

Do new, modern OT protocols have an impact on the (existing) OT network infrastructure?













Agenda

- Digitize & combine..
- Effects on network infrastructure
- Example
- Hint and tips









Digitize & combine..











Digitize & combine...

- The combination of digital world and physical world adds *significant* value.
- Kind of combinations:
 - Automate
 - Apply
 - Accompany
 - Augment
 - Abstract



https://www.gartner.com/imagesrv/books/digital-edge/TheDigitalEdge.pdf













Automate

- Digital resources *enable* operational scale.
- ERP, OLTP, MES, CRM etc..















Apply

- Digital resource *replace* physical resource.
- Autonomous operation.
- Remote sensing.













Accompany

- Digital resources *refine* the application of physical resources.
- Big data
- Digital twin















Augment

- Digital resources generate value beyond the physical resources.
- Remote sensing.
- Situational awareness.















Abstract

- Digital resources generate derivative information.
- Ubiquitous presence (pervasive computing).
- Behavioural support.





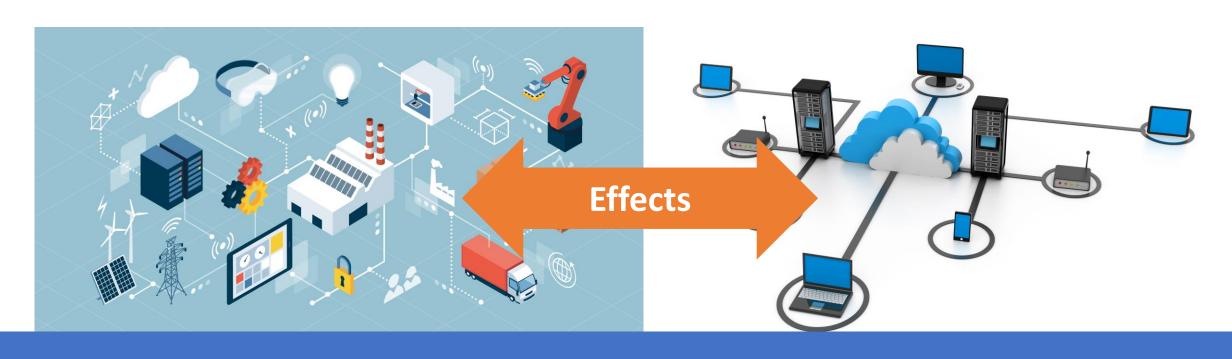








Introduction new computing paradigms



Specify network requirements













Effects on network infrastructure











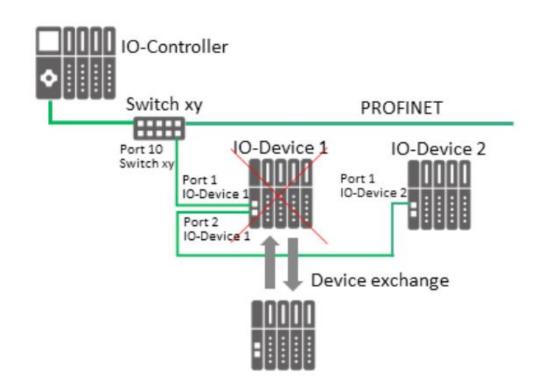
Current OT examples: Maintainability

Device replacement without an engineering tool

Conditions network:

- LLDP
- DCP

-> Management switch



https://www.profibus.fr/wp-content/uploads/2021/04/PROFINET System Description engl 2018.pdf#page=15









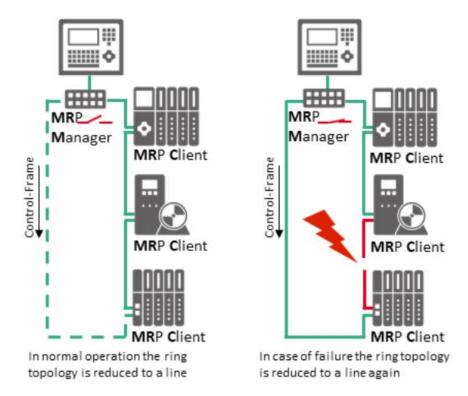






Current OT examples: Availability

- Media Redundancy Protocol
- Conditions network:
 - MRP Manager
 - MRP Client
- -> Managed switch



https://www.profibus.fr/wp-content/uploads/2021/04/PROFINET_System_Description_engl_2018.pdf#page=20















New requirements OT networks

- Scalability
 - MQTT
 - OPC UA Pub/sub
- Security
 - Generic solution? Certificate infrastructure?
- Network load.















Example















OPC UA Pub/Sub: Broker-less

- Broker-based
 - MQTT
 - AMQP
- Broker-less
 - UDP/Multicast
- Broker-less uses multicast capabilities of the network.

https://reference.opcfoundation.org/Core/Part14/v104/docs/5.1

Publisher Subscriber **Publisher** Subscriber Network infrastructure **Publisher** Subscribe

https://reference.opcfoundation.org/Core/Part14/v104/docs/5.4.4





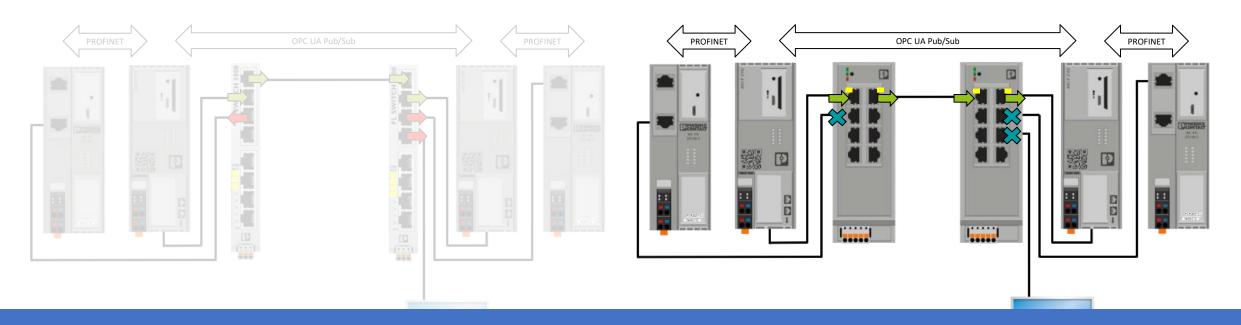




IGMP snooping

Unmanaged/ Managed without IGMP snooping

Managed with IGMP snooping



Multicast traffic => broadcast traffic!

without IGMP snooping

















PROFINET and Multicast traffic

- PROFINET and multicast traffic is not a good combination.
- Needs the right network infrastructure.
- How to handle:
 - Split load over ports.
 - Reduce cycle time.

The above search requests have one thing in common: all devices in a broadcast domain first must receive and evaluate the corresponding Ethernet packets, irrespective of their location or the topology and regardless whether they are supposed to respond or not. For all devices in the network this results in an additional communication load which may be quite important, depending on the request frequency. Therefore, additional loads generated by broadcast or

PROFINET Commissioning Guideline version 2022, p.97 PROFINET Desing Guideline version 2022, p. 132

multicast requests should be minimized. See the following chapters for details.















Hint and tips









Hint and tips

- Specify network/infrastructure requirements.
- Use managed switches.
- No protocol optimised switches but more generic switches that support multi protocols.
- Upgradable switch -> A switch with enough computer power.









Resume: Bert van der Linden



Bert van der Linden Program Manager Technical Education PHOENIX CONTACT B.V.

Postbus 246

6900 AE ZEVENAAR

Telephone +31 (0)316 59 17 10 Mobile +31 (0)6 821 552 72

E-mail blinden@phoenixcontact.nl

www.phoenixcontact.nl





This enthusiastic and passionate late bloomer has developed himself as an independent and objective expert in the domain of technical and industrial automation. He strives to explain complex topics (situations, problems) in a clear and straightforward way to gain insight



Aug 1999 – Sep 2019 **Senior Lecturer IA & IT** @ ATS Applied Tech Systems

Aug 1998 – Present **Technical Author** @ ThiemeMeulenhoff

Aug 2015 – Present Participant working groups @ PLCopen

Aug 2015 – Present Working group SU4 PITC @ PI International

Aug 2015 – Present Program Manager Technical Education @ Phoenix Contact B.V.



- PLC programming (Siemens, Mitsubishi, Codesys, Schneider Electric etc.)
- PLCnext Technology & Component-based development
- PROFINET & OPC UA
- Industrial IoT & Industry 4.0
- Manufacturing Operations Management (MES/MOM)
- Expertise development & Didactics for education of technical systems.



Wrote and edited several books about industrial automation and industrial communication for the vocational education and several articles (Magazines and LinkedIn) about the fourth industrial revolution and her effects.











