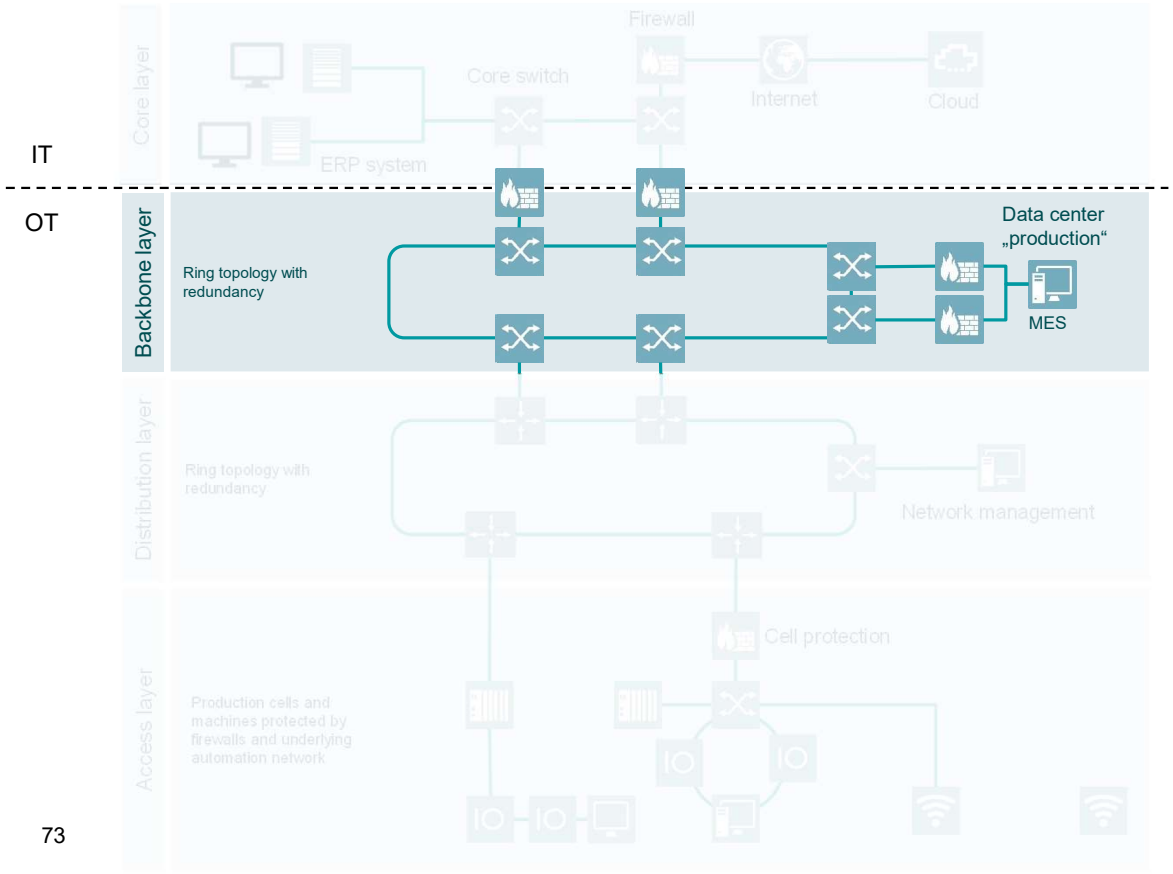
Basics – Distribution layer



- **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

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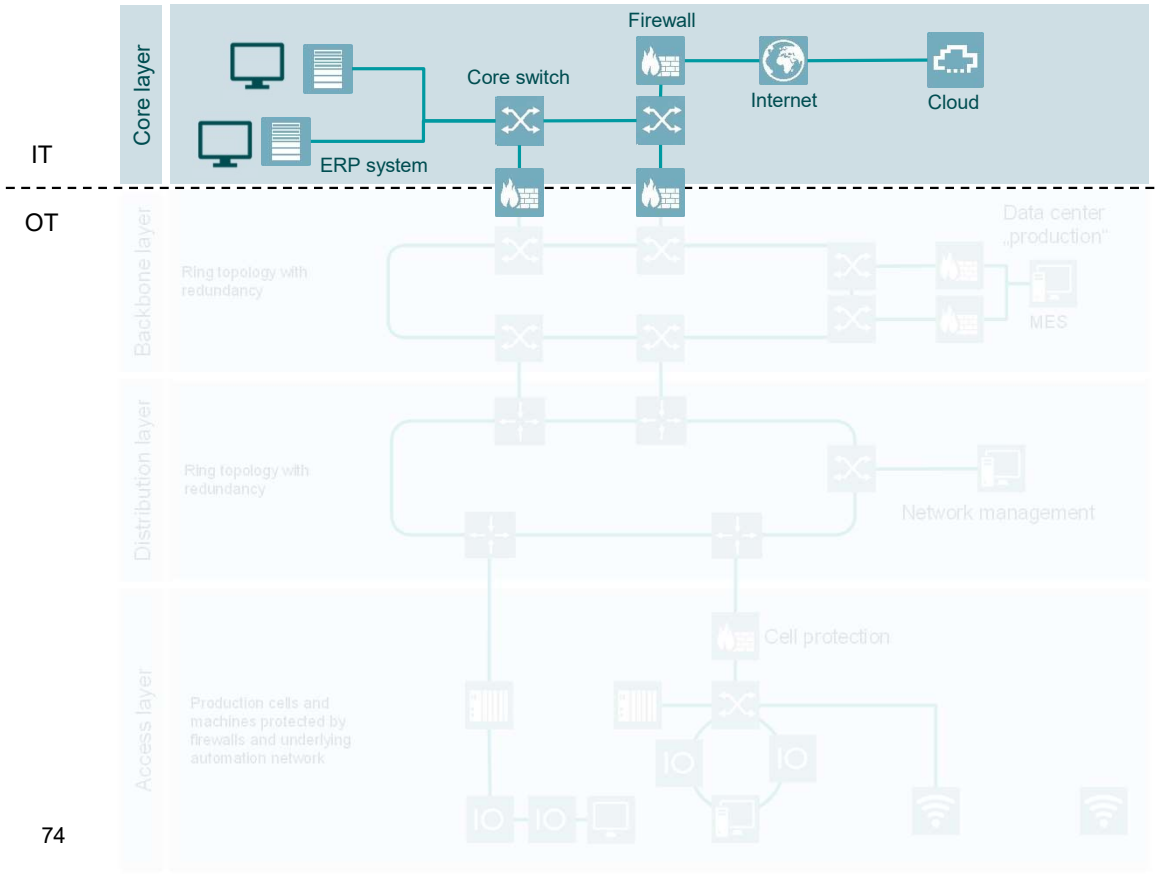
Basics – Core layer



- **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

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INSPIRING INNOVATIONS

Production network vs. office network

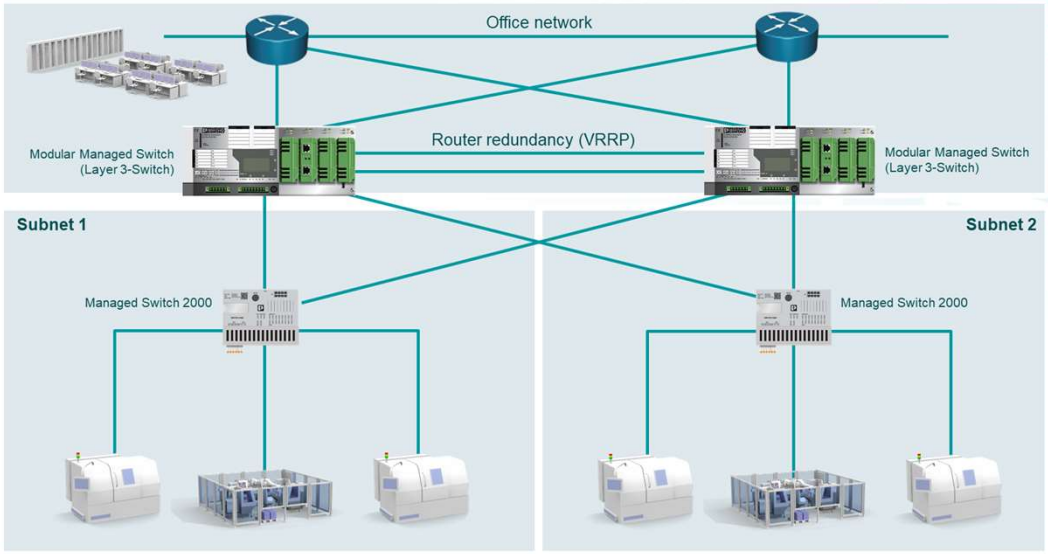
	Production	Office
Priorities	Availability Integrity Confidentiality	Confidentiality Integrity Availability
Installation	▪ Wiring dependent on machine / production plant ▪ **Assembling in the field** ▪ Industrial components ▪ **Lifespan: 10 to 20 years** ▪ Star and ring topology	▪ Fixed installation in the building ▪ Preassembled wiring ▪ Office components ▪ Lifespan: max. 5 years ▪ Star and tree topology
Data	▪ Small data packages ▪ **Cyclic deterministic data communication** ▪ **Real time** ▪ Very high network availability	▪ Big data packages ▪ Acyclic data communication ▪ No real time ▪ Medium network availability
Environment	▪ High temperatures ▪ **Dust, moisture, vibration** ▪ High load of electromagnetic effects	▪ Normal temperatures ▪ Application in normal environments ▪ Low load of electromagnetic effects

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,

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**



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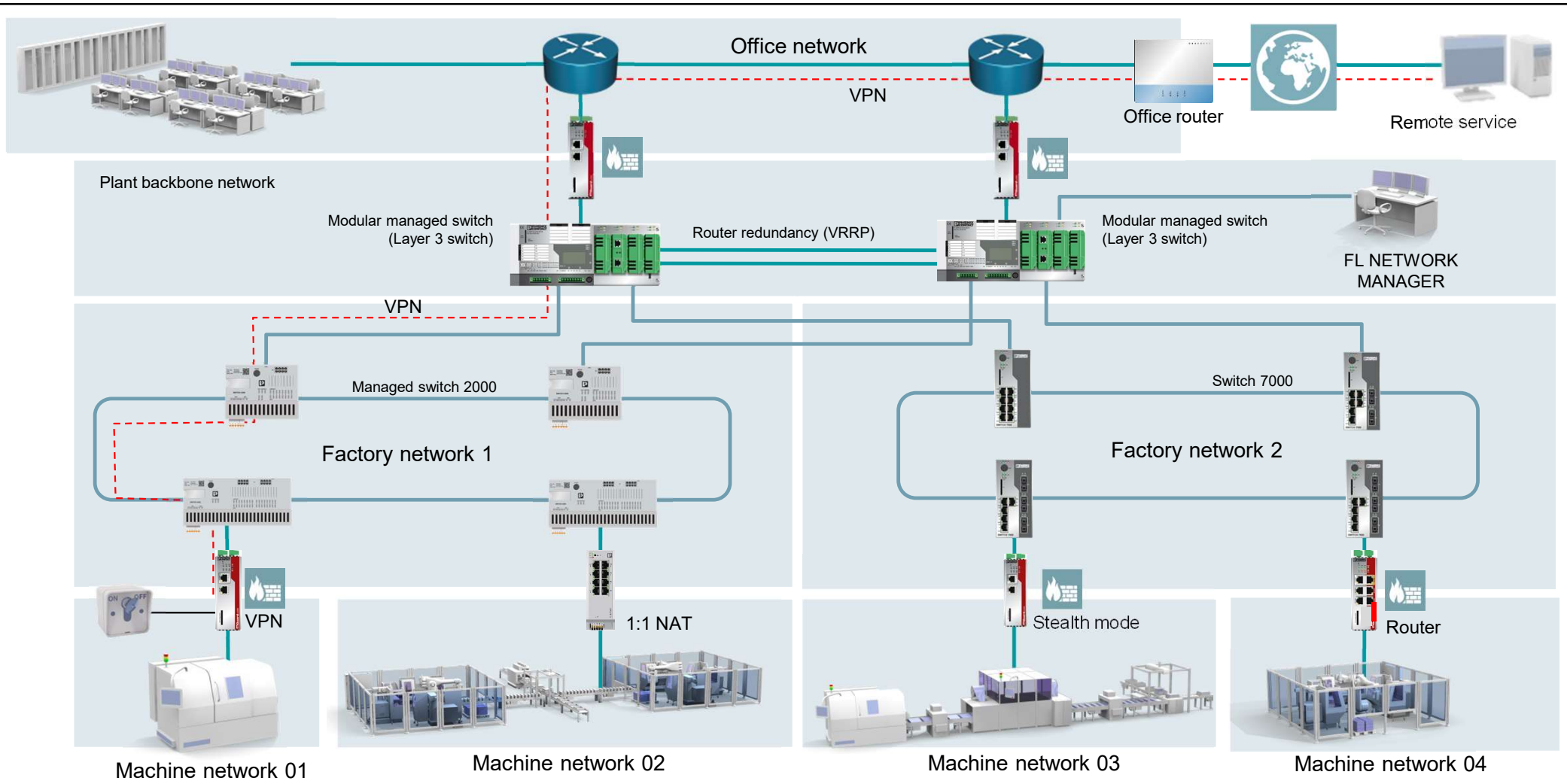

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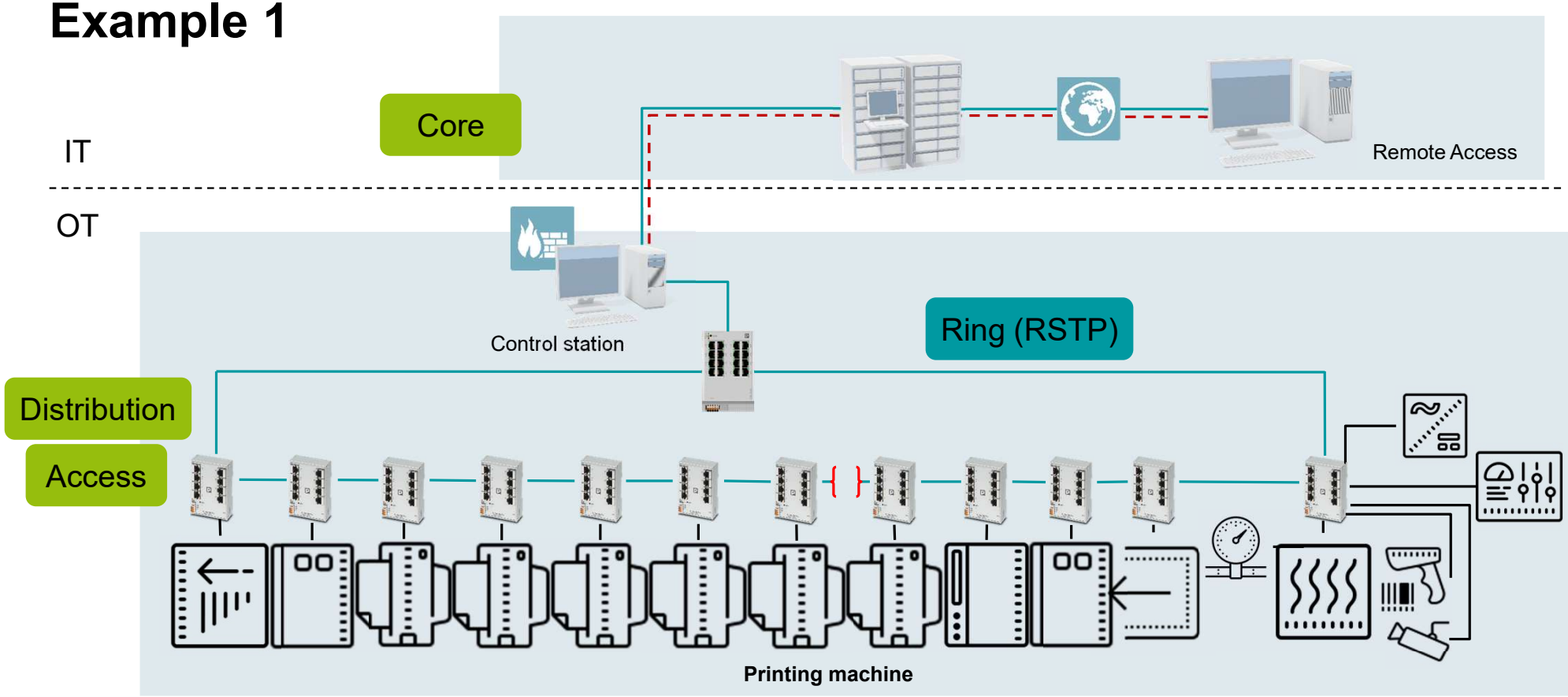
Powerful and sustainable network | Real customer network architecture

Example 1



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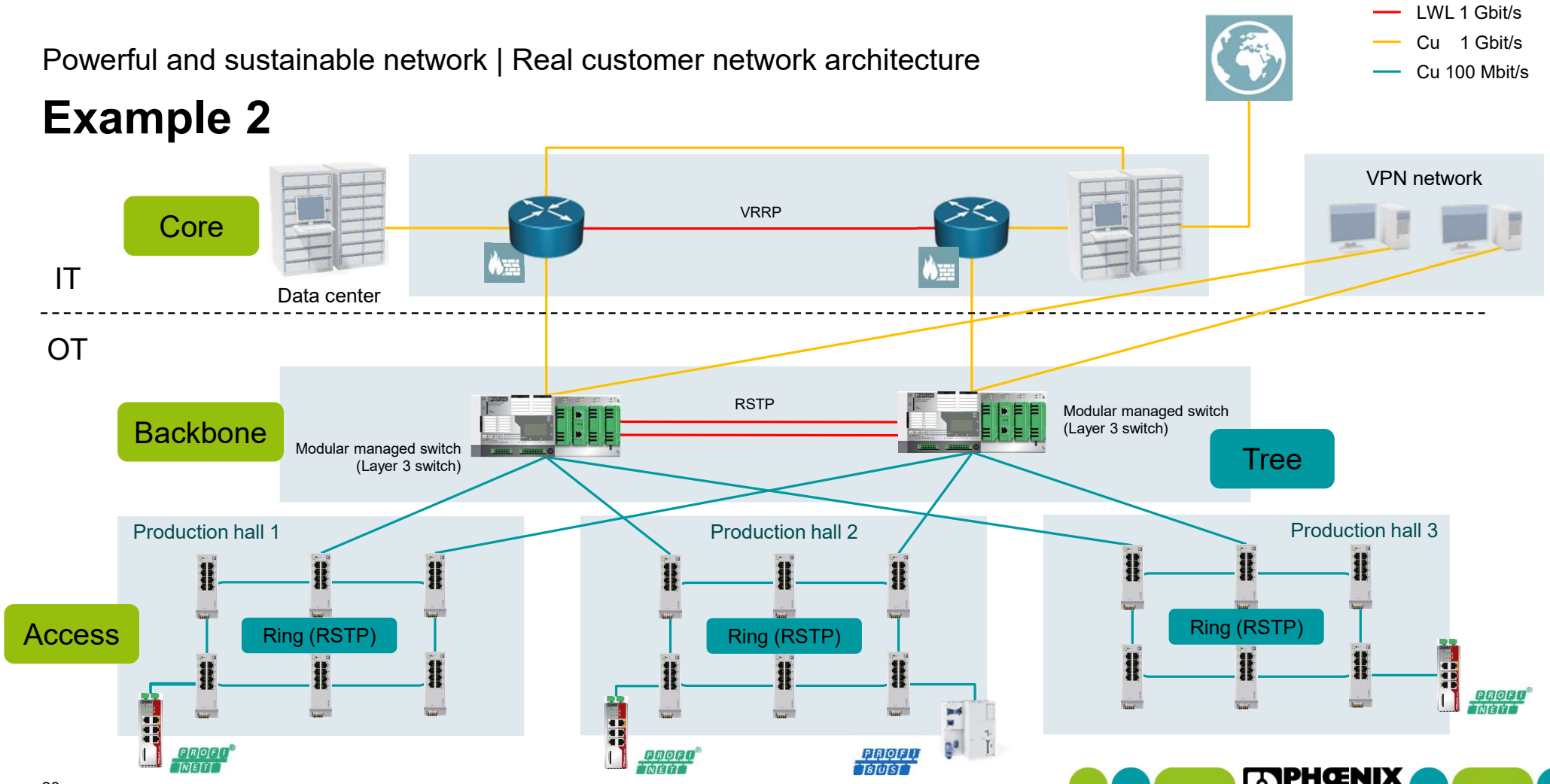
Powerful and sustainable network | Real customer network architecture

Example 2



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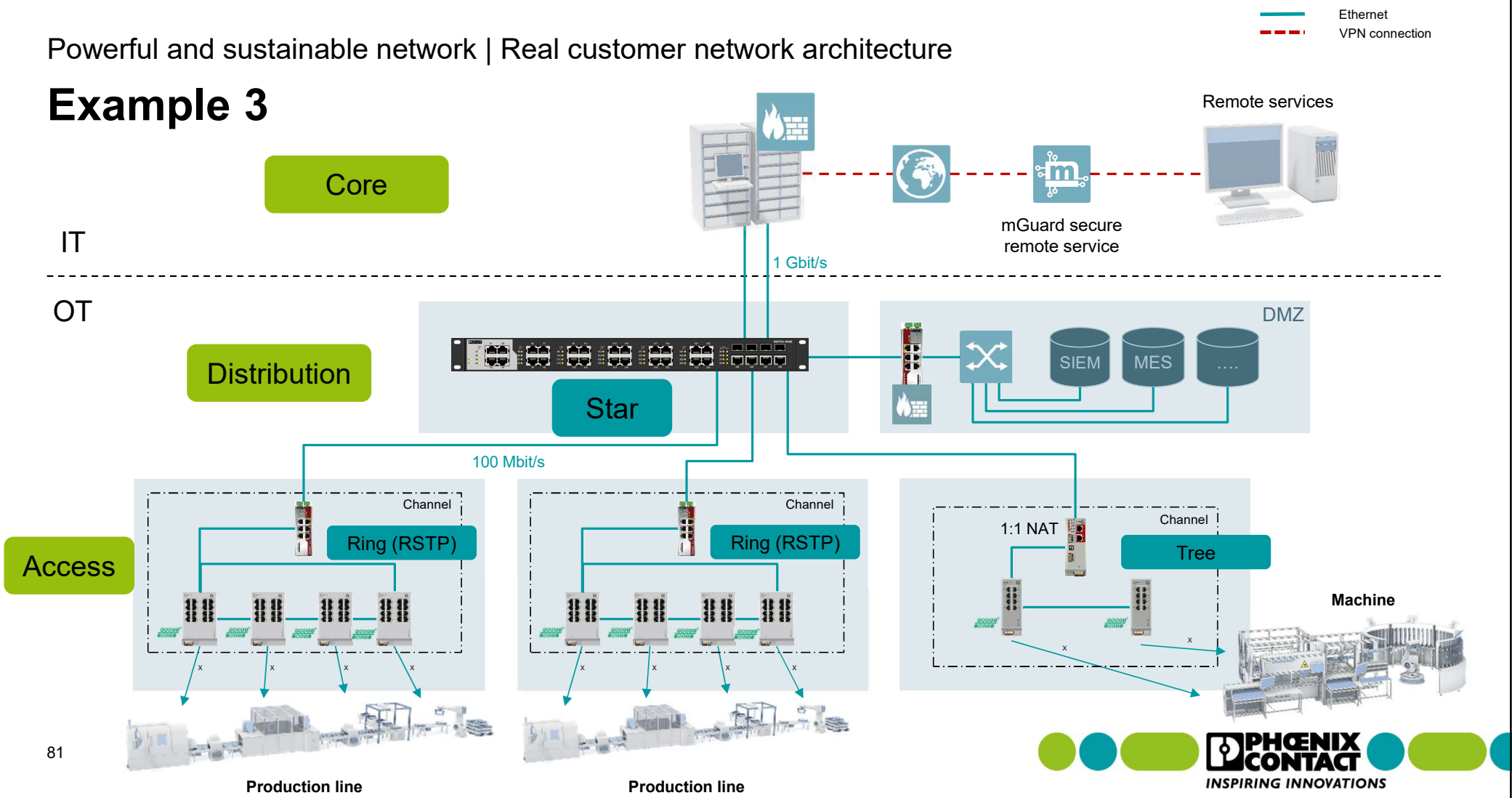
INSPIRING INNOVATIONS

Powerful and sustainable network | Real customer network architecture

Example 3



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

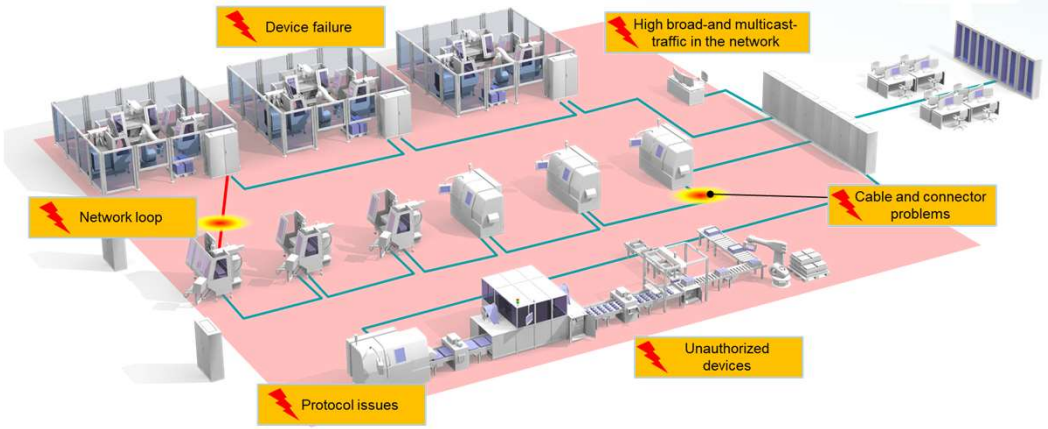
↑ Amount of network nodes

↑ Data traffic

Consequences

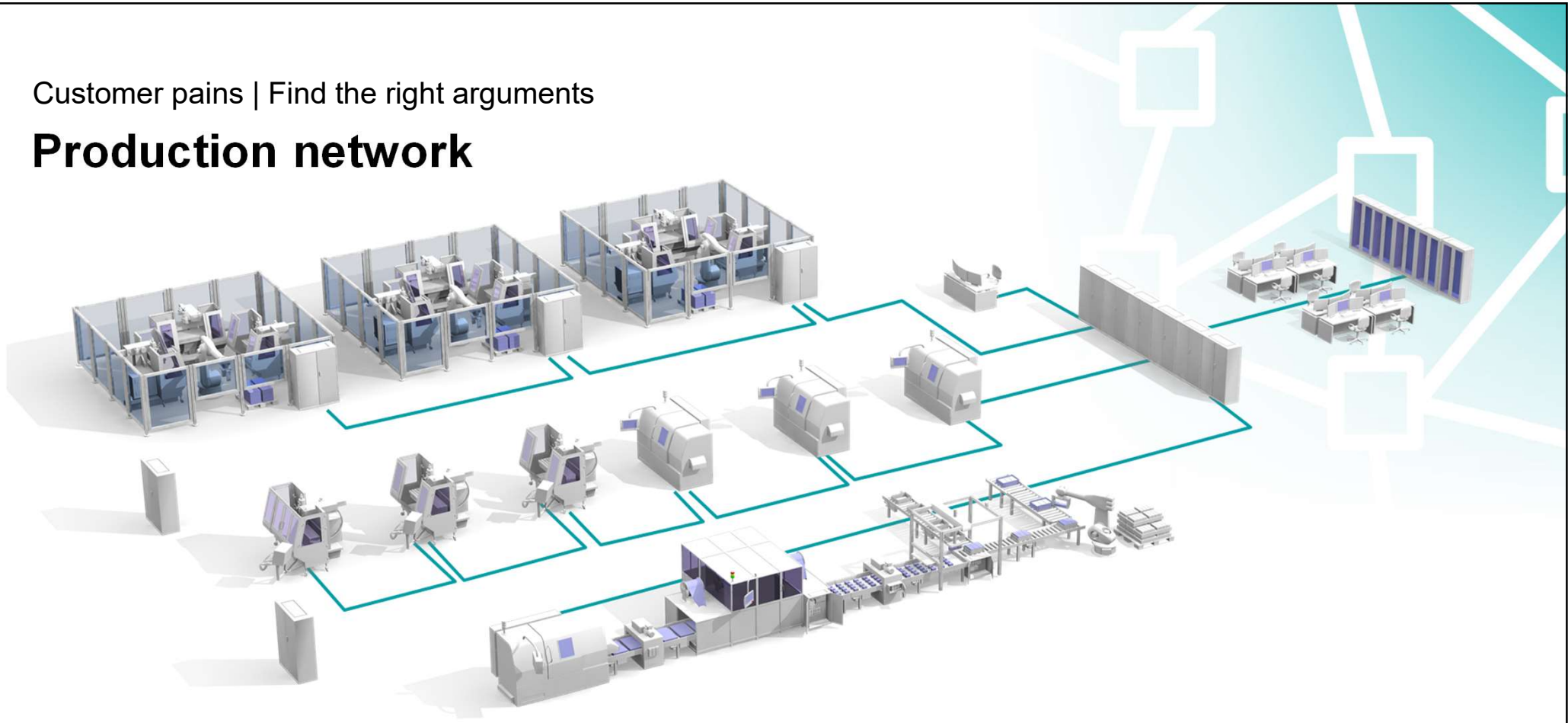
❖ High risk of system failures
❖ Longer downtimes

➢ Lower availability
➢ Higher costs



Customer pains | Find the right arguments

Production network



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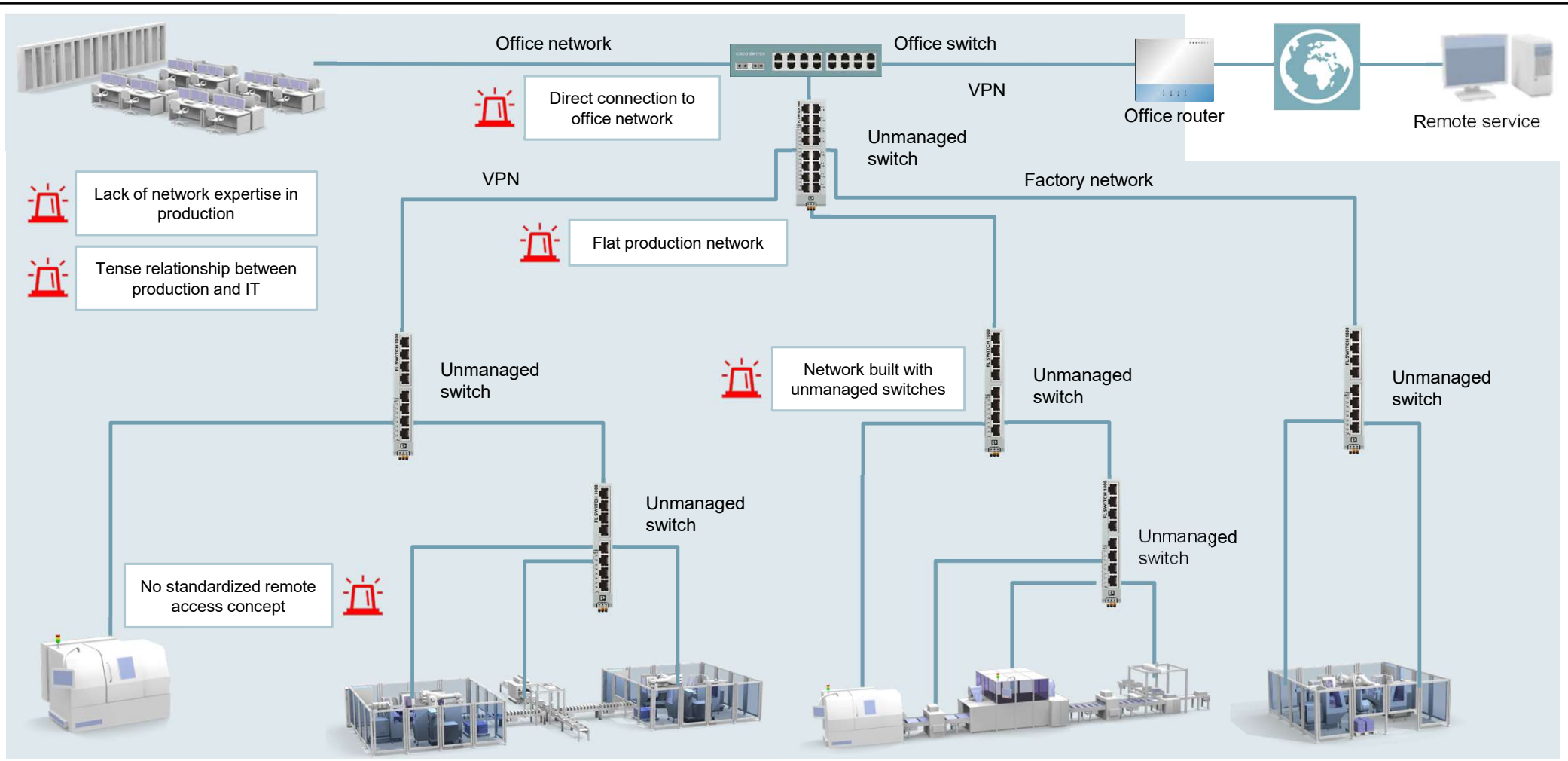

Critical situations in the network

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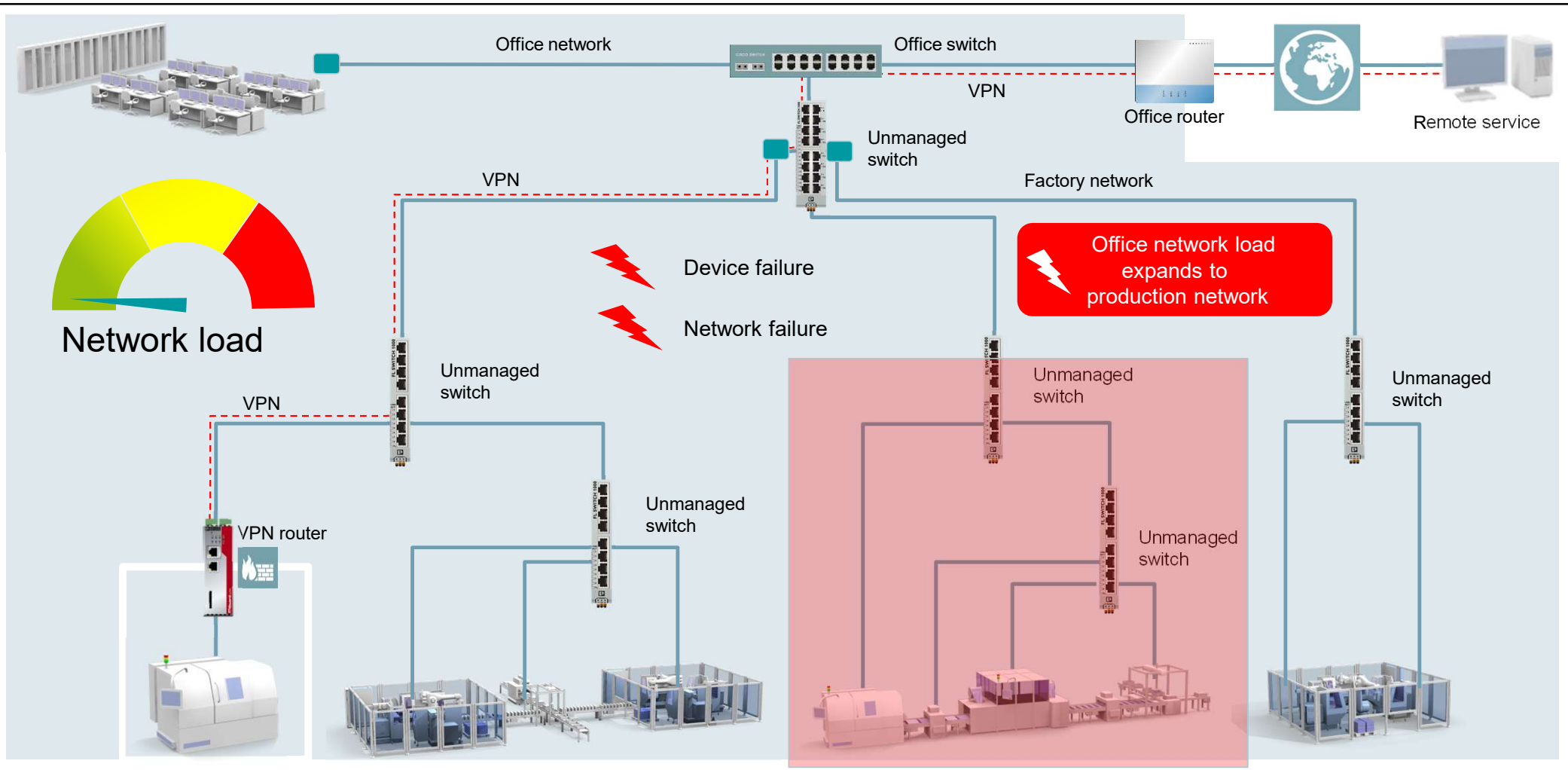

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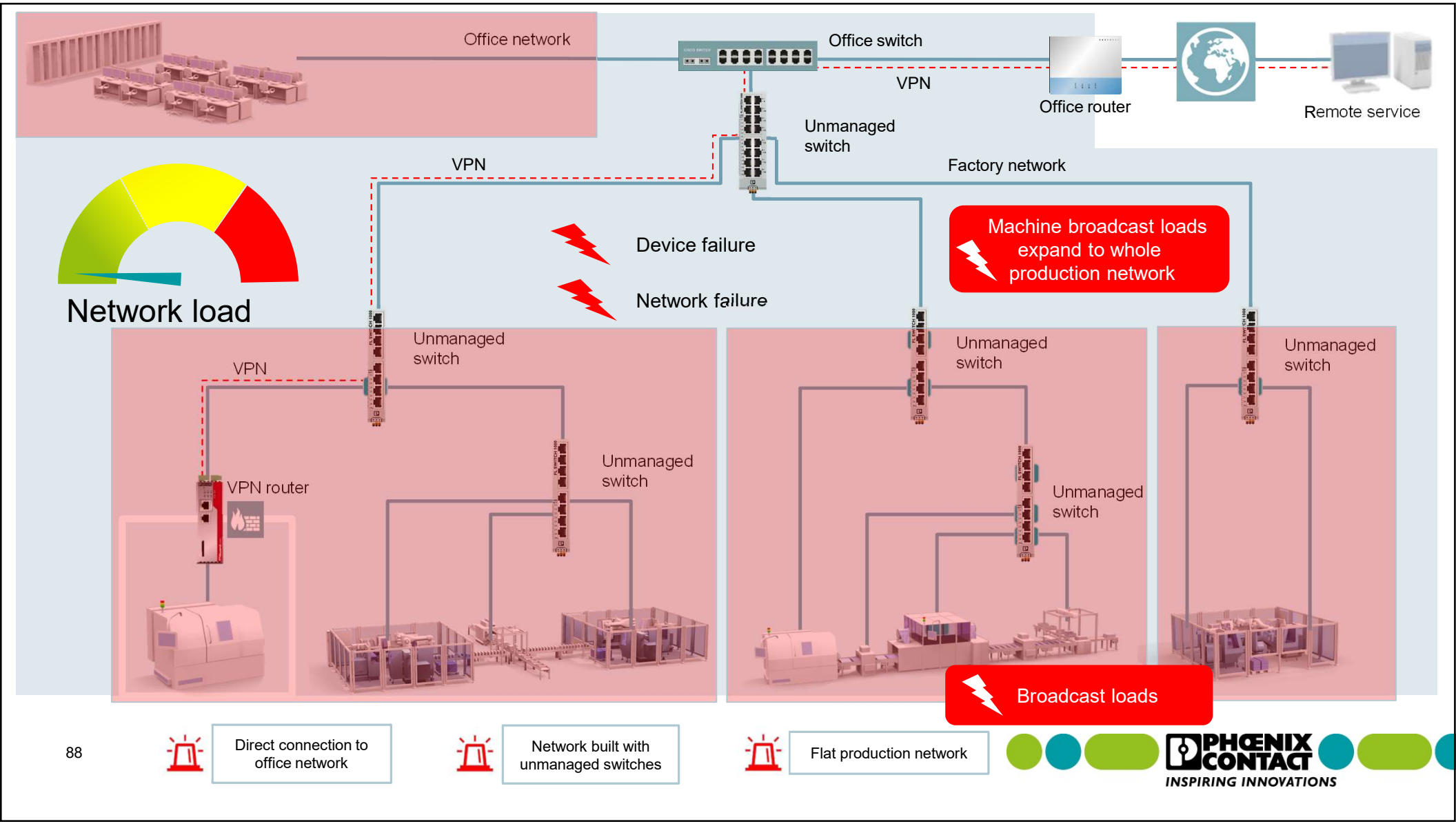
Office network
Office switch
VPN
Office router
Remote service
Unmanaged switch
VPN
Factory network
Network load
Device failure
Network failure
Machine broadcast loads expand to whole production network
Unmanaged switch
VPN
VPN router
Unmanaged switch
Unmanaged switch
Unmanaged switch
Unmanaged switch
Broadcast loads
Direct connection to office network
Network built with unmanaged switches
Flat production network
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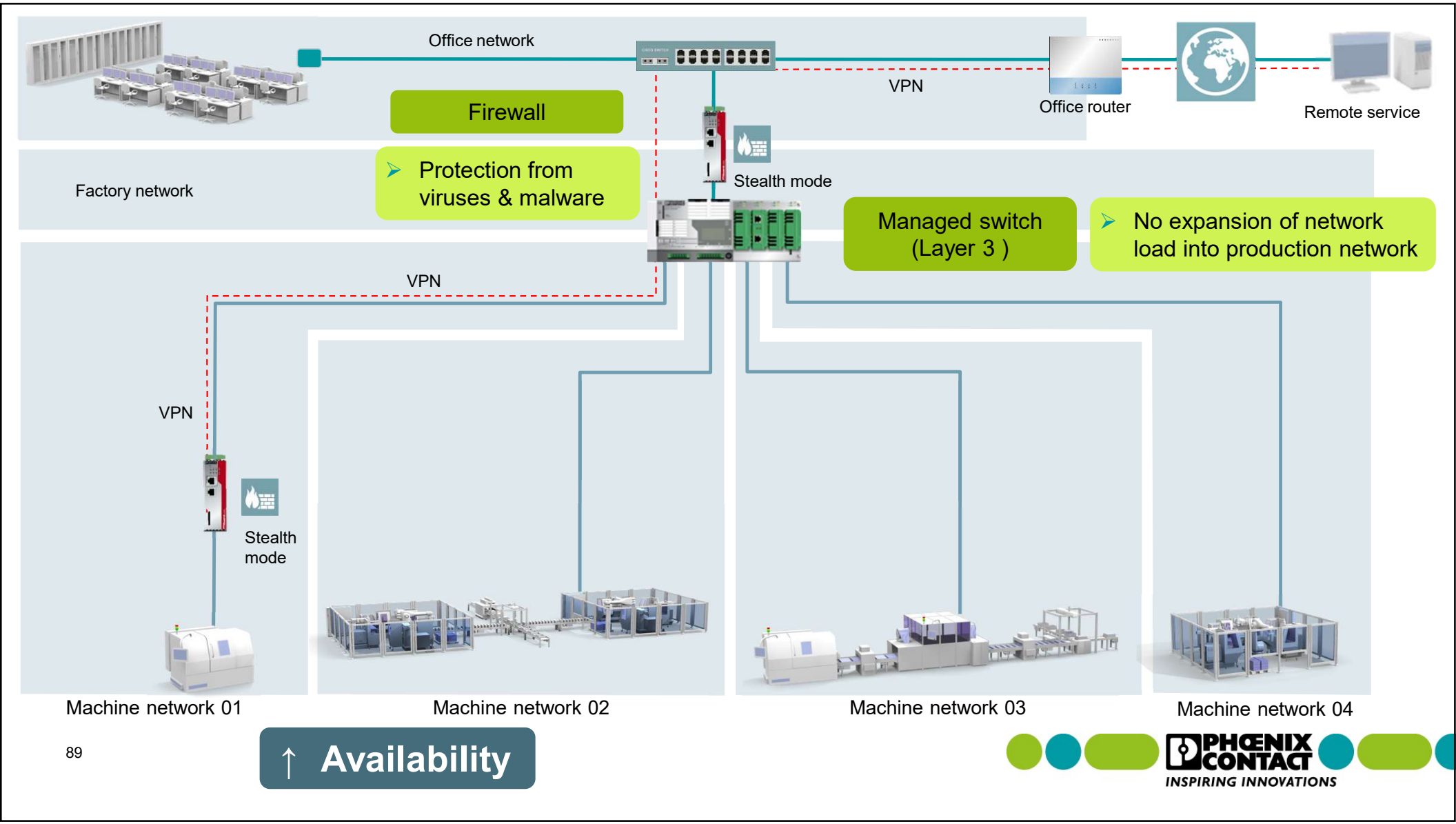
INSPIRING INNOVATIONS



↑ **Availability**

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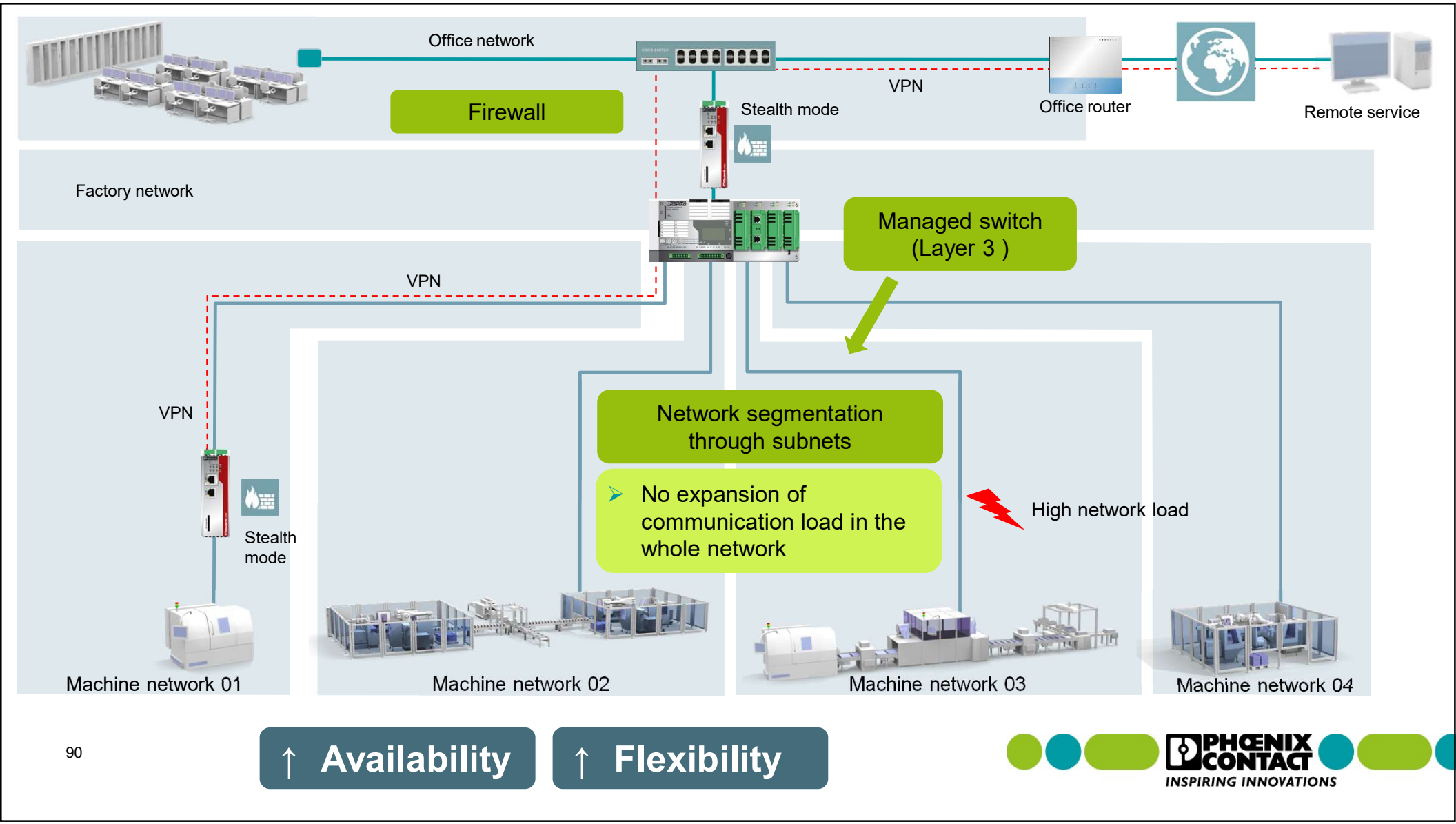

↑ Availability ↑ Flexibility

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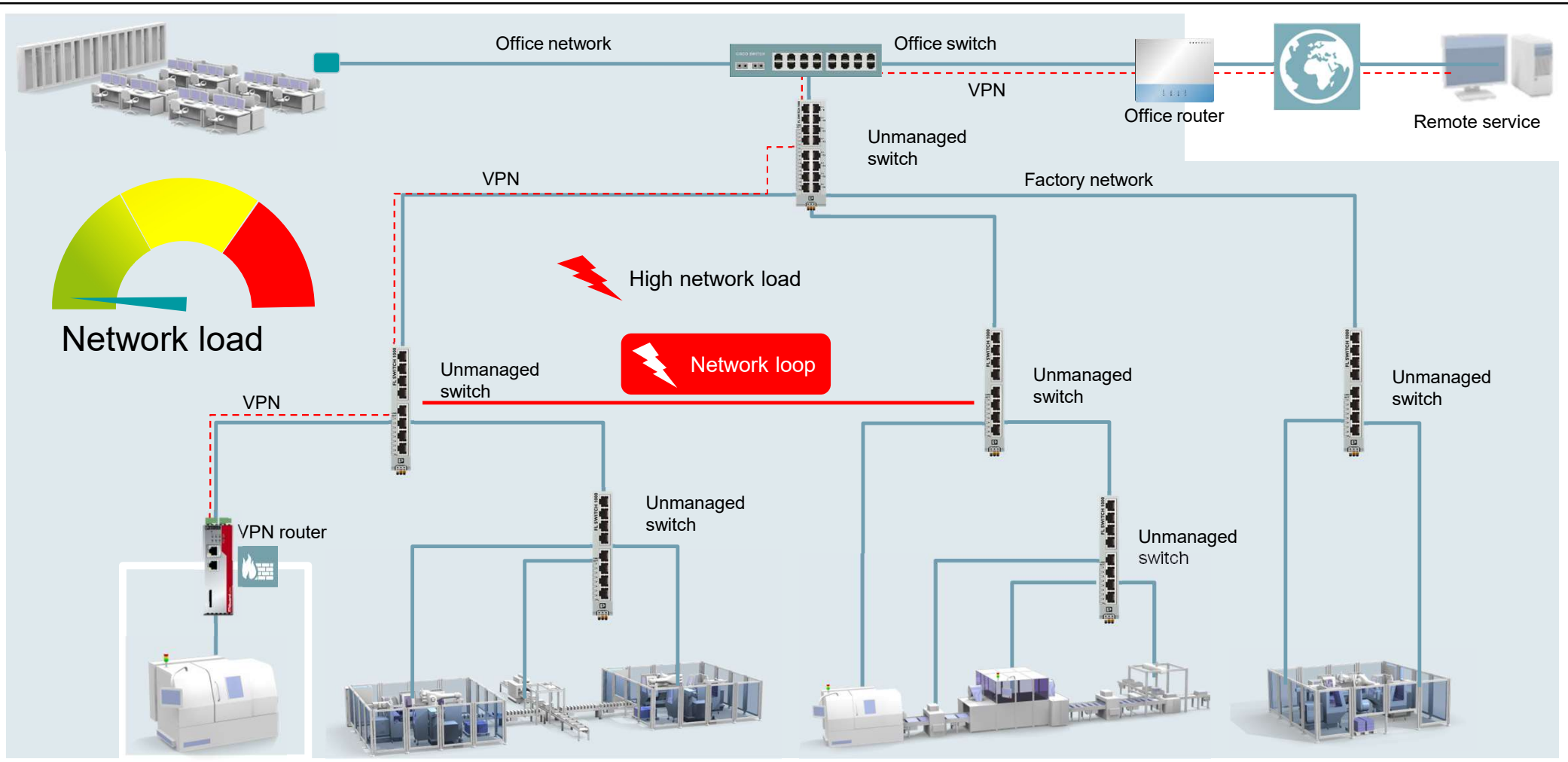

Network built with unmanaged switches

Flat production network

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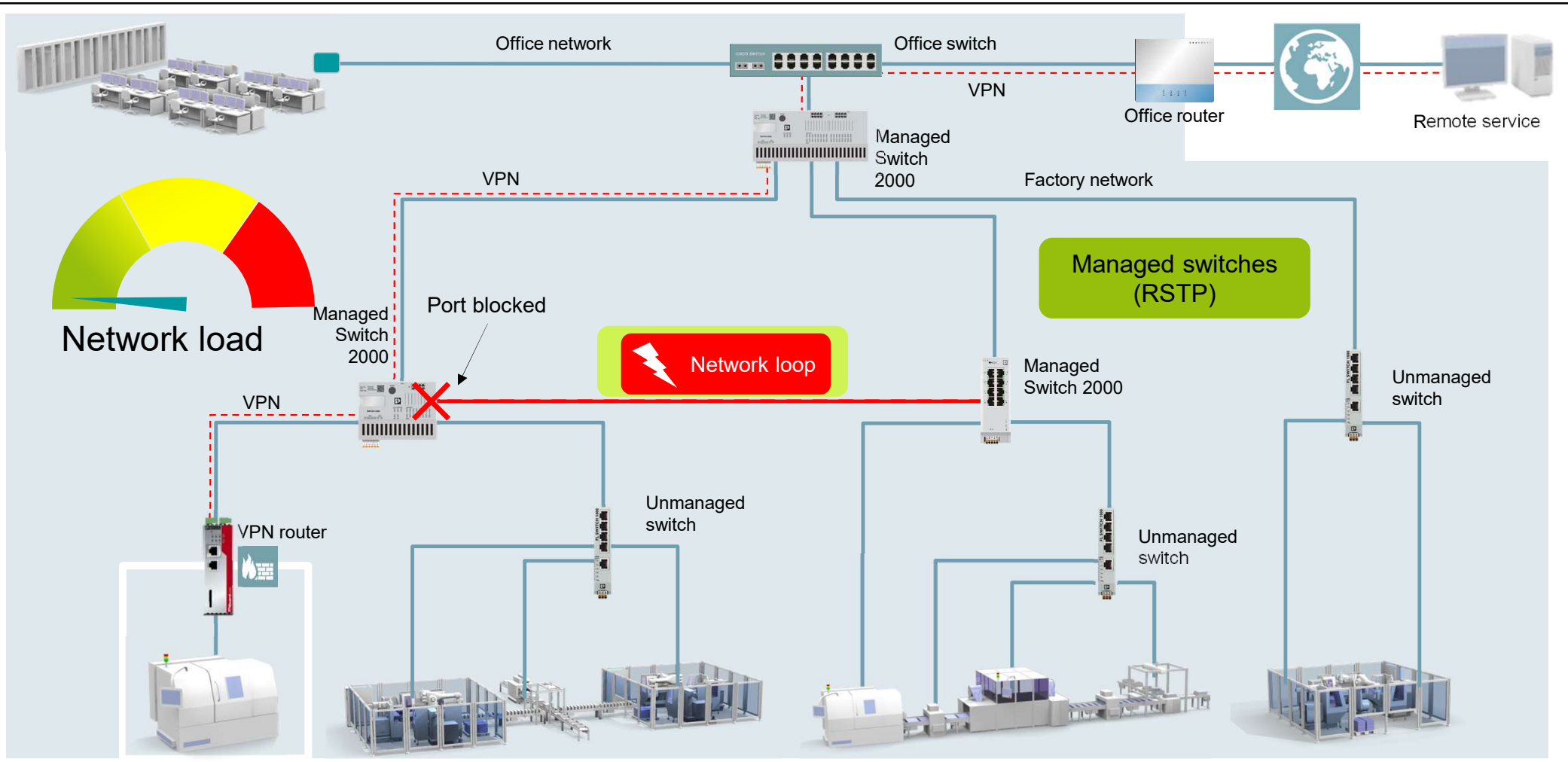

↑ **Availability**

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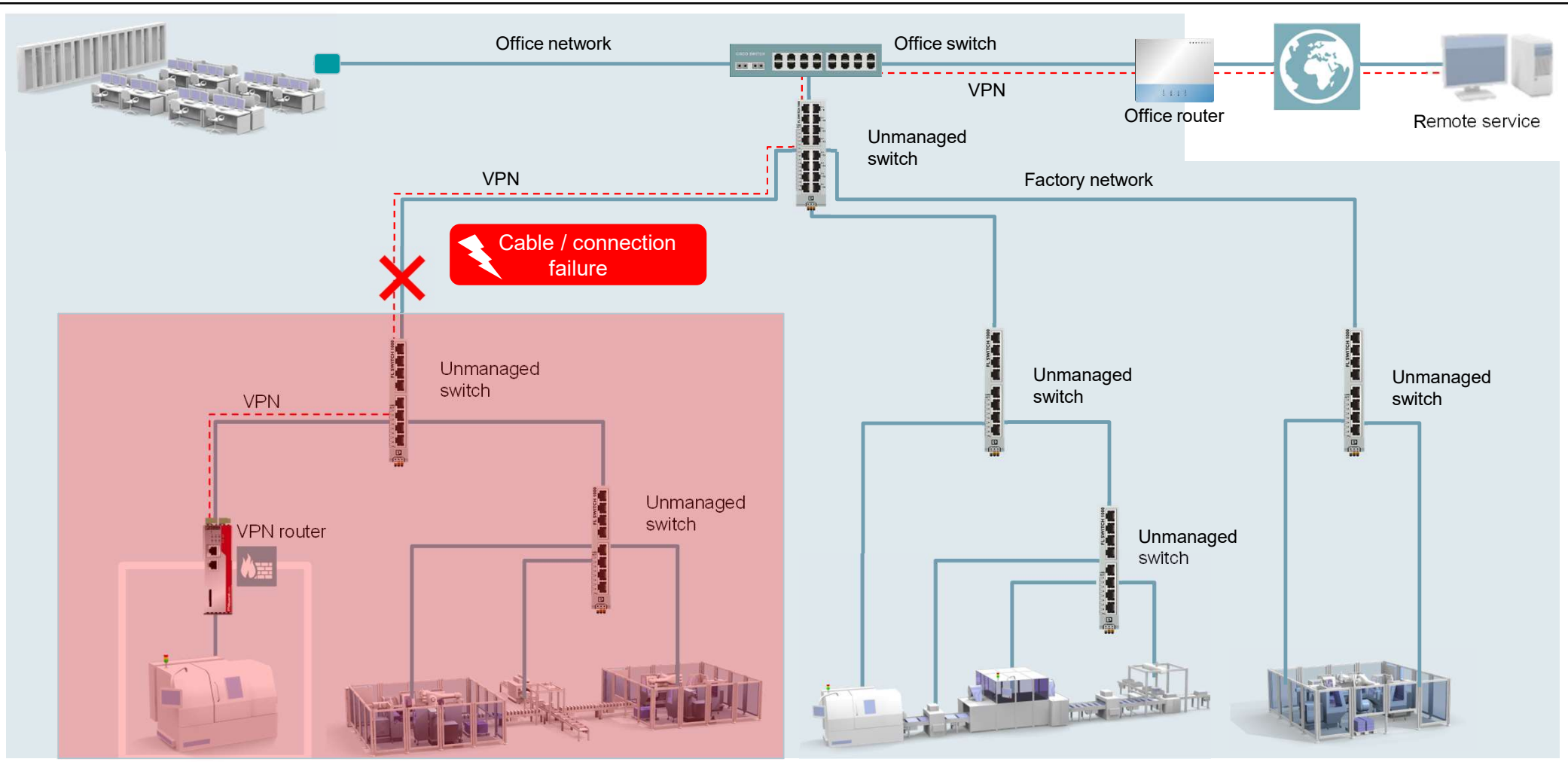

Partial failure of the network!

Network built with unmanaged switches

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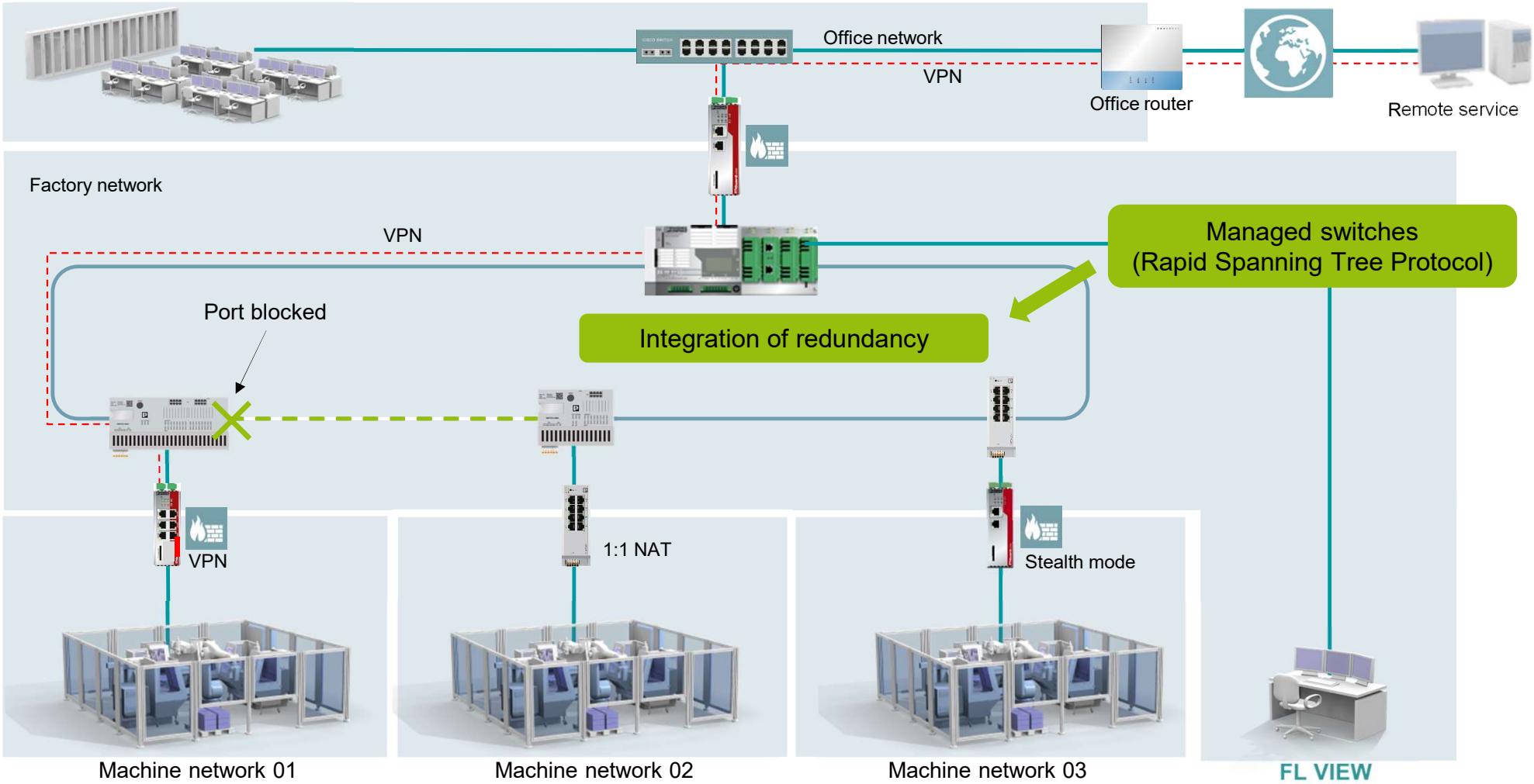

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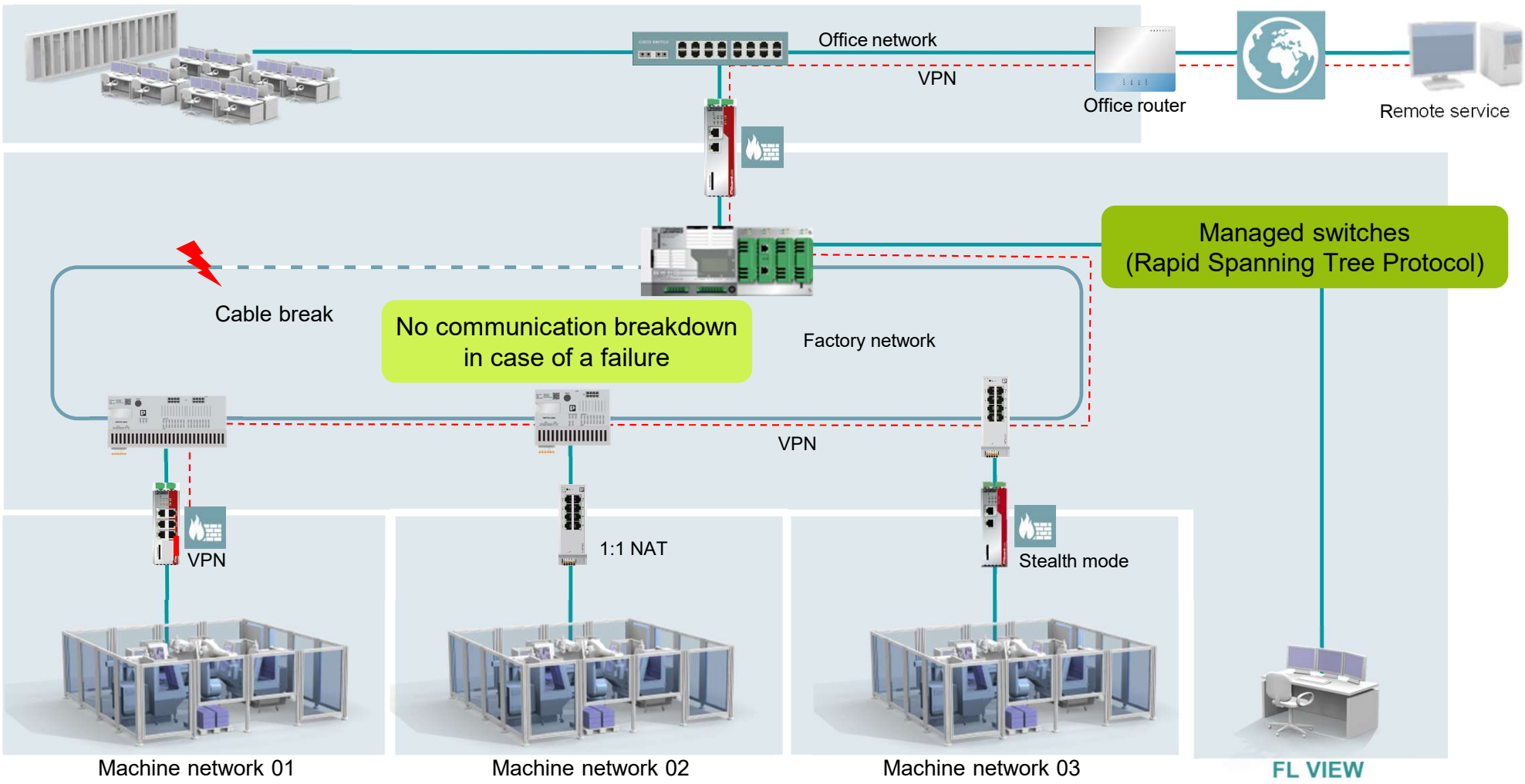

↑ **Availability**

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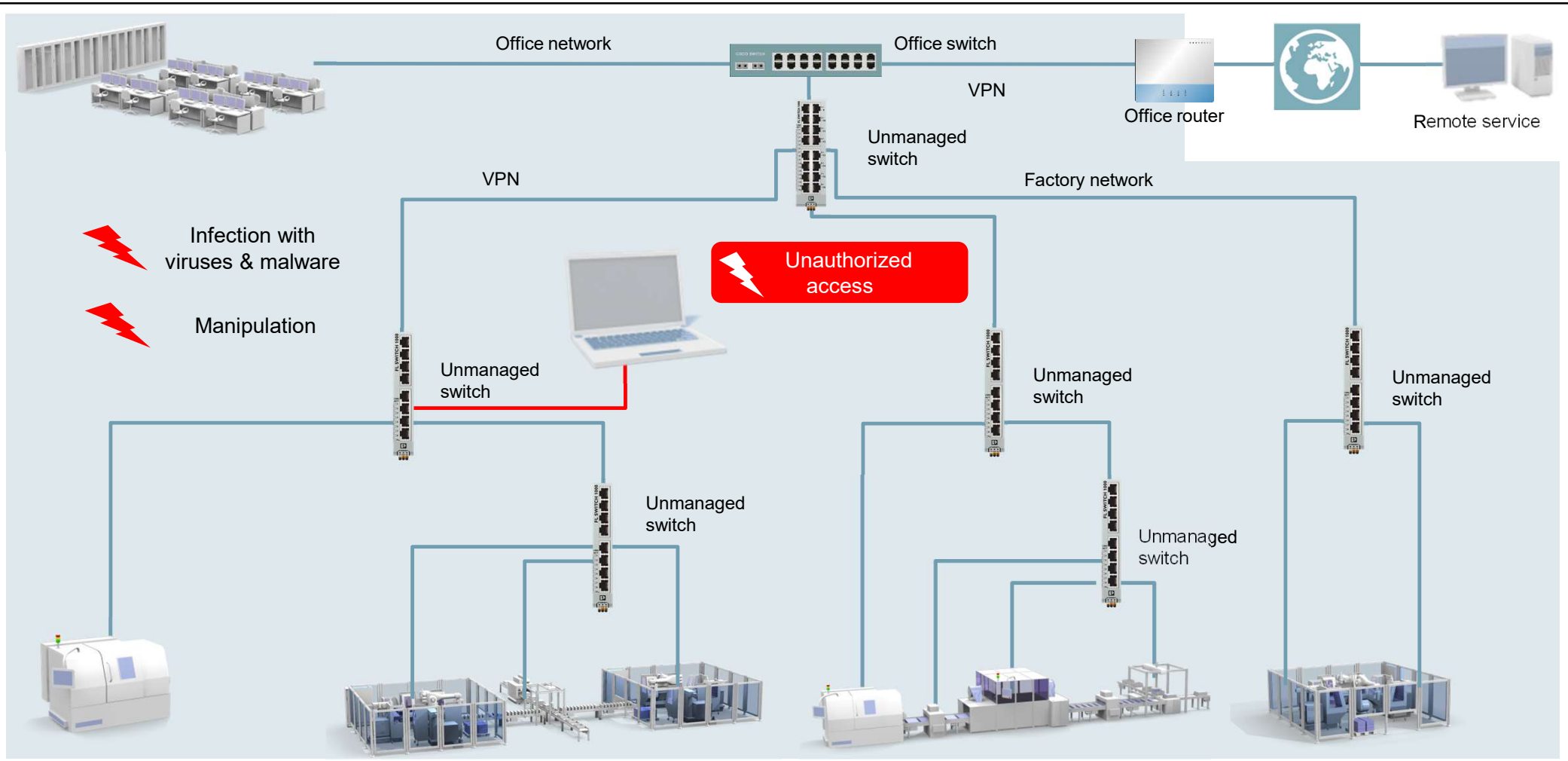

Network built with unmanaged switches

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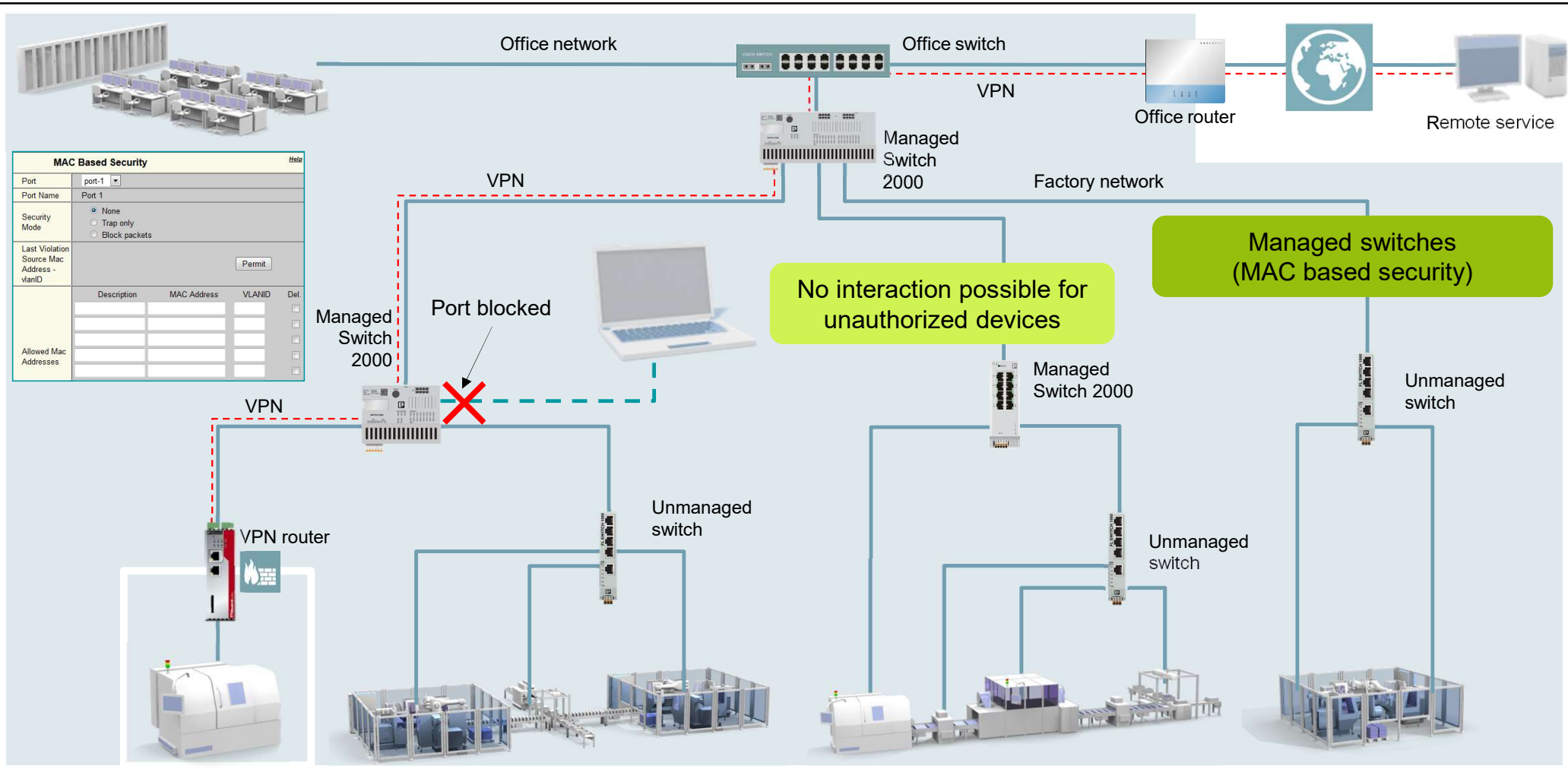

↑ **Availability**

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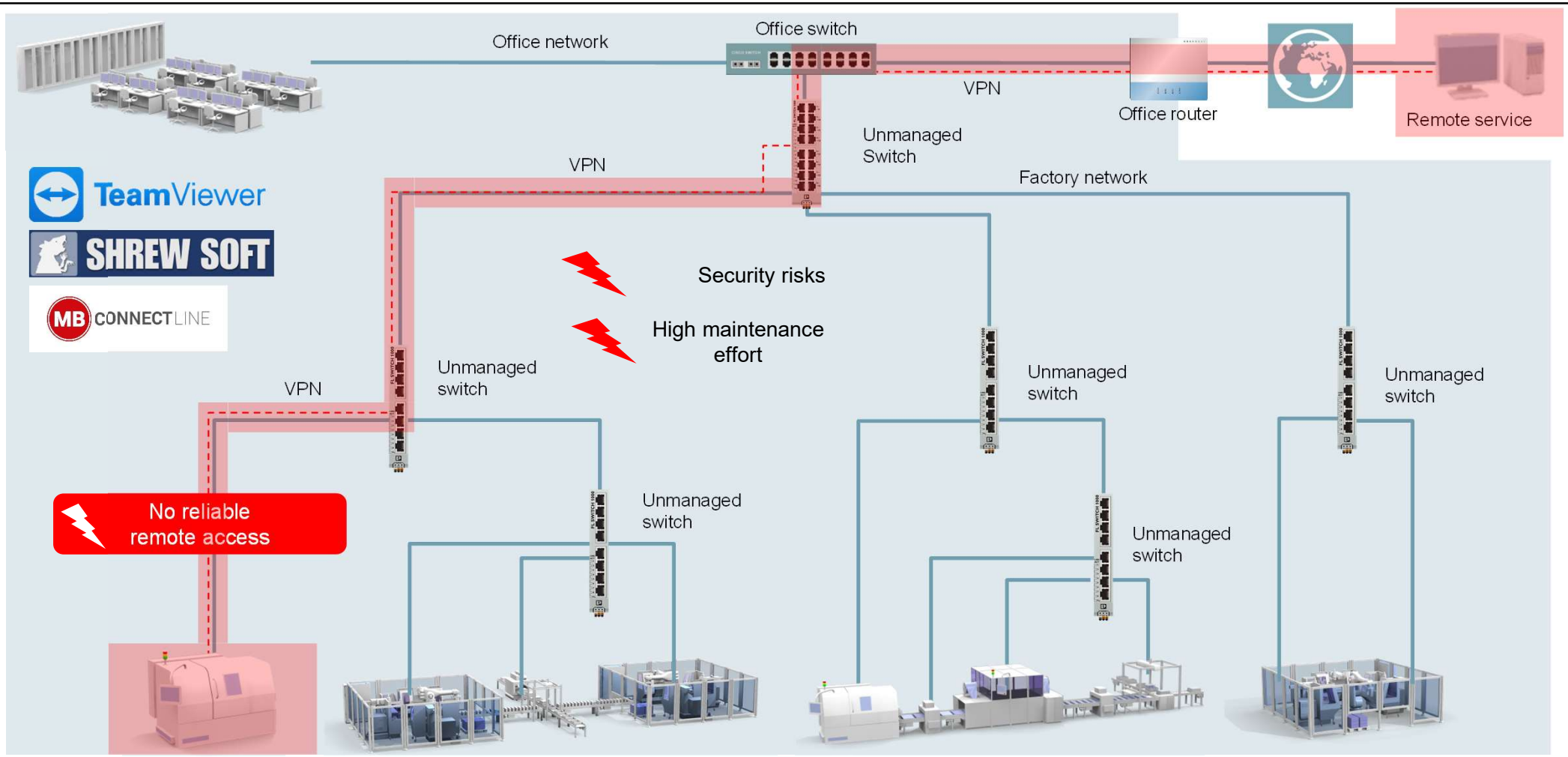

No remote service available in necessary situations!

No standardized remote access concept

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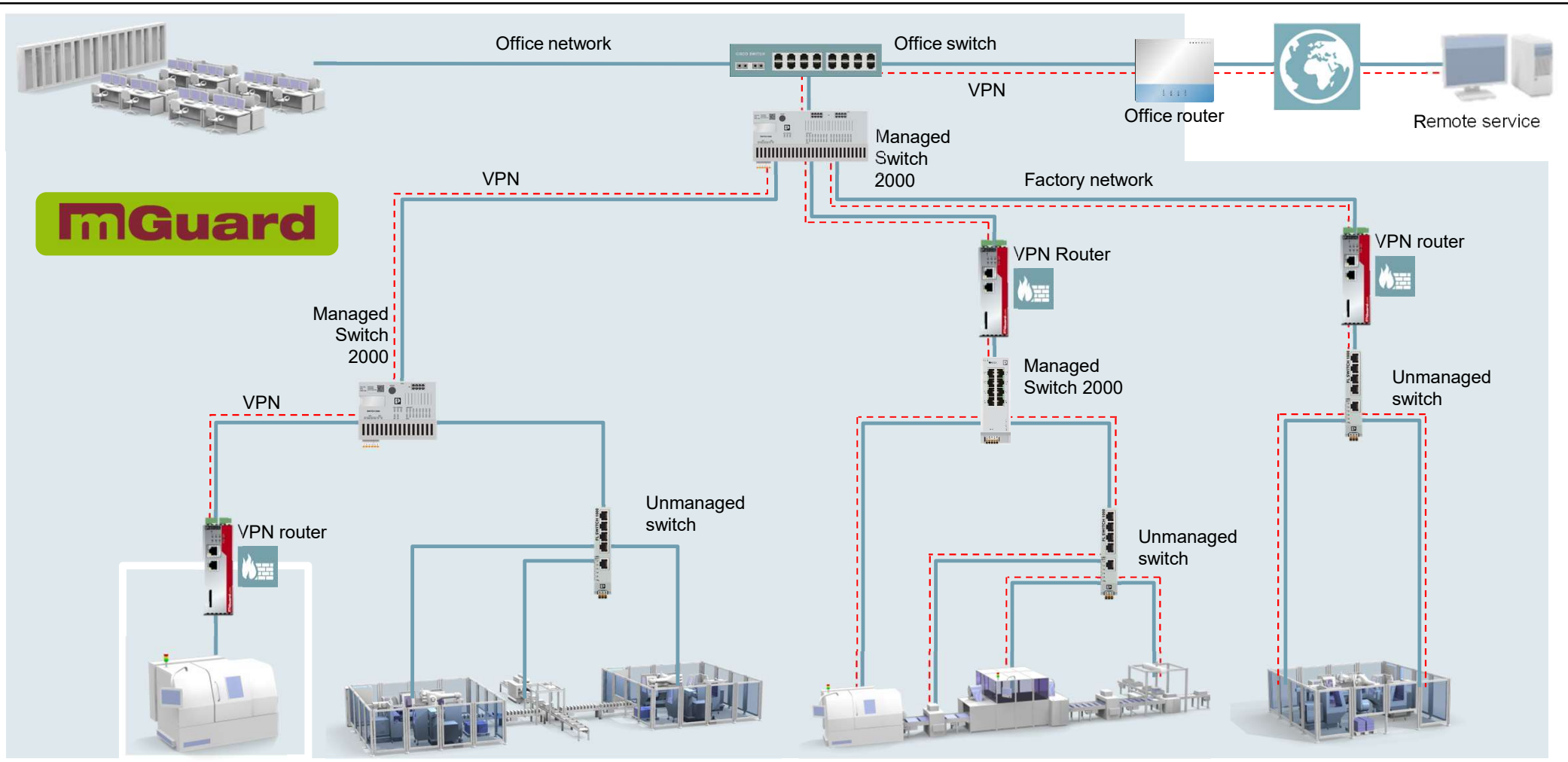
INSPIRING INNOVATIONS



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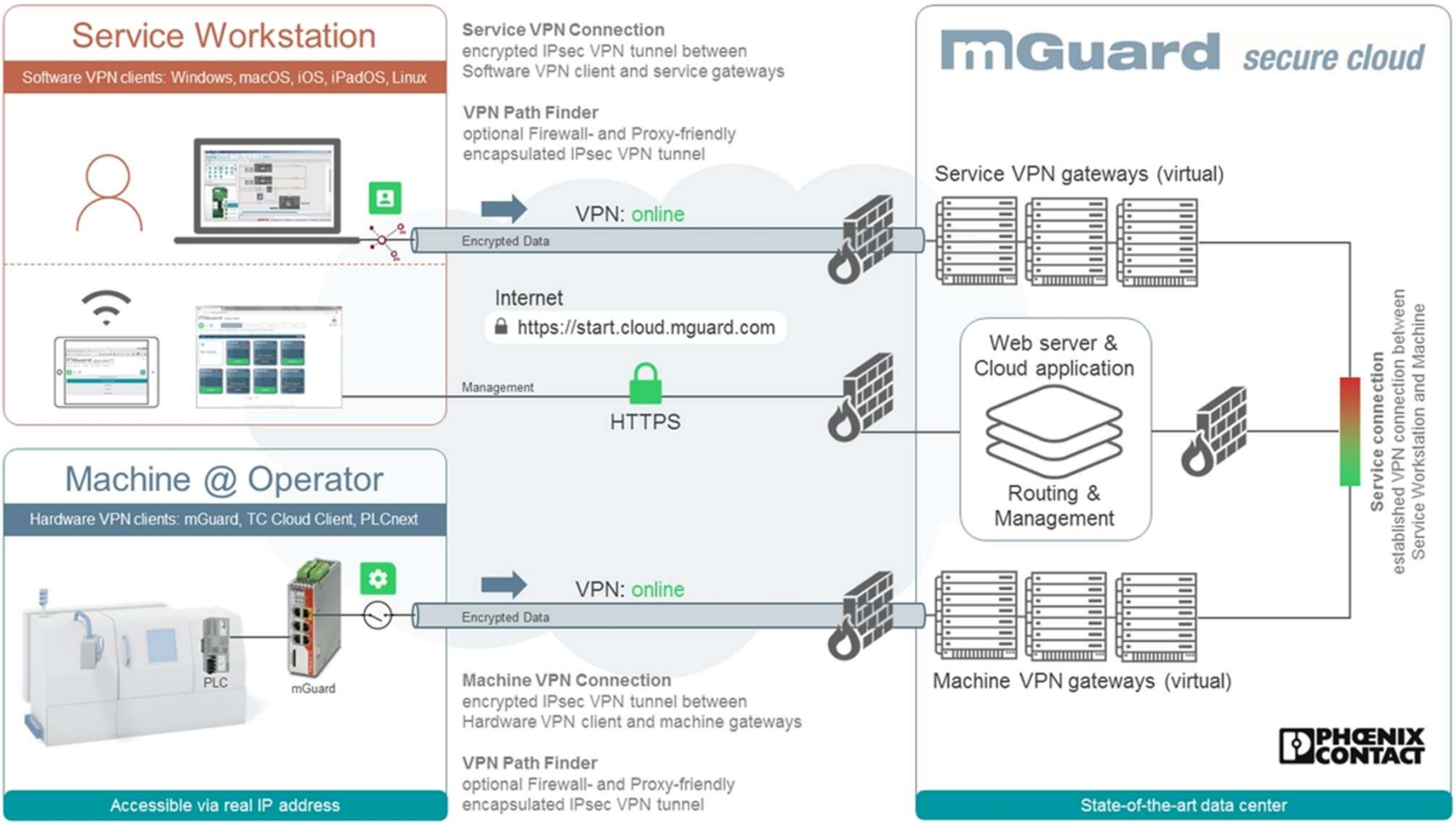
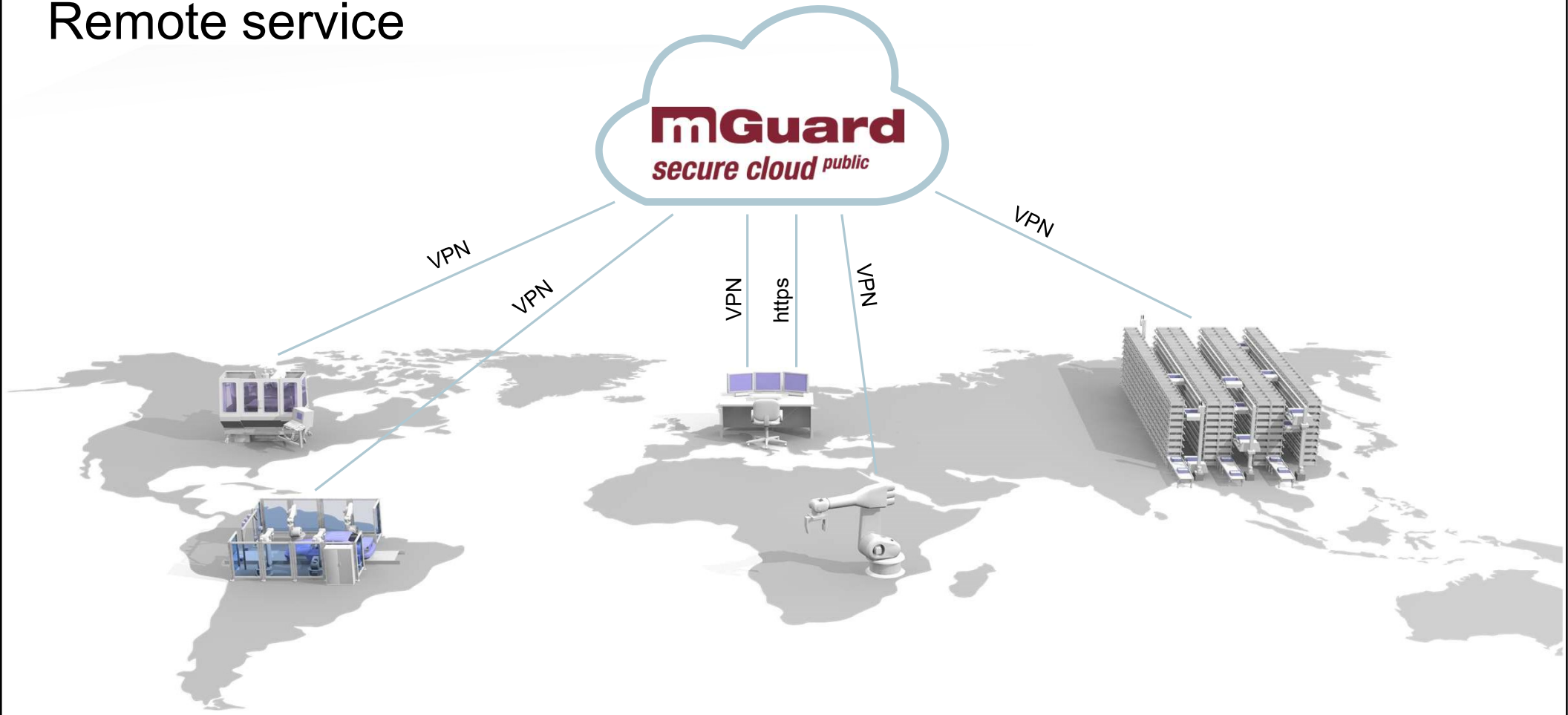


Remote service



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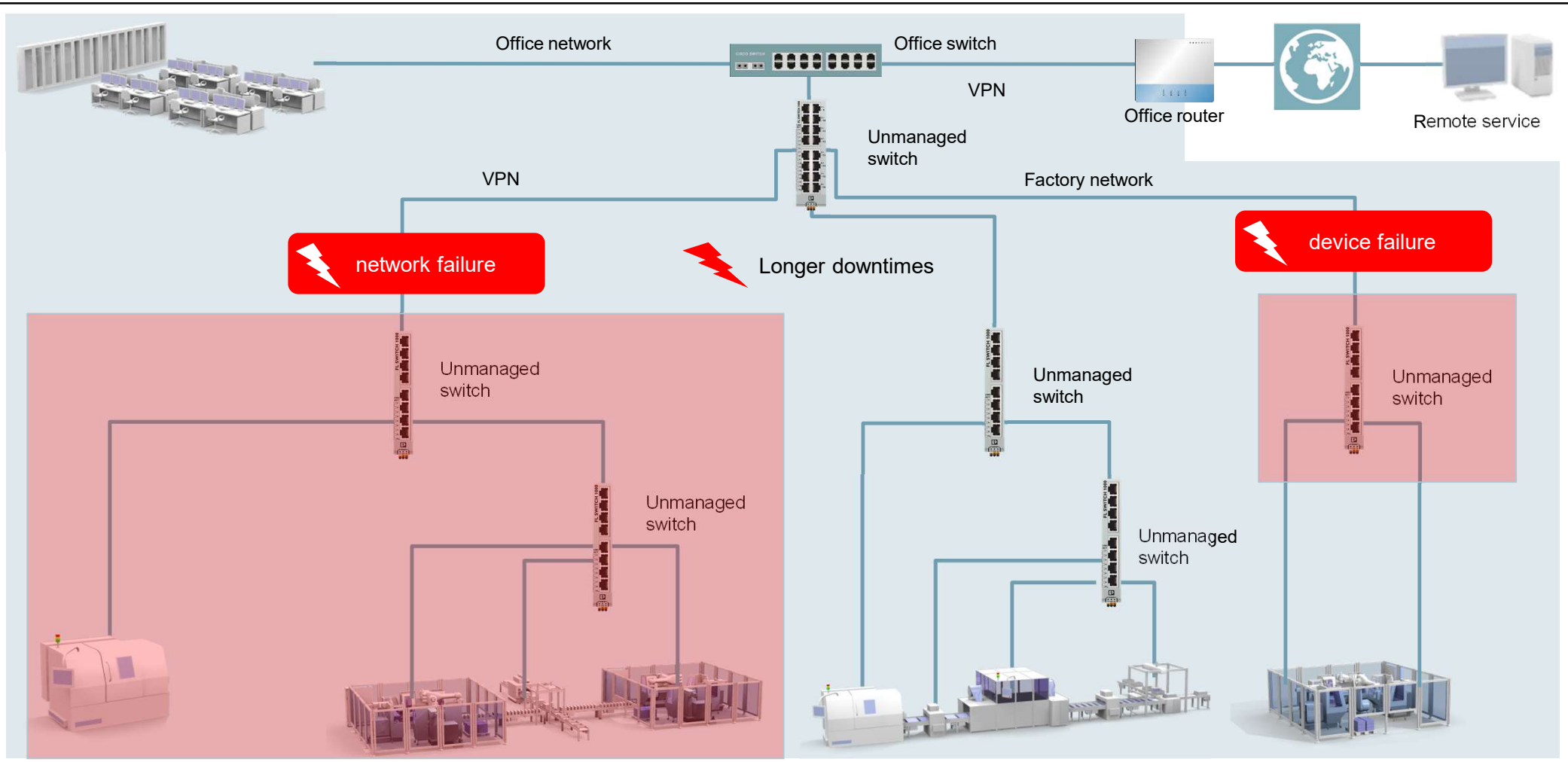

Lack of network expertise in production

Tense relationship between production and IT

Network built with unmanaged switches

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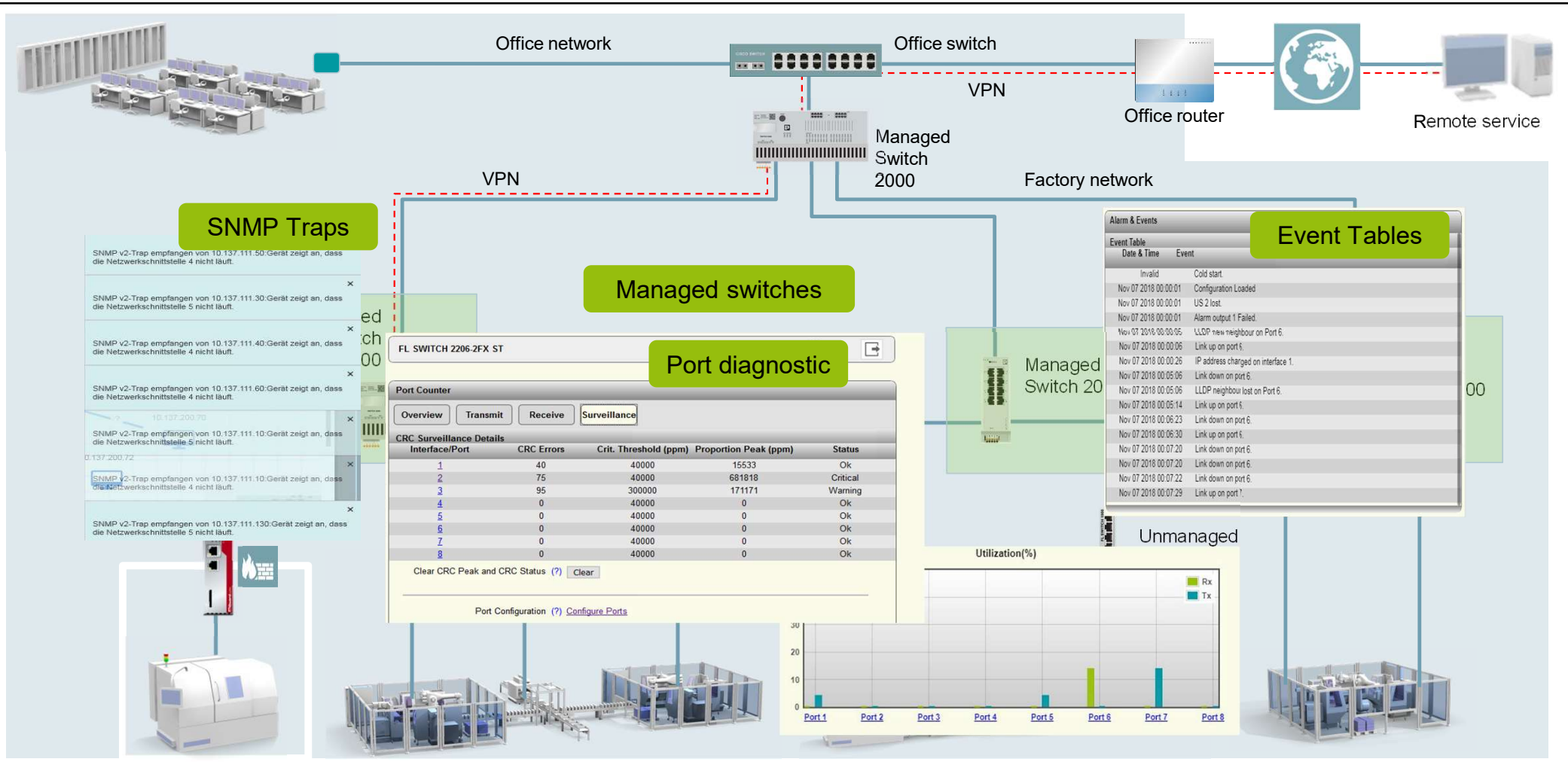

↑ Availability ↑ Flexibility

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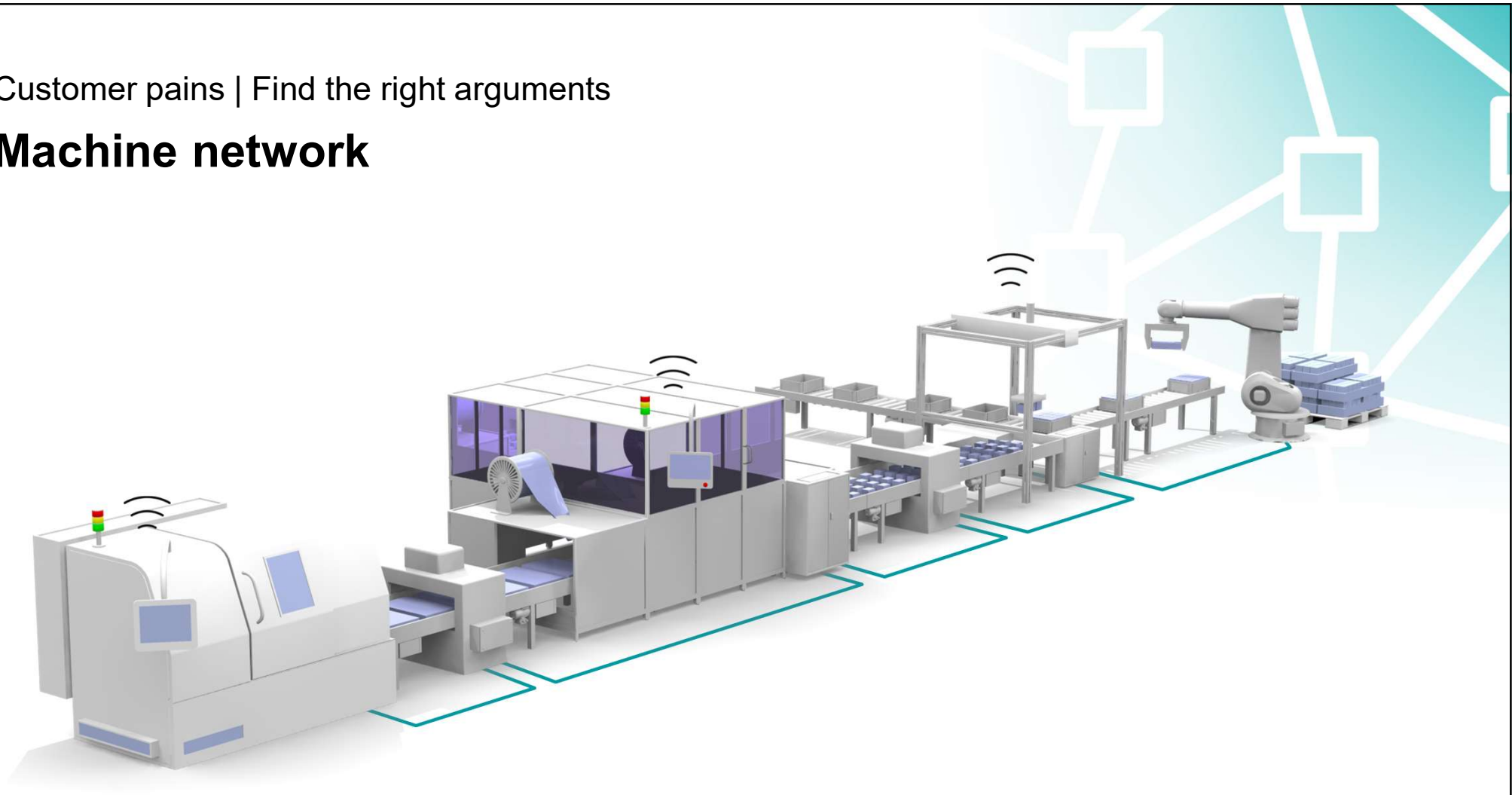
Machine network



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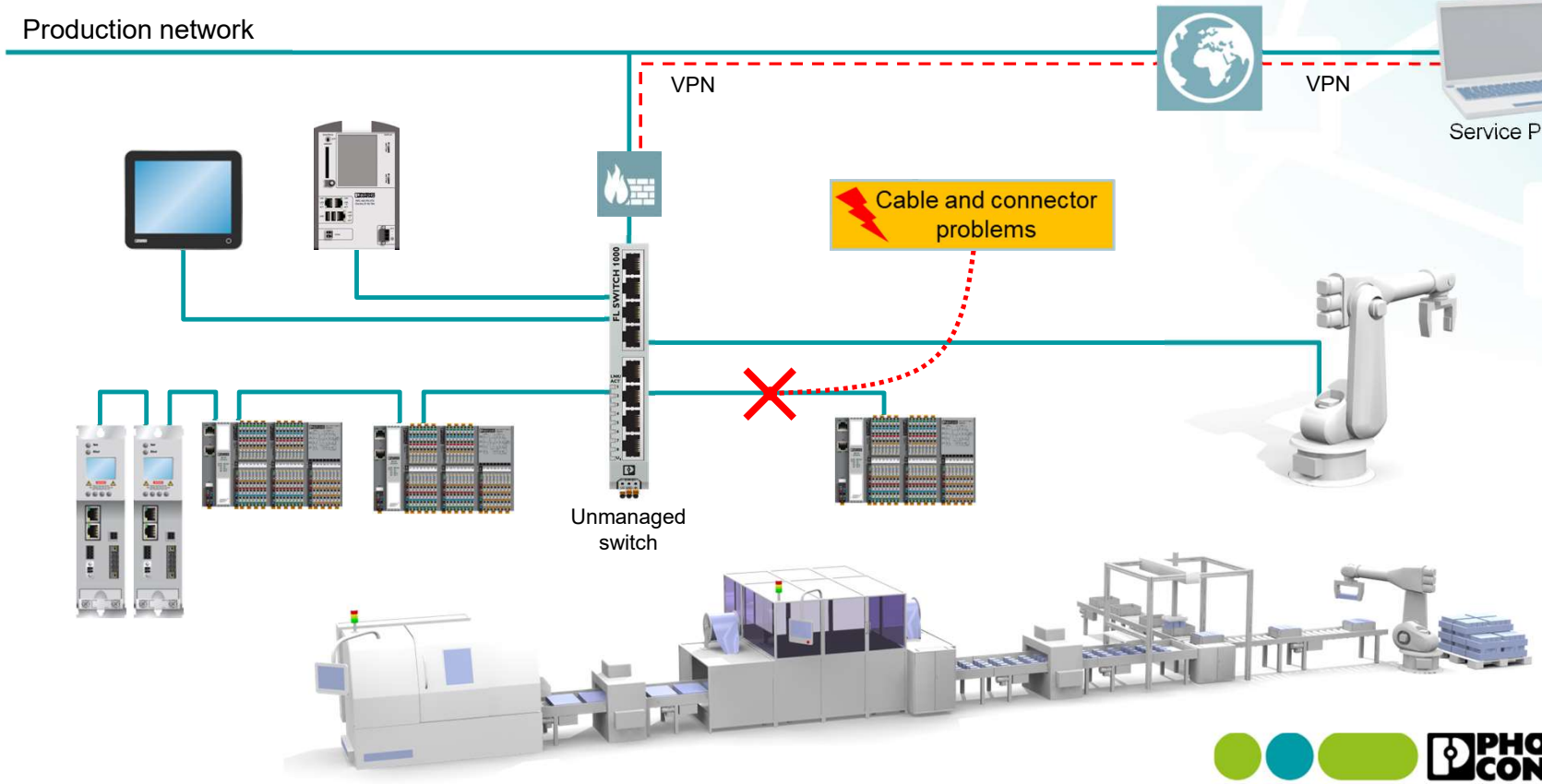
Network issue 1 – Cable and connector problems



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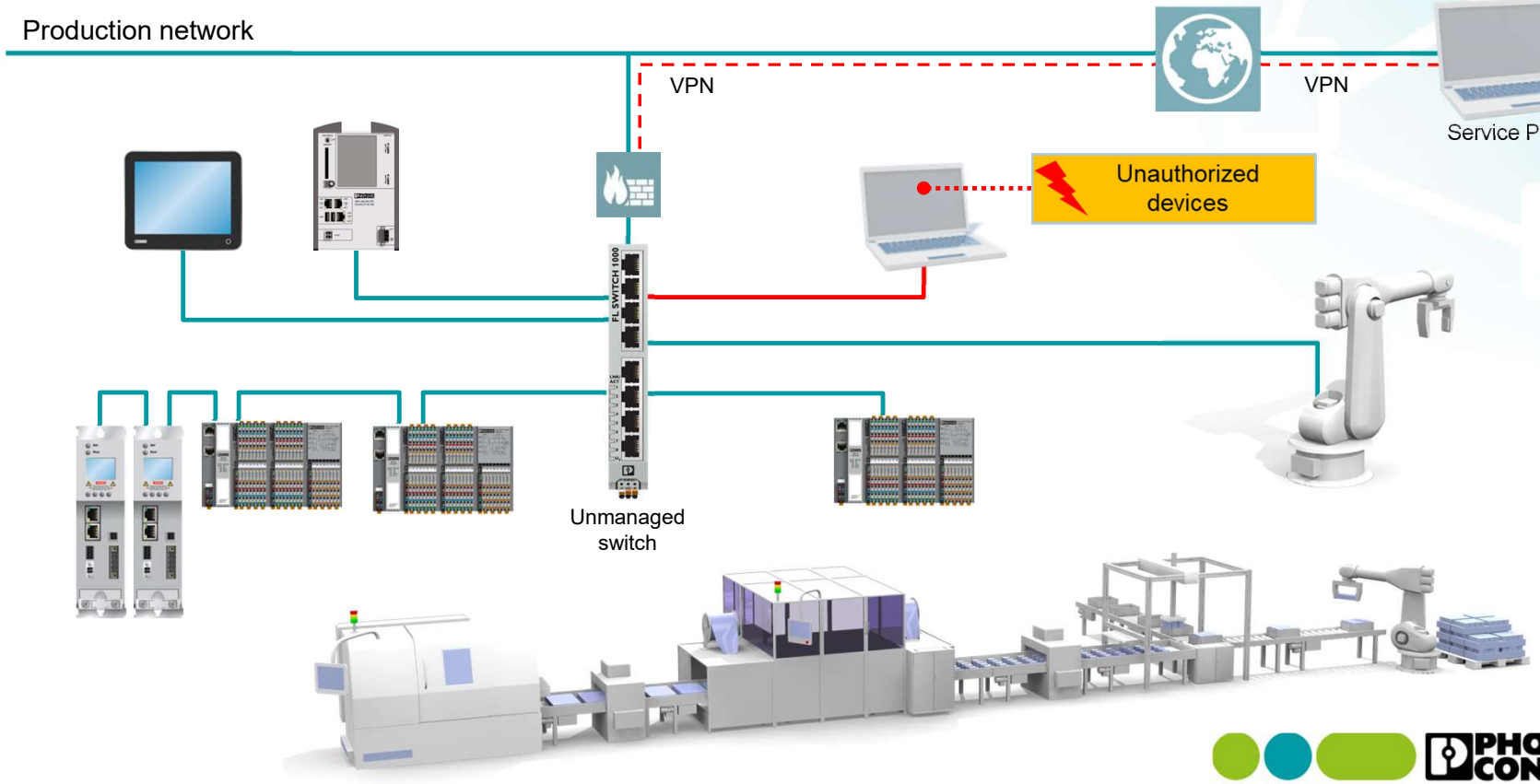
Customer pains | Machine network

Network issue 2 – Unauthorized devices



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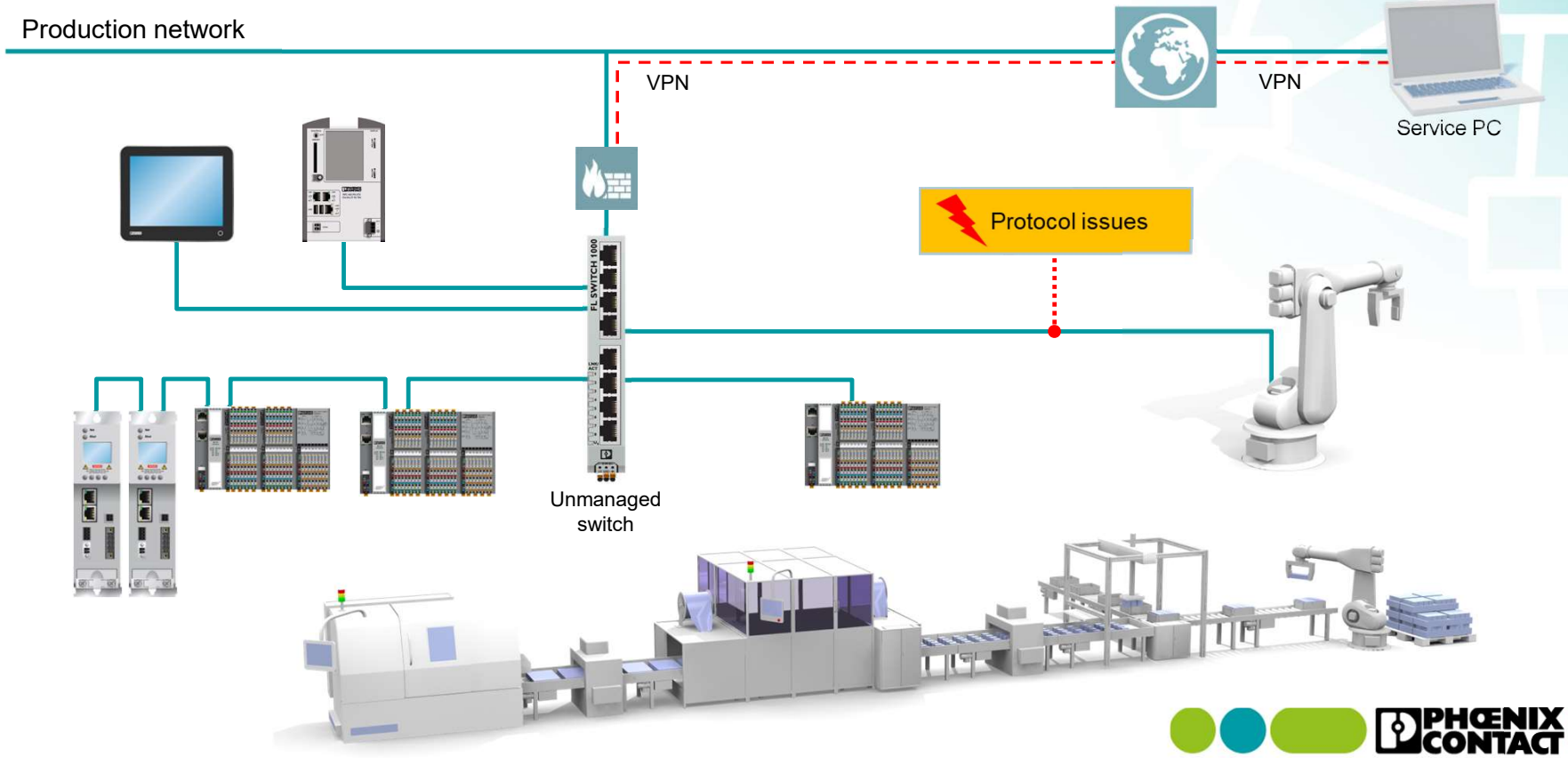
Customer pains | Machine network

Network issue 3 – Protocol issues



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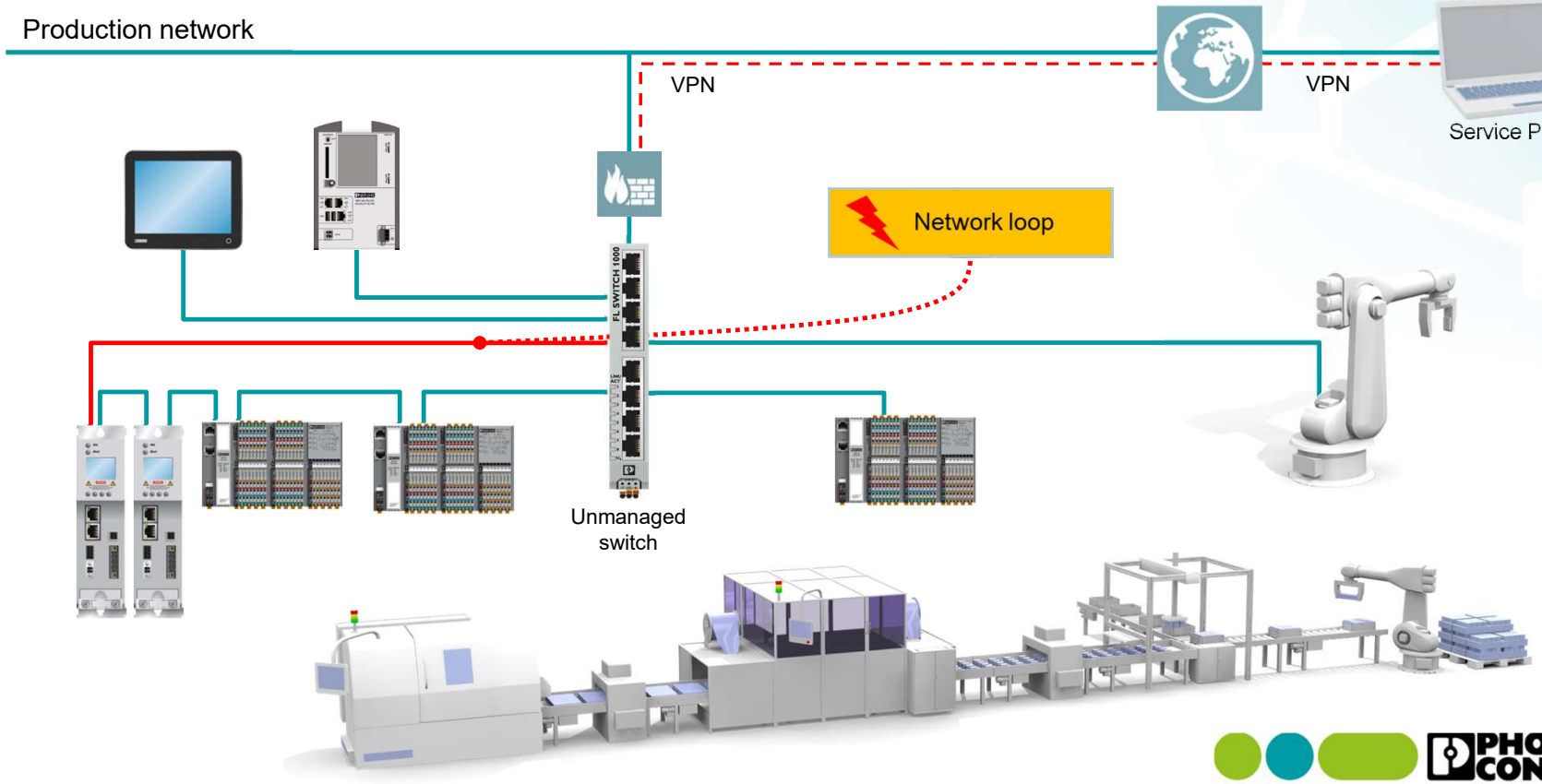
Customer pains | Machine network

Network issue 4 – Network loops



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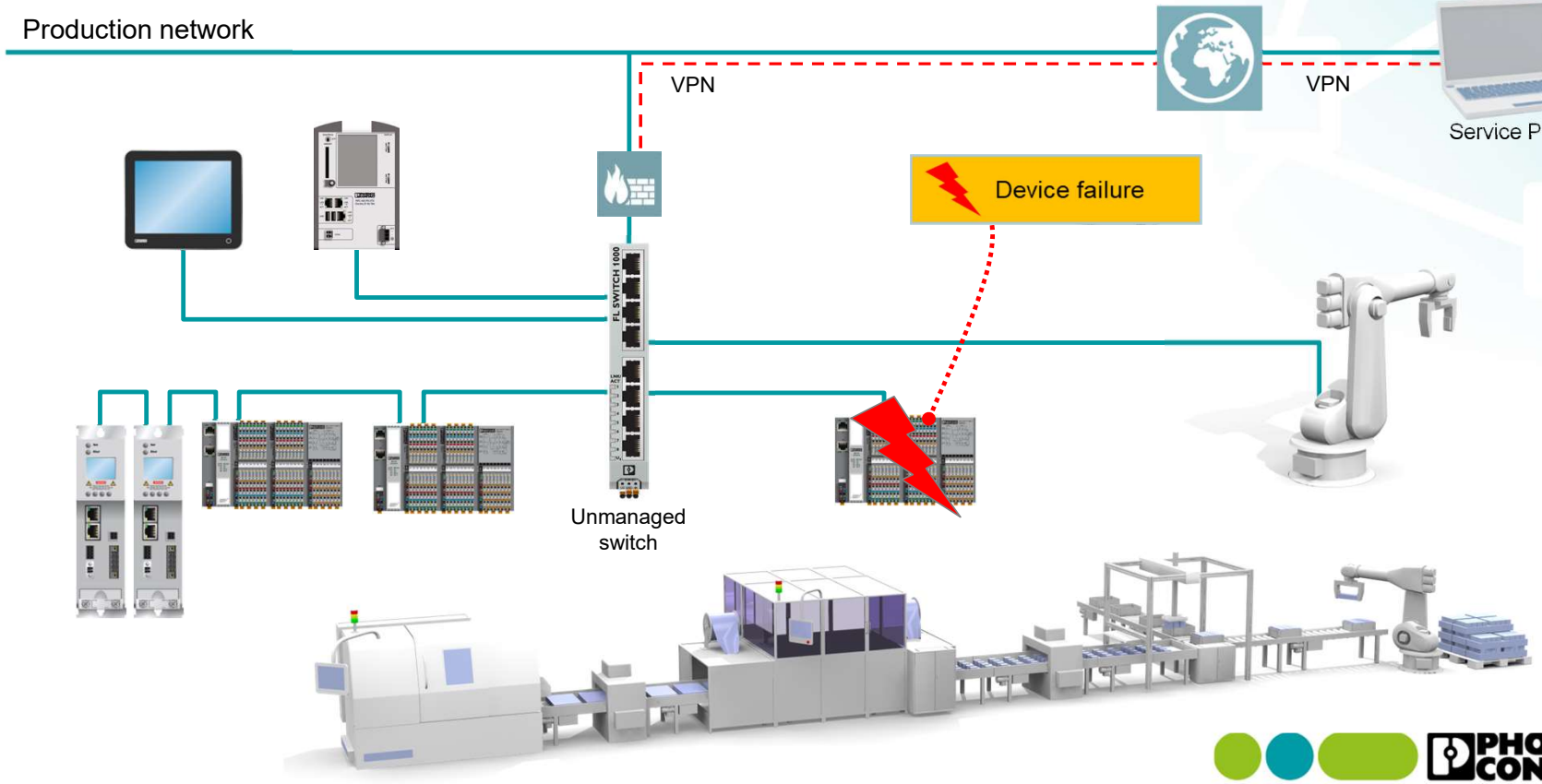
Customer pains | Machine network

Network issue 5 – Device failure



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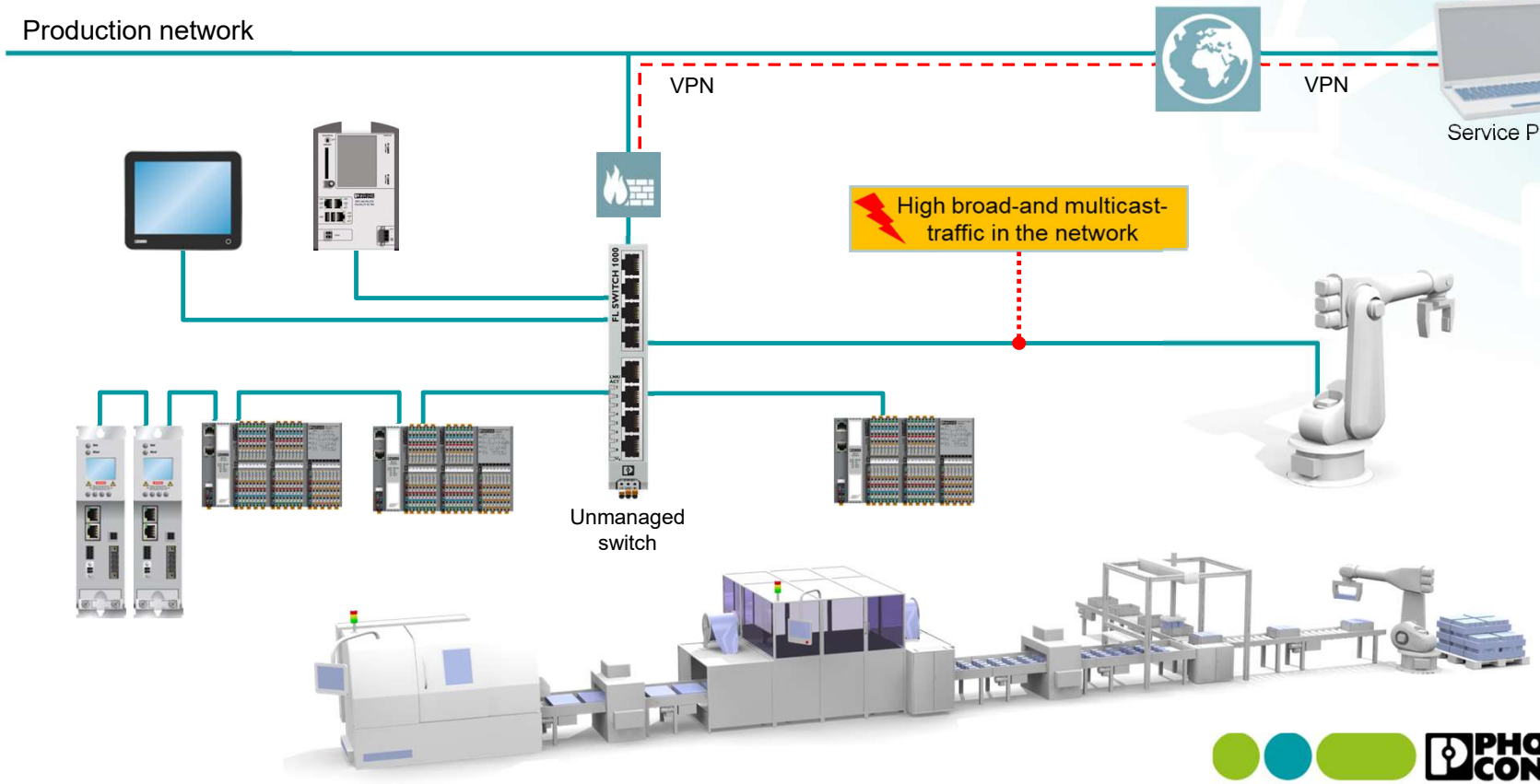
Network issue 6 – High broadcast and multicast load



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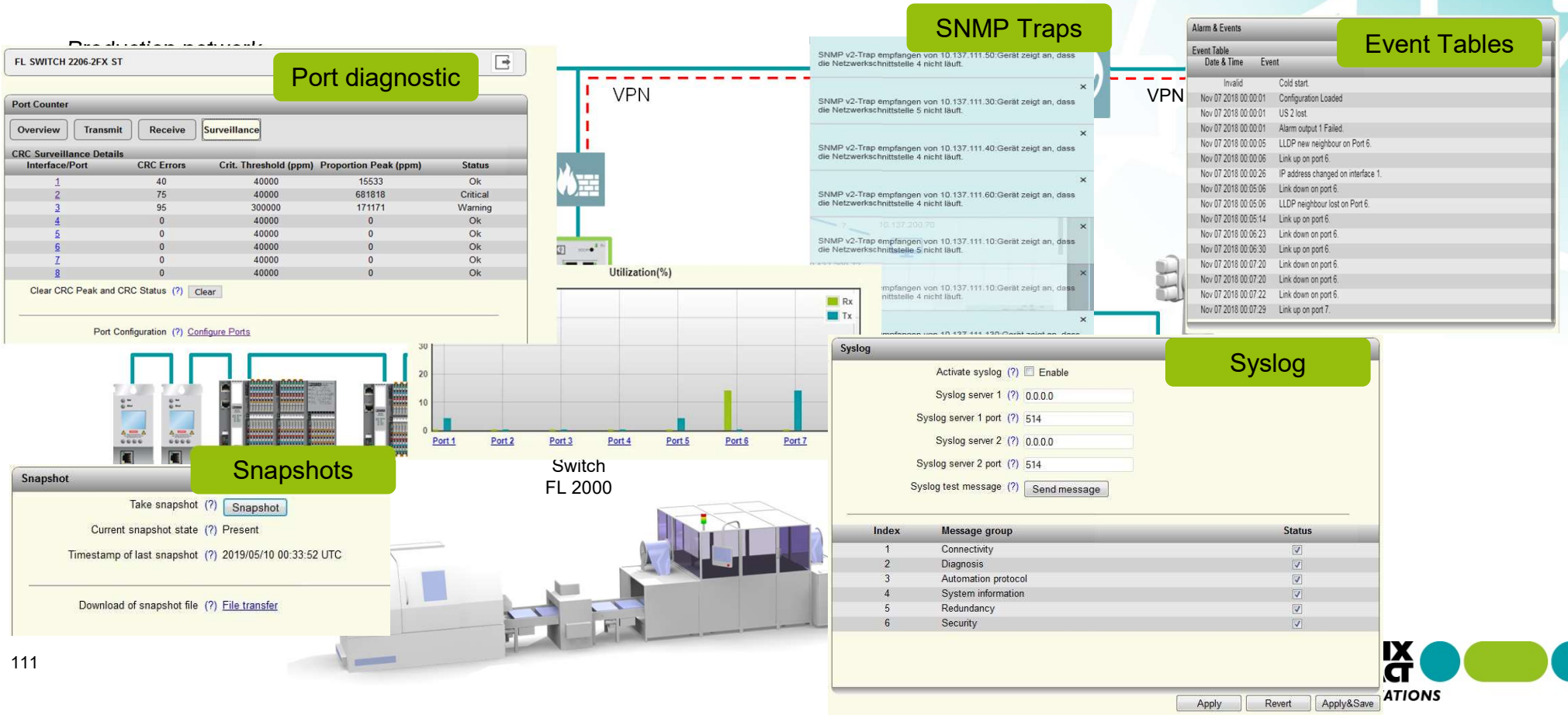
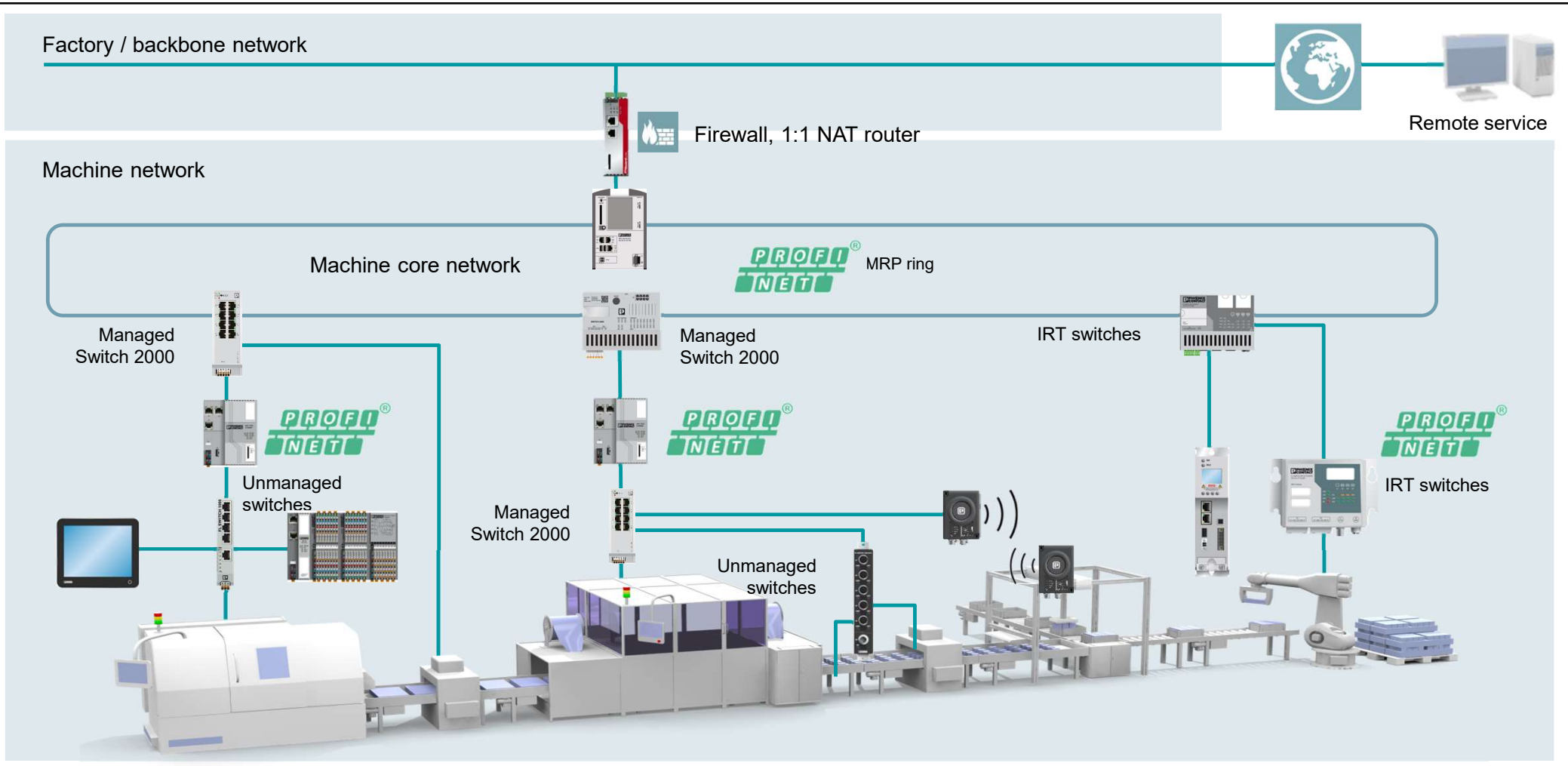
Customer pains | Machine network

Network issue 6 – Solution





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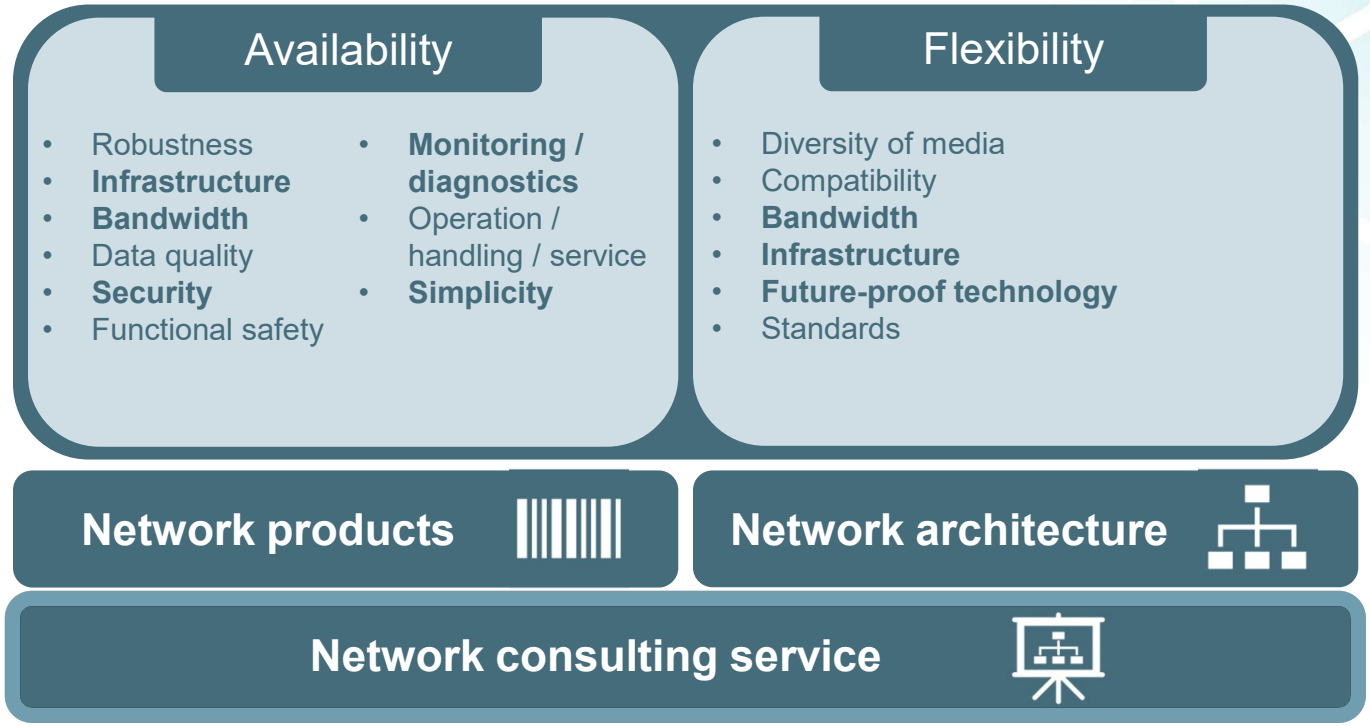
Network consulting service

Network consulting service

Maximize industrial communication for available and flexible production



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„Don’t sell - help buy!“

- Unknown

Network consulting service

Example




1st contact	Rough analysis	Network specification	Commercial success

▪ What is the customer's target?
  ▪ New network architecture
  ▪ Redesign
  ▪ Network issues
▪ What issues/pains/troubles?
▪ Topology plan available?
▪ Does he already have possible solutions in mind?
	▪ First analysis of existing network architecture
	▪ What are requirements?
	▪ Explain importance of performant, flexible and sustainable network
	▪ Further questions to the customer
		▪ Specification
		▪ Commitment
			▪ Order
			▪ Contract
			▪ SLA

➢ **Meeting for a deeper rough analysis**	➢ **Order for network specification**	➢ **Specification of a network architecture**	➢ **Sustainable commercial success**

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

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

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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 €
Unauthorizesed 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				

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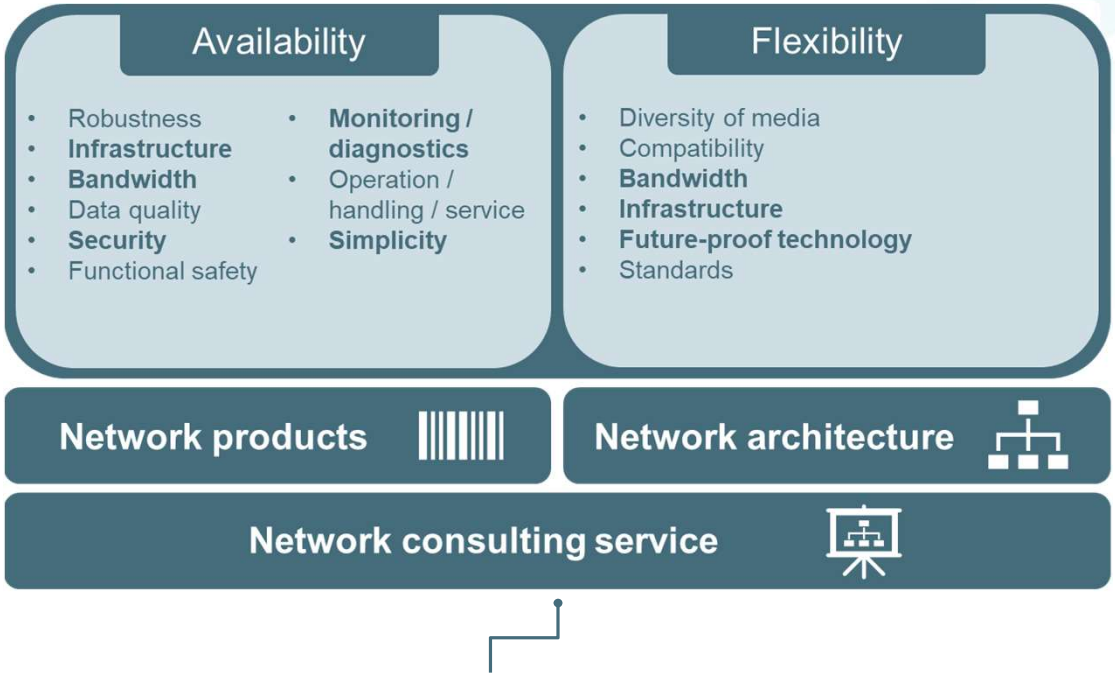
Smart automation network

Key takeaways

Avaliablity 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

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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 adresses
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 adresses
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 prameters
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 standardbased 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 possible to specify MAC addresses that are permitted to access the network. All other addresses are denied access.

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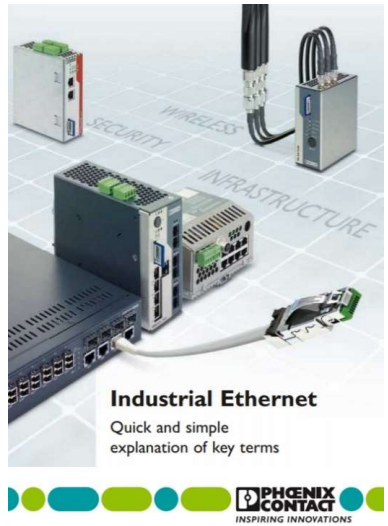
Glossary

Profinet	Ethernet communication model from field level to control level.
PSIRT	Product Security Incident Response act similar to CERT (Computer Emergancy 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 authentification	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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Digital Factory

Smart automation network

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DIGITAL FACTORY NOW

Summary

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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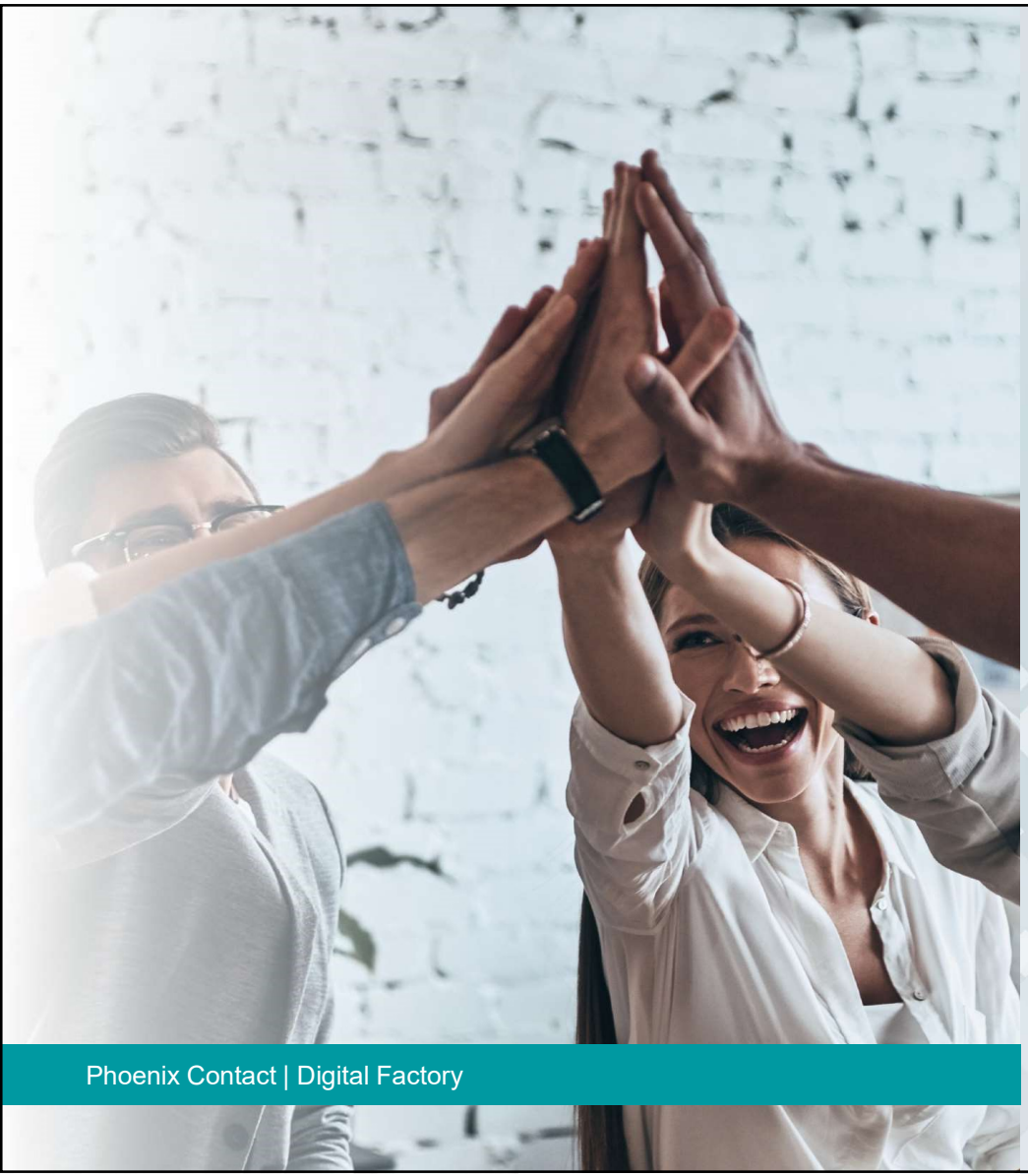

Phoenix Contact | Digital Factory

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NOW