

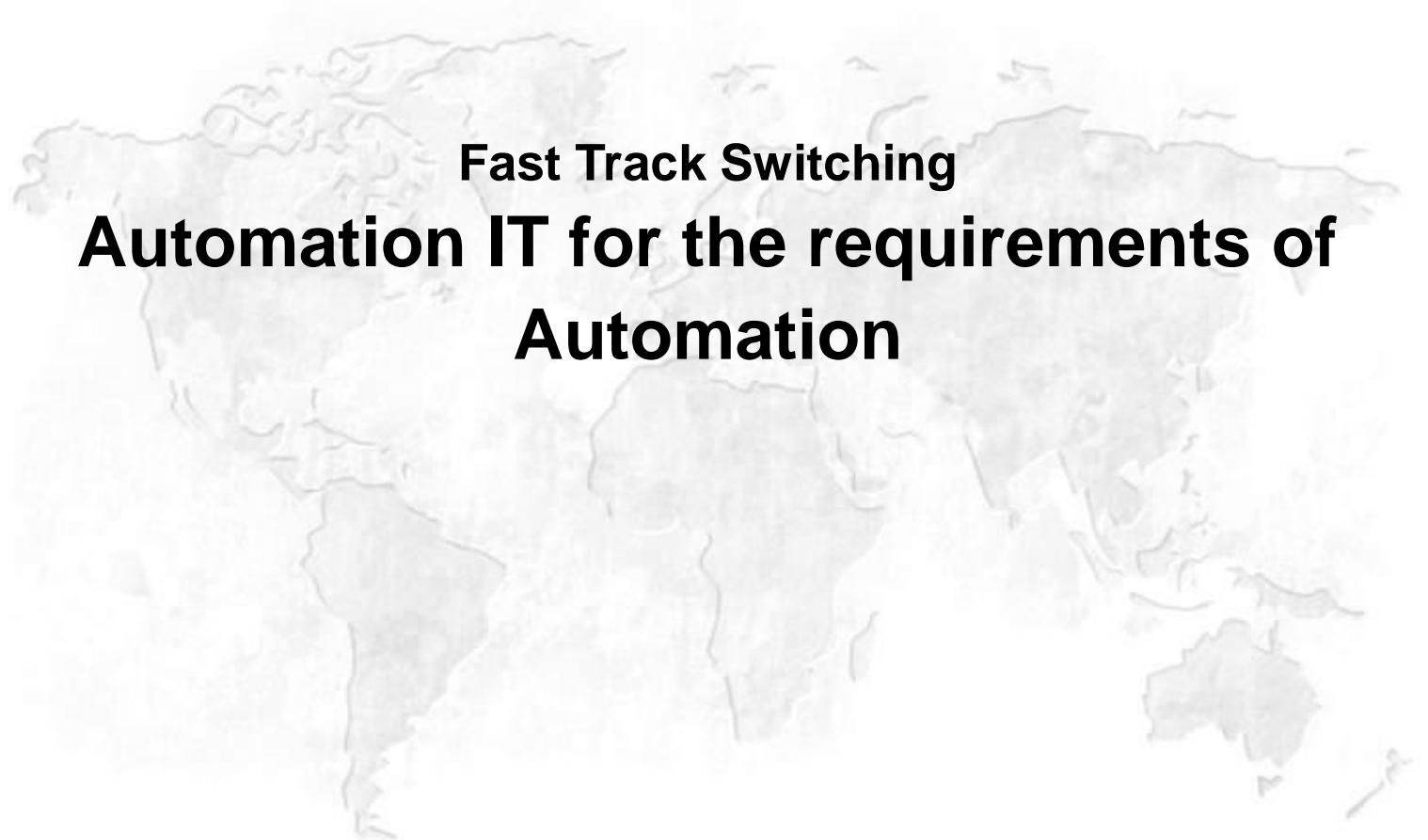


Pushing Performance

**HARTING**  
Technology  
Group

**Fast Track  
Switching**

People | Power | Partnership



**Fast Track Switching**  
**Automation IT for the requirements of**  
**Automation**



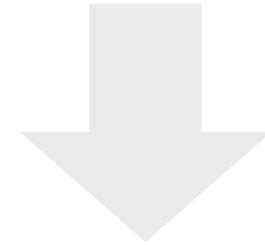
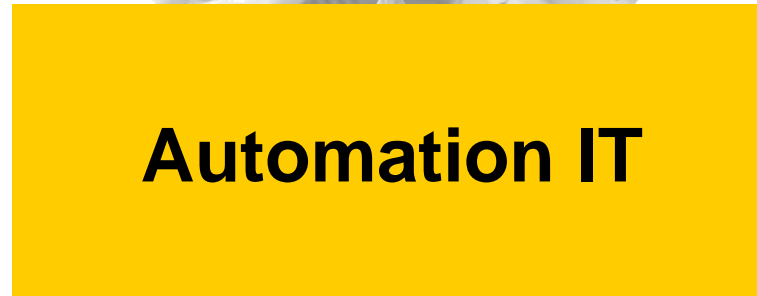
# Automation IT

Pushing Performance

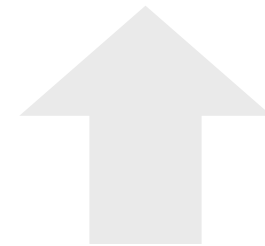
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*Ethernet  
IEEE 802.3*



**One network for all applications:  
In the office, in the production area, in the plant and in the  
machine**



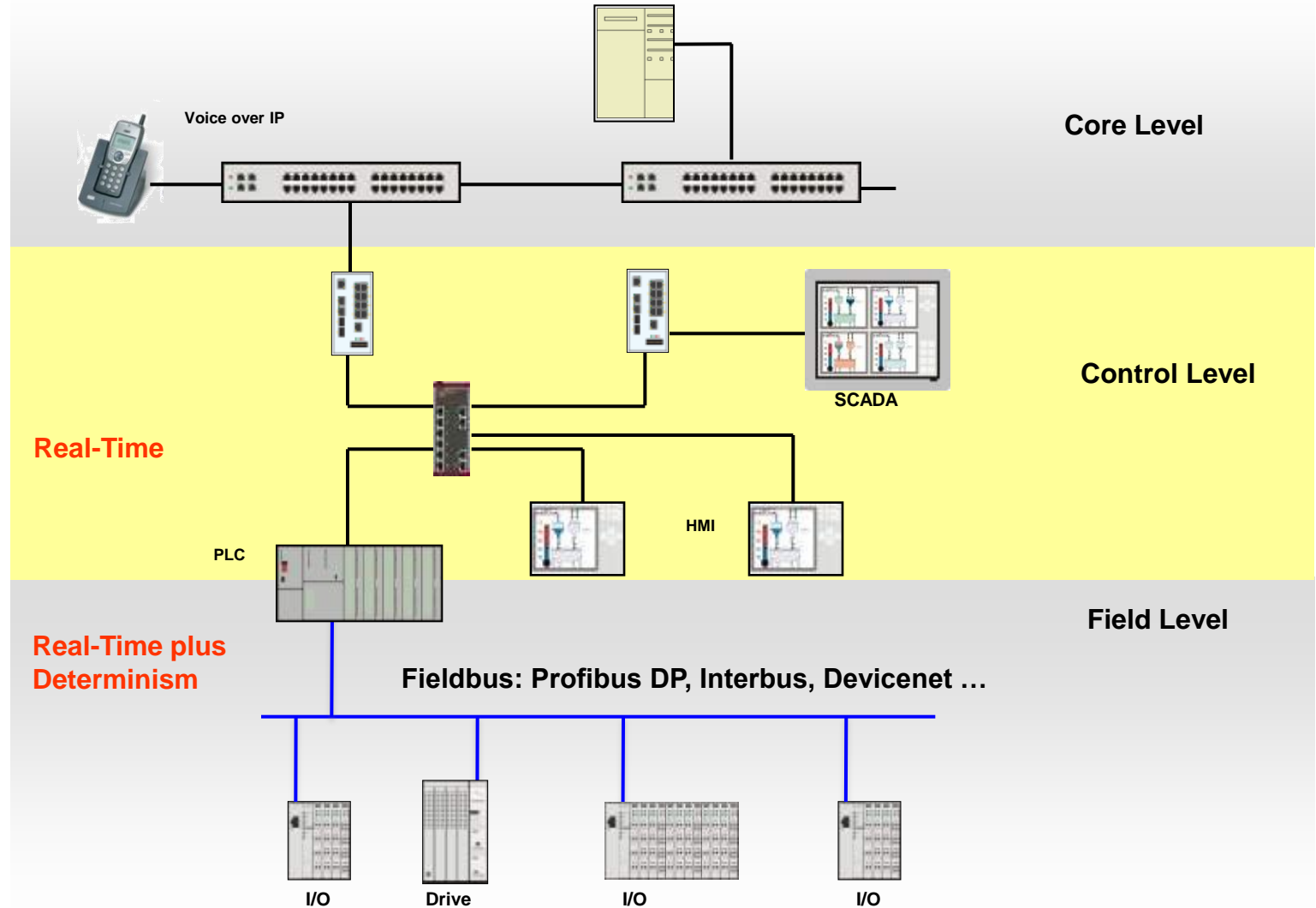
# Situation in industrial Automation today:

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Core Level

Control Level

Field Level

Real-Time

Real-Time plus  
Determinism

Voice over IP

SCADA

PLC

HMI

Fieldbus: Profibus DP, Interbus, Devicenet ...

I/O

Drive

I/O

I/O



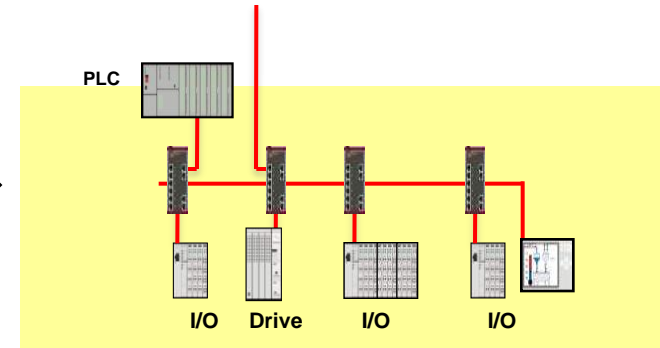
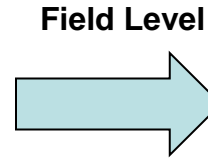
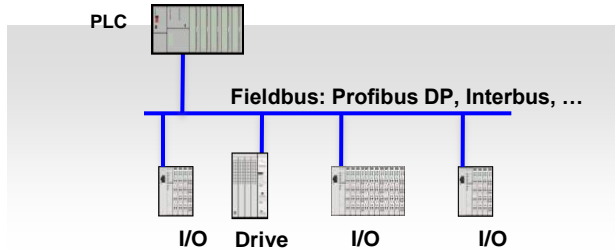
# Substitution in the field level until 2015

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- PROFIBUS
- INTERBUS
- DeviceNet
- ...

- Industrial Ethernet



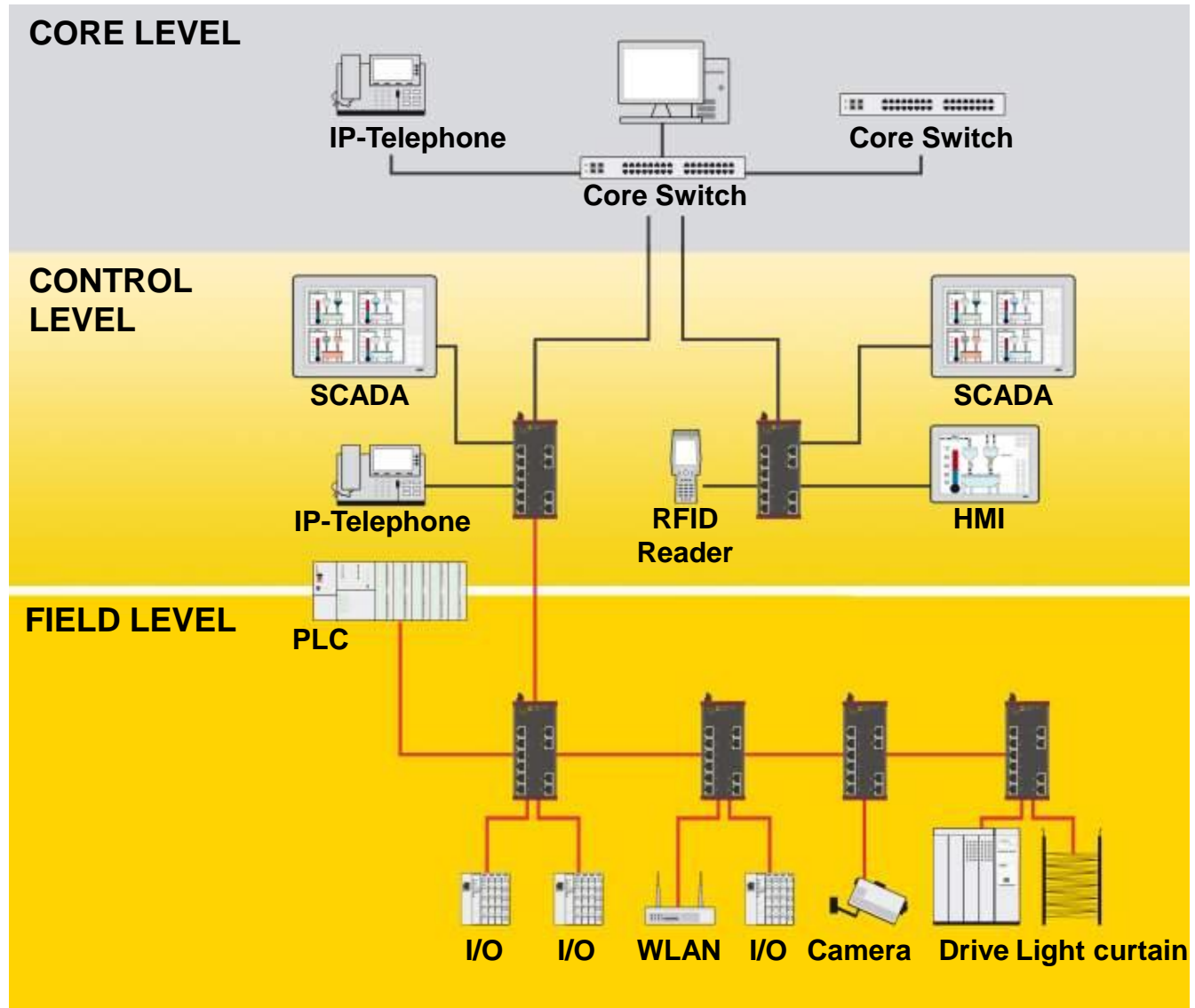
# Ethernet in the system levels

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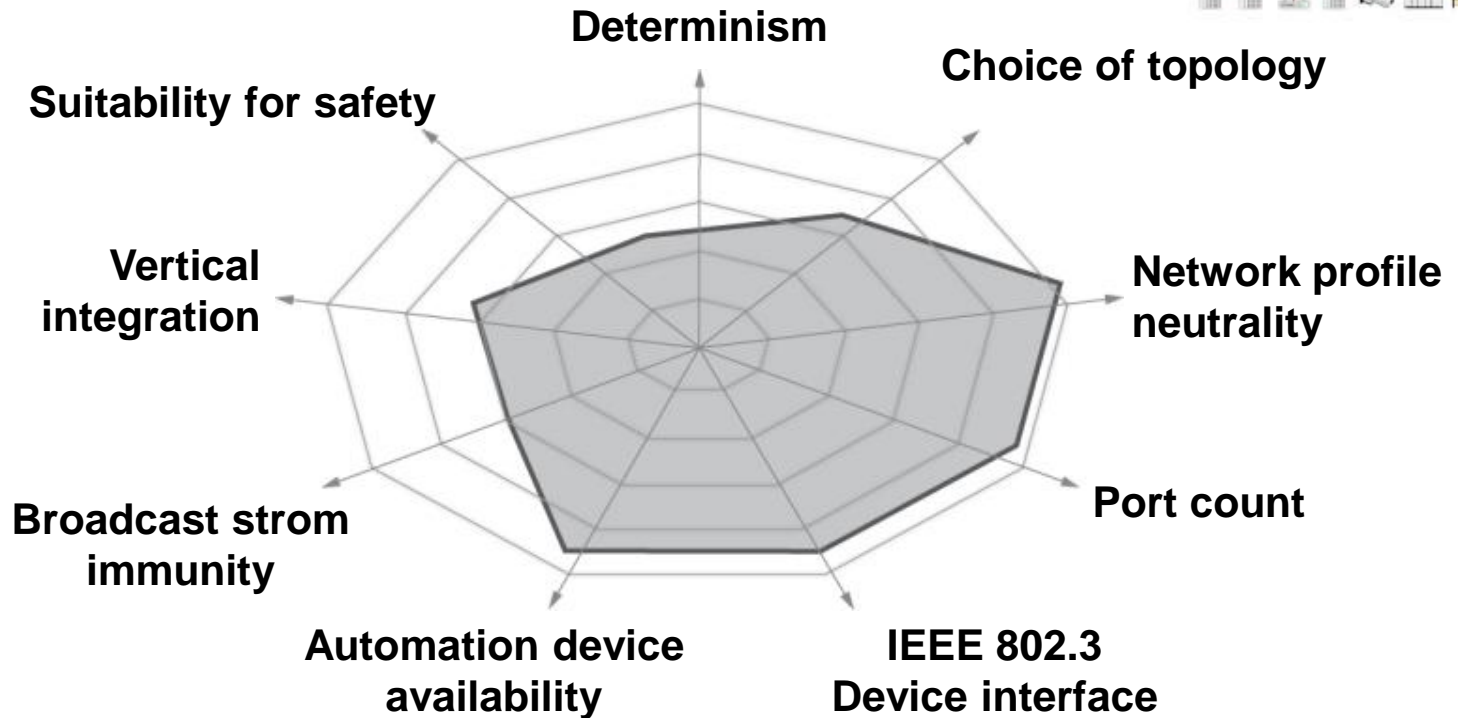
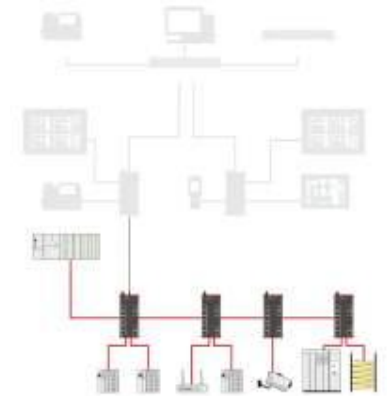
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Switching

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# Strengths and weaknesses of Standard unchanged Ethernet in the field level



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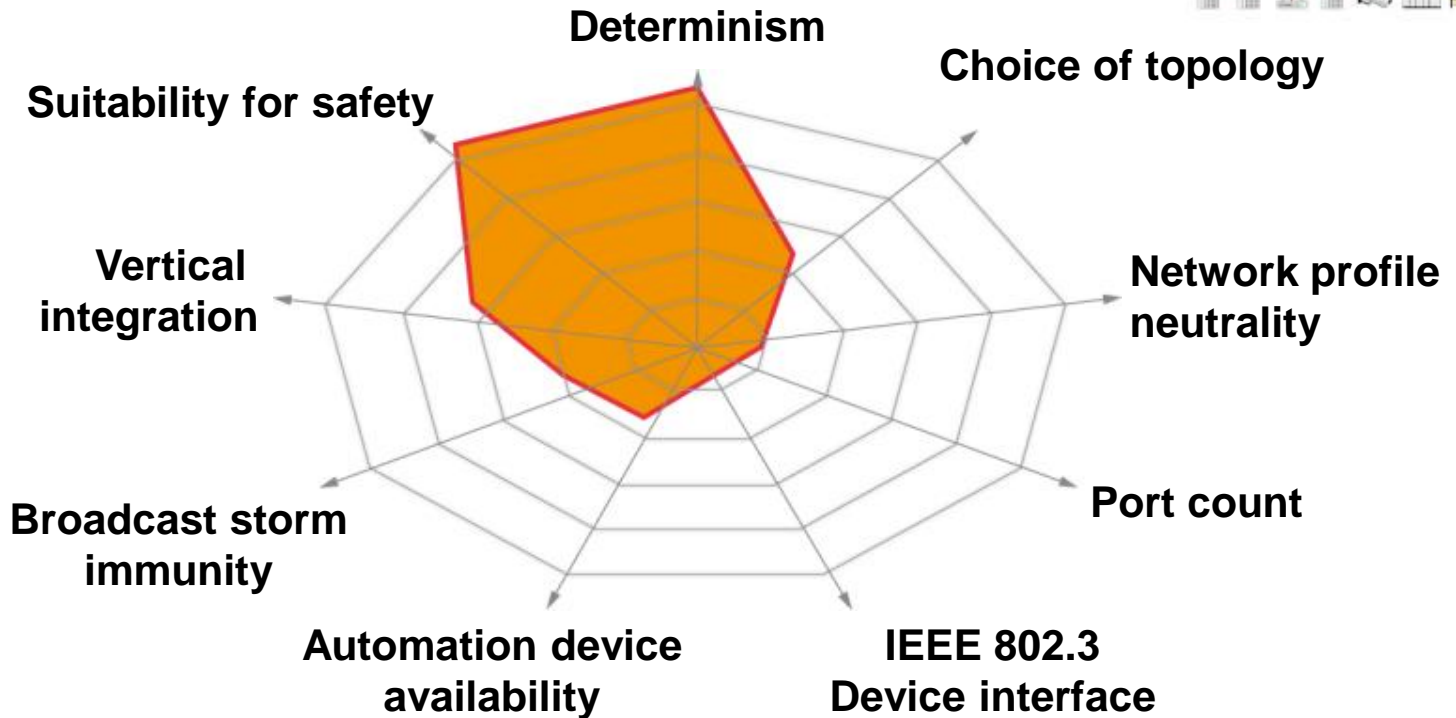
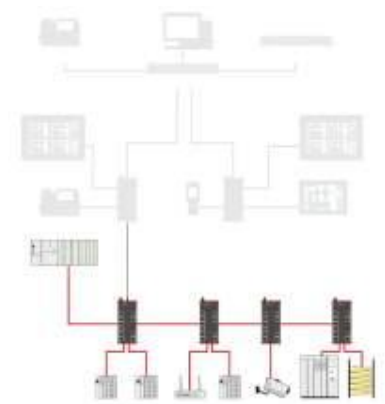
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# Strengths and weaknesses

of changed Ethernet in the field level



- The network system guarantees determinism
- Every device in the network needs special hardware

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# Standard Ethernet Performance (IEEE 802.3)

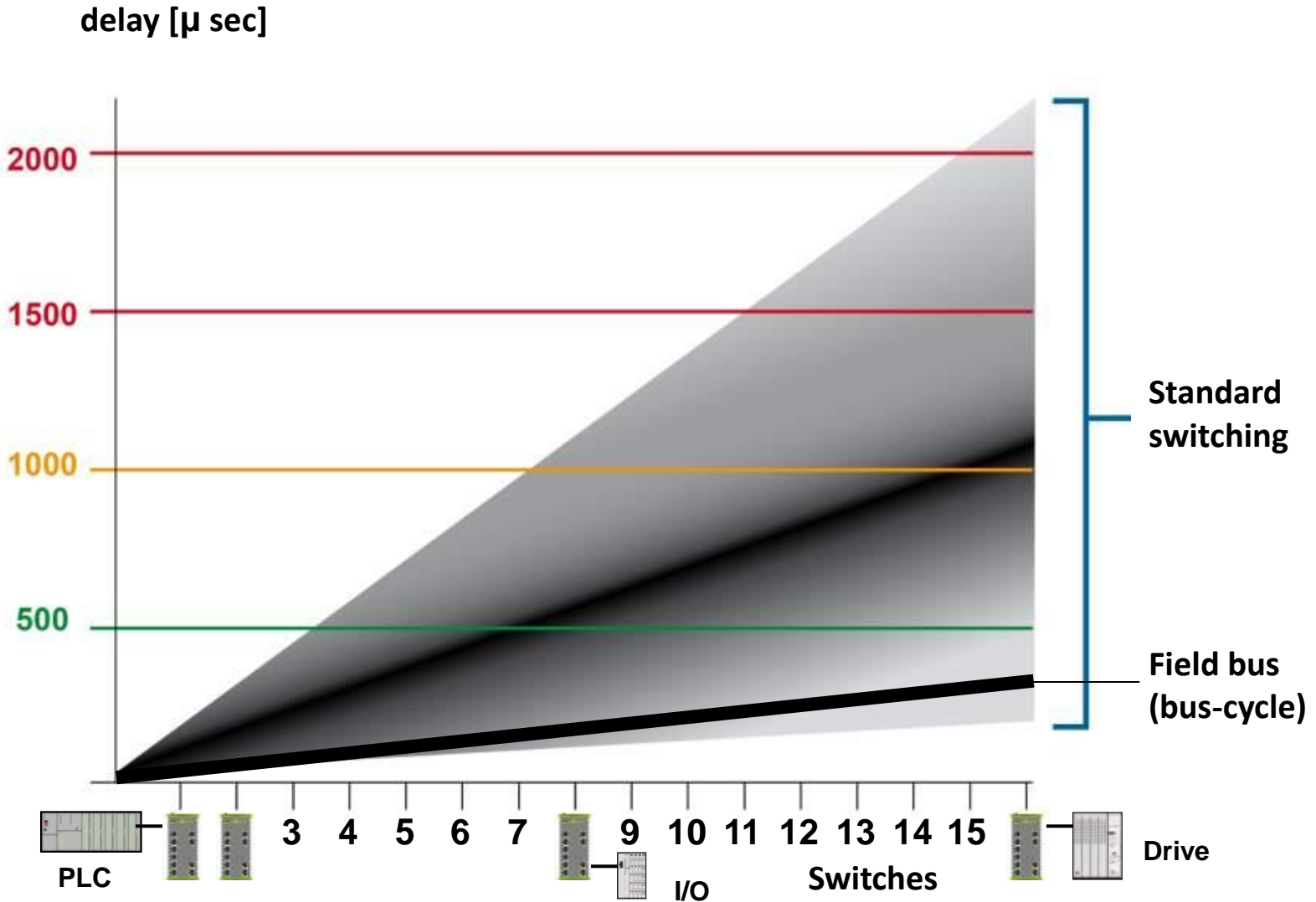
Example for 16 Switches

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# Ethernet IEEE 802.1q: regulations that do not work!

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Preamble	SFD	Destination	Source	VLAN		Type	Data	FCS
7 Byte	1	6 Byte	6 Byte	8100	xx	8892		4 Byte

## Ethernet Header

Example of prioritization  
of automation protocols



Priority	Type
7	Network critical
6	Voice
6	Automation
5	Video
4	Business critical
0-3	Datatransfer
0-3	Web
0-3	TCP acknowledge

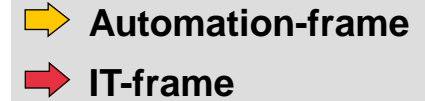


Automation-frames and IT-frames are  
competing

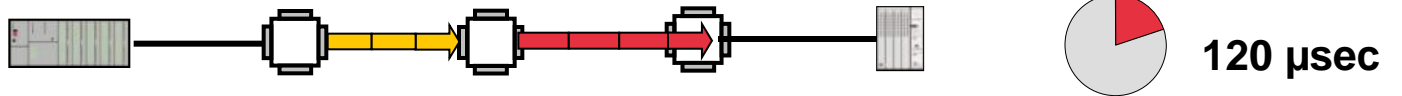
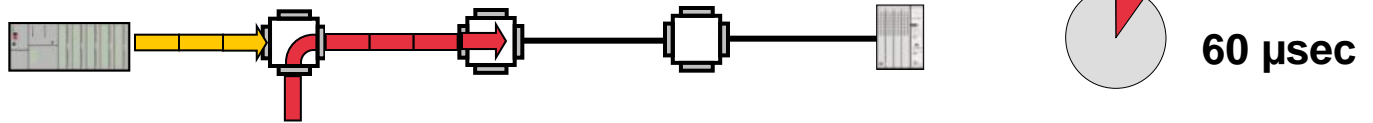
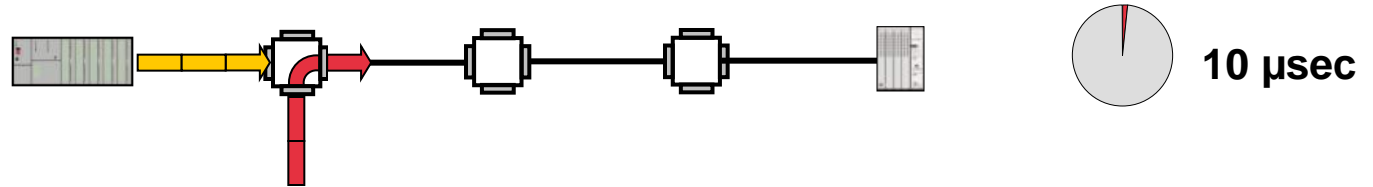



# Traffic-jam despite prioritisation (IEEE 802.3)

## Example for 3 Switches



PLC      Switch 1    Switch 2    Switch 3    Drive



 Automation-frames have to wait, until the whole IT-frame has left the port!

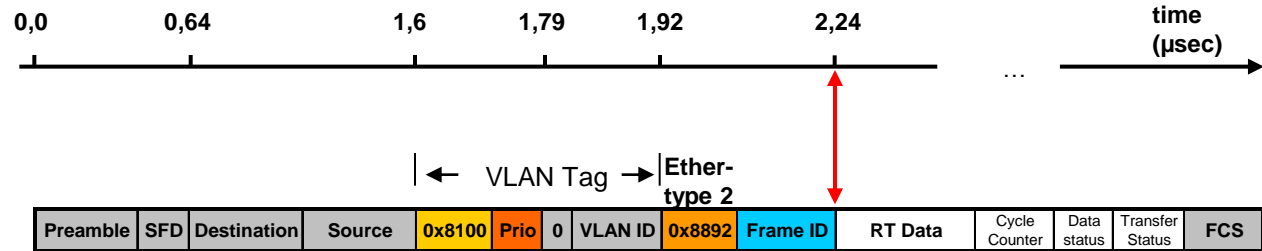
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Switching



# Identify profiles and prioritize them?

## Profinet



## Ethernet/IP



## Modbus TCP/IP



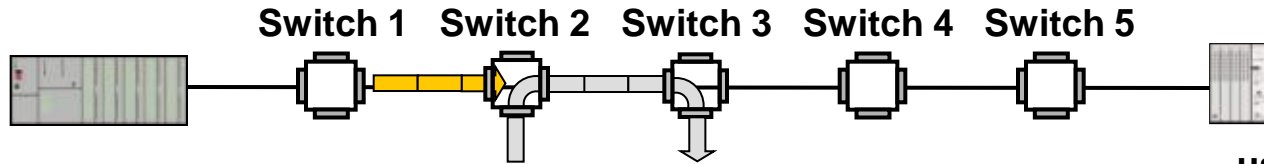
**Automation-frames and IT-frames do not compete any more. But the traffic-jam is not avoided!**



# Traffic-jam despite prioritization(IEEE 802.3)

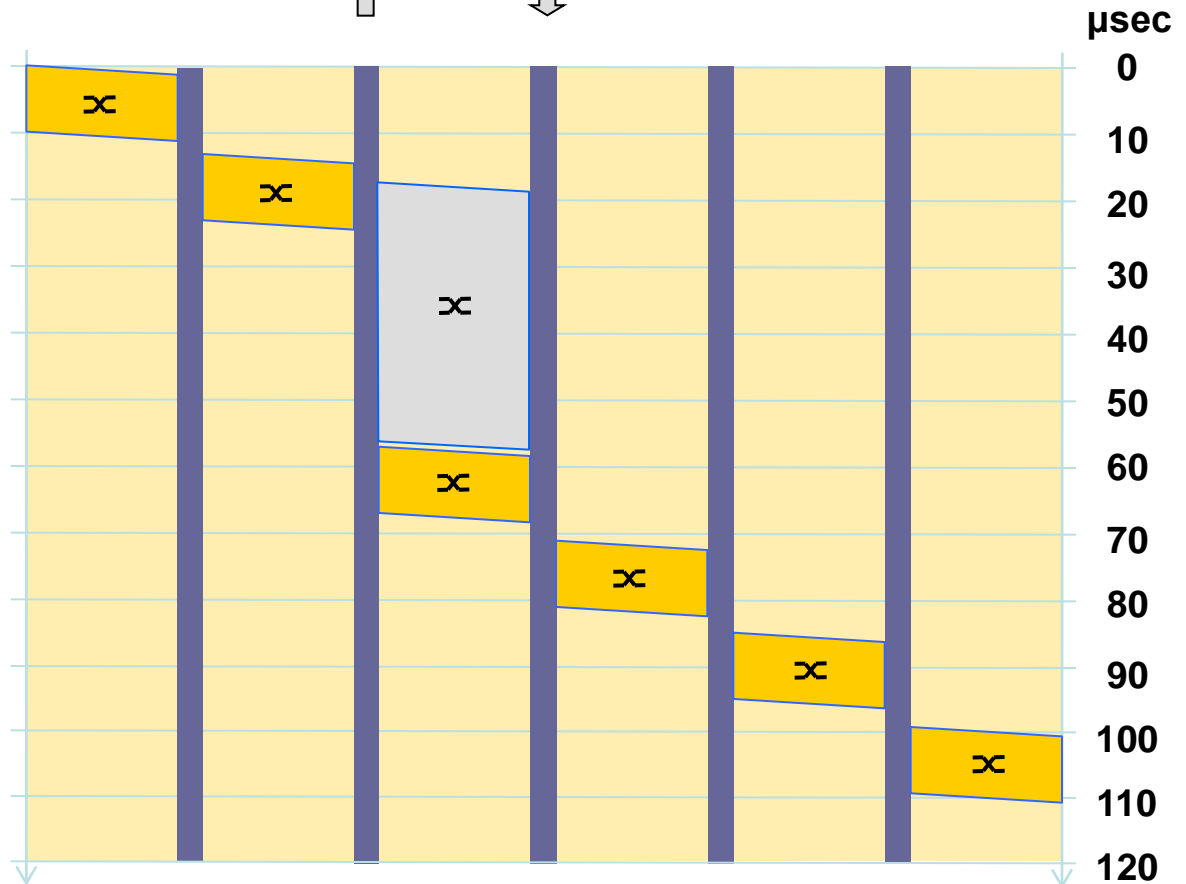
## Example for 5 Switches

 Store & forward



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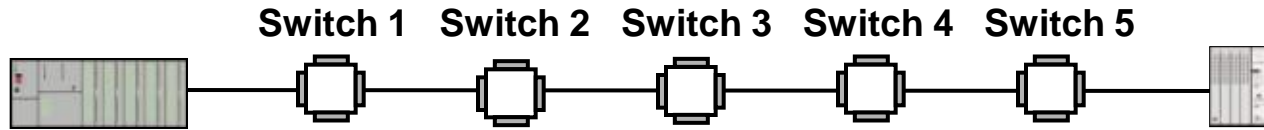


# Acceleration with Cut-Through

without network load

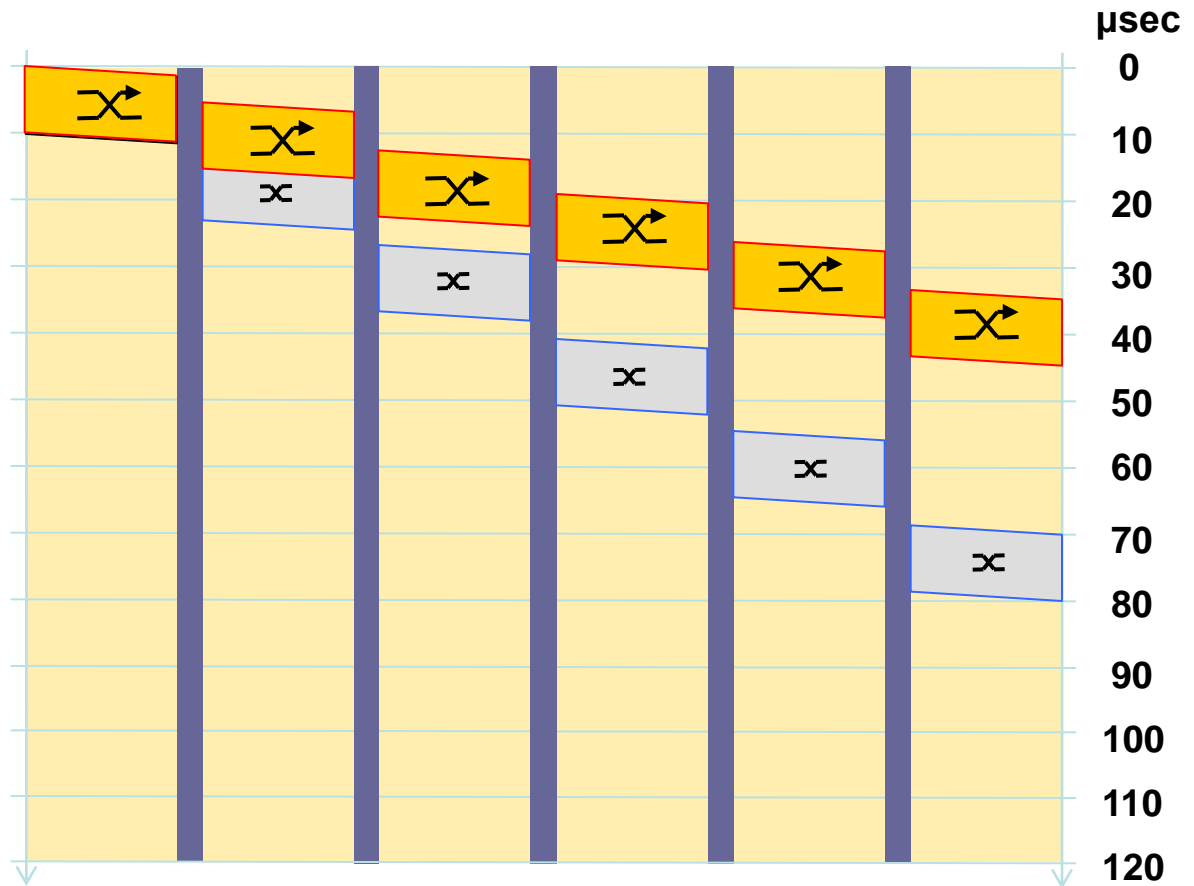
 cut through

 Store & forward



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µsec

0

10

20

30

40

50

60

70

80

90

100

110


120

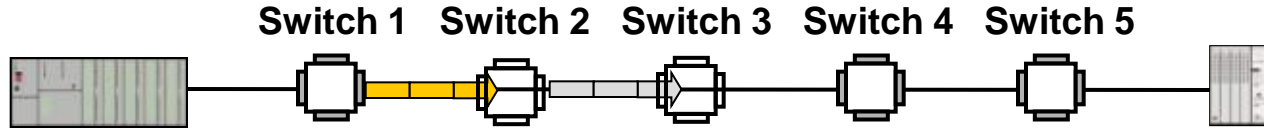


# Acceleration of identified frames

cut through with network load

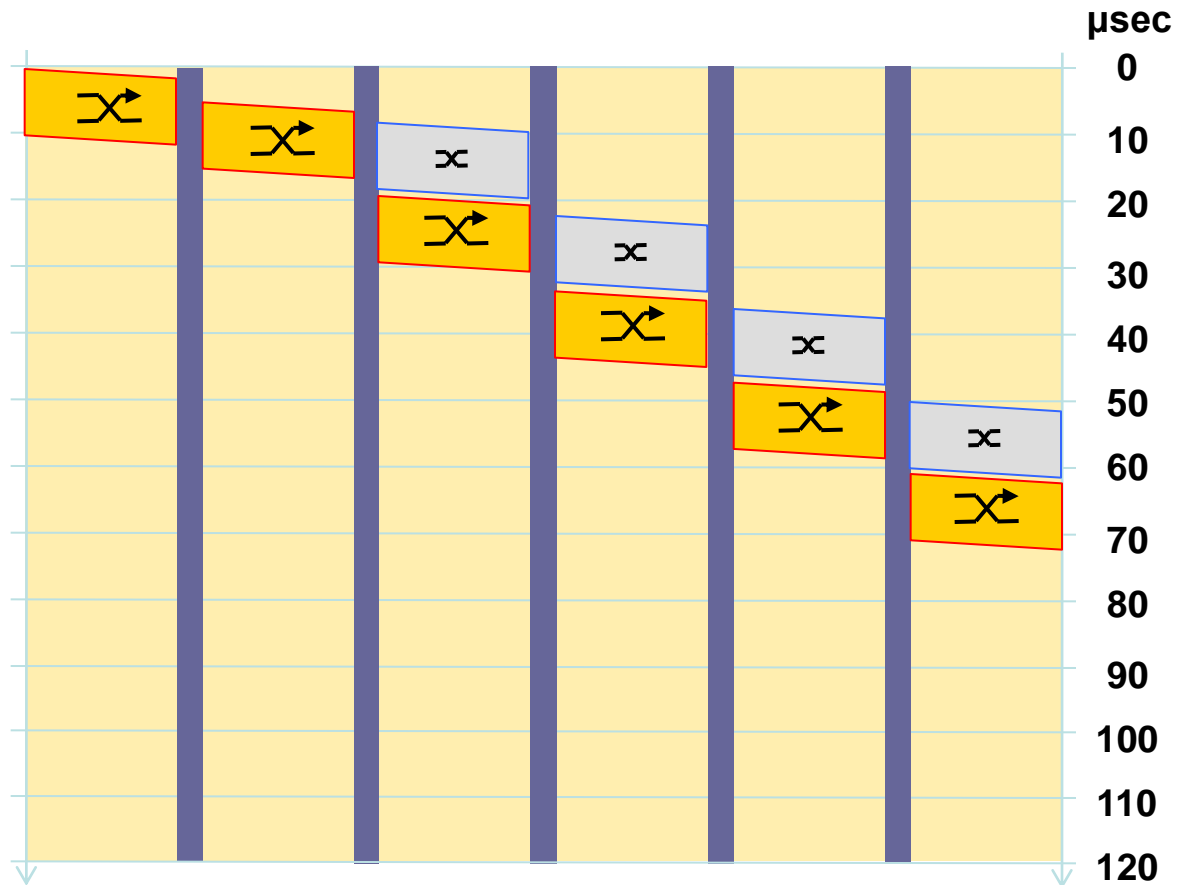
 cut through

 Store & forward



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# How to reach determinism?

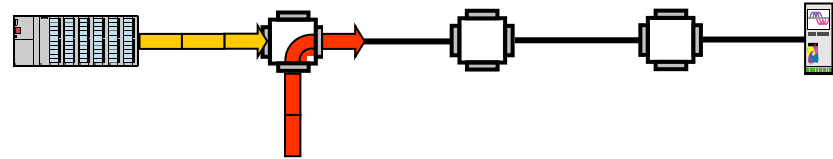
Pushing Performance

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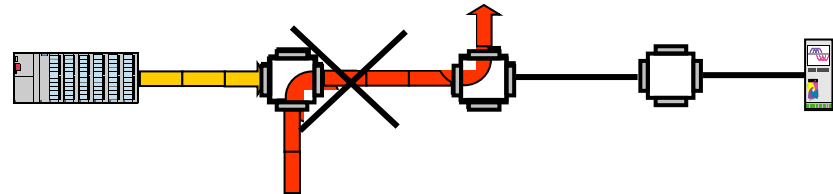
Fast Track  
Switching

➔ Automation frame  
➔ IT-frame

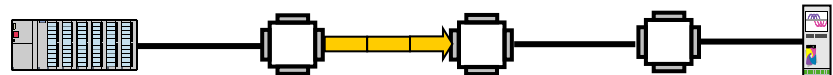
1. Identify the automaion frame



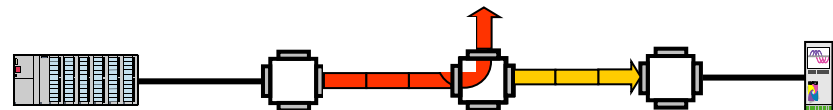
2. Suspend the NRT-frame



3. Direct transmission of the automation frame



4. Resend of the NRT-frame



People | Power | Partnership

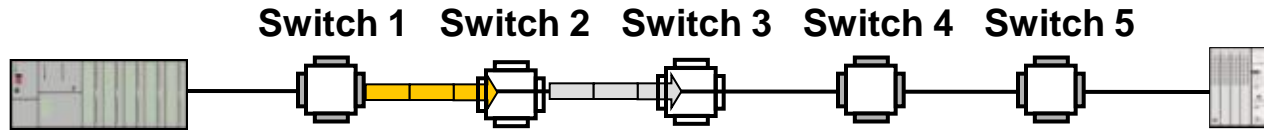


# Avoid traffic jam with overtaking

## Example for 5 Switches

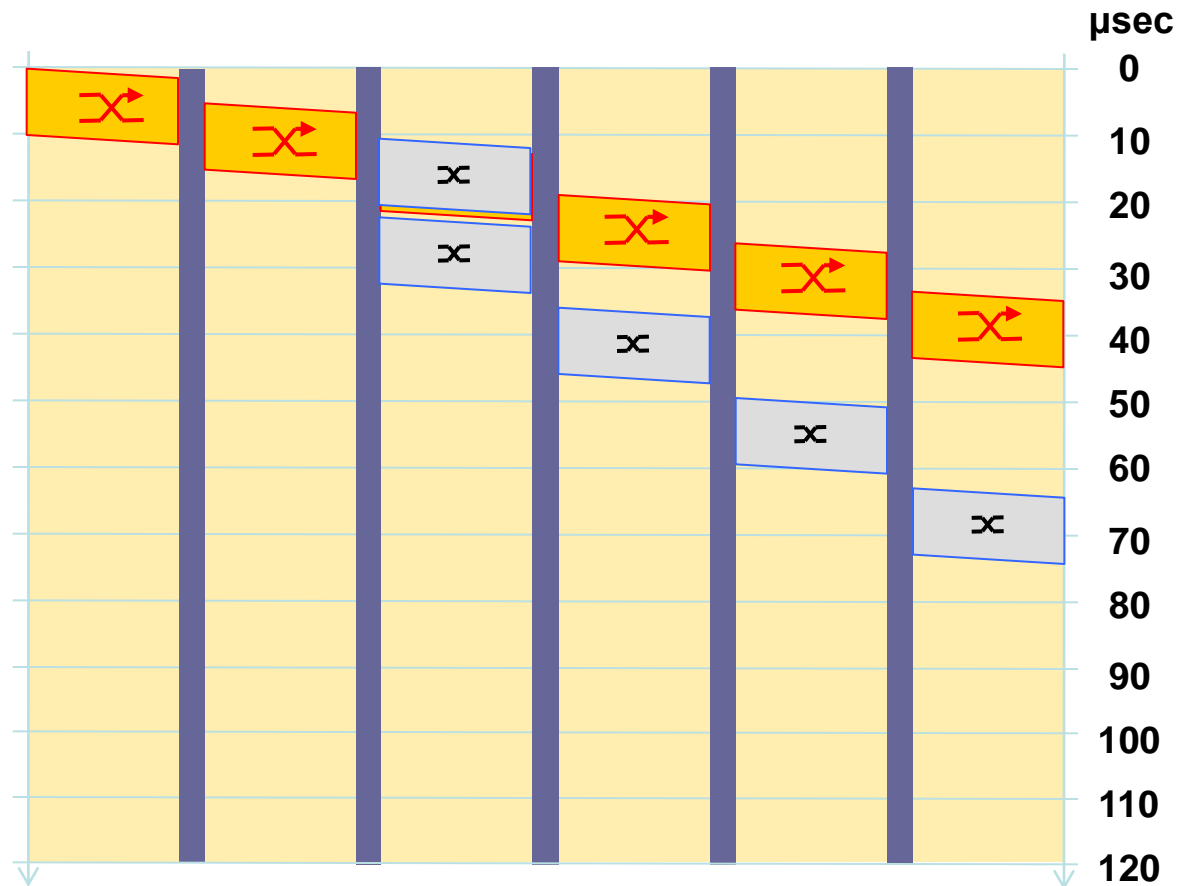
 Fast Track Switching

 Store & forward



HARTING  
Technology  
Group

Fast Track  
Switching

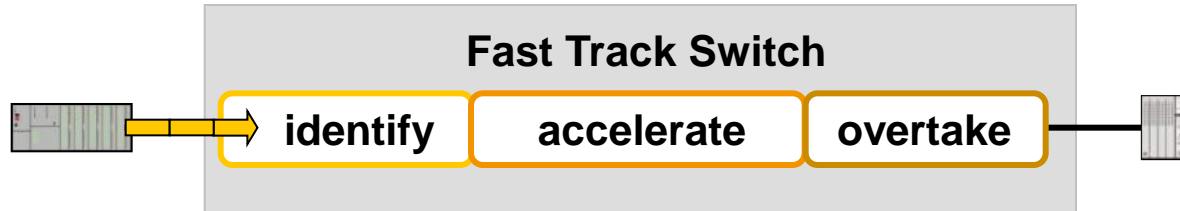






# THE Solution: Fast Track Switching

Pushing Performance



HARTING  
Technology  
Group

Fast Track  
Switching

1. Identify the automation-frame
2. Acceleration of the switch-latency with cut-through
3. Automation-frames overtake IT-frames

People | Power | Partnership

Seamless Ethernet  
up to the field level

Office IT  
Fast Track Switch  
Industrial Automation

The graphic features a large white arrow pointing right on a yellow background. To the right of the arrow is the text "Seamless Ethernet up to the field level". Further right is a logo for "Fast Track Switch" which includes a stylized yellow and red arrow and the text "Office IT" above and "Industrial Automation" below.



# Fast Track Switching

## High Performance and determinism



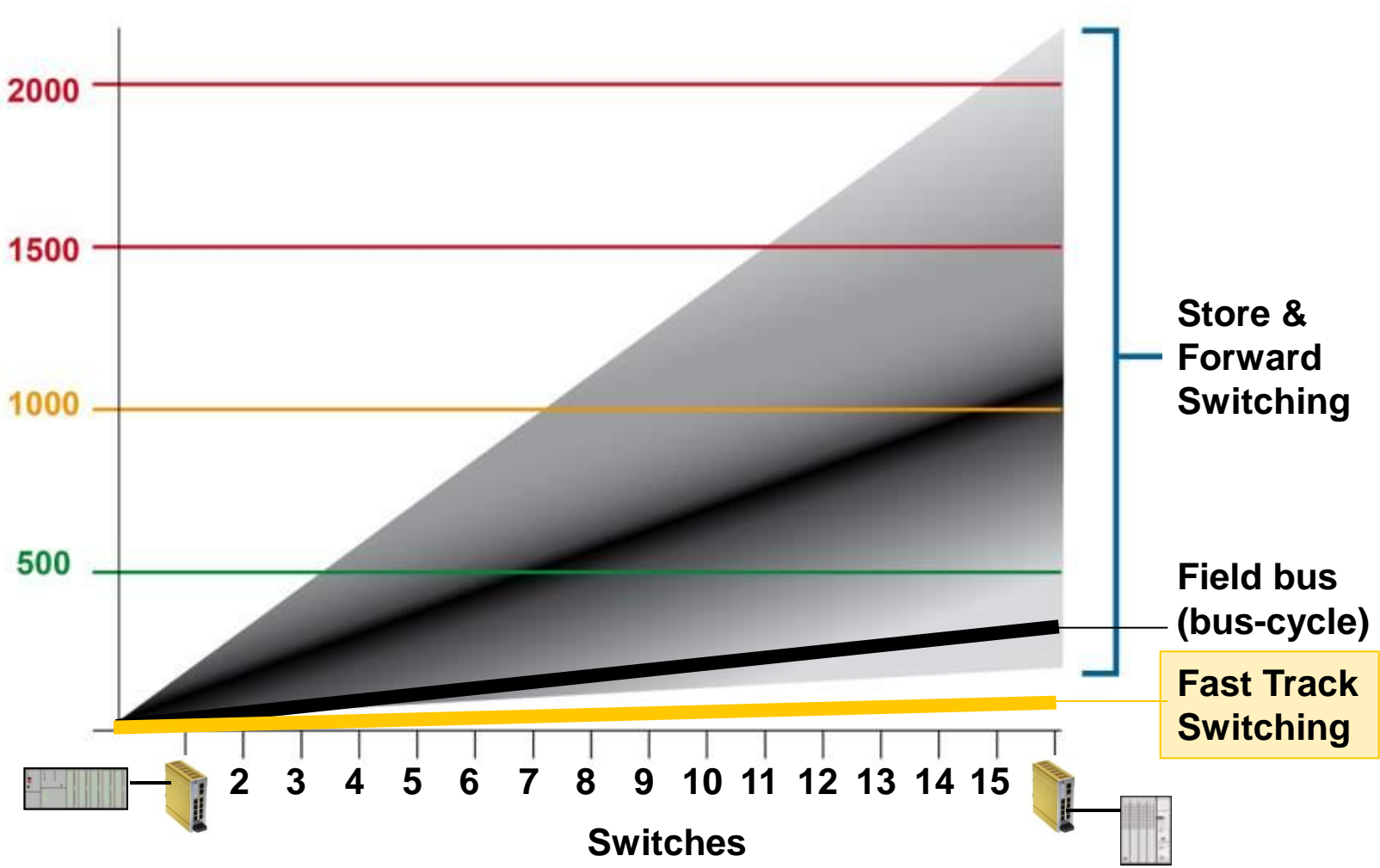
Pushing Performance

HARTING  
Technology  
Group

Fast Track  
Switching

People | Power | Partnership

Delay [ $\mu$  sec]



Store &  
Forward  
Switching

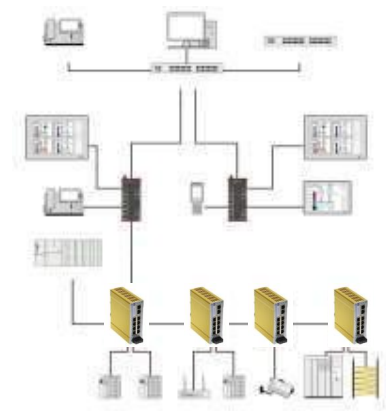
Field bus  
(bus-cycle)

Fast Track  
Switching



# Strengths and weaknesses

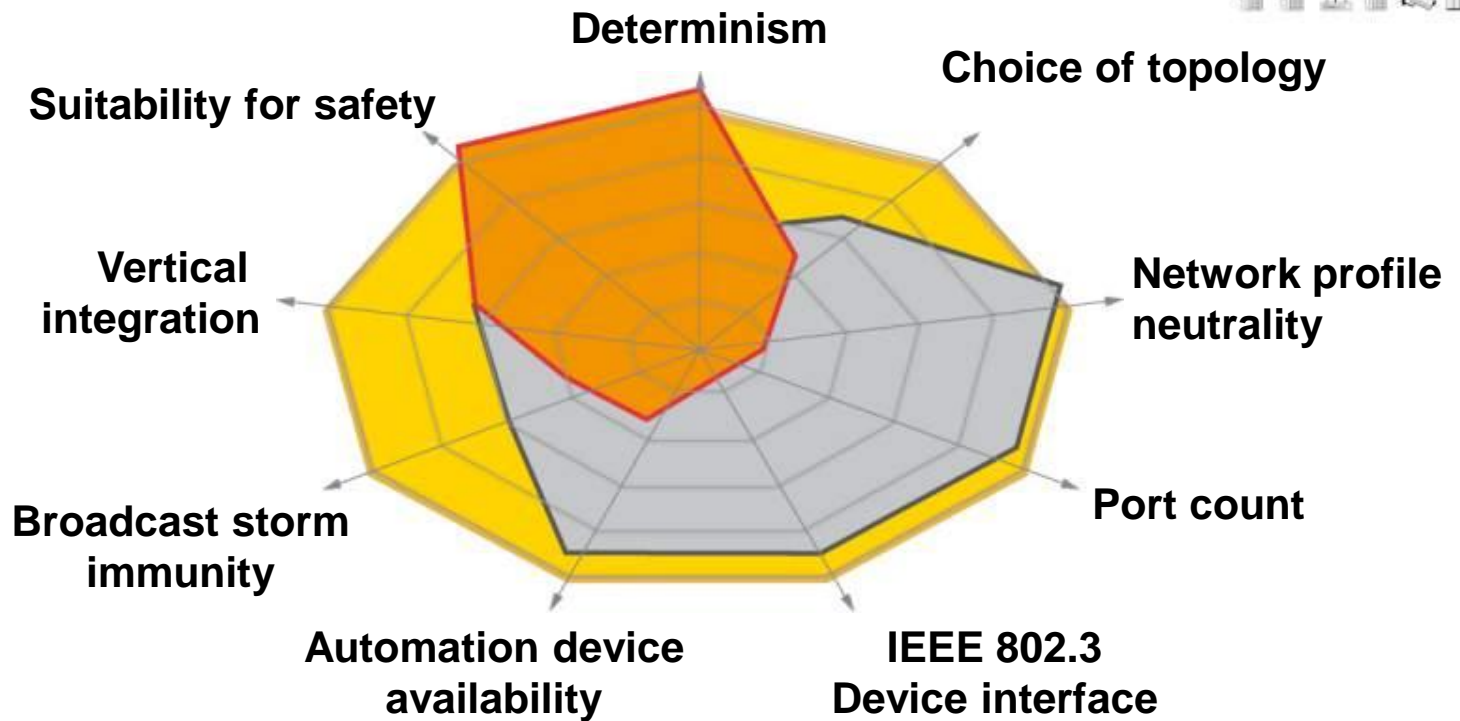
## of Standard unchanged Ethernet with Fast Track Switching for all levels



Pushing Performance

HARTING  
Technology  
Group

Fast Track  
Switching



- Standard unchanged Ethernet
- changed Ethernet networks
- Standard unchanged Ethernet with Fast Track Switching

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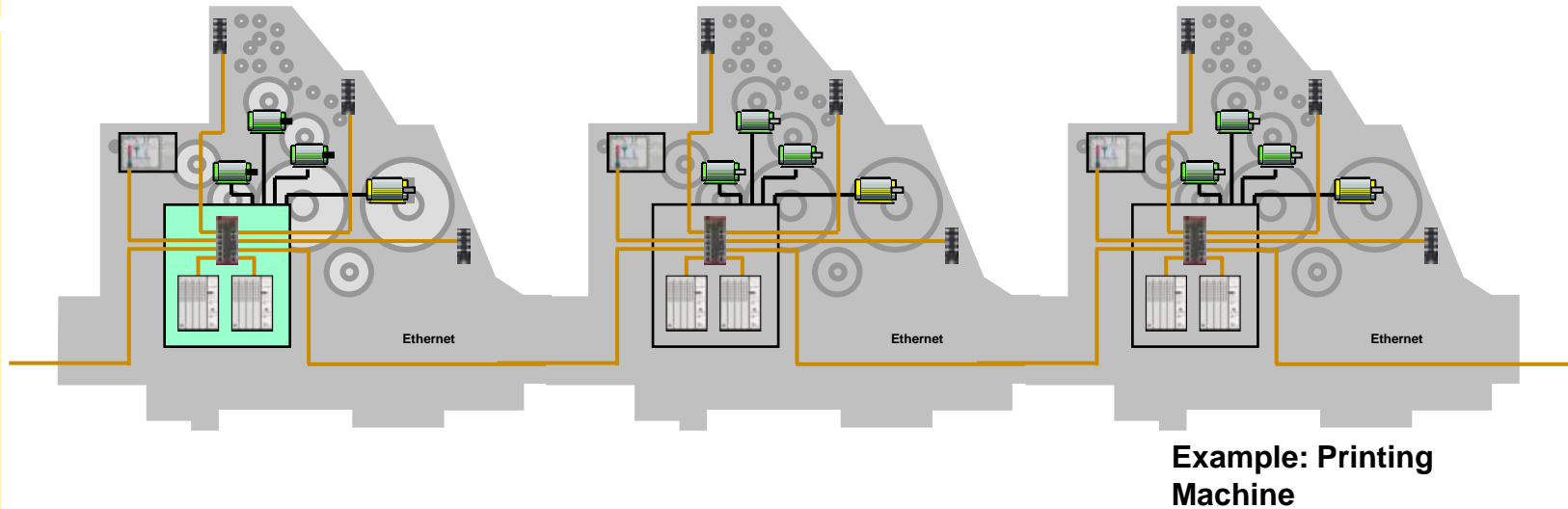
Pushing Performance

HARTING  
Technology  
Group

Fast Track  
Switching

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# Fast Track Switching Appliance



**Seamless and open for unchanged Ethernet profiles  
(Profinet, Ethernet IP, Modbus TCP ...)  
High degrees of freedom and flexibility  
less Switches  
no chips in the devices**



# Technology-Innovation Fast Track Switching

Pushing Performance

HARTING  
Technology  
Group

Fast Track  
Switching



**THE** Solution for Automation IT

People | Power | Partnership

