

PROFINET

**Theorie & Praktijk
Engineering & Fout zoeken**

24 & 25/04, 2 & 3/05/2017



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- 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



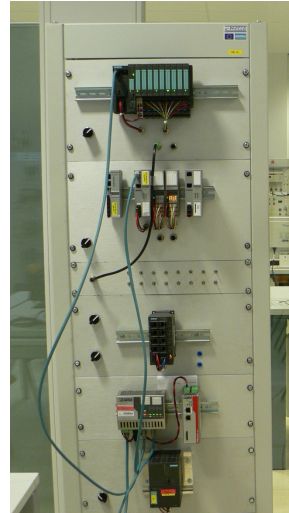
2

PROFINET course – Equipment used

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Basic setup is mounted on 2 racks => small footprint



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Basic setup is mounted on 2 racks => small footprint

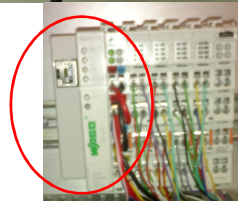
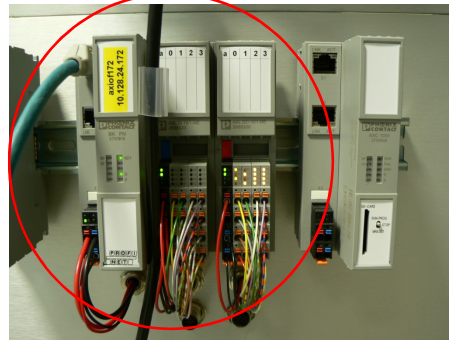
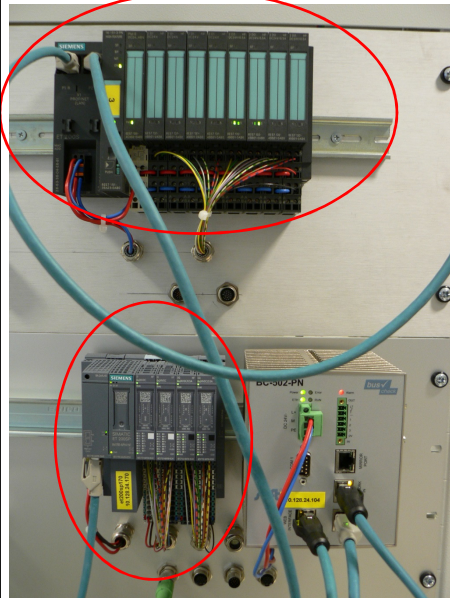
Use of 1 or 2 masters in a network

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2 modular slaves per set-up, different vendors

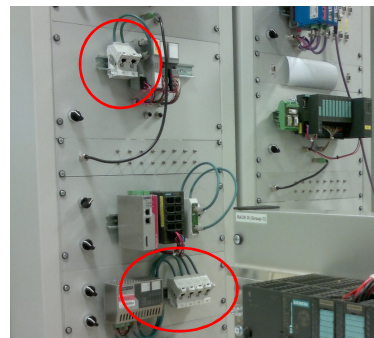
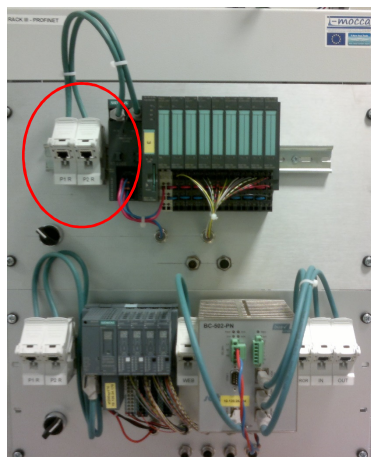


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Now mounted using separate sockets for longer lifecycle

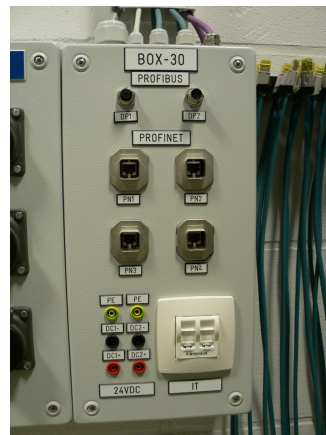


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Measurements, Analysis &
Diagnostics: cable testing



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Measurements, Analysis &
Diagnostics: Wireshark

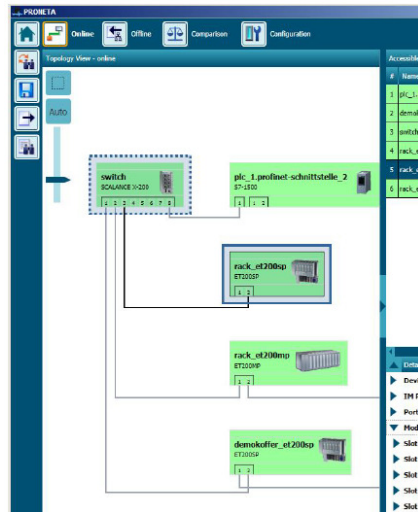
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help						
Filter: Expression... Clear Apply						
No.	Time	Source	Destination	Protocol	Length	Info
37	10.58350000	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.101? Tell 10.26.1.66
38	16.38589000	PhoenixC_34:e3:cf	SiemensA_fa:e1:14	ARP	60	10.26.1.101 is at 00:a0:45:34:e3:cf
39	17.08530700	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
40	17.08532400	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
41	17.28536700	SiemensA_fa:e1:15	LLDP_Multicast	PN-PTCP	60	DelayReq Seq= 4, Delay=
42	17.91855500	Siemens_Ob:70:49	LLDP_Multicast	LLDP	162	Chassis Id = scalance-x208-4 Port Id =
43	18.08542000	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
44	18.08544100	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.66? Tell 0.0.0.0
45	18.48631900	SiemensA_fa:e1:15	LLDP_Multicast	PN-PTCP	60	DelayReq Seq= 5, Delay=
46	18.48632800	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.101? Tell 10.26.1.66
47	18.48633700	SiemensA_fa:e1:14	Broadcast	ARP	60	who has 10.26.1.101? Tell 10.26.1.66
48	18.48671300	PhoenixC_34:e3:cf	SiemensA_fa:e1:14	ARP	60	10.26.1.101 is at 00:a0:45:34:e3:cf
49	18.48742800	10.26.1.66	10.26.1.101	PNIO-CM	704	Connect request, ARBlockReq, IOCRBlock
50	18.54942900	10.26.1.101	10.26.1.66	PNIO-CM	212	Connect response, OK, ARBlockRes, IOCR
51	18.55074700	PhoenixC_34:e3:cf	SiemensA_fa:e1:14	PNIO	63	RTC2, ID:0x8061, Len: 43, Cycle:44505
52	18.55253000	10.26.1.66	10.26.1.101	PNIO-CM	215	Write request, TODWriteReqHeader, Ani3

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Measurements, Analysis & Diagnostics: Proneta



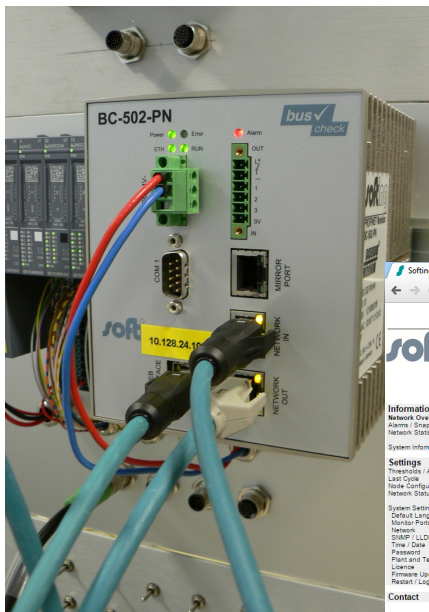
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Measurements, Analysis & Diagnostics:
Softing PN Inspektor

New HW version and Software suite are coming ...



Softing Industrial Automation X

10.128.24.104

Name of the Network:

Network Overview

Current Time/Data	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
Packettfilter [%]	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				

Information

- Network Overview
- Alarm / Snapshots
- Network Statistics

System Information

Settings

- Thresholds / Alarms
- Last Cycle
- Node Configuration
- Network Status

System Settings

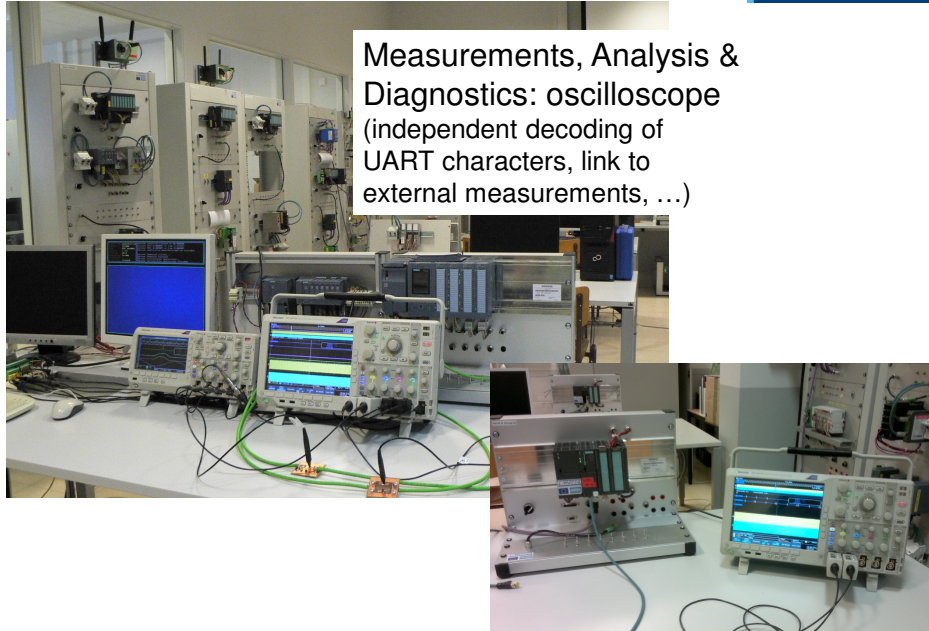
- Default Language
- Monitor Ports
- Network
- SNMP / LLDP
- Time / Date
- Password
- Plant and Tester
- License
- Firmware Update
- Restart / Log off

Contact

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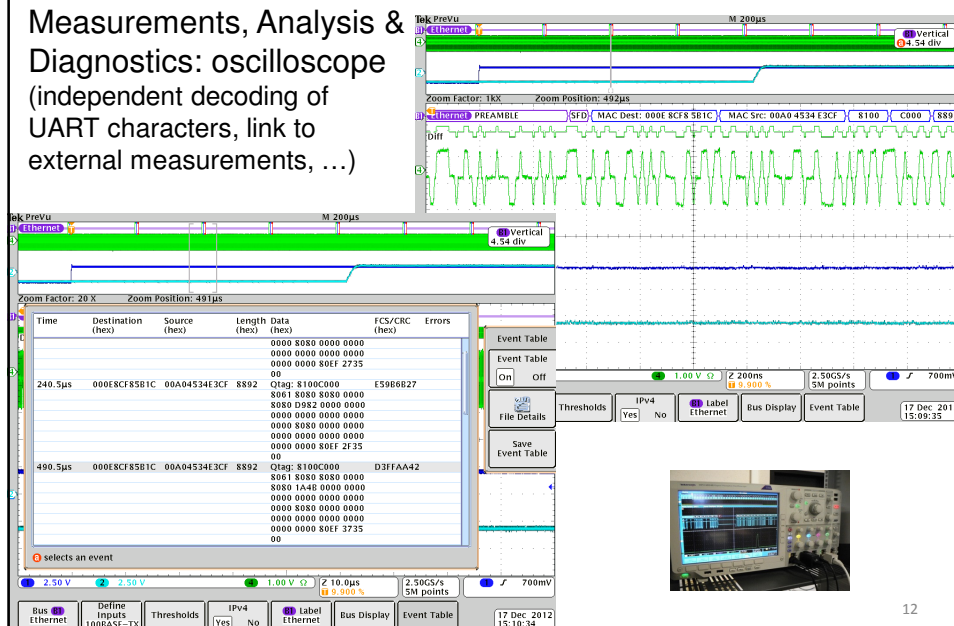
Measurements, Analysis & Diagnostics: oscilloscope
(independent decoding of UART characters, link to external measurements, ...)



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



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Measurements, Analysis &
Diagnostics:
Hilscher netANALYZER



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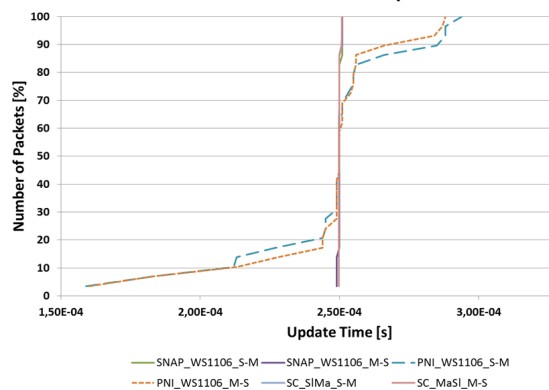
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Measurements, Analysis &
Diagnostics: accuracy of tools ...

Update time

Wireshark accuracy

Cumulative Distribution of Update Times



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Measurements, Analysis &
Diagnostics:
TH-Link for PROFINET



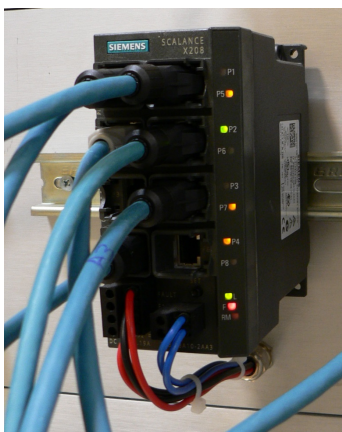
TH Scope software for DP and
PN, using input from TH-Links

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

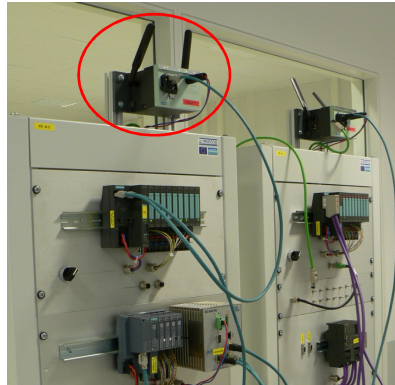


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Extra network components:
wireless link, IE-PB link,
CP343, ...

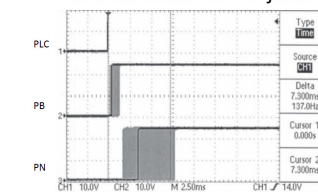


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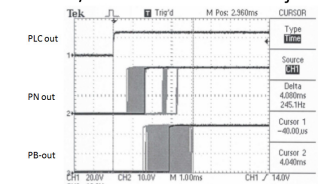
Extra network components: ...
introduced jitter, combined PN and
DP networks ...

CP343: local-PN-PB jitter



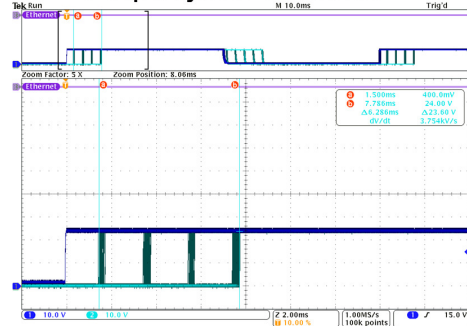
The total local-PN jitter is 8 ms.
PN via CP343 (update time = 2 ms).

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



Maximum local-PB delay: 4.8ms.
It is possible that PB-output is set before PN-output.

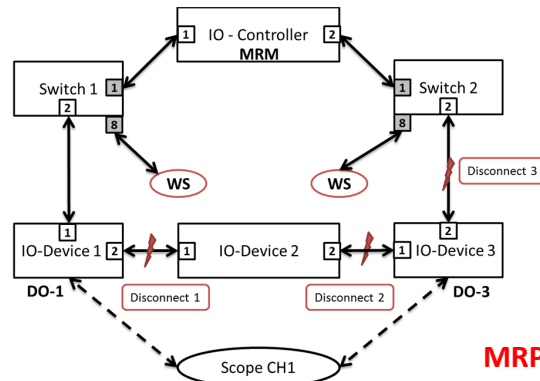
Output jitter Profinet wired



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Extra network components: ...
redundancy testing and measuring



Legend:
IO-Controller:
Switch 1:
Switch 2:
IO-Device 1:
IO-Device 2:

Setup left
cpu315f122
scalance-x208-13
scalance-x208-11
et200s164
et200s162

Setup right
cpu315f123
scalance-x208-12
scalance-x208-14
et200s165
axiof173

**MRP redundancy: recovery
time about 200 ms**

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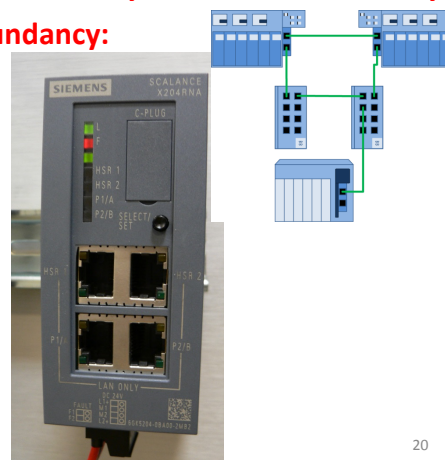
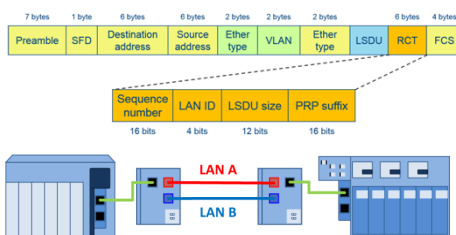
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Extra network components: ...
redundancy testing and measuring

PRP: Parallel Redundancy Protocol
HSR: High-availability Seamless Redundancy

**PRP & HSR redundancy:
extremely fast.**



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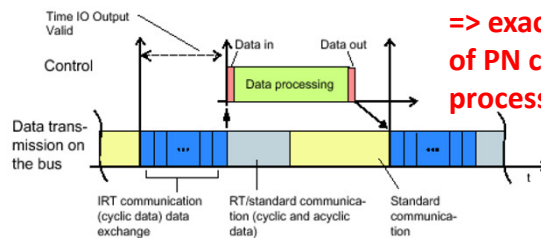
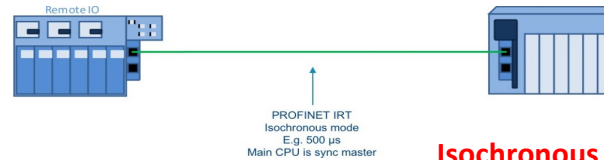
Extra network components: ... “oversampling”
using IRT and isochronous mode

Analog input with oversampling

- Values per cycle, max.
- Resolution, min.

Yes
16
50 μ s

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



**Isochronous processing using OB6x
=> exact knowledge of the number
of PN cycles from actual input =>
processing => actual output**

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View on a lab set-up for one
group

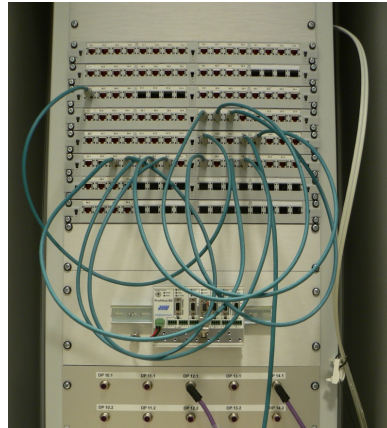


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In the new lab we can easily patch larger PROFIBUS and PROFINET networks.



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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.

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