PERFORMANCE TESTING FOR INDUSTRIAL APPLICATIONS

Lisa Underberg

Institut für Automation und Kommunikation – ifak
Werner-Heisenberg-Str. 1
39106 Magdeburg
lisa.underberg@ifak.eu
+49 (0)391 9901 454
www.ifak.eu

Performance Testing

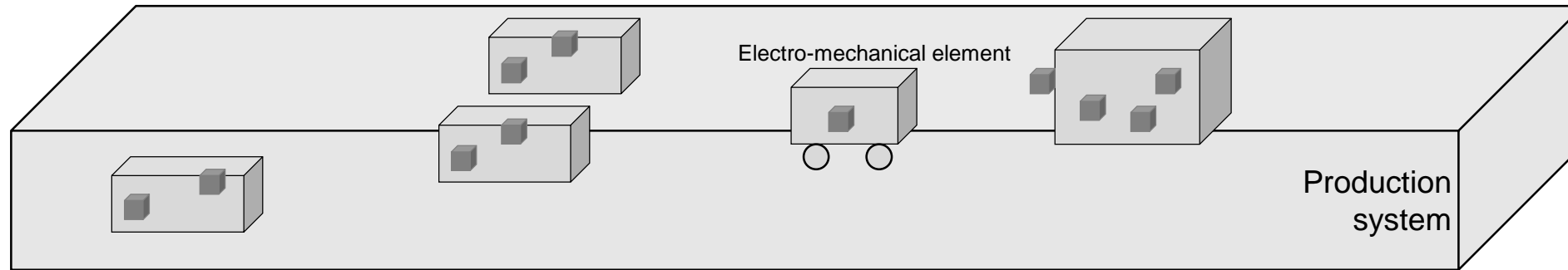for industrial applications

approach and experience

Performance Testing

for industrial applications

approach and experience

Electro-mechanical element

Production system

INDUSTRIAL AUTOMATION AS SYSTEM OF SYSTEMS
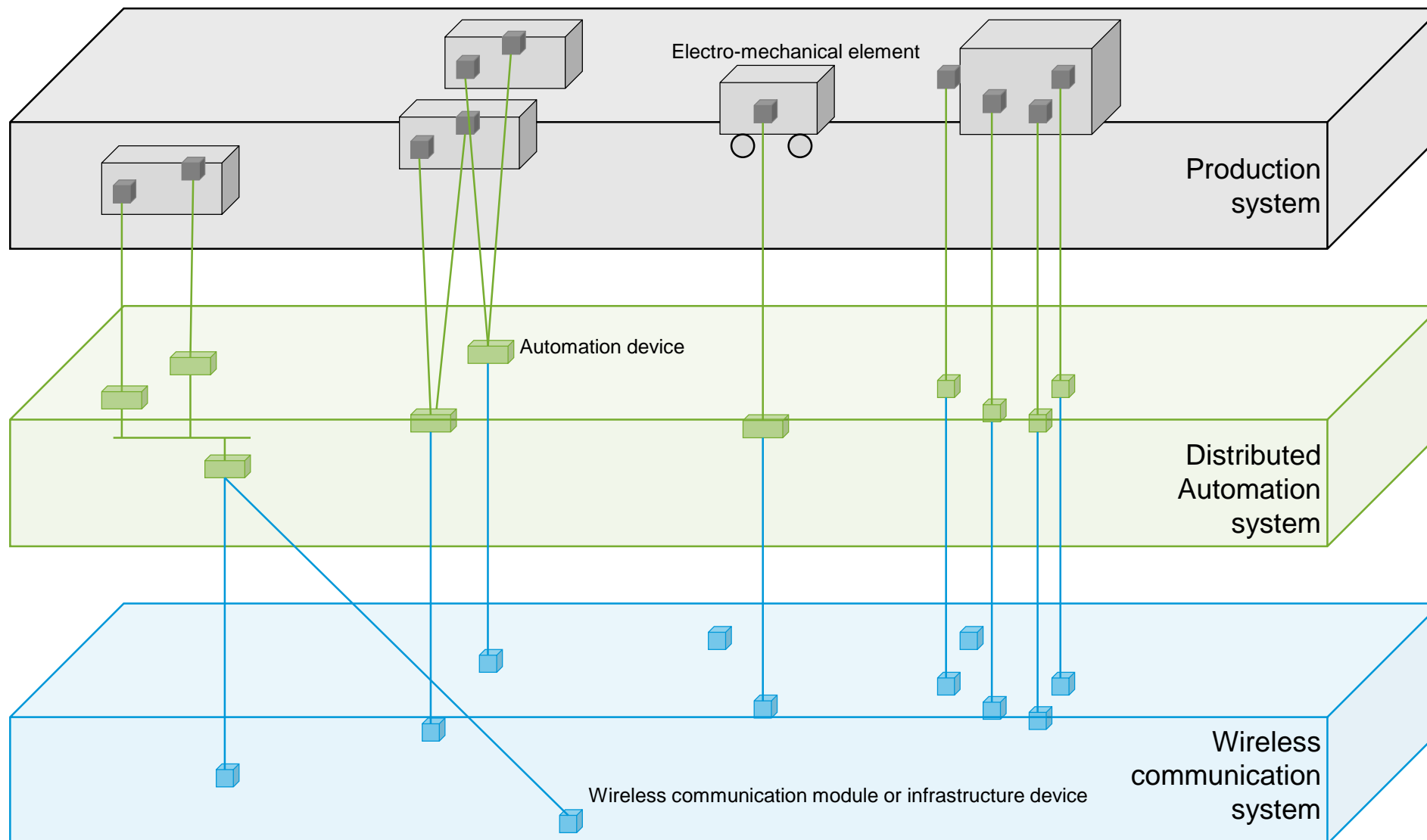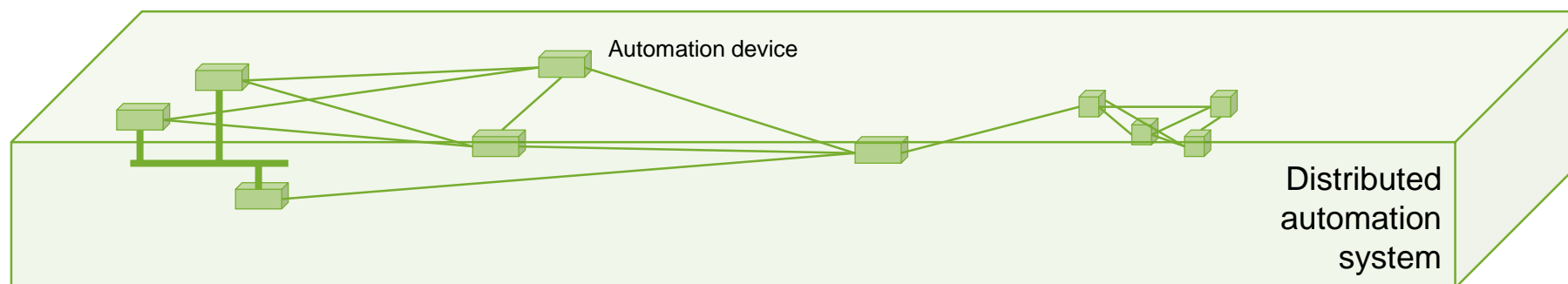
Production system

Electro-mechanical element

Automation device

Distributed Automation system

Wireless communication module or infrastructure device

Wireless communication system

Automation device

Distributed automation system

Industrial Ethernet

Logical link

Automation device

Distributed automation system

Reference interface

Wireless communication module or infrastructure device

Wireless communication system

	Industrial Ethernet		Reference interfaces
	Logical link		Physical links

Automation device

Distributed automation system

Reference interface

Wireless communication module or infrastructure device

Wireless communication system
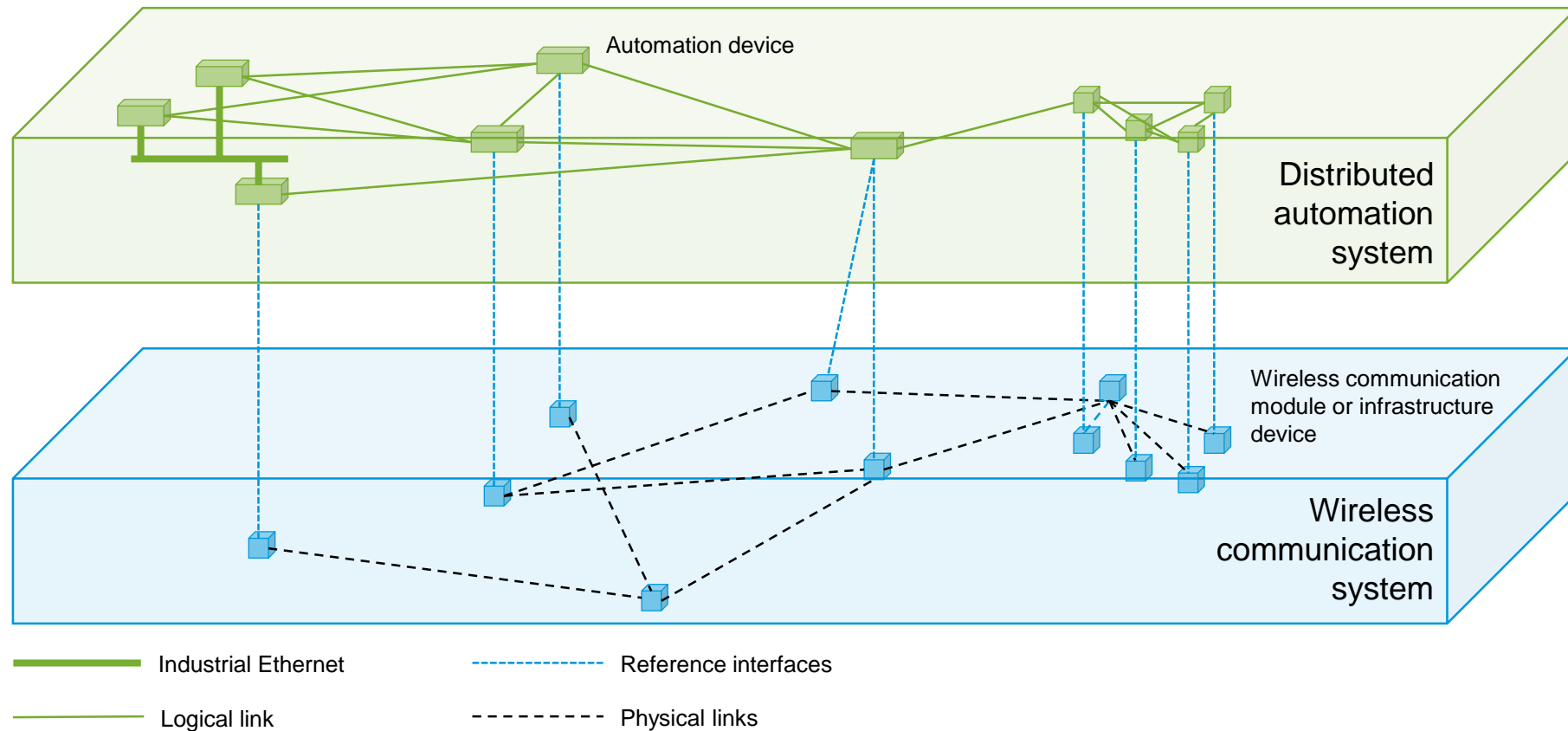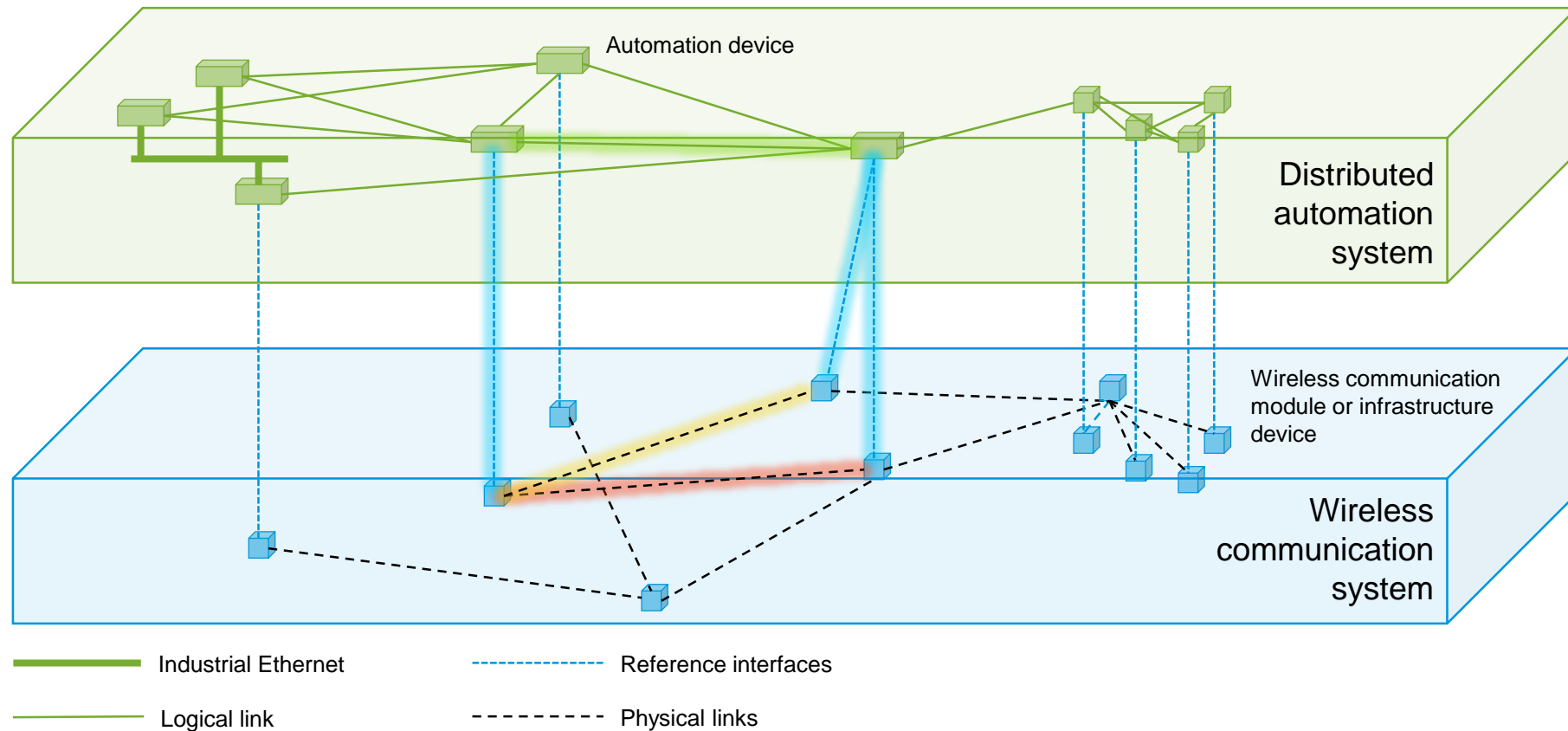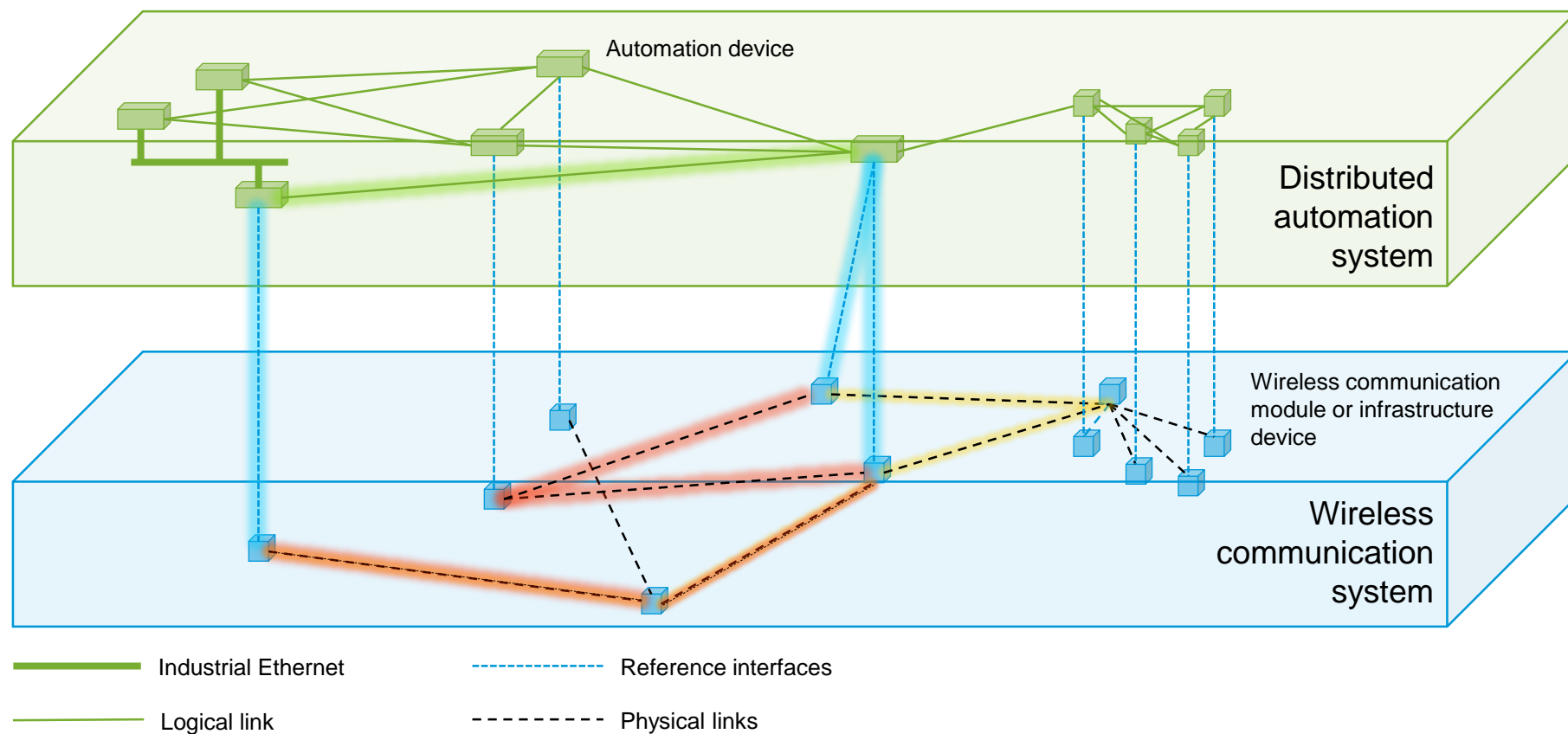
	Industrial Ethernet			Reference interfaces
	Logical link			Physical links

■ **Quantifiable requirements**

  ☐ Requirement profile as spider web

■ **Qualitative requirements**

  ☐ Security

  ☐ Privacy

  ☐ Operator models

  ☐ Security of investment

  ☐ Usability

  ☐ Commercial availability
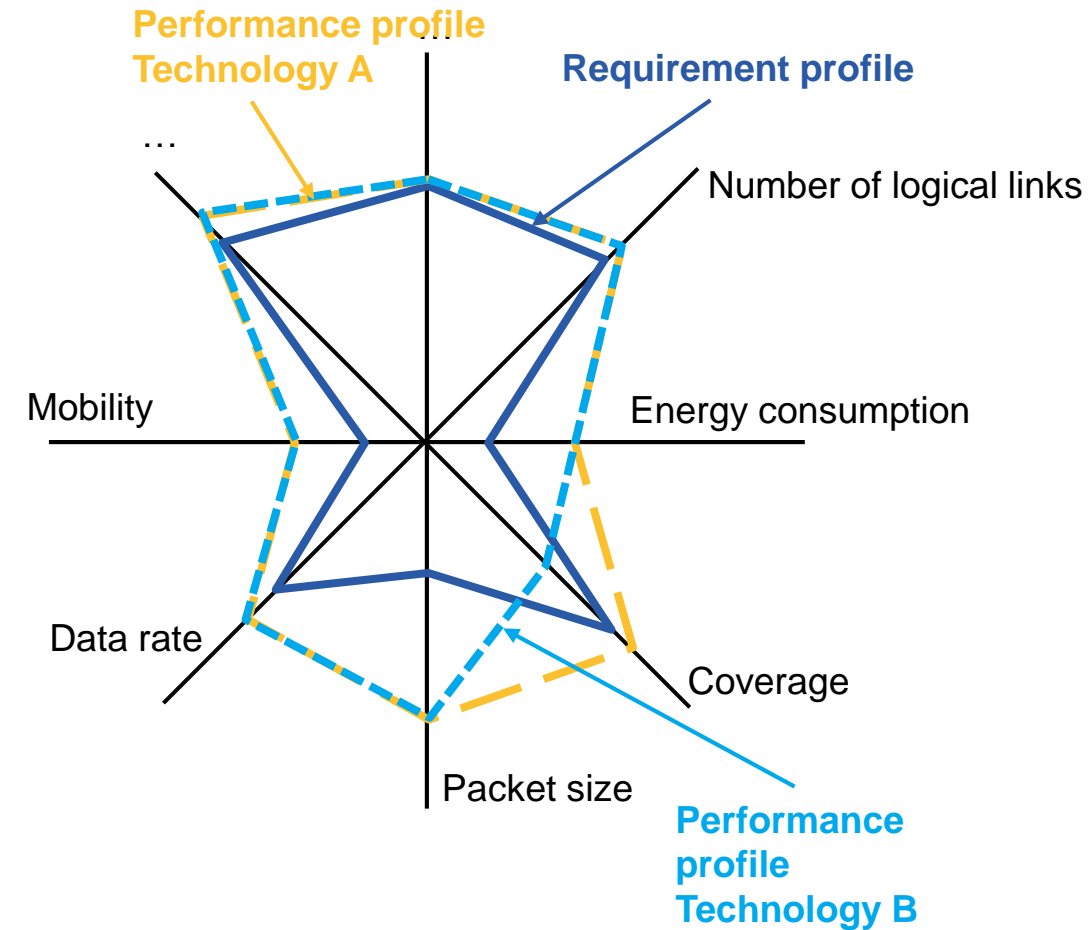
Further reading on requirement specification: VDI/VDE Guideline 2185 Part 1

Performance profile Technology A
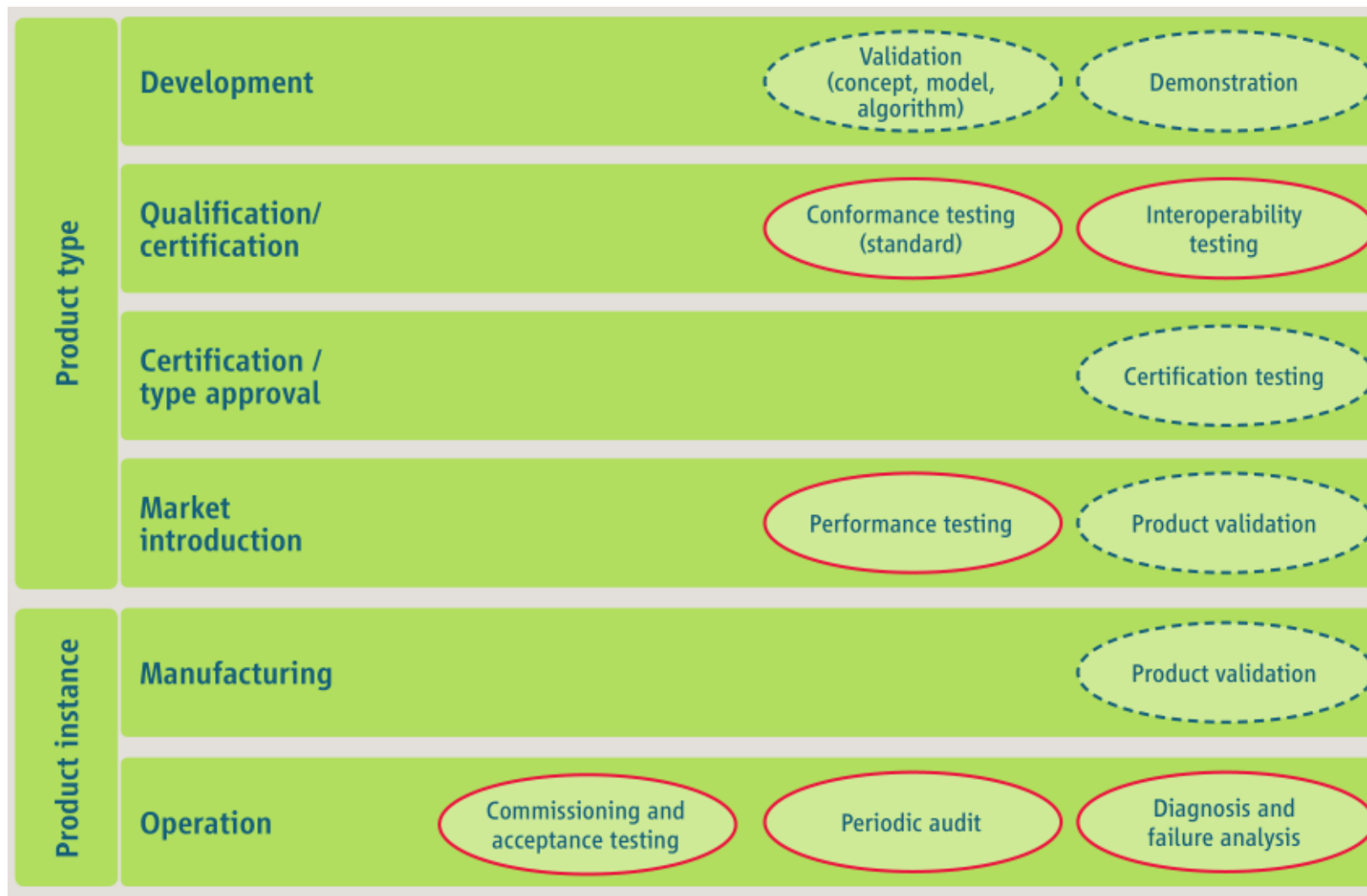
Requirement profile

…

Number of logical links

Mobility

Energy consumption

Data rate

Coverage

Packet size

Performance profile Technology B

Performance Testing

for industrial applications
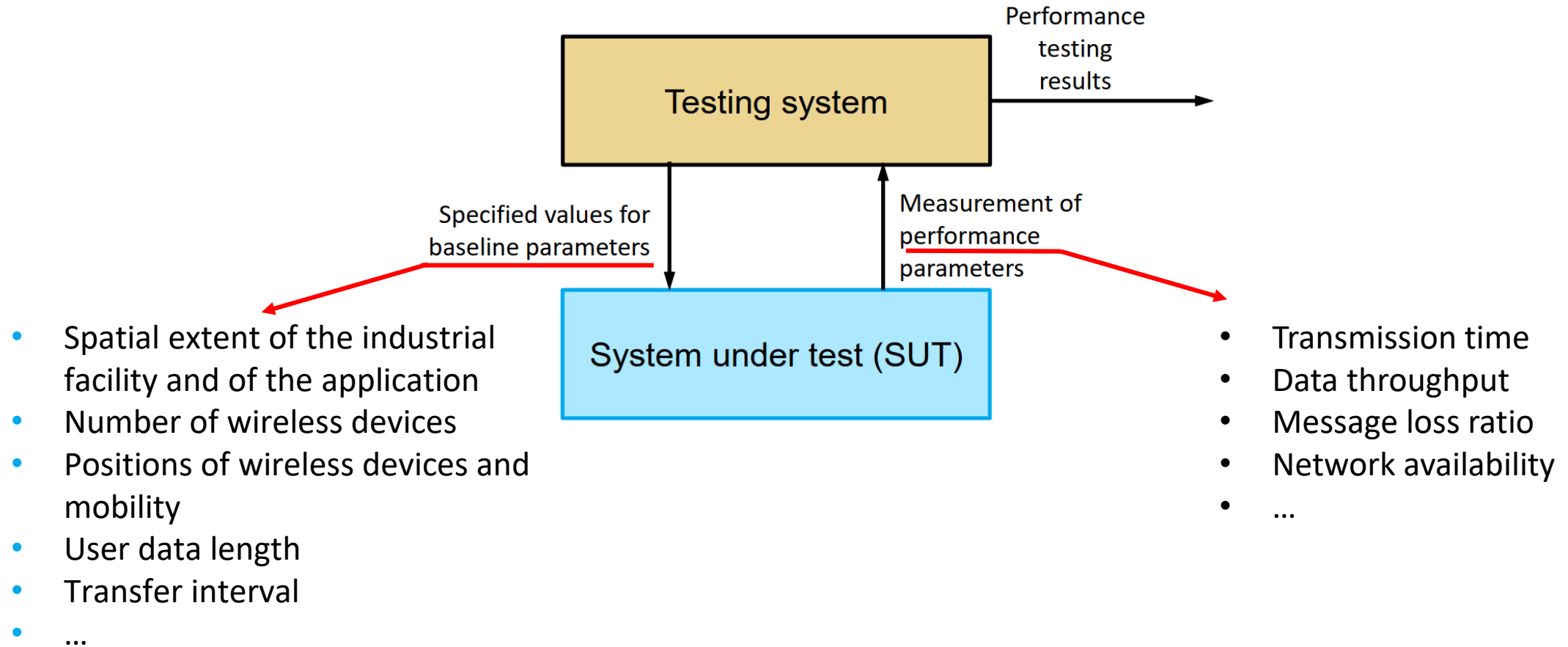
approach and experience

Source: 5G ACIA, „Selected Testing and Validation Considerations for Industrial Communication with 5G Technologies", White Paper, Nov. 2019
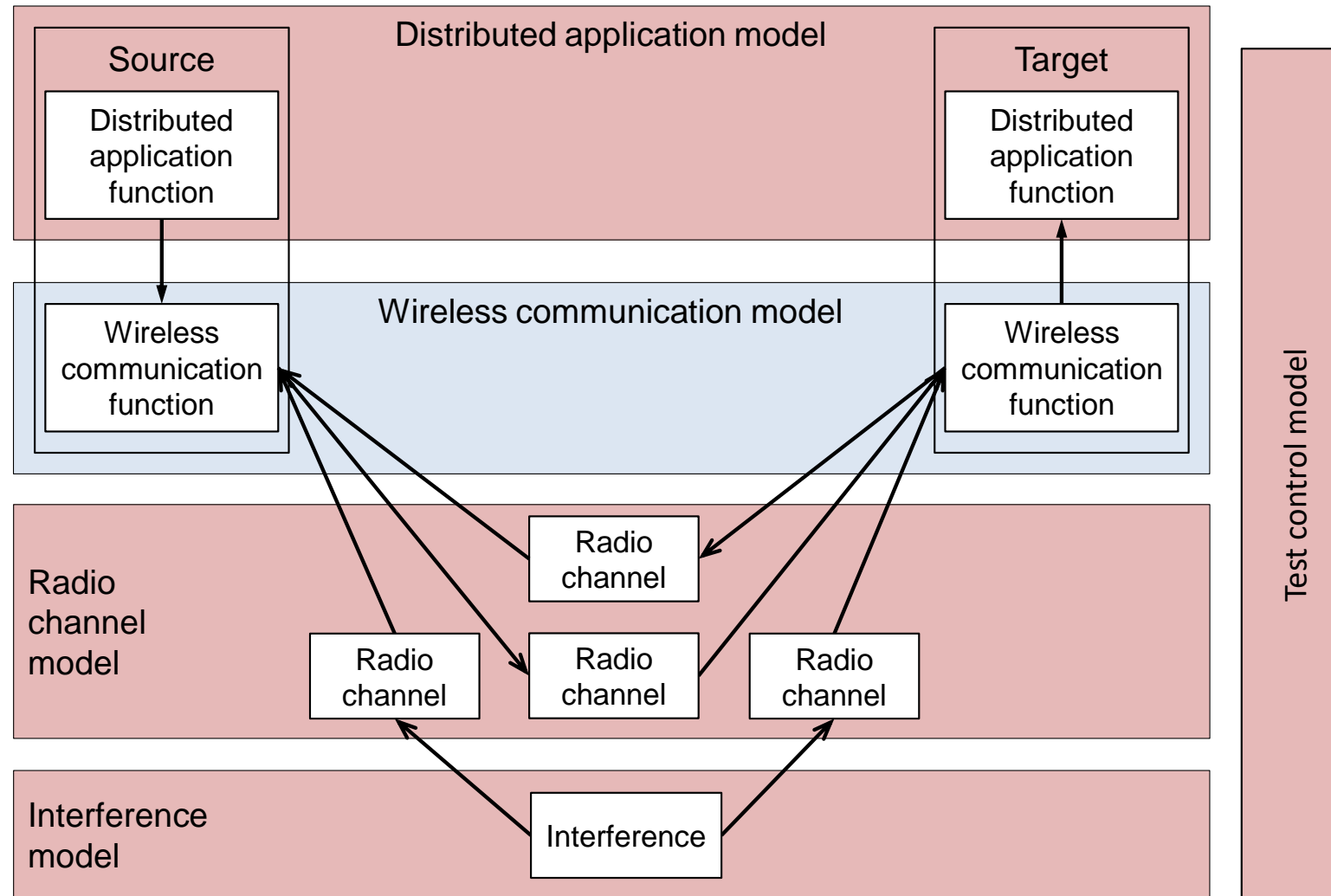
TESTING SYSTEM AND SYSTEM UNDER TEST (SUT)

Testing system

Performance testing results

Specified values for baseline parameters

Measurement of performance parameters

System under test (SUT)

- Spatial extent of the industrial facility and of the application
- Number of wireless devices
- Positions of wireless devices and mobility
- User data length
- Transfer interval
- …

- Transmission time
- Data throughput
- Message loss ratio
- Network availability
- …

Further reading:
VDI/VDE Guideline 2185-4 „Radio-based communication in industrial automation - Metrological performance rating of wireless solutions for industrial automation applications ", 2019
5G ACIA, „Performance Testing of 5G Systems for Industrial Automation", White Paper, 2021

Performance Testing

for industrial applications
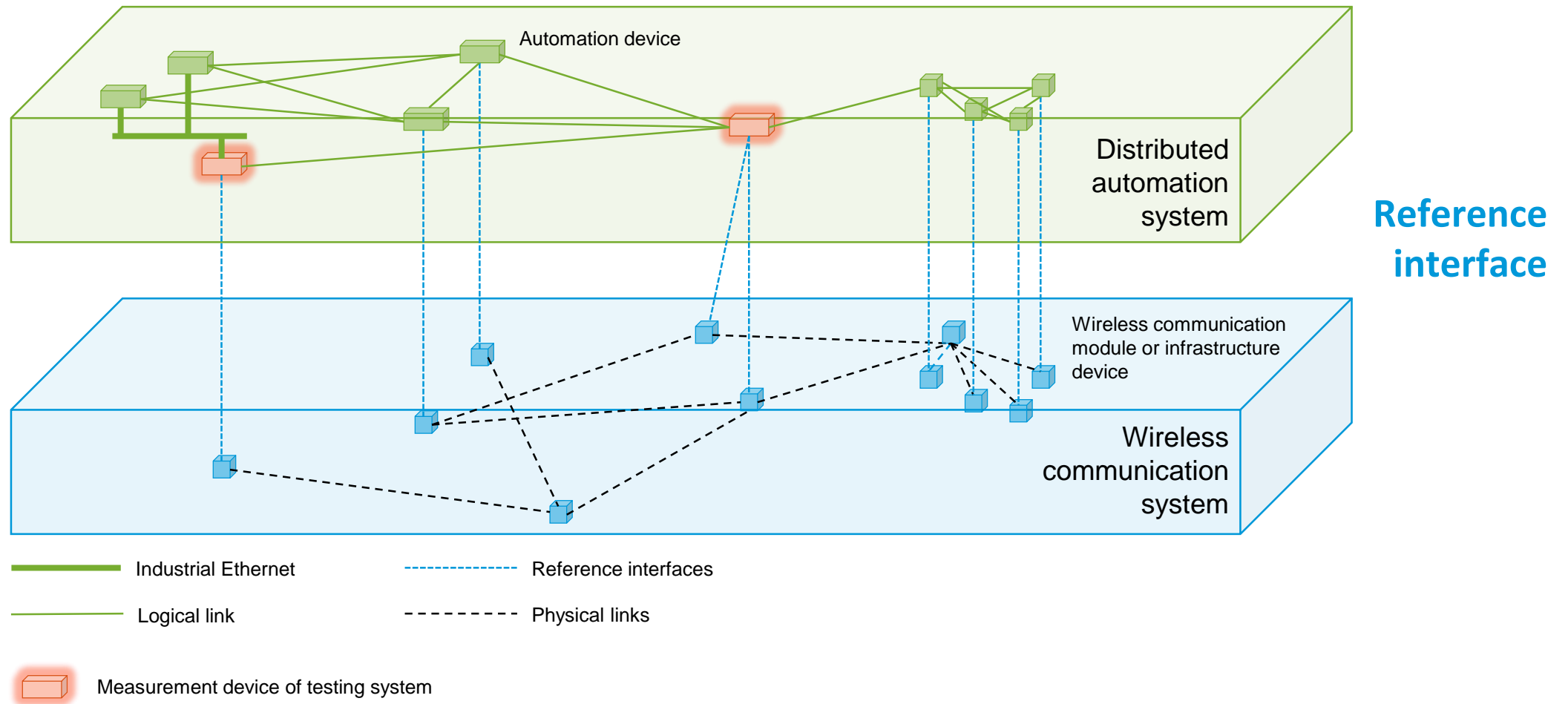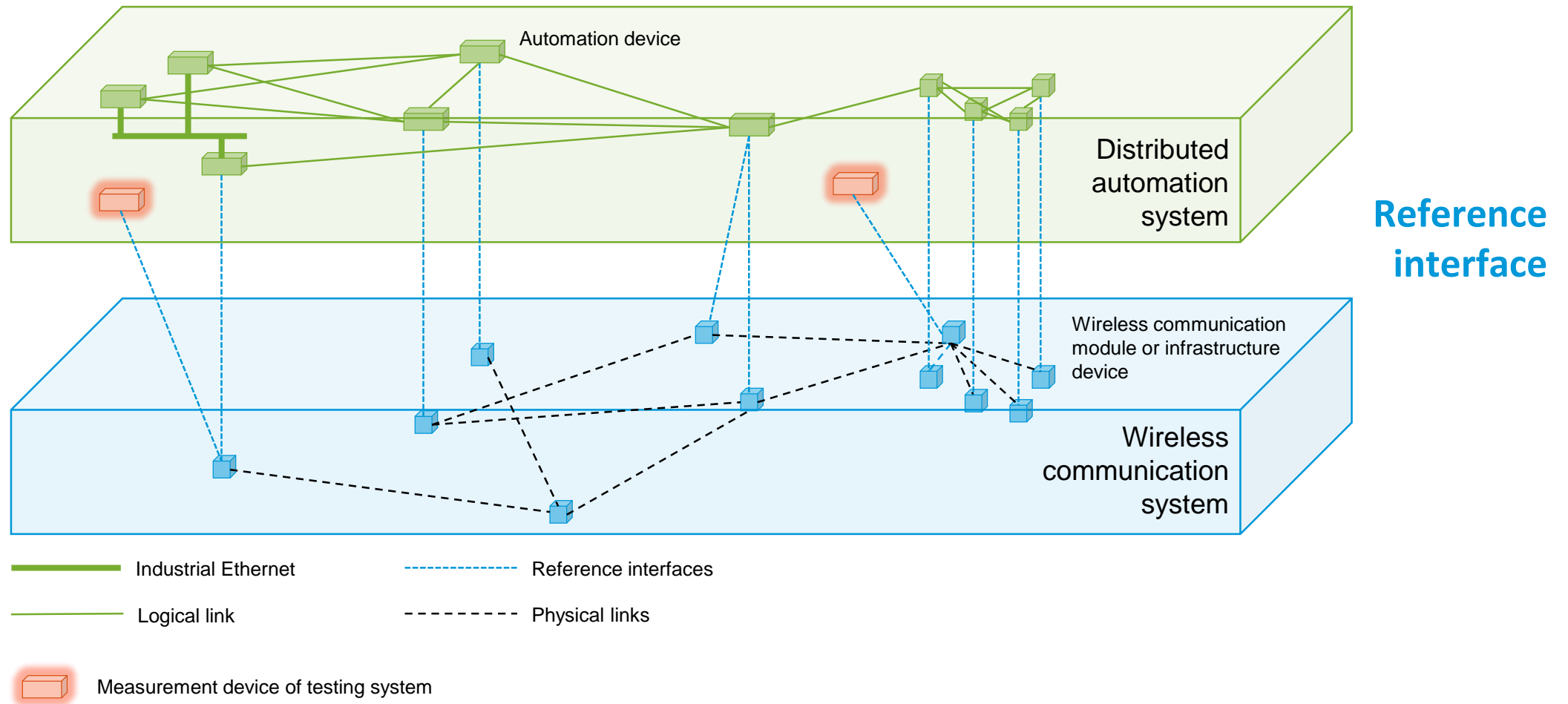
approach and experience

Automation device

Distributed automation system

Reference interface

Wireless communication module or infrastructure device

Wireless communication system

▬▬▬ Industrial Ethernet	┄┄┄	Reference interfaces
───── Logical link	╌╌╌	Physical links

Measurement device of testing system

SIMPLE MEASUREMENT EXAMPLE AT IFAK: PROFINET OVER BLUETOOTH

logical link for **downlink** measurement

Multiface MF 1 (source)

Digital I/O

PROFINET IO controller

PROFINET

BT-M

Bluetooth

e.g. channel emulator

Bluetooth

BT-D1

PROFINET

Multiface MF 2 (target)
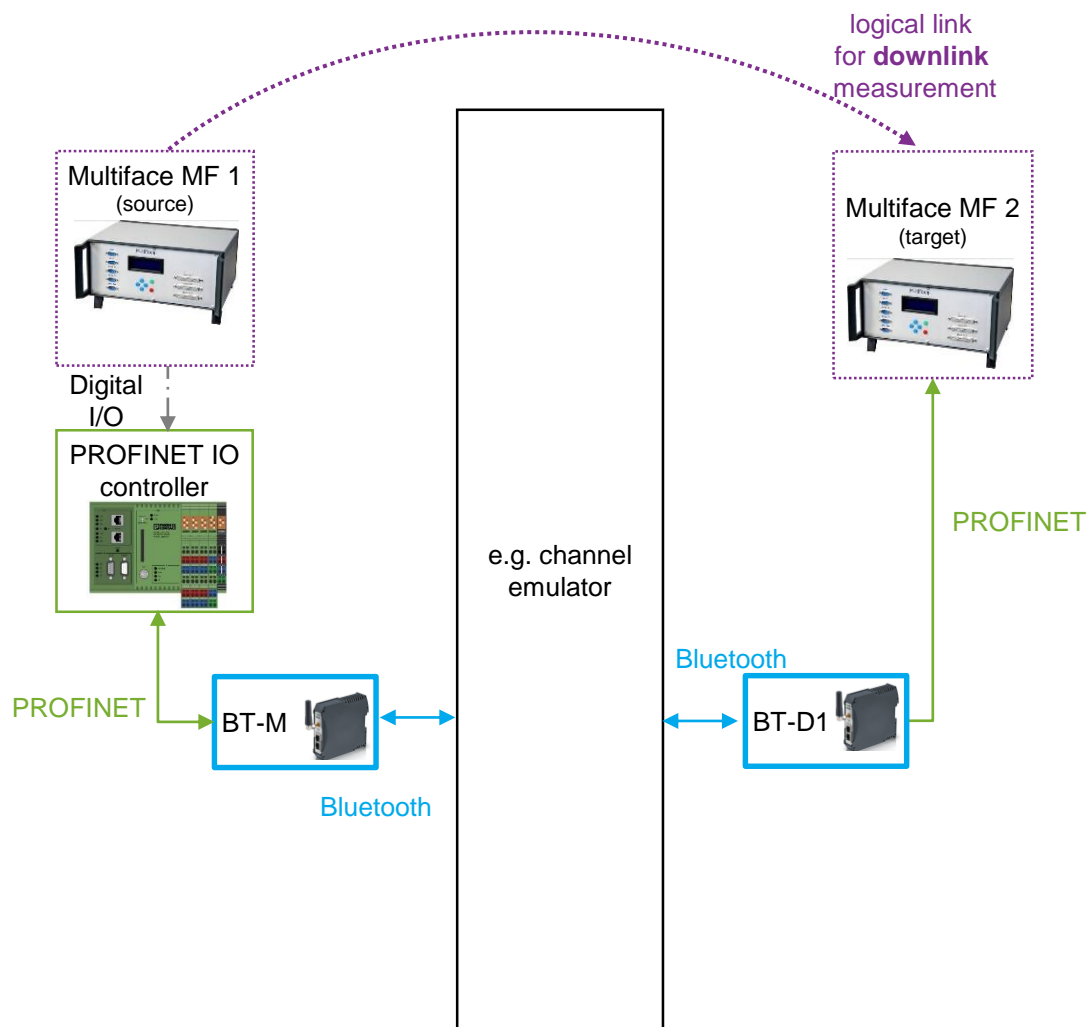
Laboratory environment

Reference environment

Target environment

https://5g-acia.org/insight/endorsed-testbets/

https://industrial-radio-lab.eu/industrial-radio-day-2021/

So what's next?

- **Elaborate performance testing concept already in place**
  - ☐ Easily applicable to 5G networks…
  - ☐ … due to separation of system under test (SUT) and testing system

- **Industrial devices and time synchronisation needed!**

- **Well, so we have to wait…? – No, be proactive.**
  - ☐ Gain experience, work with available technologies / available 5G implementations towards digitalization.
  - ☐ Migration from 5G to 5G and beyond will be ensured.

Thank you.

lisa.underberg@ifak.eu

ifak - Institut für Automation
und Kommunikation e.V.
Werner-Heisenberg-Str. 1
39106 Magdeburg

www.ifak.eu