

PROFINET

Theorie & Praktijk

Engineering & Fout zoeken

11, 12, 18 & 19/01/2017



1

- In depth 4 day course
- Short theoretical overview as introduction
- Followed by detailed theoretical and practical coverage of most subtopics
- A lot of practical exercises => it's what you make of it!
- You work in groups of 2
- Introducing a lot of measuring techniques for analysis and diagnostics
- Using new laboratory set-ups



2

PROFINET course – Equipment used

KU LEUVEN



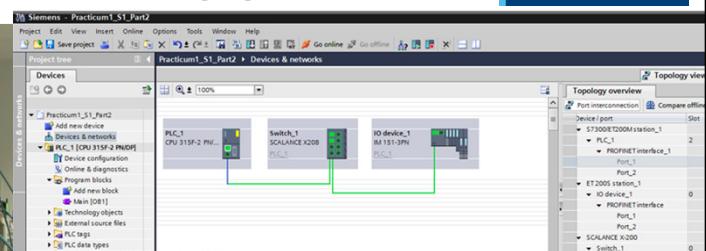
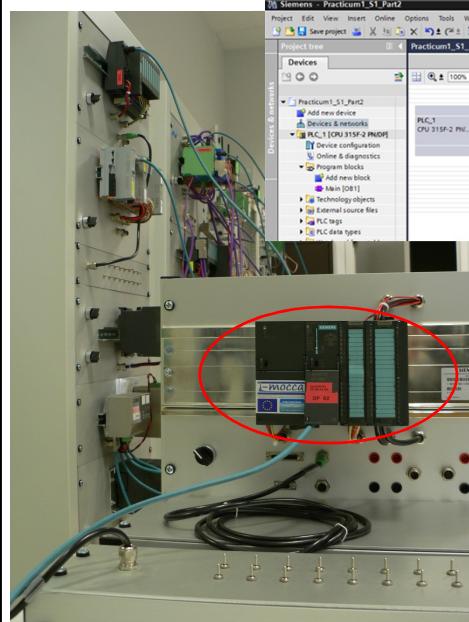
Basic setup is mounted on
2 racks => small footprint



3

PROFINET course – Equipment used

KU LEUVEN



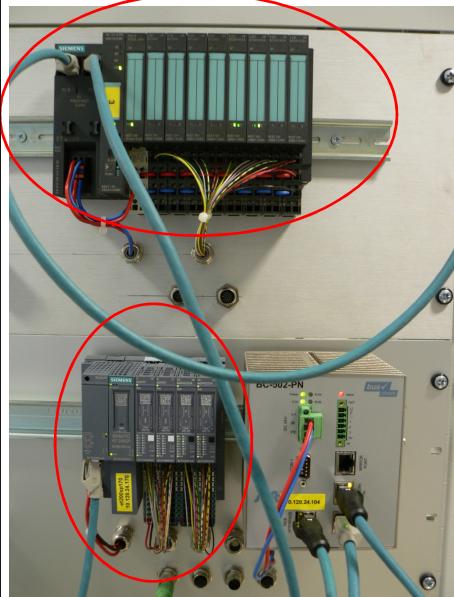
Basic setup is mounted on
2 racks => small footprint

Use of 1 or 2 masters
in a network

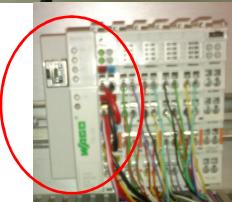
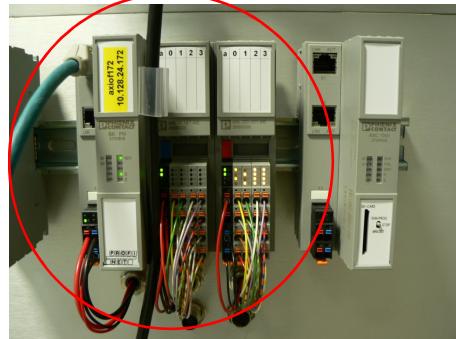
4

PROFINET course – Equipment used

KU LEUVEN



2 modular slaves per set-up, different vendors

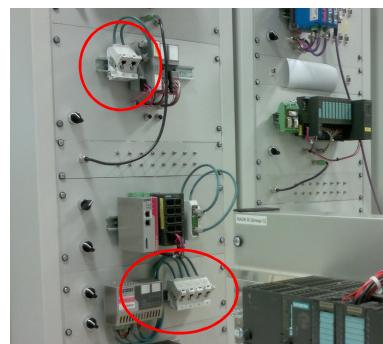


5

PROFINET course – Equipment used

KU LEUVEN

Now mounted using separate sockets for longer lifecycle



6

PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis &
Diagnostics: cable testing



7

PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis &
Diagnostics: Wireshark

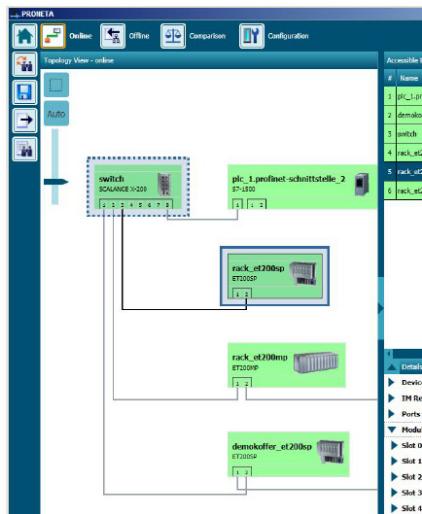
No.	Time	Source	Destination	Protocol	Length	Info
37	10.365587000	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.101? Tell 10.26.1.00
38	16.385890000	(PhoenixC_34:e3:cf)	SiemensA_fa:e1:14	ARP	60	10.26.1.101 is at 00:a0:45:34:e3:cf
39	17.085307000	(SiemensA_fa:e1:14)	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
40	17.085324000	(SiemensA_fa:e1:14)	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
41	17.285367000	(SiemensA_fa:e1:15)	LLDP_Multicast	PN-PTCP	60	DelayReq , Seq= 4, Delay=
42	17.918555000	(SiemensA_0b:70:49)	LLDP_Multicast	LLDP	162	chassis Id = scalance-x208-4 Port Id =
43	18.085420000	(SiemensA_fa:e1:14)	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
44	18.085441000	(SiemensA_fa:e1:14)	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
45	18.486319000	(SiemensA_fa:e1:15)	LLDP_Multicast	PN-PTCP	60	DelayReq , Seq= 5, Delay=
46	18.486328000	(SiemensA_fa:e1:14)	Broadcast	ARP	60	who has 10.26.1.101? Tell 10.26.1.66
47	18.486337000	(SiemensA_fa:e1:14)	Broadcast	ARP	60	who has 10.26.1.101? Tell 10.26.1.66
48	18.486713000	(PhoenixC_34:e3:cf)	SiemensA_fa:e1:14	ARP	60	10.26.1.101 is at 00:a0:45:34:e3:cf
49	18.487428000	10.26.1.66	10.26.1.101	PNIO-CM	704	Connect request, ARBlockReq, IOCRBlock
50	18.549429000	10.26.1.101	10.26.1.66	PNIO-CM	212	Connect response, OK, ARBlockRes, IOCR
51	18.550747000	(PhoenixC_34:e3:cf)	SiemensA_fa:e1:14	PNIO	63	RTC2, ID:0x8061, Len: 43, Cycle:44505
52	18.552530000	10.26.1.66	10.26.1.101	PNTO-CM	215	write request, TOTwriteReqHeader, Ani:

8

PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis & Diagnostics: Proneta



9

PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis & Diagnostics:
Softing PN Inspektor

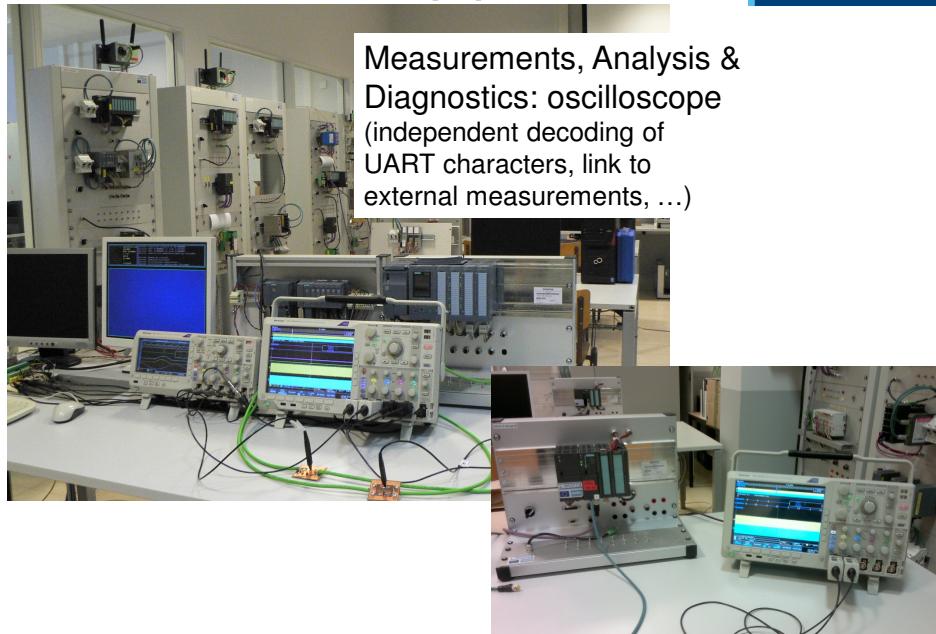
New HW version and Software suite are coming ...



Network Overview				
Current Time/Date	10/23/2014 14:11:26	Last Minute	Last Cycle 24h	History
Lost Nodes	0	0	0	0
High Priority Alarm	0	0	0	0
Low Priority Alarm	0	0	0	0
Packetloss [%]	0	0	0	0
Missing RTC Packets	0	0	0	0
Loading Ratio	0.0	0.0	0.0	0.0
Update Rate min/max [ms]	- / -	- / -	- / -	- / -
Network Status	100	100	100	100
Network Loading min/average/max [%]	- / - / 0	- / - / 0	- / - / 0	- / - / 0
Throughput maximal [Bytes/ms]	0	0	0	0
Error Telegrams	0	0	0	0
Connection Retries maximal	0	0	0	0
Start of Measurement	10/23/2014 14:10:50	10/23/2014 13:16:47	10/23/2014 13:16:47	
Last SNMP Request				

PROFINET course – Equipment used

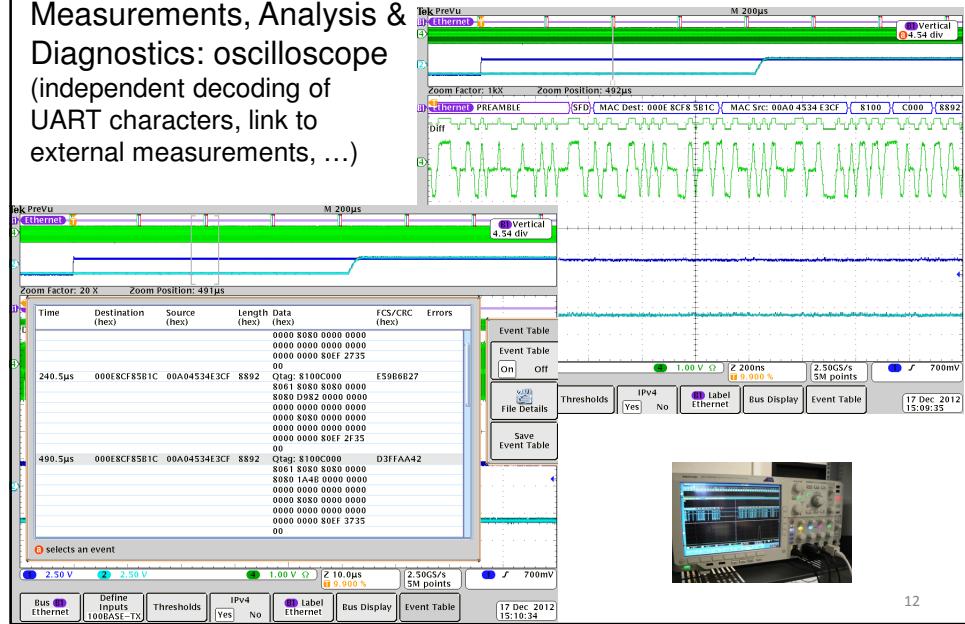
KU LEUVEN



PROFINET course – Equipment used

KU LEUVEN

**Measurements, Analysis & Diagnostics: oscilloscope
(independent decoding of
UART characters, link to
external measurements, ...)**



PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis &
Diagnostics:
Hilscher netANALYZER



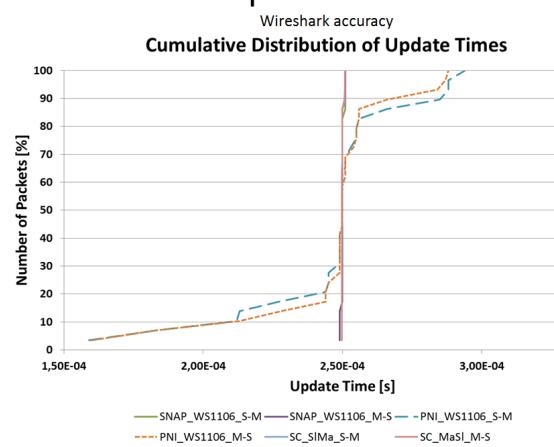
13

PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis &
Diagnostics: accuracy of tools ...

Update time



14

PROFINET course – Equipment used

KU LEUVEN



Measurements, Analysis & Diagnostics:
TH-Link for PROFINET



TH Scope software for DP and PN, using input from TH-Links

15

PROFINET course – Equipment used

KU LEUVEN

Measurements, Analysis & Diagnostics: switches (RT/IRT), webserver IO-controller

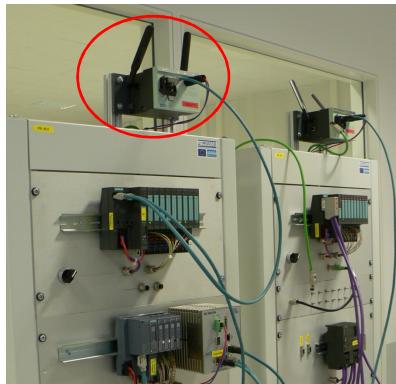


16

PROFINET course – Equipment used

KU LEUVEN

Extra network components:
wireless link, IE-PB link,
CP343, ...

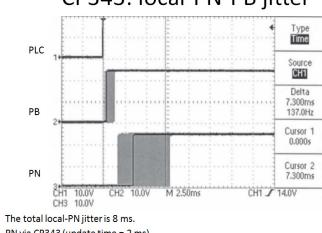


17

PROFINET course – Equipment used

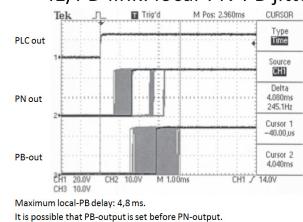
KU LEUVEN

CP343: local-PN-PB jitter

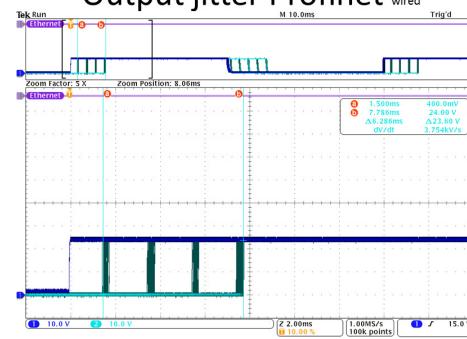


Extra network components: ...
introduced jitter, combined PN and
DP networks ...

IE/PB-link: local-PN-PB jitter



Output jitter Profinet wired

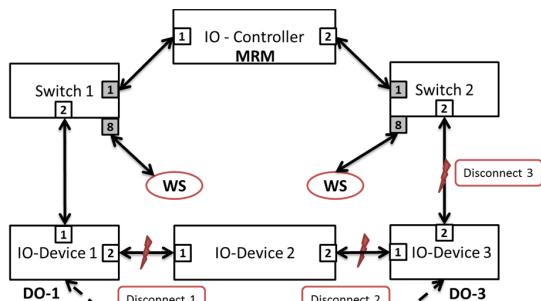


18

PROFINET course – Equipment used

KU LEUVEN

Extra network components: ...
redundancy testing and measuring



MRP redundancy: recovery time about 200 ms

Legend:	Setup left	Setup right
IO-Controller:	cpu315f122	cpu315f123
Switch 1:	scalance-x208-13	scalance-x208-12
Switch 2:	scalance-x208-11	scalance-x208-14
IO-Device 1:	et200s164	et200s165
IO-Device 2:	et200s162	axiof173

19

PROFINET course – Equipment used

KU LEUVEN

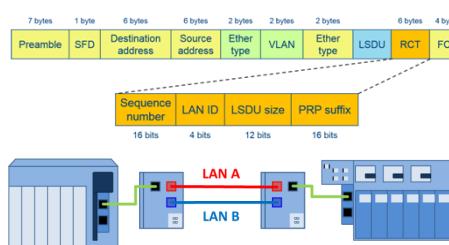
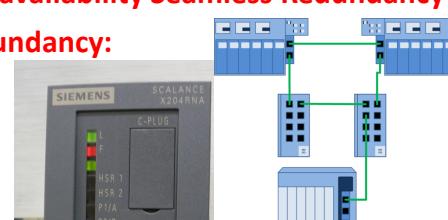


Extra network components: ...
redundancy testing and measuring

PRP: Parallel Redundancy Protocol

HSR: High-availability Seamless Redundancy

PRP & HSR redundancy: extremely fast.



20

PROFINET course – Equipment used

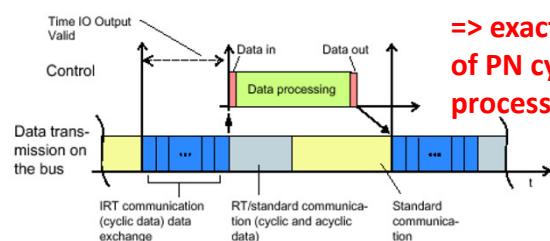
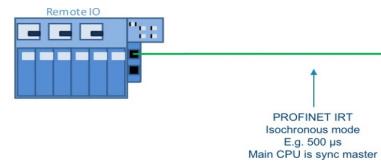
KU LEUVEN

Extra network components: ... “oversampling”
using IRT and isochronous mode

- Analog input with oversampling
- Values per cycle, max.
 - Resolution, min.

Yes
16
50 µs

Oversampling of e.g. analog
inputs using HF ET200 SP



21

PROFINET course – Equipment used

KU LEUVEN

View on a lab set-up for one
group

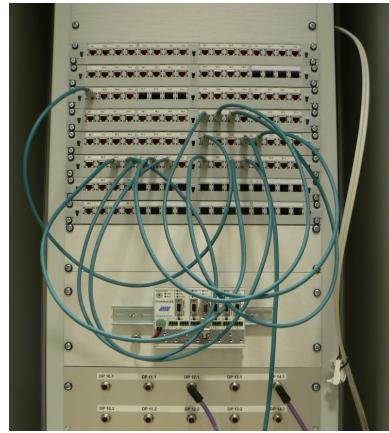


22

PROFINET course – Equipment used

KU LEUVEN

In the new lab we can easily patch larger PROFIBUS and PROFINET networks.



23

PROFINET course

KU LEUVEN

Very interactive and hands-on:

- Measurements, configurations, exercises => print the results, make conclusions, add to your course notes
- Work on 4 set-ups with equipment from different vendors => a lot of variation
- Your account and networkdrive move with you from set-up to set-up => save results, select your printouts,
- If you have suggestions for exercises, typical errors or set-ups, ... => we are constantly adapting the course, making it as (industrially) relevant as possible.
- No exam, but many exercises and at the end a test scenario (in a network of 15+ components with all diagnostic hardware and software)

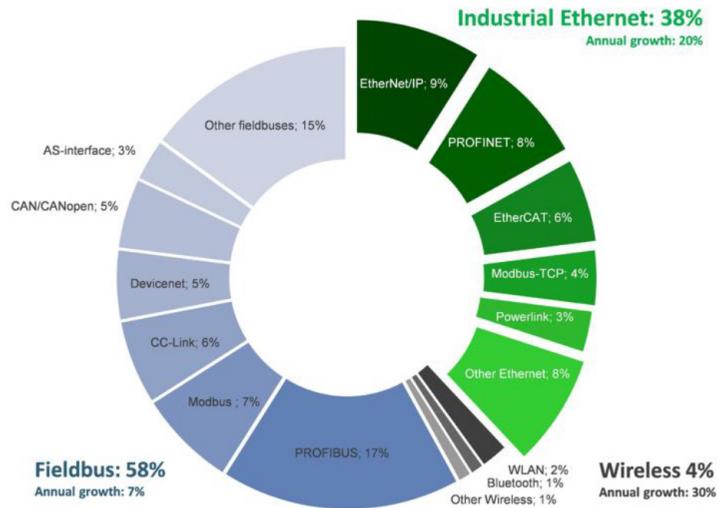
If possible: extra on IRT and/or oversampling, response measurement drive, etc.

24

PROFINET course

KU LEUVEN

Fieldbuses worldwide 2015 (HMS)



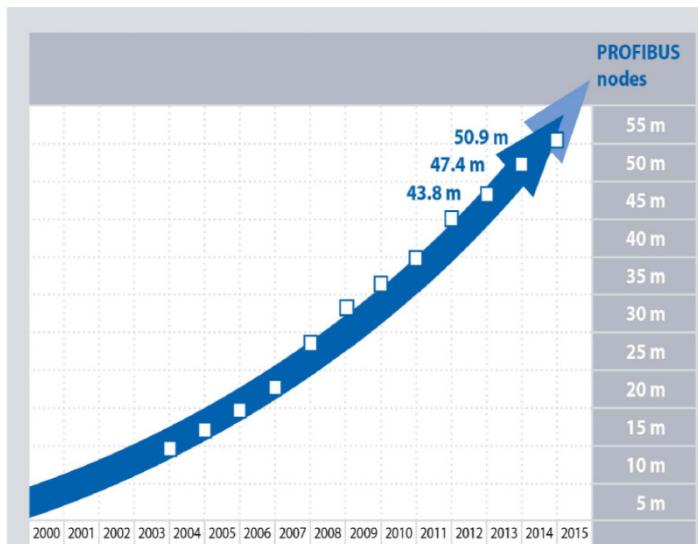
Industrial Ethernet now account for 38% market share, but is also growing at a 20% annual growth rate.

25

PROFINET course

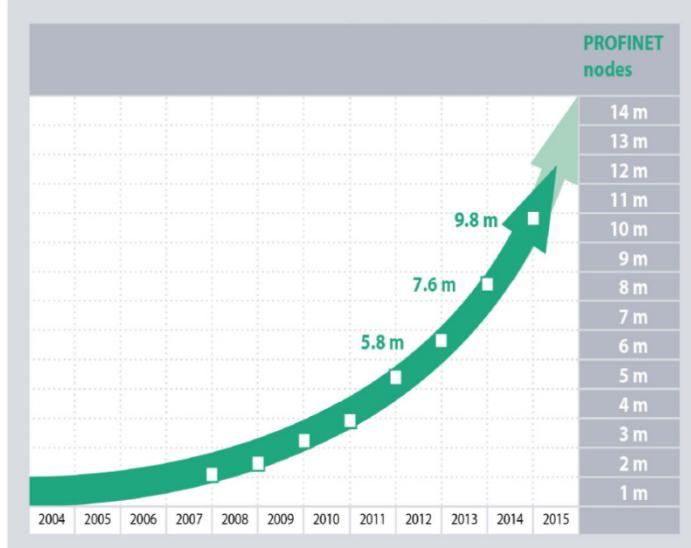
KU LEUVEN

PROFIBUS: about 3,5 mln nodes per year



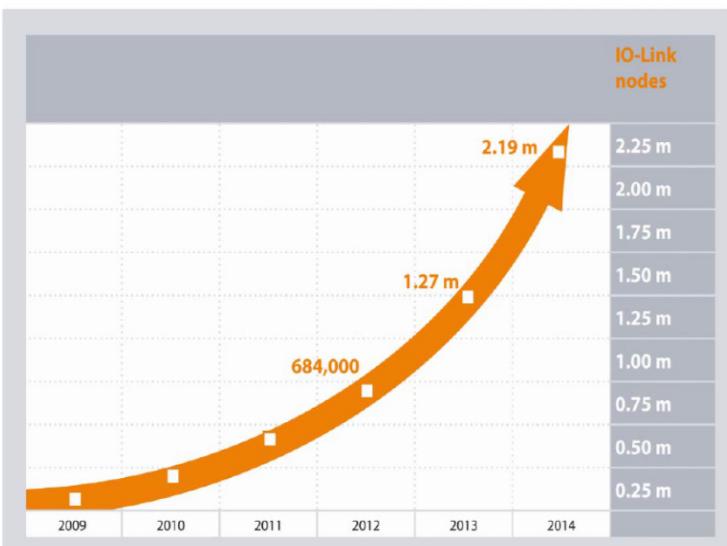
26

PROFINET: about 2 mln nodes per year



27

IO-Link: finally (?) gaining momentum?



28

Course content

Day 1

- Introduction
- Conformance classes
- Network topology
- Device addressing
- Ethernet fundamentals
- Real-time Ethernet
- PROFINET communication
- RT & IRT
- Cycle times
- PROFINET V2.3

29

Course content

Day 2

- Device description
- ProfiEnergy
- Alarms
- PN ASICs
- Switches and hubs
- PROFINET redundancy
- Cables
- Connectors
- Wireless
- PB vs. PN

30

Course content

Day 3

- Delay measurement
- Security
- Measurement tools

31

Course content

Day 4

- Network design + commissioning
- Installing
- Troubleshooting

32