& Present

Singapore (South East Asia)

PROFIBUS

Open Solutions for the World of Automations

Presented by

RPA South East Asia
Andreas Agostin, Richard Jennens, Volker Schulz

Overview PROFIBUS Technology

Welcome 18.45 – 19.00

- Mr. Jacky Chan – GM Siemens Pte Ltd – A&D
- Mr. TJ Kang – President ICS & MD Cegelec Pte Ltd

PROFIBUS Organization 19.00 – 19.45

Standard & Technology

- Mr. Andreas Agostin – PM Pepperl+Fuchs Pte Ltd

Break 19.45 – 20.00

Application Profiles 20.00 – 20.45

Integration Technology

- Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd

PROFINET 20.45 – 21.15

References

- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

Q&A Lucky Draw 21.15 – 21.30

Overview Siemens Pte Ltd

Medical

Medical Solutions (Med)

Information and Communication

Information and Communication Networks (ICN)
Information and Communication Mobile (ICM)
Siemens Business Services Pte Ltd*(SBS)

Automation & Control

Automation and Drives (A&D)
Industrial Solutions and Services (I&S)
Siemens Dematic Pte Ltd*(SD)
Siemens Building Technologies (SBT)
Siemens Westinghouse Technical Services Pte Ltd *

Lighting

Osram Pte Ltd*

Power

Power Generation (PG)
Power Transmission and Distribution (PTD)

Transportation

Transportation Systems (TS)
Siemens VDO Automotive Pte Ltd *

Financing & Real Estate

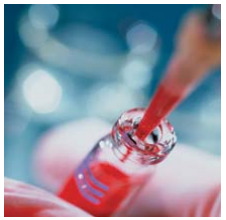
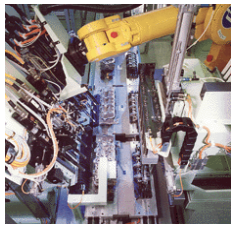
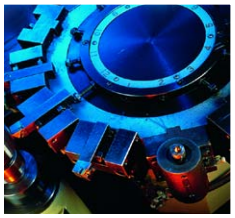
Siemens Financial Services*(SFS)
Siemens Real Estate (SRE)

*Groups with own legal structure

Overview A&D Solutions

- Programmable Logic Controllers
- Micro Automation
- PC-based Automation
- Industrial Software
- Distributed I/O
- SIMATIC based Technology
- Industrial Communication SIMATIC NET
- Human Machine Interface SIMATIC HMI
- MES Software SIMATIC IT
- Industrial PC
- Programming Devices
- Machine Vision
- Process Control System PCS7
- Field and Panel Instrumentation
- Process Analytics
- Weighing Systems SIWAREX

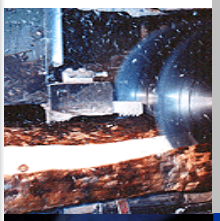


Manufacturing Industry
Process Industry

Overview A&D Solutions

- AC Motors
- DC Motors
- Distributed Drive Solution
- AC Converters
- DC Converters
- Engineering Software
- CNC Family SINUMERIK
- Motion Control System SIMOTION



The driving force behind A&D innovations is the need to save energy, boost performance and integrate into the world of automation. Intelligent concepts guarantee comprehensive drive solutions.

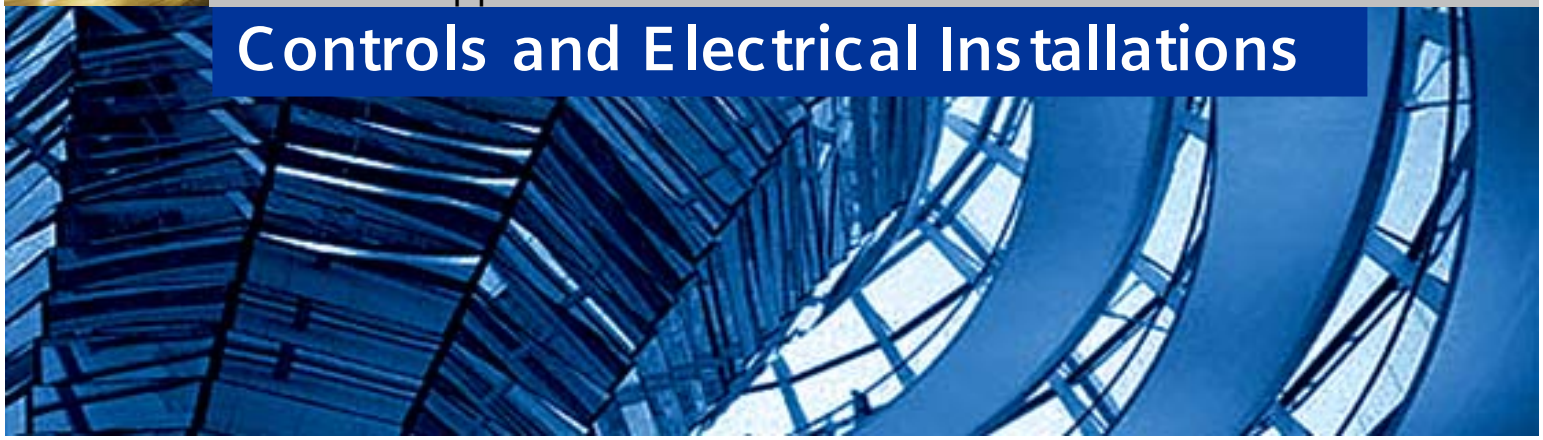
Drives

Overview A&D Solutions

- Safety Devices SIGUARD
- Proximity Switches BERO
- Protection Devices
- Push Buttons and Indicator Lights SIGNUM
- Relay Terminal SIMIREL
- Switchgear
- Fuse Systems
- Inline-Terminals
- Cubicle Systems SICUBE
- Transformers SIDAC T

Secure, user-friendly, economical and modern: controls and electrical installations from A&D for domestic, purpose-built and industrial applications.

Controls and Electrical Installations



Overview A&D Solutions

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PROFIBUS

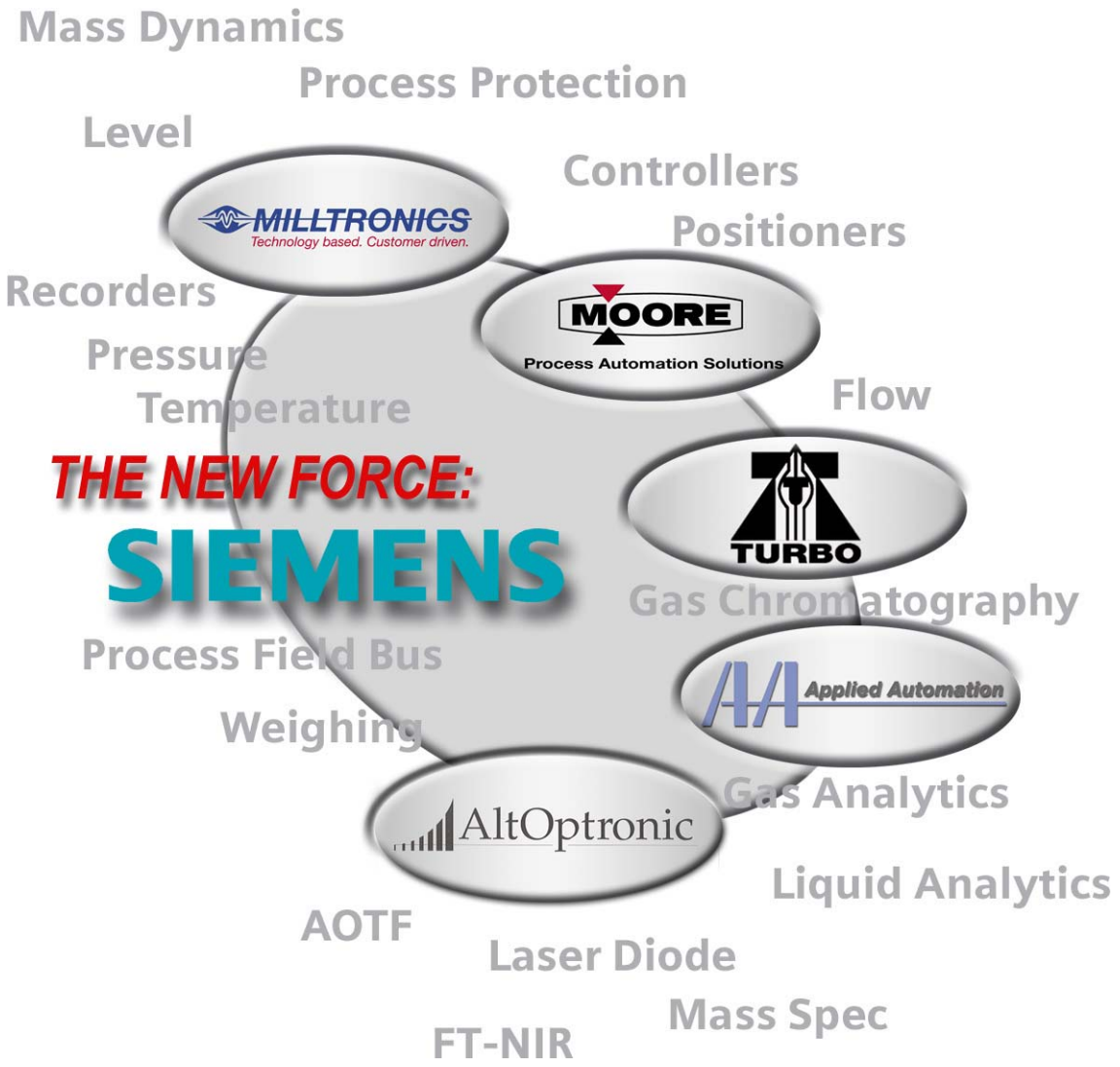
Standard & Technology

Application Profiles

Integration Technology

PROFINET

References



Overview A&D Solutions

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PROFIBUS

Standard & Technology

Application Profiles

Integration Technology

PROFINET

References

RPA S.E.A. – our next events in Singapore

PROFIBUS 30.09.2004

- FuRIOS (Fieldbus Remote I/O Study)
- PROFIBUS Design Standard & Technology
- Sponsored by Pepperl+Fuchs Pte Ltd

PROFIBUS 18.11.2004

- DP/PA integration with Diagnostic
- FDT/DTM Technology
- Sponsored by Endress + Hauser S.E.A. Pte Ltd

PROFIBUS 13.01.2005

- PROFIsafe
- Applications and technology
- Sponsored by Siemens Pte Ltd

Register for our bi-weekly update on PROFIBUS under

southeastasia@profibus.com

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Q&A Lucky Draw 21.15 – 21.30

Speaker - Andreas Agostin

Technological Knowledge

- In-depth knowledge about PROFIBUS due to seven years of experience in Pepperl+Fuchs Germany – R&D Department
- One year with Pepperl+Fuchs Kolleg (Seminar and documentation).
- 3 years with Pepperl+Fuchs Singapore as Product Manager and Business Development Manager for bus devices
- Certified PROFIBUS PA Engineer (2004)

Society experience

- Member of PROFIBUS Singapore Organization since 2001
- Member of Technical Committee RPA S.E.A.
- Member of FF Society Singapore since 2001
- Technical Director and Auditor of the FF Marketing Society Singapore (2004)

Public Relations

- Over 60 Fieldbus seminars in Australia, China, India, Korea, Singapore, Malaysia, Thailand, Philippines and Indonesia
- Seminars at ICS, CIA, IICA, JA, and many other societies and organizations
- Numerous publications for marketing and promotion

Overview PROFIBUS Technology

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- Integration Technology
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- References

History, organization, market position
With wide range of application

- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology

- Transmission Technology
- RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles

- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

Integration Technology

- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References

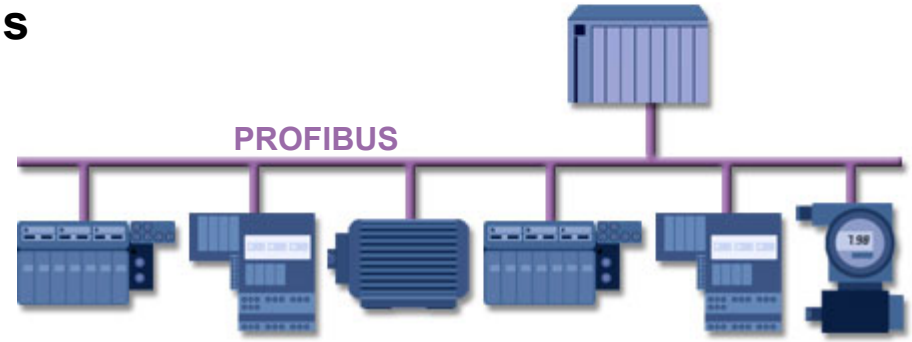
Changes in Automation Structures

From central automation systems

- with a central PLC and
- sensors/actuators
- based on 4-20 mA or 0-10 V technology

… over distributed automation systems

- with a PLC/IPC and
- distributed peripherals
- based on field bus technology



Changes in Automation Structures

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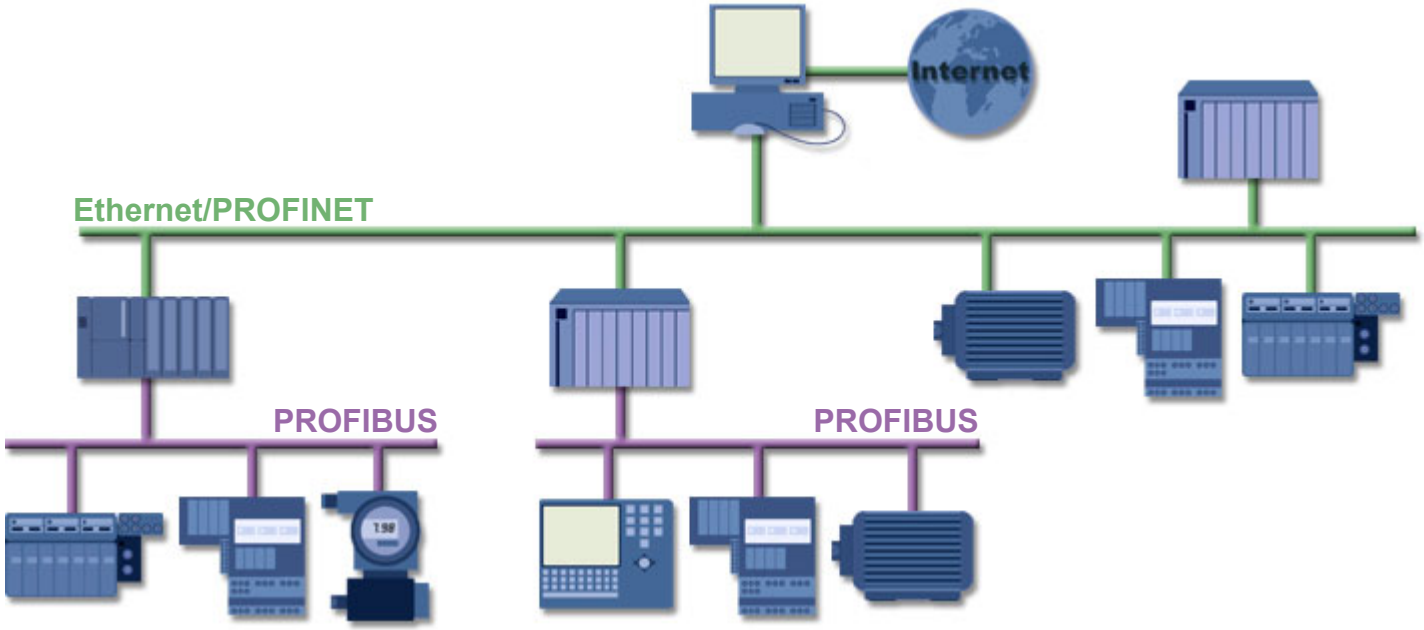
… for automation technology with

- distributed intelligence (intelligent field devices)
- symbiotic interaction of field bus and Ethernet communication
- consistency right through to corporate management level and Internet



With integrated motion, safety and Ex applications

Milestones to Market Leadership (organizational)

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2002	Founding of the first PROFINET Competence Center and Test Laboratory
2001	Founding of 22nd regional PROFIBUS User Organization
2000	CERN becomes the 1000th member of PROFIBUS International
1999	Founding of PROFIBUS Competence Center
1998	Deutsche Shell AG becomes the 200th member of PNO
1995	Founding of PROFIBUS International
1992	PROFIBUS goes international (Switzerland, USA, ...)
1989	"Field bus" development/joint project leads to founding of the PROFIBUS User Organization e.V.

Milestones to Market Leadership (technical)

2003	PROFIsafe established at market
2002	PROFIBUS DP-V2 and PROFINET in IEC 61158 and IEC 61784 10 profiles available
2001	Presentation of Ethernet-based PROFINET
2000	100,000 PROFIBUS devices in process automation
1999	Profile for safety technology - PROFIsafe
1998	Profile for process automation - PROFIBUS PA
1997	More than 1 million PROFIBUS devices installed Profile for variable-speed drives PROFIdrive
1996	PROFIBUS becomes European Standard EN 50170
1995	1st application in process automation (PA)
1993	PROFIBUS DP becomes DIN 19245 (Part 3)
1991	PROFIBUS becomes DIN 19245 (Part 1 and 2)

PROFIBUS International

PROFIBUS International (PI)

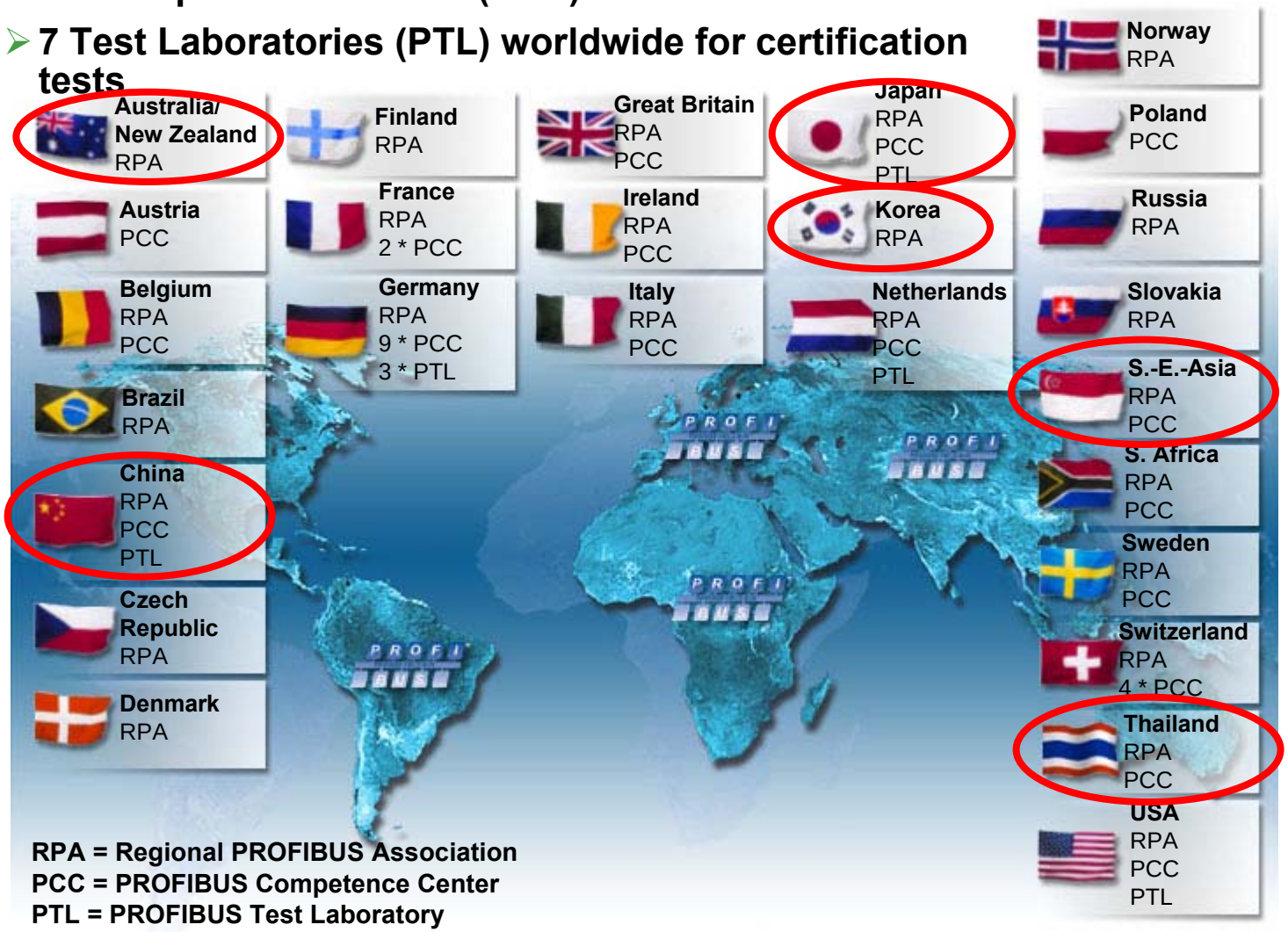
24 Regional PROFIBUS Associations (RPA)	30 PROFIBUS Competence Center (PCC)	7 PROFIBUS Test Laboratories (PTL)

About 1.200 members worldwide

- **Globally organized consortium**
- **Tasks: technological developments and marketing**

Presence and Support Worldwide

- 24 Regional PROFIBUS Associations (RPA) worldwide
- 30 Competence Centers (PCC) in 13 countries
- 7 Test Laboratories (PTL) worldwide for certification tests



RPA = Regional PROFIBUS Association
PCC = PROFIBUS Competence Center
PTL = PROFIBUS Test Laboratory

PCC At Singapore Polytechnic

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- Integration Technology
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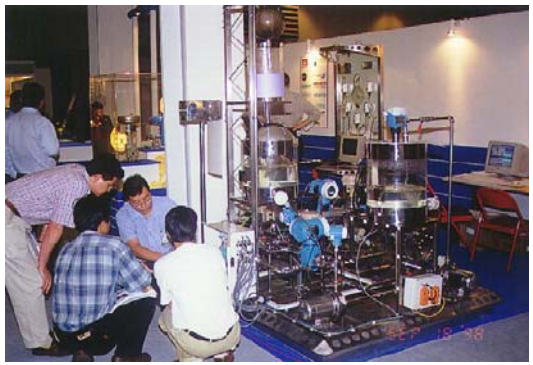
PA Plant

Coffee Maker

Arm Wrestler

Sorting Machine



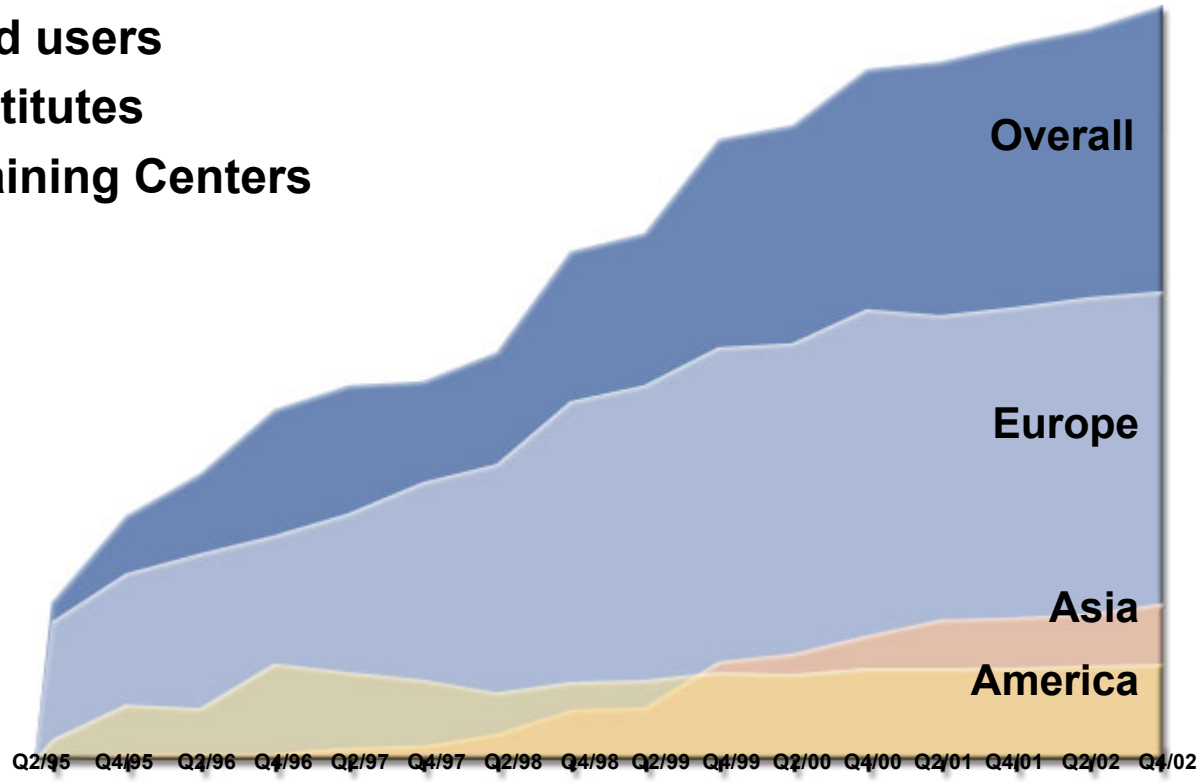
Mixing plant with PA installations

Fast automation line

Members Worldwide

- Manufacturers
- Distributors
- Consultancies
- Integrators
- End users
- Institutes
- Training Centers

1200 members in 2002



Regional PROFIBUS Associations S.E.A.

Manufacturers

- Valmet Instrumentation
- Samson Control
- Pepperl+Fuchs
- Hirschman Electronics
- Festo
- Buerkert Contromatics
- ABB
- Endress+Hauser
- Siemens
- Weidmueller
- MTL
- LAPP Logistics – new
- SMAR – new

End-Users

- Centre for Advanced Technology
- Flotech Control
- CMC
- German-Singapore Institute
- Messe Duesseldorf
- Power Seraya
- Singapore Polytechnic
- Total Automation
- Vector Info Tech
- DNR Process Solutions
- ICS

Internet

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PROFIBUS on the Internet

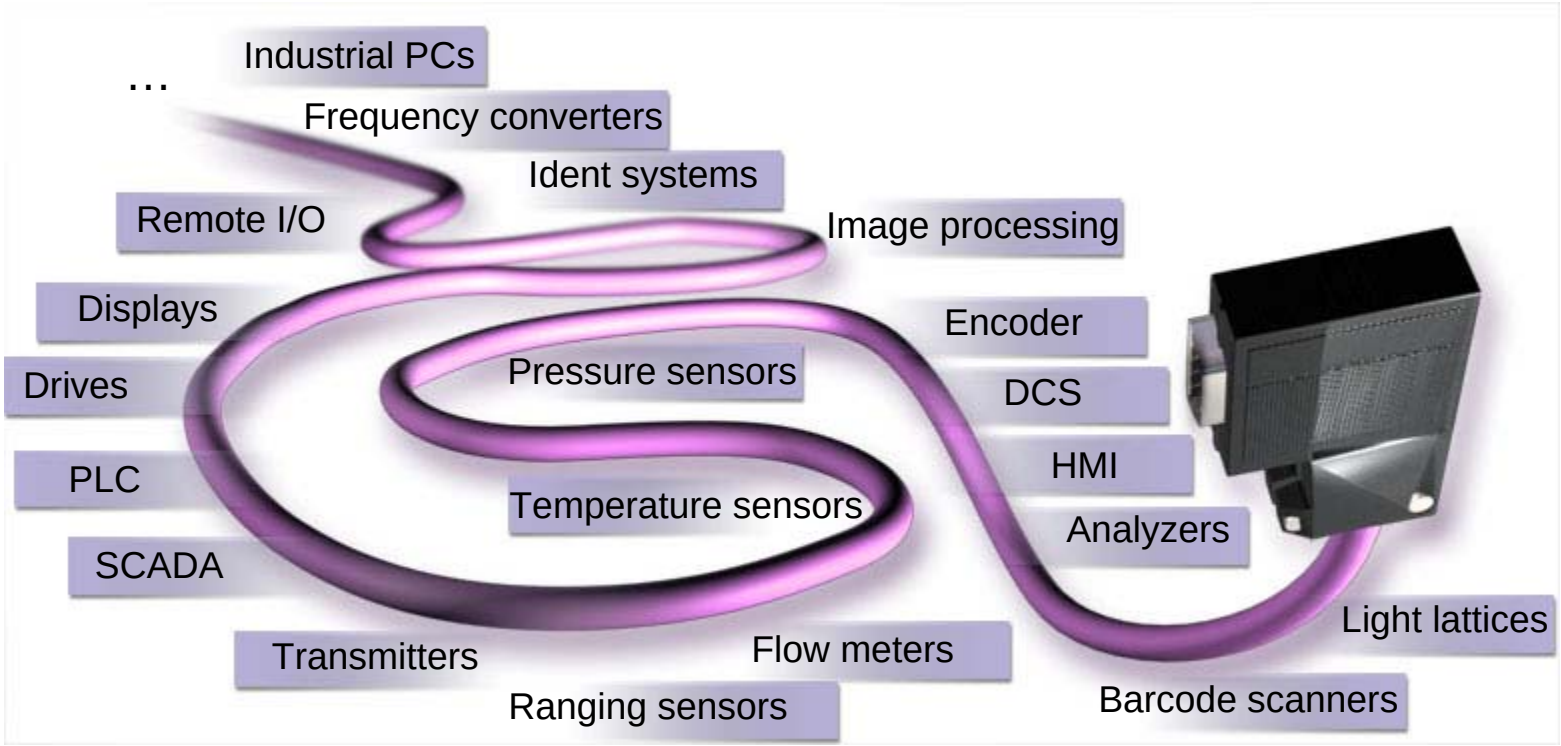
- millions of hits for www.profibus.com per year

Banner advertising at www.profibus.com

- thousands of links per month;
  in isolated case up to 11,000

An efficient and cost-effective promotional exercise for our members!

Product Spectrum



More than 2000 products overall from more than 250 manufacturers available

PROFIBUS - Plant-Wide Implementation

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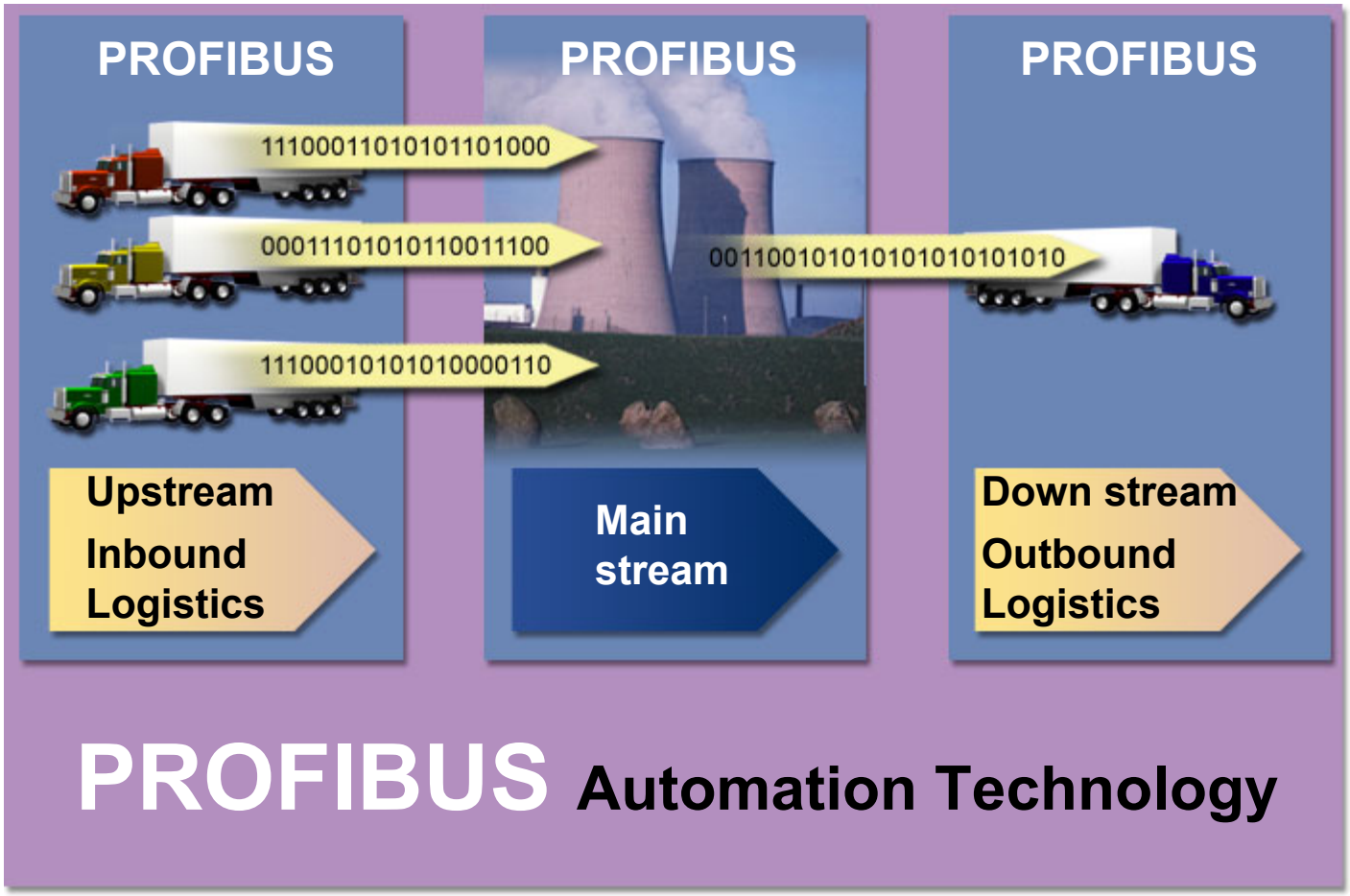
A single consistent solution for all plant sections



Key Applications

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- References

Production automation

- Vehicle manufacture
- Bottling plants
- Warehousing systems
- Switchgear
- Hollow glass production

Process automation

- Chemical industry
- Petrochemical industry
- Paper and textile industry
- Foodstuffs
- Power stations
- Sewage plants

Drive technology

- Machine tools
- Packaging machines
- Pressing plants
- Paper production

Safety applications

- Vehicle assembly
- Machine tool building

1 million PROFIBUS systems implemented

PROFIBUS for Factory Automation

For factory automation PROFIBUS is the undisputed No. 1 fieldbus technology worldwide.

Our strengths are:

- the large number of existing application profiles
- the leading position for safety applications
- proven and accepted solutions for drives and Motion Control applications

PROFIBUS for Process Automation

Process Automation is not a monolithic application. It is subdivided in discrete and continuous/batch applications:

- for discrete applications, the same fieldbusses can be used as we use for factory automation applications.
- only the continuous or batch applications segment requires a specific feature to connect process instrumentation devices (2-wire, bus powered transmission with or without intrinsic safety).
- FF H1 and PROFIBUS PA both offer an identical transmission interface for these applications, based on IEC 61158-2.

PROFIBUS for Process Automation

PROFIBUS is in an equivalent position with FF for process instrumentation devices

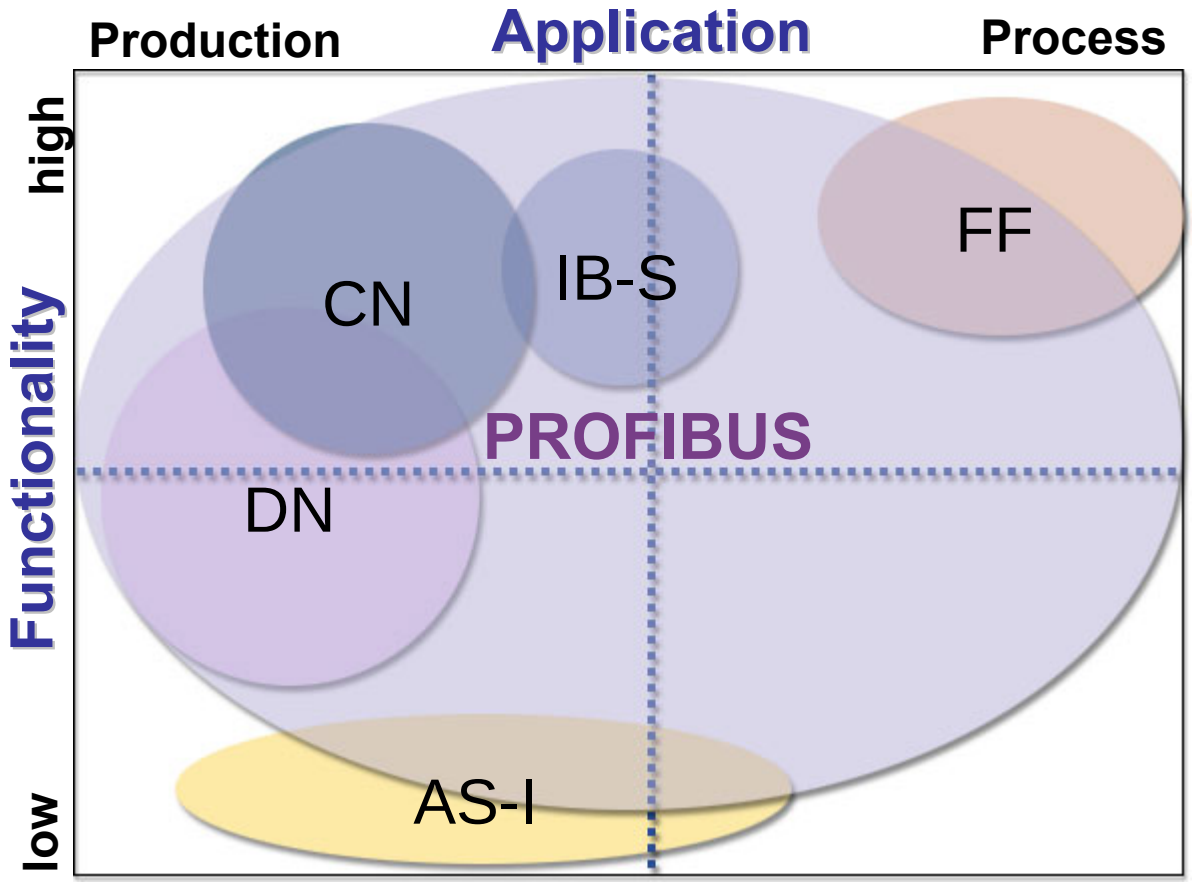
- FF is the leader in North America
- PROFIBUS PA is dominant in Europe
- In Asia both systems have similar market shares

The strengths of PROFIBUS are

- the technical fit for hybrid applications (primary and secondary processes as well as upstream and downstream)
- the high numbers of plants for low-end and mid-range applications like Water/ Waste Water Treatment, Food & Beverage, Chemicals, Pharmaceuticals

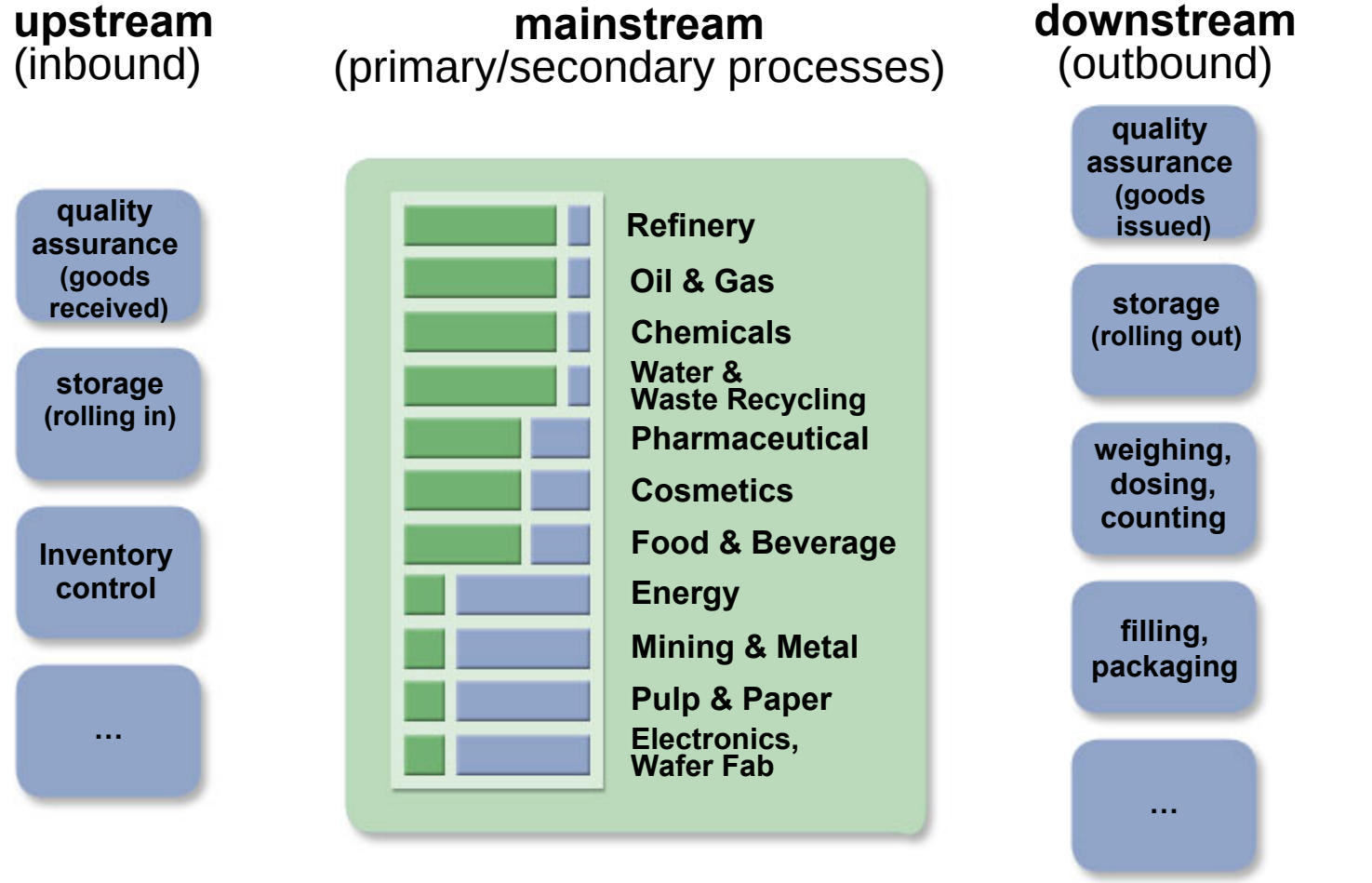
Market Positioning

PROFIBUS is the universal solution for the entire spectrum of industrial automation



DN=DeviveNet, CN=ControlNet, FF=Foundation Fieldbus, IB-S=Interbus, AS-I=AS-Interface

Fieldbusses in Process Applications



IEC 61158-2/ MBP-IS (PROFIBUS PA, FF H1)

RS 485 (PROFIBUS, DeviceNet, …)

Market potentials for Fieldbus Systems

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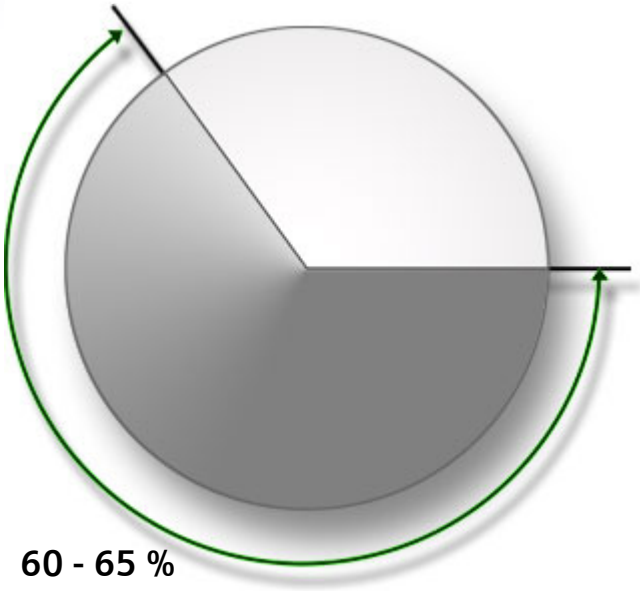
- Integration Technology
- PROFINET
- References

FA

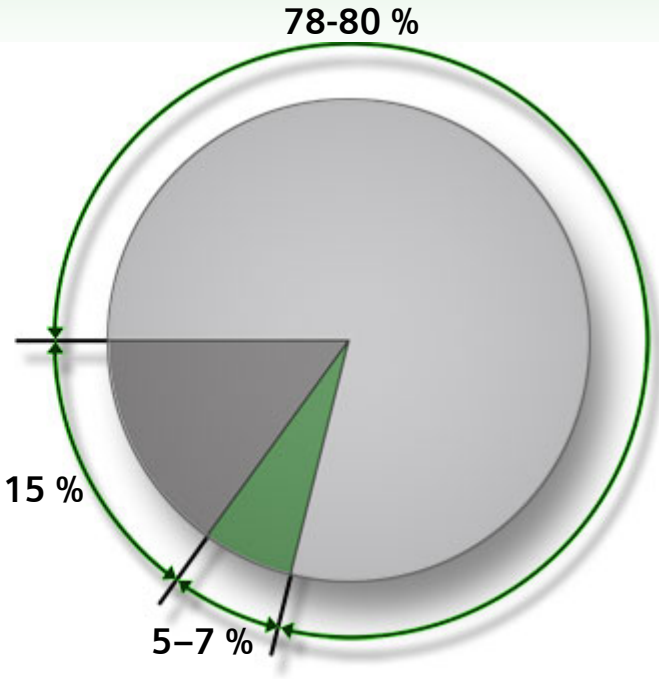
Factory Automation Market



- RS 485 (PROFIBUS DP, Device Net, CC-Link, ...)
- e.g. hard-wired

PA

Process Automation Market



- RS 485 (PROFIBUS DP, Device Net, CC-Link, ...)
- PROFIBUS PA, FF H1
- HART, 4...20 mA

Regional Market Leader of Fieldbus Systems

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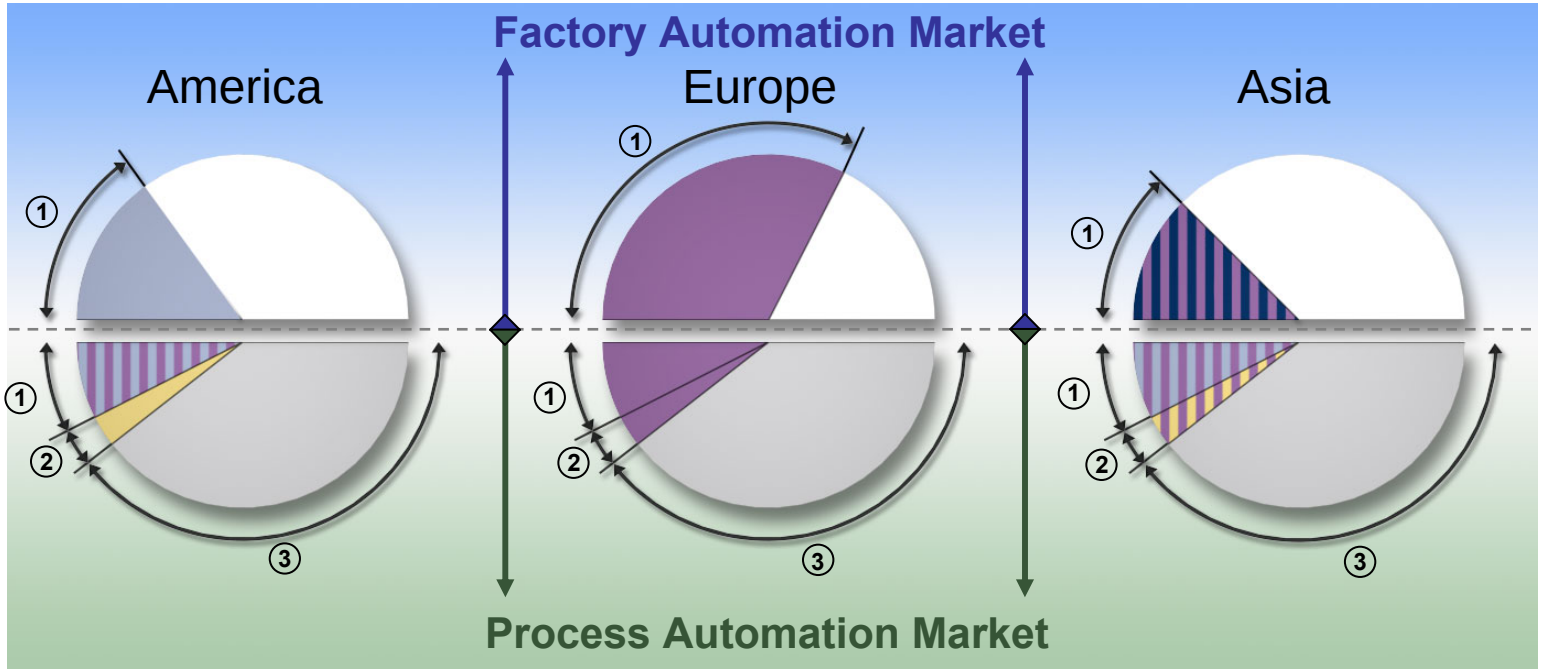

Installed Fieldbus nodes

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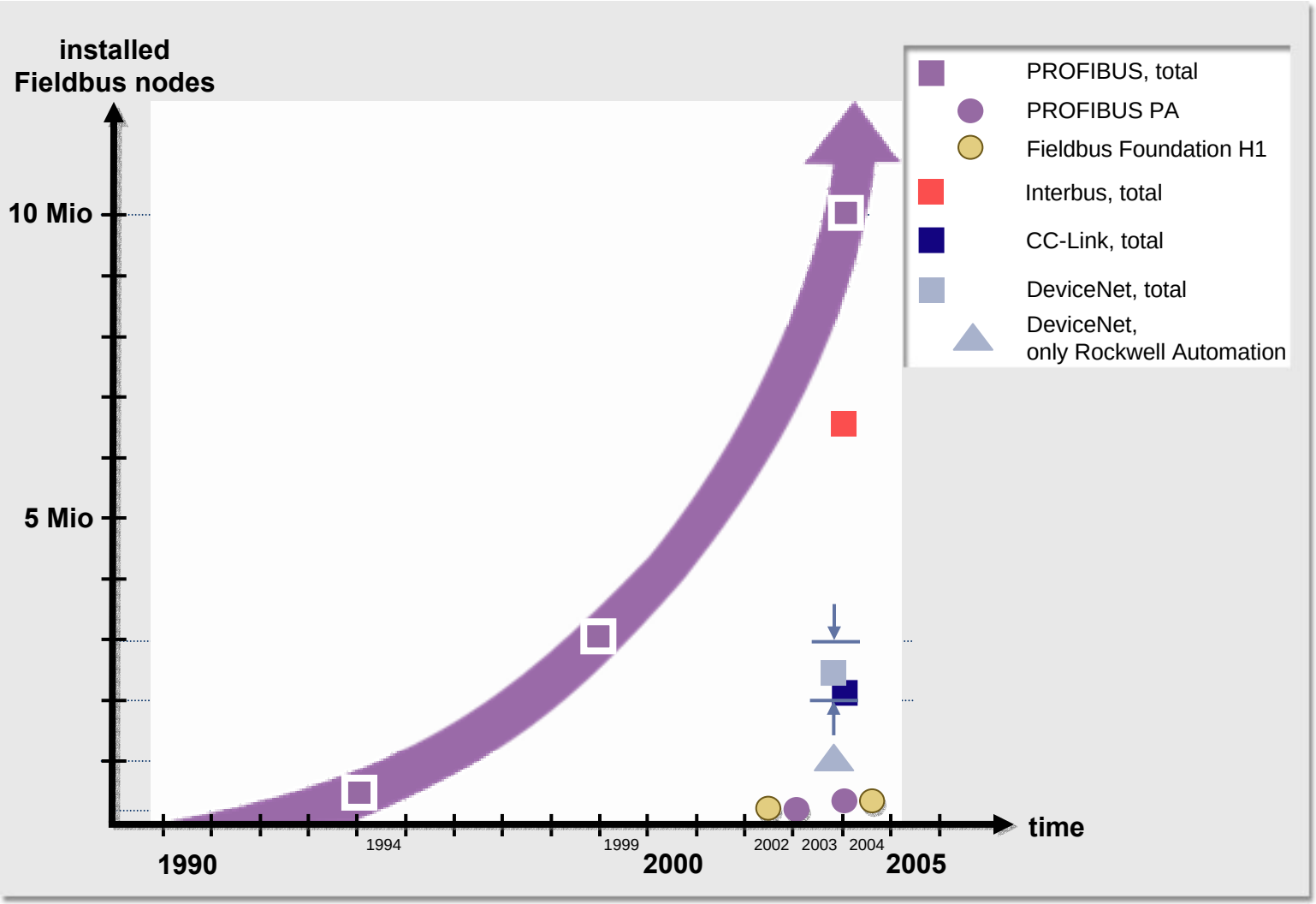

PROFIBUS Position

PROFIBUS is the leading Fieldbus system with a superior position worldwide

Our strengths are:

- the fit for factory and process automation
  → lowest total cost of ownership!
- the international network of regional PROFIBUS organizations
  → worldwide qualified support!
- the large number of available PROFIBUS products and services
  → complete offering of different products!
- the large number of member companies
  → the freedom to select the right supplier!

Situation PROFIBUS

PROFIBUS as the leading Fieldbus system is the driver for the automation and communication technology and is the best practice for

- Drives and Motion Control applications
- Safety applications
- Engineering

→ **Within the next 4 years we will double the installed PROFIBUS nodes to 20 Million !**

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PROFINET

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History, organization, market position

With wide range of application

- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology

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- RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles

- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

Integration Technology

- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References

Guaranteed Investment Protection

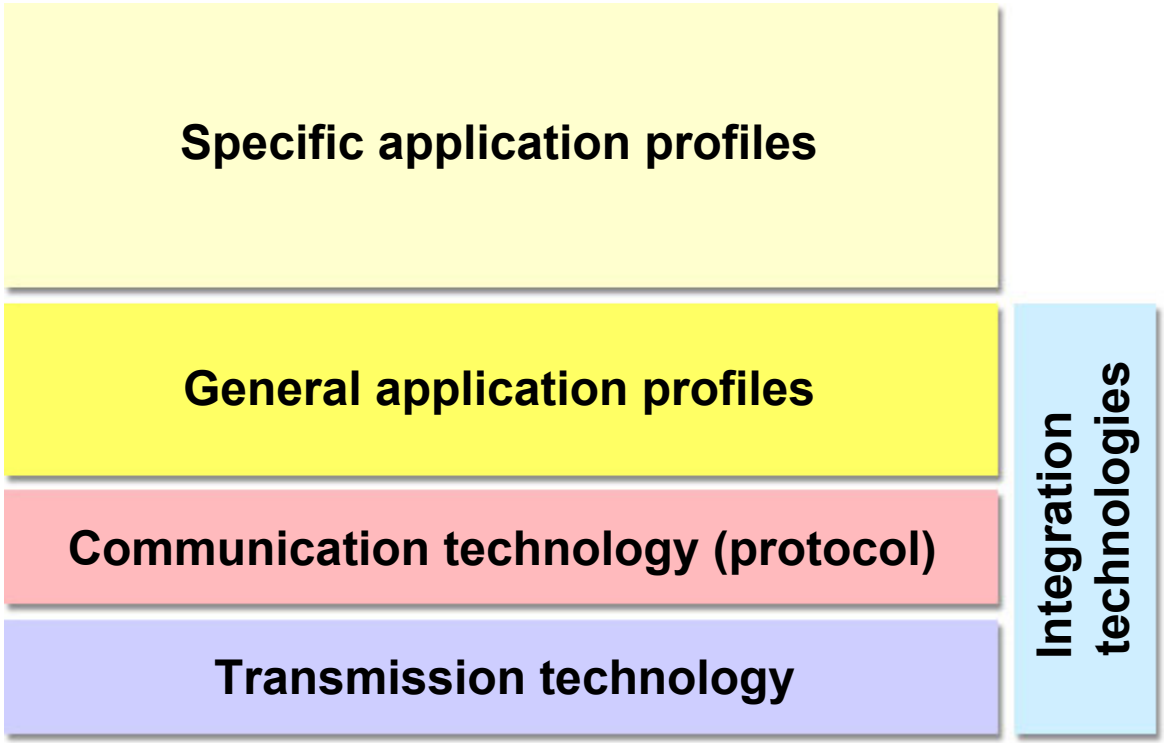
PROFIBUS provides investment protection

A single communications protocol for all applications
Standardized in IEC 61158 /IEC 61784

Innovations together with users
Fully compatible with existing technology
Binding specifications

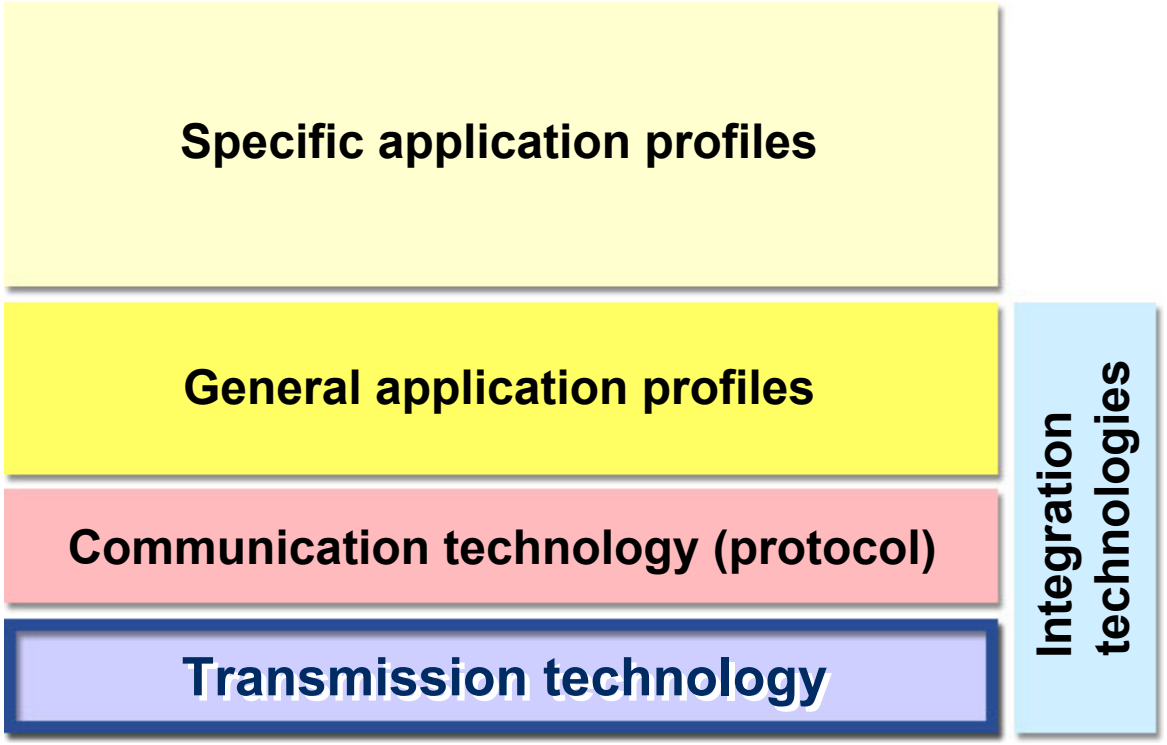
Tried and tested technology through 10 million devices installed worldwide

The PROFIBUS Modular System



- PROFIBUS is a modular system
- The modules are arranged according to functions
- An application is implemented using a combination of modules

Transmission Technology



Transmission Technology in the Production and Process Industry

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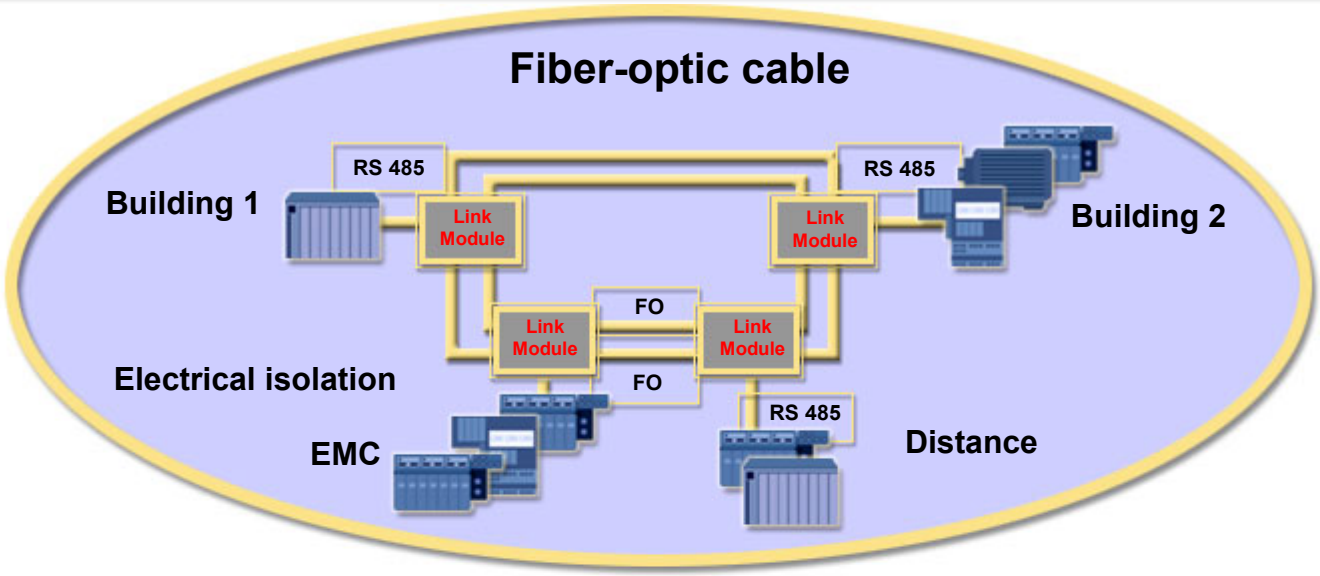
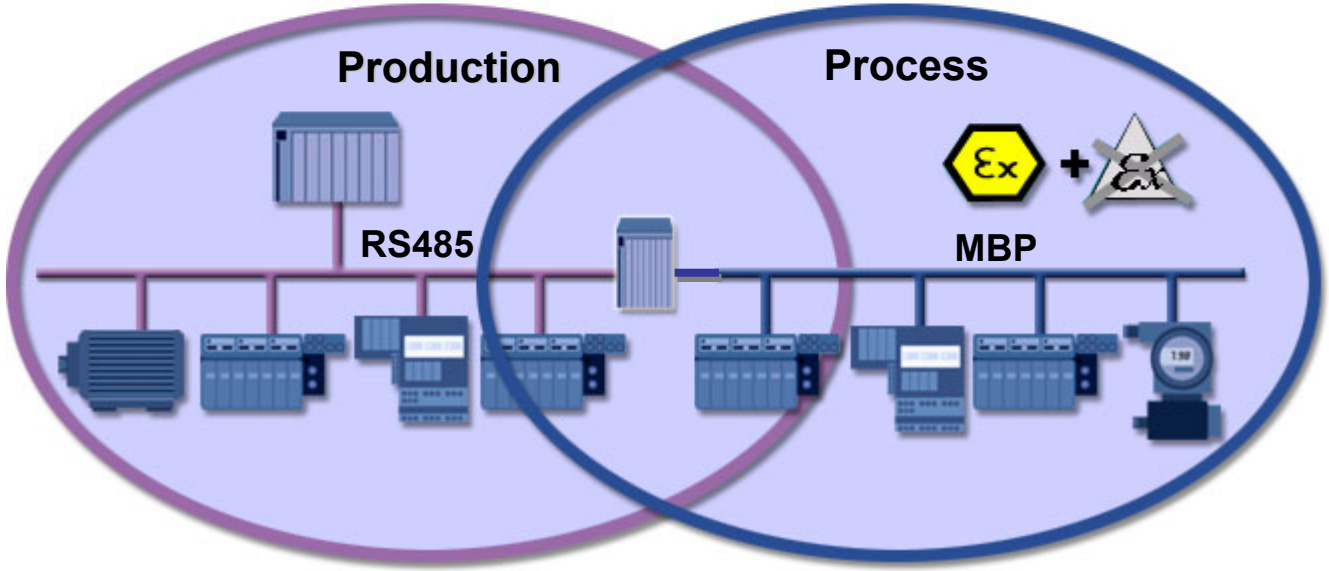
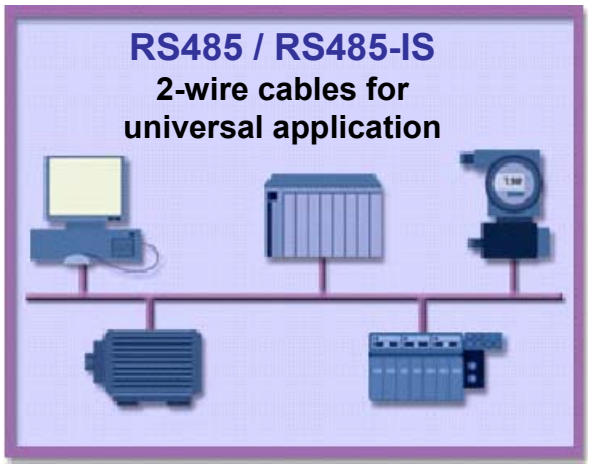




Transmission Technology RS-485/ RS-485-IS

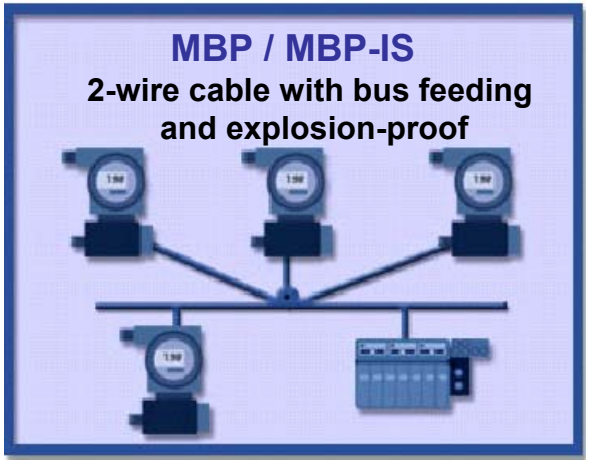


	maximum Segment length [m]	
Transmission Rate [kBits/s]	RS-485 [m]	RS-485-IS [m]
9.6; 19.2; 45.45; 93.75	1200	1200
187.5	1000	1000
500	400	400
1500	200	200
3,000; 6,000; 12,000	100	

The values refer to cable type A with the following properties:

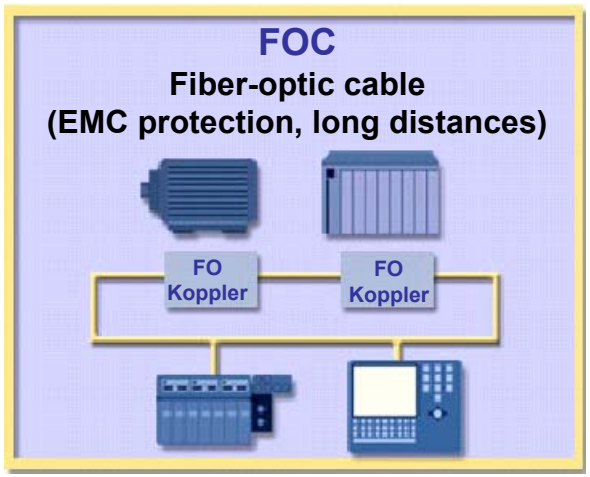
Impedance	135 to 165 Ω
Capacity	≤ 30 pF/m
Loop resistance	≤ 110 Ω/km
Wire diameter	> 0.64 mm
Core cross-section	> 0.34 mm²

Transmission Technology MBP/ MBP-IS



	MBP	MBP-IS FISCO
Transmission Rate [kBits/s]	31.25	31.25
Max. distance including stub lines	1900 m	1000 m
Max. numbers of devices	32	10
Max spur length 1 - 12 13 - 14 15 - 18 19 - 24 25 - 32	 120 m 90 m 60 m 30 m 0 m	30 m
The values refer to cable type A with the following properties: Loop resistance Core cross-section R' L' C'	 44 Ω/km < 0.8 mm² 15 to 150 Ω/km 0.4 to 1 mH/km 80 to 200 nF/km	

Transmission Technology FOC

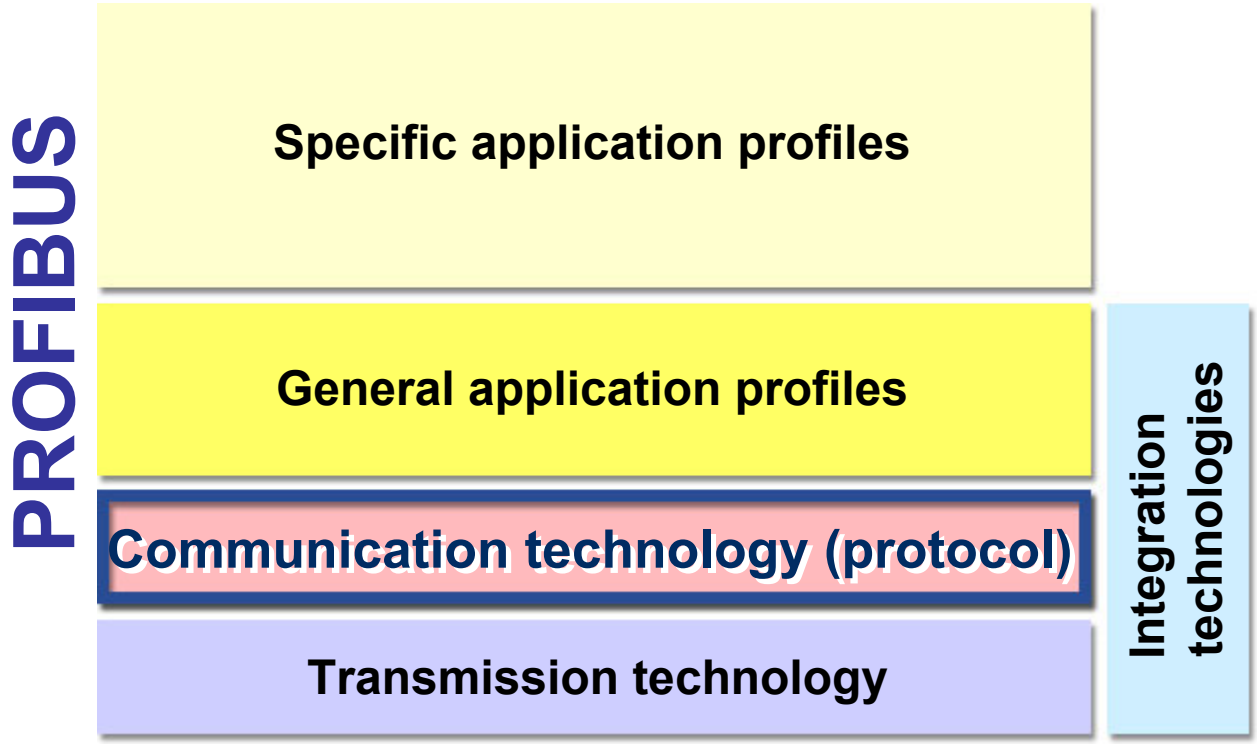


	Up to 12,000 kBit/s	
Fiber Type	**Core diameter [µm]**	**Range**
Multimode glass fiber	62.5/125	2-3 km
Singlemode glass fiber	9/125	>15 km
Plastic fiber	980/1000	< 80 m
HCS® fiber	200/230	< 500 m

Transmission Technology Summary

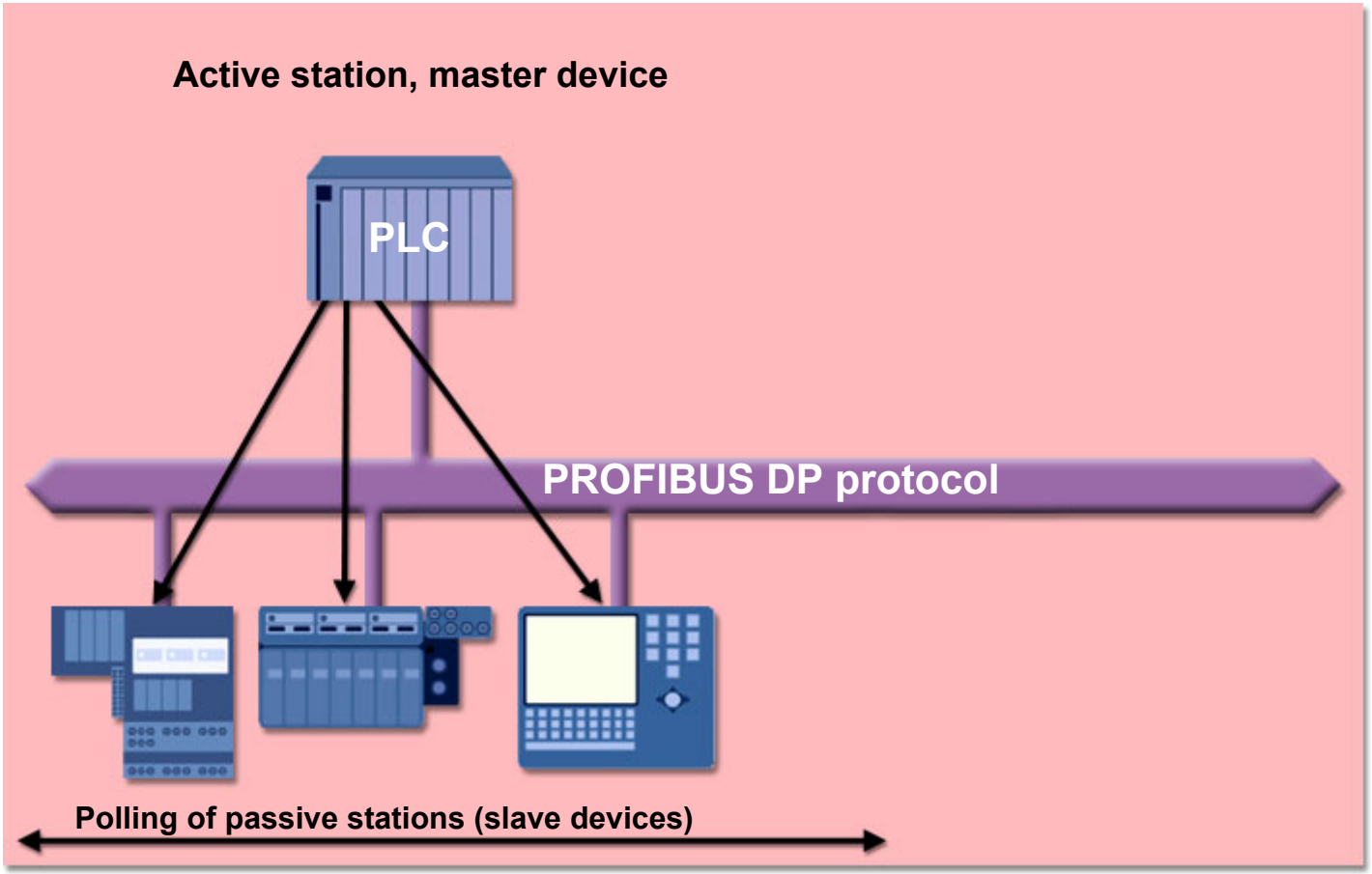
	MBP	RS485	RS485-IS	Fiber Optic
Data transmission	Digital, bit-synchronous, Manchester encoding	Digital, differential signals according to RS485, NRZ	Digital, differential signals according to RS485, NRZ	Optical, digital, NRZ
Transmission rate	31.25 KBit/s	9.6 to 12,000 KBit/s	9.6 to 1,500 KBit/s	9.6 to 12,000 KBit/s
Data security	Preamble,error-protected, start/end delimiter	HD=4, Parity bit, start/end delimiter	HD=4, Parity bit, start/end delimiter	HD=4, Parity bit, start/end delimiter
Cable	Shielded, twisted pair copper	Shielded, twisted pair copper, cable type A	Shielded, twisted 4-wire, cable type A	Multimode glass fiber, singlemode glass fiber, PCF, plastic
Remote feeding	Optional available over signal wire	Available over additional wire	Available over additional wire	Available over hybrid line
Protection type	Instrinsic safety (EEx ia/ib)	None	Instrinsic safety (EEx ib)	None
Topology	Line and tree topology with termination; also in combination	Line topology with termination	Line topology with termination	Star and ring topology typical; line topology possible
Number of stations	Up to 32 stations per segment; total sum of max. 126 per network	Up to 32 stations per segment without repeater; up to 126 stations with repeater	Up to 32 stations per segment; up to 126 stations with repeater	Up to 126 stations per network
Number of repeaters	Max. 4 repeater	Max. 9 repeater with signal refreshing	Max. 9 repeater with signal refreshing	Unlimited with signal refreshing (time delay

Communication Technology



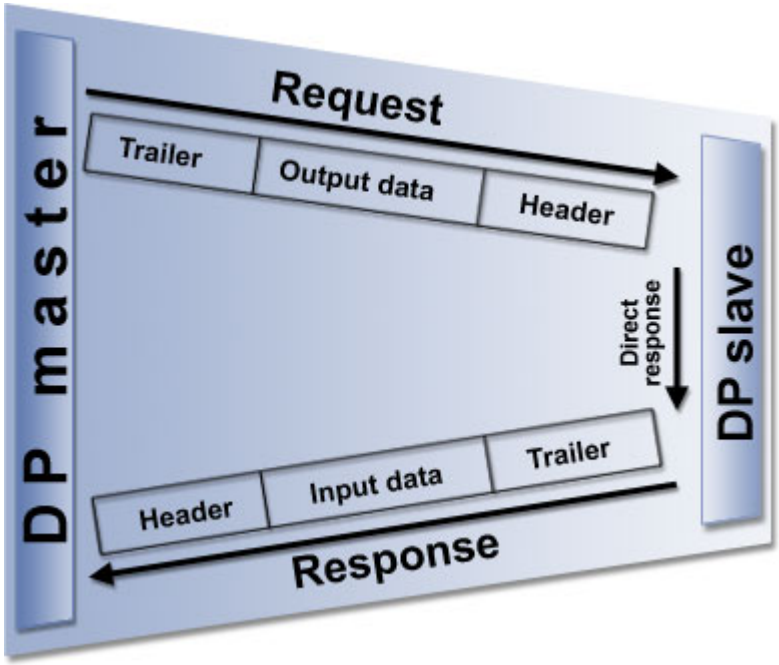
Communication Technology

PROFIBUS uses the master/slave procedure



Communication Technology

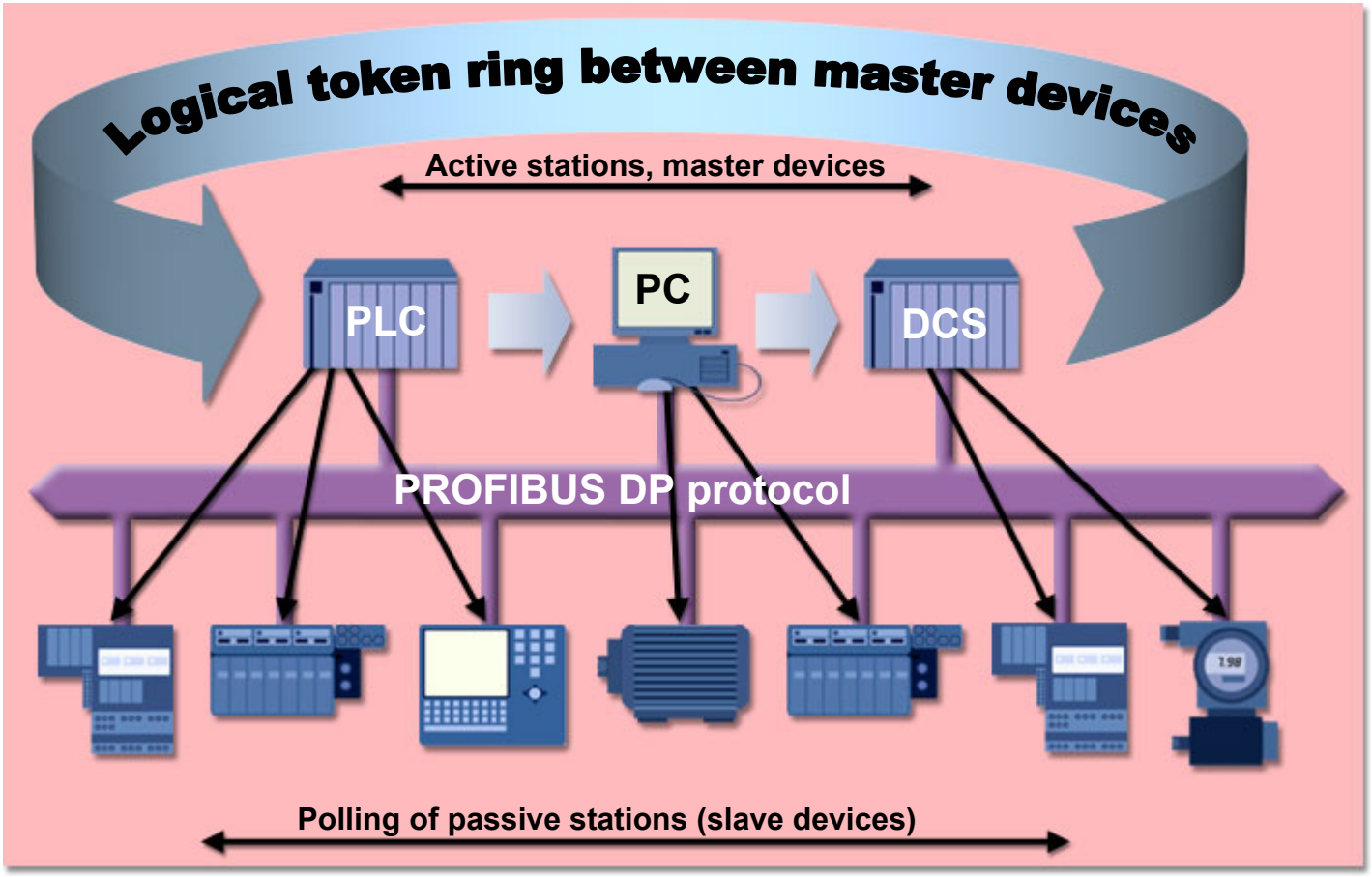
PROFIBUS master/slave principle



- Each PROFIBUS system has at least one master
- A maximum of 127 devices (masters + slaves) are permitted in a single system
- Several masters can be integrated
- Each Slave support up to 244 bytes of In/ Output and diagnostic data

Communication Technology

Token procedure for multimaster operation



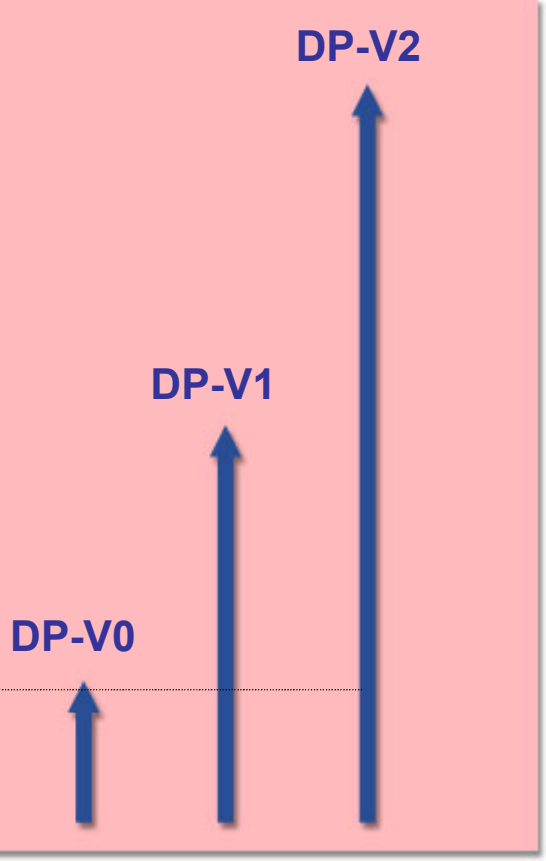
The PROFIBUS DP communications protocol
Graded functional scope

PROFIBUS DP

Data Exchange Broadcast
Isochronous Mode
Clock Synchronization,
Time Stamps
HART on DP
Redundancy

Acyclic Data Exchange
Engineering (EDD, FDT)
Fail-Safe Communication
Alarms

Cyclic Data Exchange
DDBF, Configuration and
Diagnosis



Overview PROFIBUS Technology

Welcome 18.45 – 19.00

- Mr. Jacky Chan – GM Siemens Pte Ltd – A&D
- Mr. TJ Kang – President ICS & MD Cegelec Pte Ltd

PROFIBUS Organization 19.00 – 19.45

Standard & Technology

- Mr. Andreas Agostin – PM Pepperl+Fuchs Pte Ltd

Break 19.45 – 20.00

Application Profiles 20.00 – 20.45

Integration Technology

- Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd

PROFINET 20.45 – 21.15

References

- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

Q&A Lucky Draw 21.15 – 21.30

Speaker – Richard Jennens

Technological Knowledge

- In-depth knowledge about PROFIBUS due to 10 years of experience in Endress+Hauser S.E.A. for Project Engineering and Product Management
- 2 years as Product Manager – Digital Communications
- Certified PROFIBUS PA Engineer (2004)

Society experience

- Member of PROFIBUS Singapore Organization since 2001
- Member of Technical Committee RPA S.E.A.

Education Background

- M.Sc. Biochemical Engineering University College London, UK
- B.Sc. Hons Biochemisty and Genetics, University of Nottingham, UK

Public Relations

- Over 50 seminars in Singapore, Malaysia, Thailand, Philippines and Indonesia
- Seminars at MWA, AW and many other societies and organizations
- Numerous publications for marketing and promotion

Overview PROFIBUS Technology

History, organization, market position

With wide range of application

- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology

- Transmission Technology
- RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles

- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

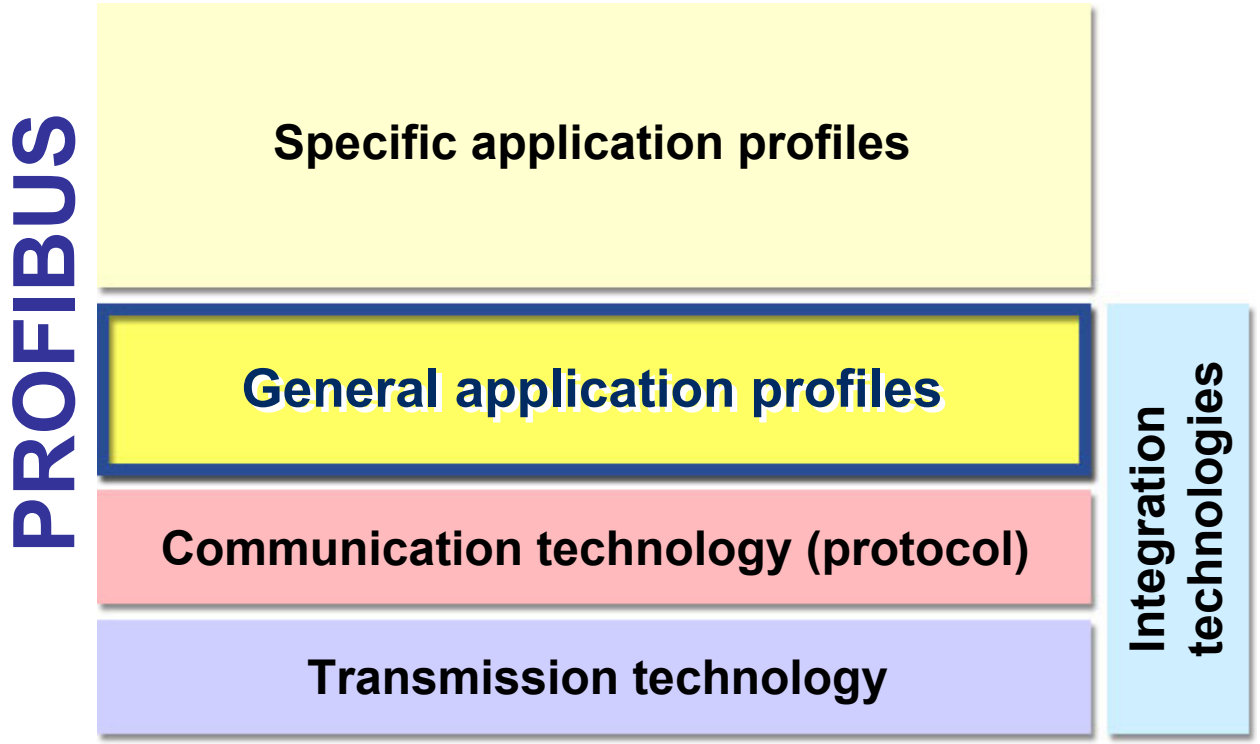
Integration Technology

- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References

General application profiles



What Distinguishes a Profile?

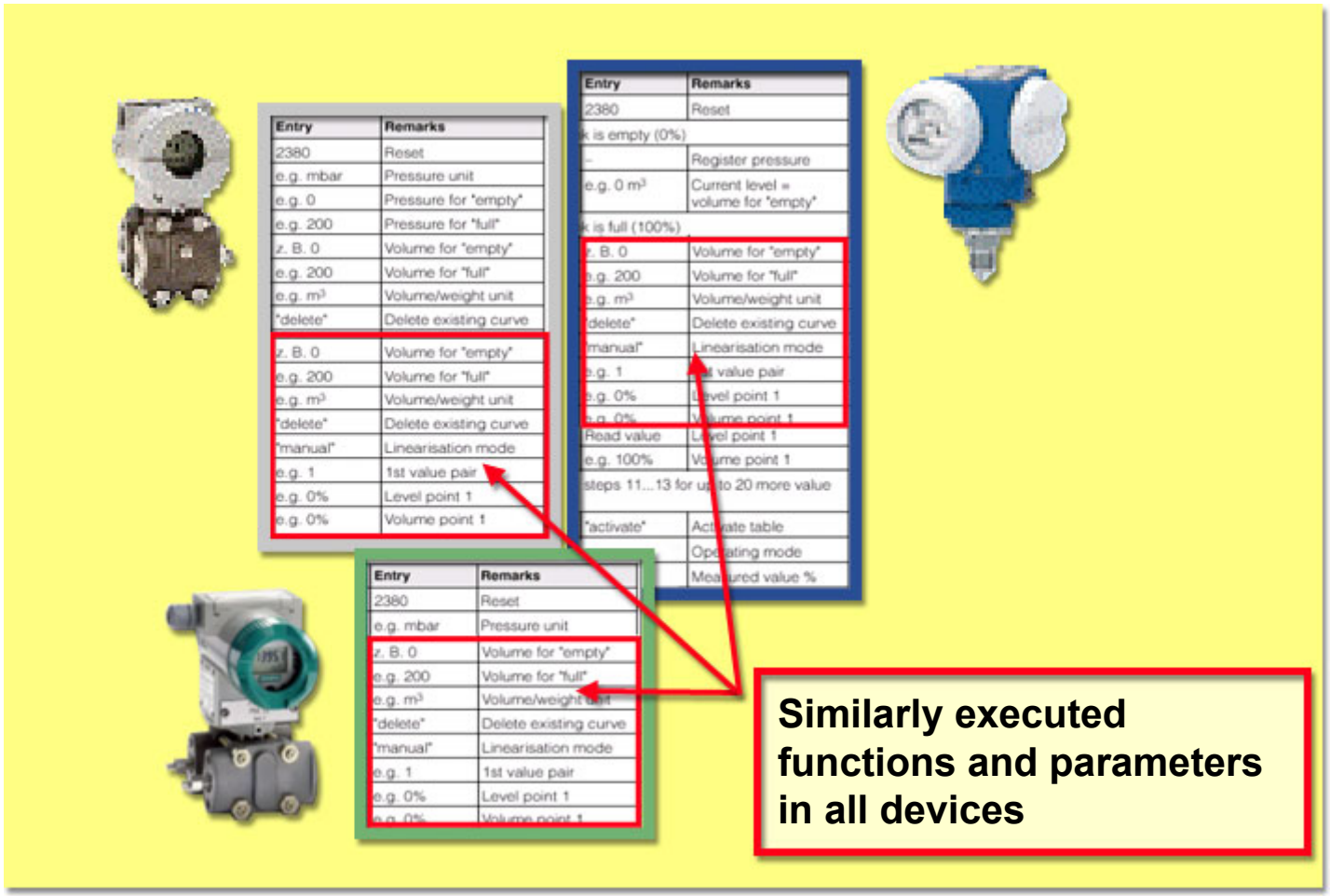
PROFIBUS Profiles

A profile enables the application-orientated interaction of devices of different manufacturers on PROFIBUS

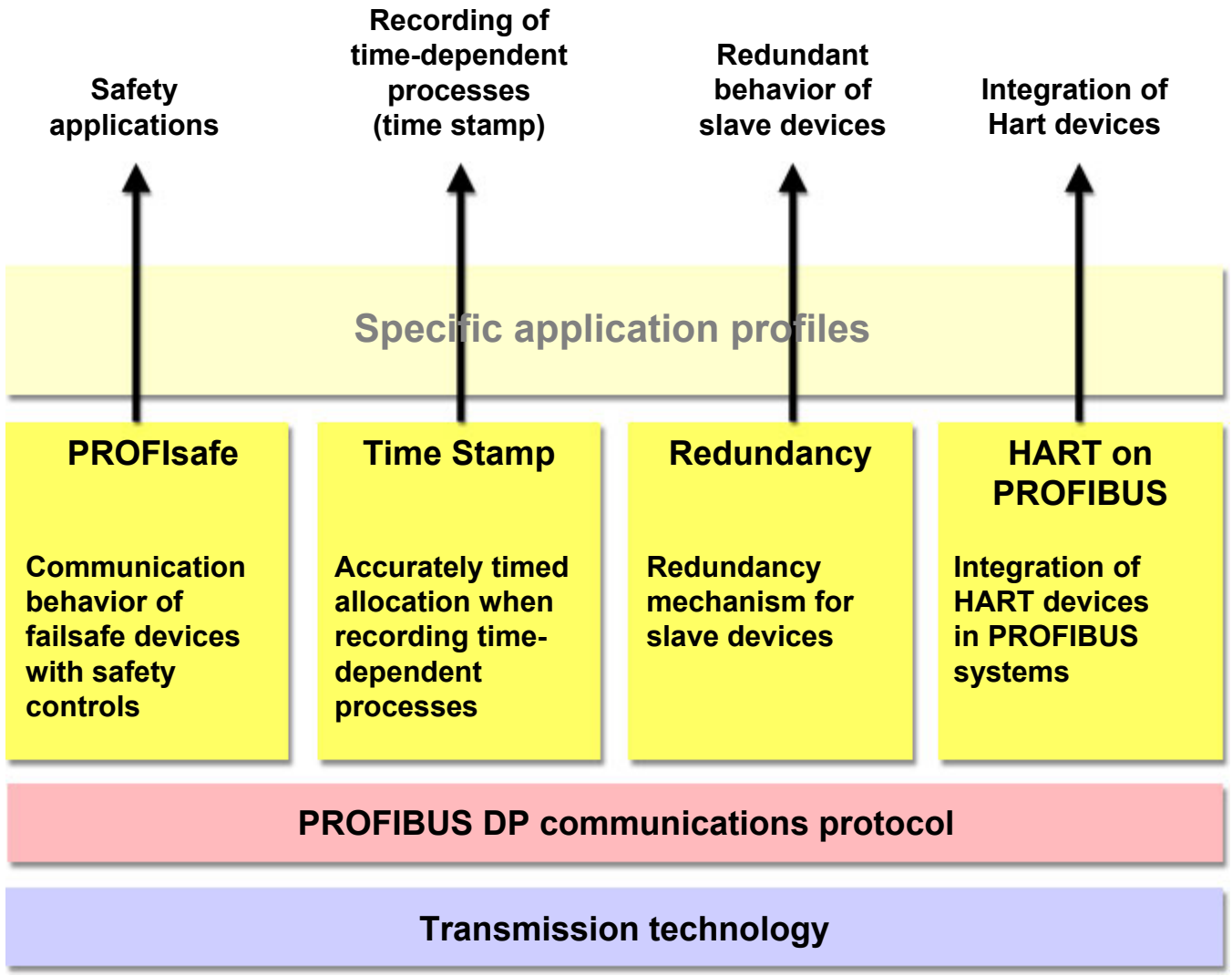
PROFIBUS Profiles	➢ are vendor-independent specifications on homogeneous device behavior ➢ are documented in PROFIBUS guidelines ➢ can be optionally used
PROFIBUS profiles describe	➢ device classes, e.g. drives ➢ operating modes, e.g. redundancy ➢ application-specific requirements, e.g. process engineering
Devices developed according to profiles are	➢ interoperable at application level ➢ interchangeable

Interoperability Due to Profiles

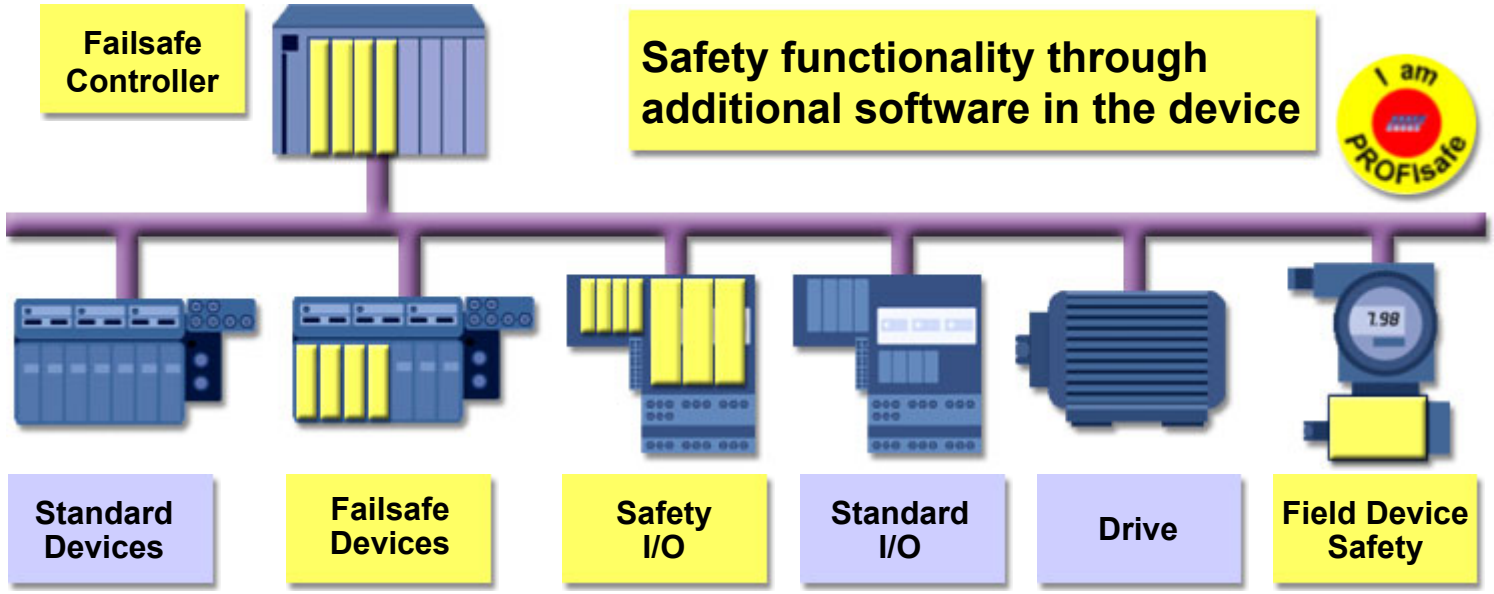
Vendor-independent device interchanging



General Application Profiles



PROFIsafe for Safety Applications



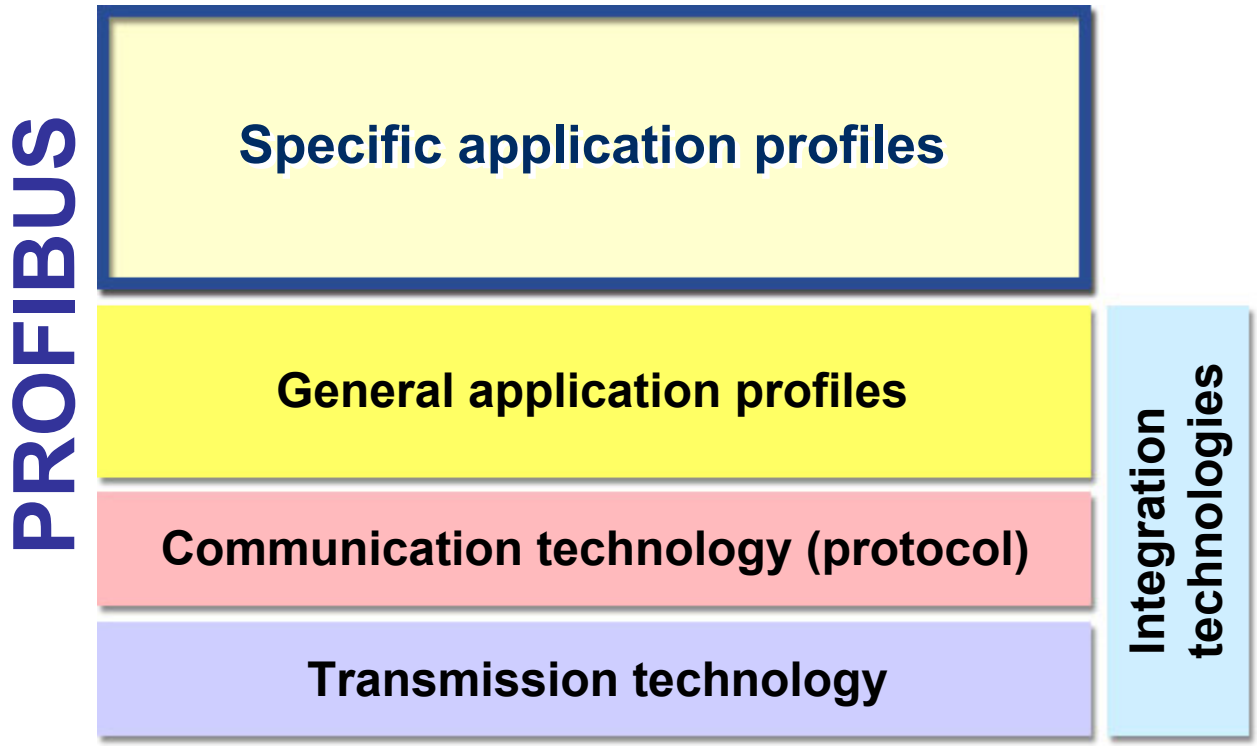
Key features of PROFIsafe

- Standard and failsafe functions over a single cable
- Cost cutting - no need for special bus; only one engineering environment
- One training course, one documentation, ...
- Certified to SIL 3, AK6 and CAT 4 to EN954-1
- Based on IEC 61508 and IEC 61511

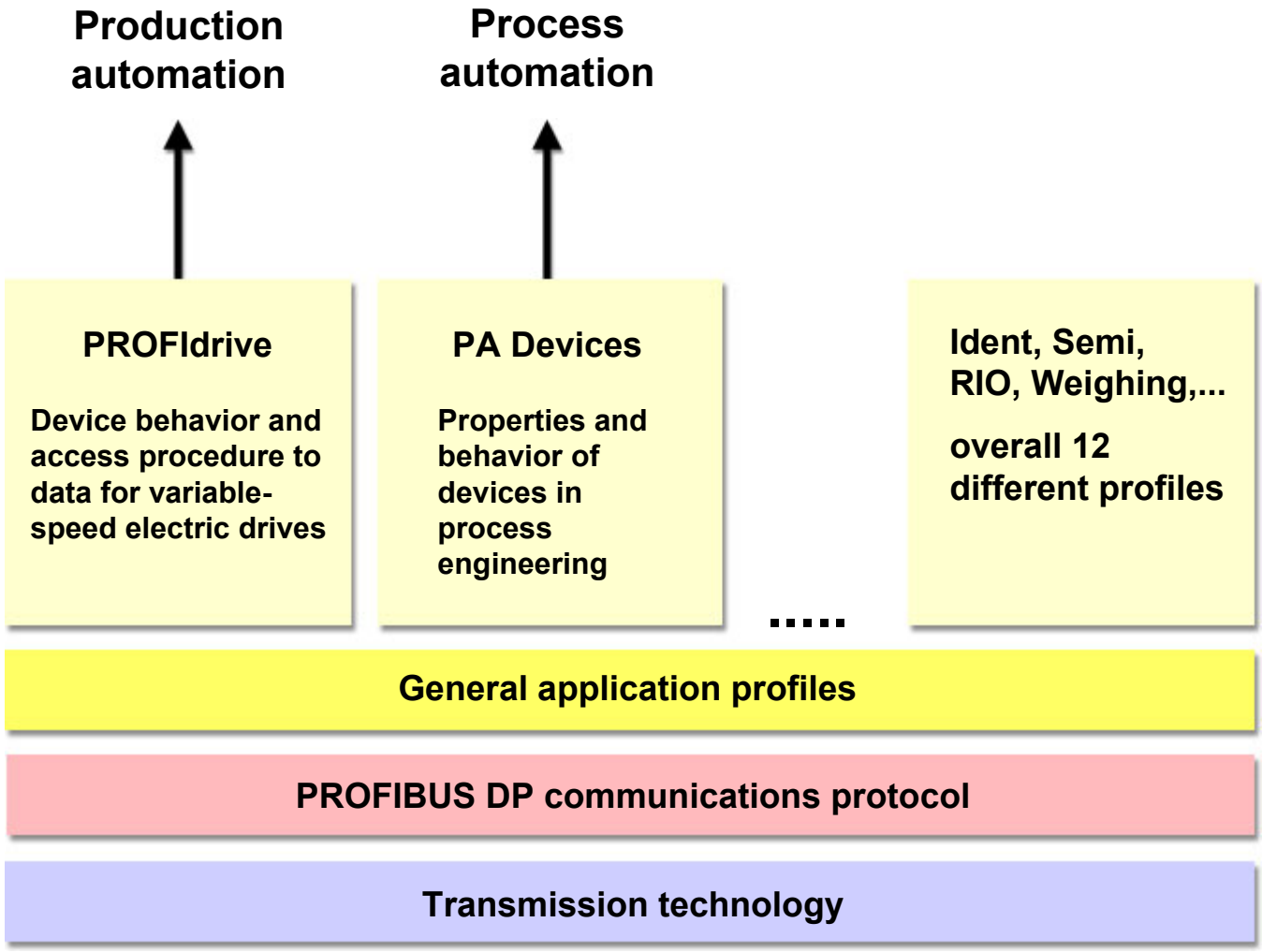
Specific Application Profiles

RPA S.E.A.
Press Tour
2004

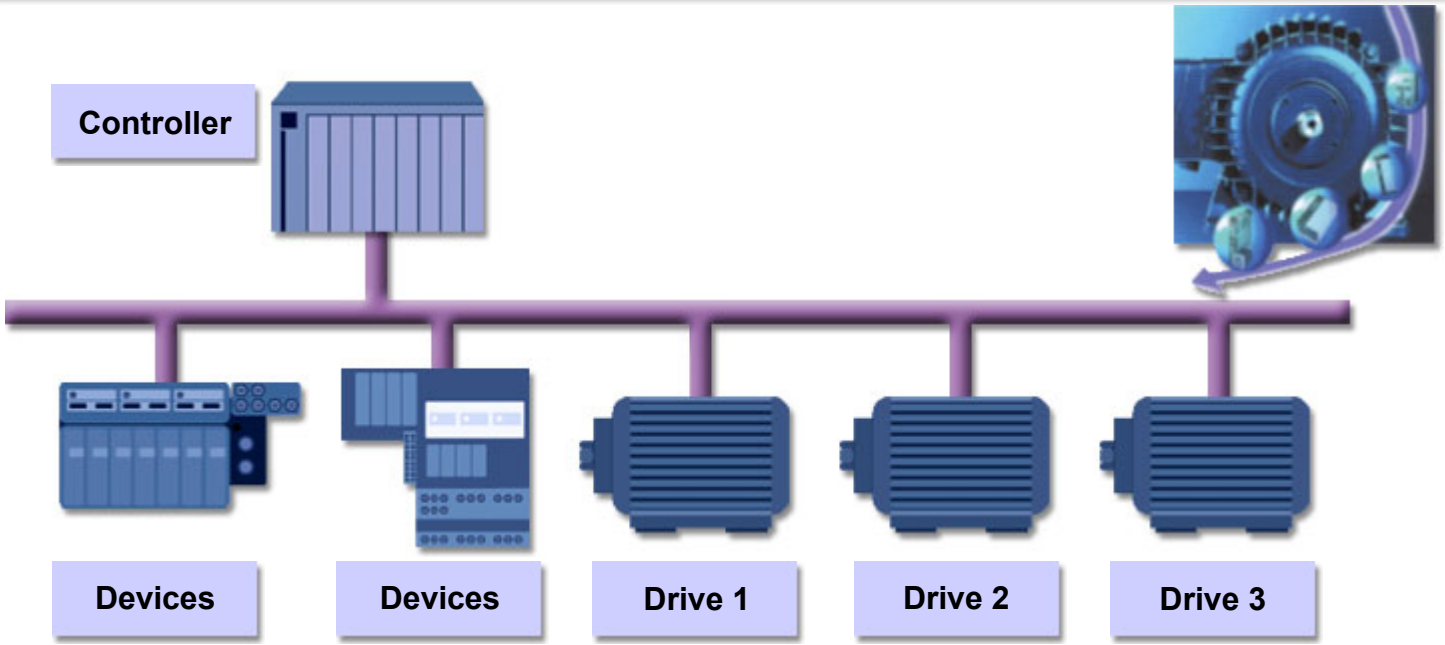
- PROFIBUS
- Standard & Technology
- Application Profiles
- Integration Technology
- PROFINET
- References



Specific Application Profiles



Motion Control with “PROFIdrive” (1)



Key features of the “PROFIdrive” profile

- Exact synchronization of different drives
- Standard and drive functions over a single cable
- Cost cutting - no need for special bus
- Only one engineering environment, one training course, one documentation, ...
- Suitable for (e.g.) wiring-, fiber spin and packaging machines

Motion Control with PROFIdrive (2)

PROFIdrive application profile (Version 3.1)

- Interoperability of drive technology products of different manufacturers in automated systems
- 6 application classes, from standard drives through to direct communication of distributed intelligent drives
- Special specifications also enable use in process engineering

PROFIBUS DP communications protocol (rating class V2)

- Clock synchronization for highly dynamic distribution of signals
- Lateral communication for direct communication between intelligent servo drives without activating the control system
- Acyclic parameter access during process for e.g. diagnostics

Key applications of Motion Control

The vendor-independent, consistent automation solution for drive technology with a single bus system for all tasks

- Savings on hardware, assembly, wiring and engineering
- Independent of manufacturer; investment protection

PROFIBUS and Motion Control

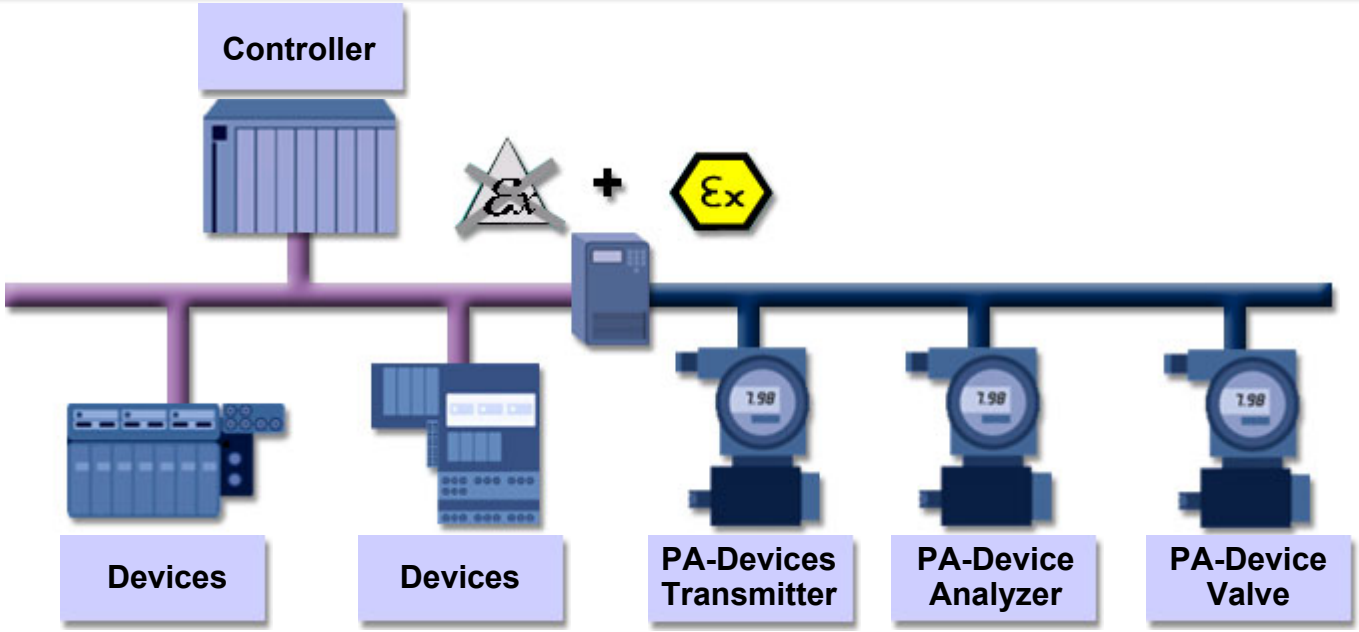
RPA S.E.A. Press Tour 2004

- PROFIBUS
- Standard & Technology
- Application Profiles
- Integration Technology
- PROFINET
- References

PROFIdrive

Production automation
with variable-speed electric drives

"PA Devices" for Process Automation (1)



Key features of "PA Device" profile

- Interoperability; vendor-independent interchangeability of devices
- Process and "discrete" tasks over a single bus
- Cost cutting - no need for connection technology
- Only one engineering environment
- High plant availability through on-line diagnostics
- Wide product range

“PA Devices” for Process Automation (2)

PA Device application profile (Version 3.0)

- Interoperability of process devices of different manufacturers taking all device classes into account
- Standardized specification of functional steps from the sensor signal through to preprocessed process value

MBP-IS, MBP or RS485, RS-485-IS interface

- With 2-wire bus feeding (MBP), or without bus feeding (RS485)
- With intrinsic safety (MBP-IS), or without intrinsic safety (MBP, RS485)

PROFIBUS DP communications protocol (rating class V1)

- Access to devices during operation for parameterization, diagnostics and maintenance

Key features of PROFIBUS PA

Consistent solution for process automation, including operation in potentially explosive areas

- Cost cutting over all stages of a plant life cycle
- High plant availability through diagnostics and preventative maintenance
- Key contributions to asset management

PROFIBUS and Process Automation

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Press Tour
2004

- PROFIBUS
- Standard & Technology
- Application Profiles
- Integration Technology
- PROFINET
- References

PA Devices

Process automation
devices for process engineering

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- Safety Application

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- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

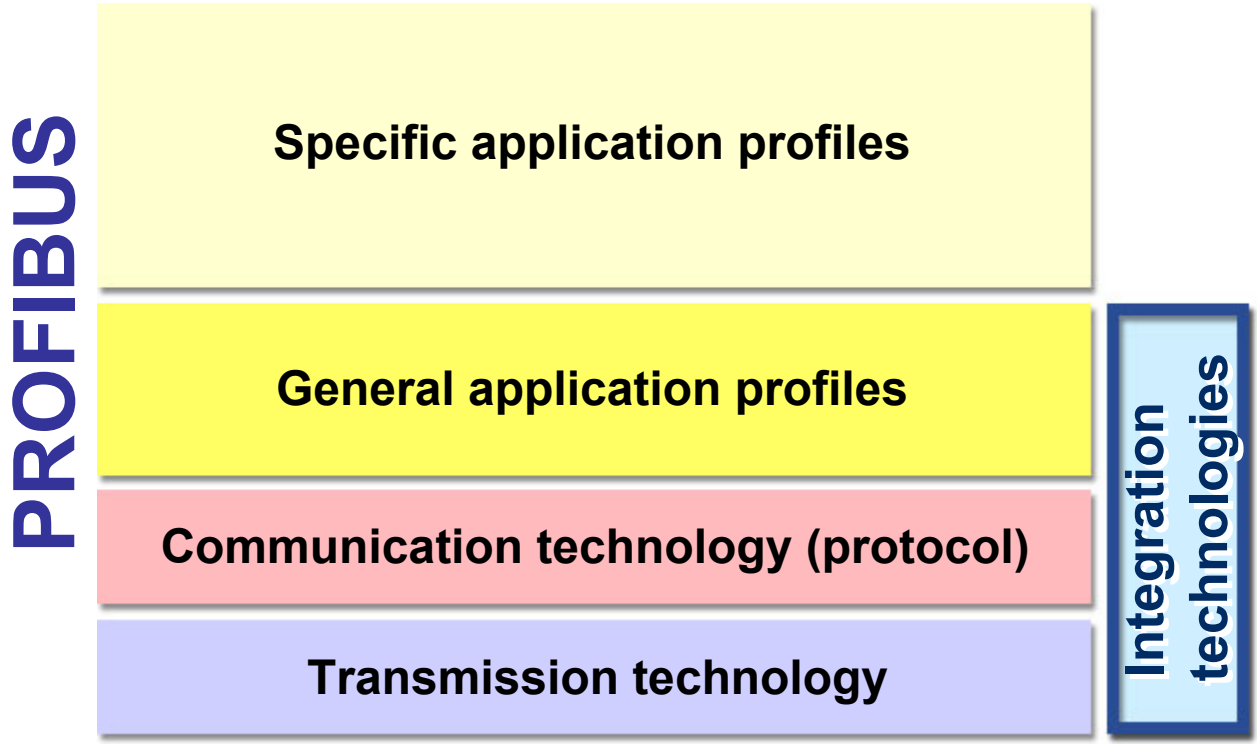
Integration Technology

- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

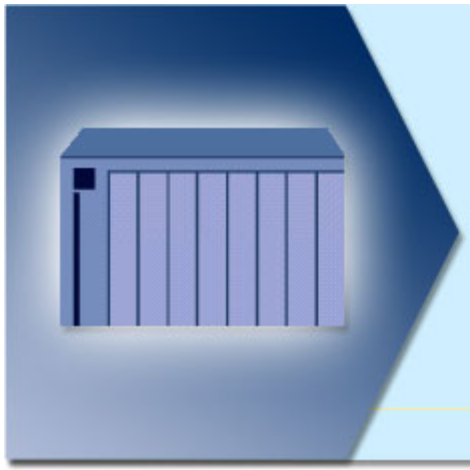
References

Integration Technologies



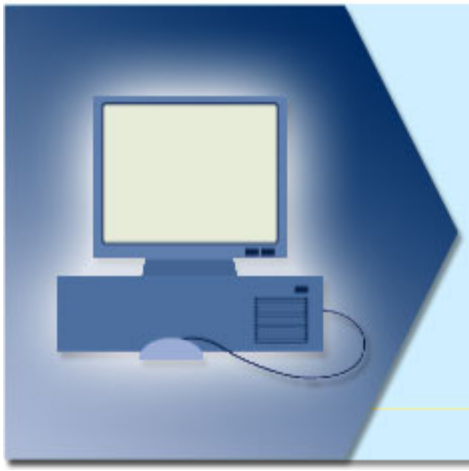
Integration Technologies

Two aims for device integration



Device integration in the master

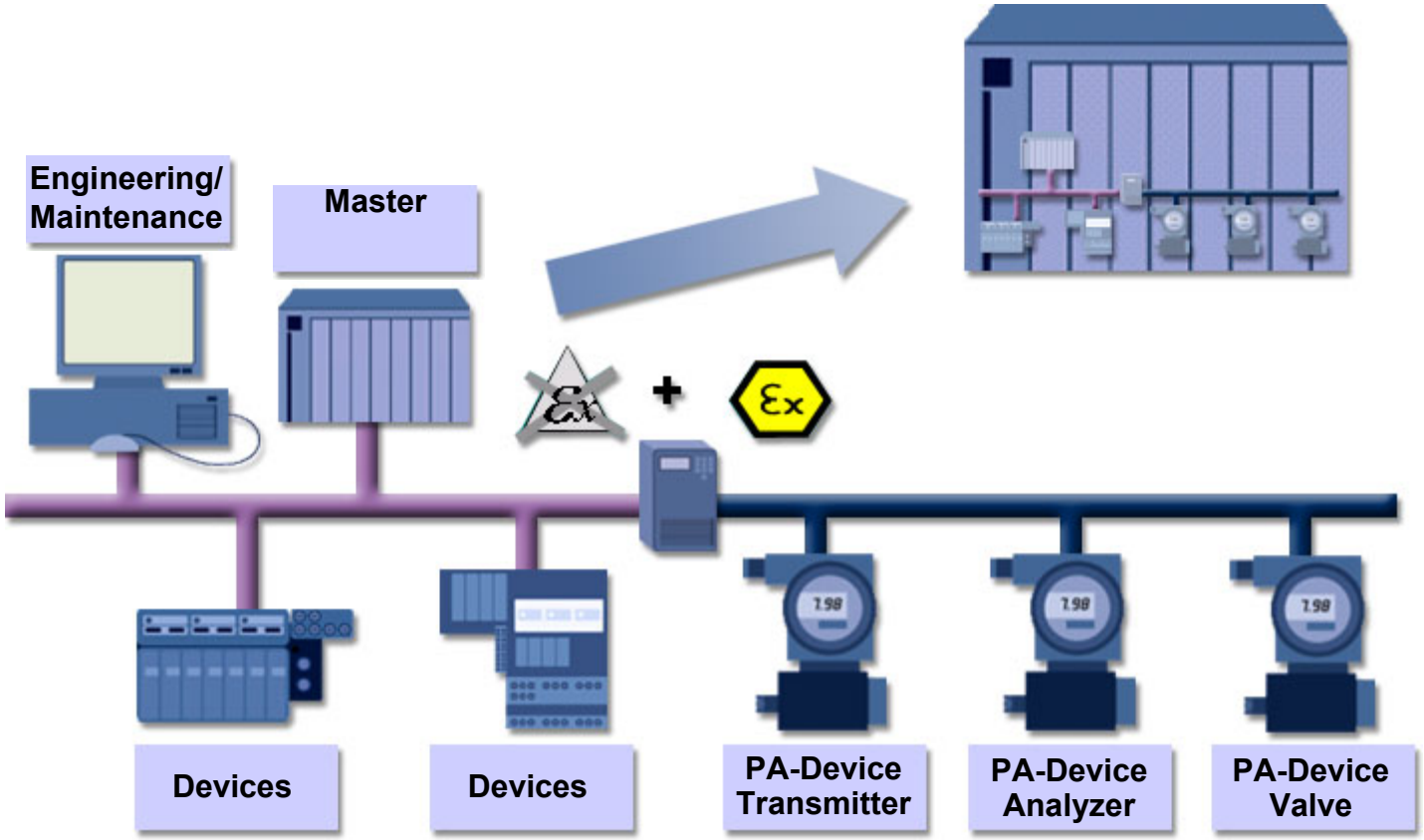
- "What does the installation look like?"



Device integration in the engineering or maintenance system

- "How are the field devices set?"
- "What information is available for asset management?"

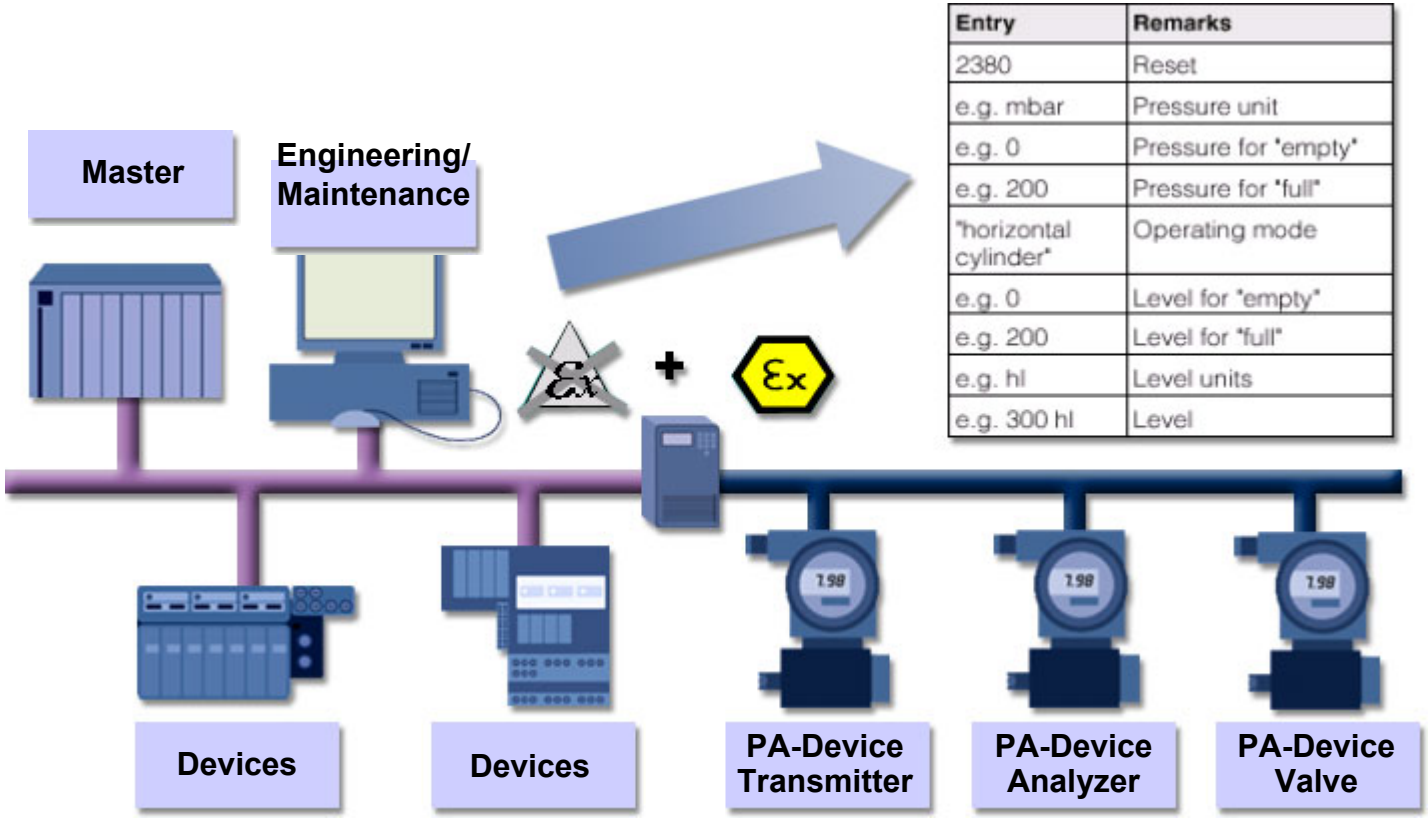
Device Integration in the Master



Device integration - What must the master know?

- Which devices are connected?
- What functionality does the devices have?

Device Integration in the Engineering System



Entry	Remarks
2380	Reset
e.g. mbar	Pressure unit
e.g. 0	Pressure for "empty"
e.g. 200	Pressure for "full"
"horizontal cylinder"	Operating mode
e.g. 0	Level for "empty"
e.g. 200	Level for "full"
e.g. hl	Level units
e.g. 300 hl	Level

Device integration – does the system engineering/ maintenance have access to all parameters?

- Process information
- Maintenance and asset information

Integration Technologies

PROFIBUS innovated device integration

Conventional plant

- Specific operator tools
- No central device access
- No data consistency

Innovations through PROFIBUS

PROFIBUS plant

- Standardization
- Data consistency
- Central access

Advantages for users

- Access to all devices and information from a single location
- Access to all devices using a uniform method
- Uniform data management with description of all assets

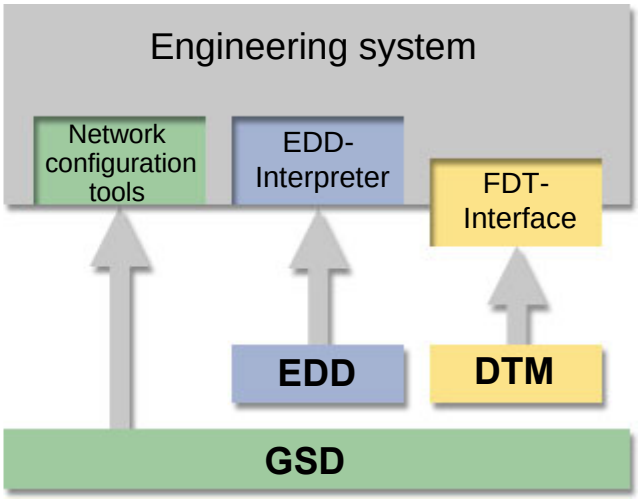
PROFIBUS Integration Technologies

PROFIBUS offers three application-orientated graded technologies for device integration

GSD technology

EDD technology

FDT/DTM technology



GSD

- Mandatory basic description for each PROFIBUS device
- Integration in the master and exchange of measured values and manipulated variables

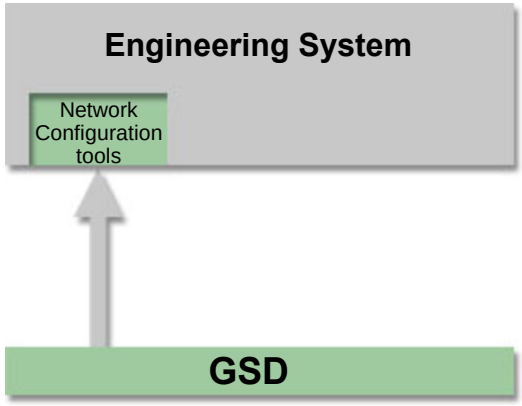
EDD and FDT/DTM

- Used in addition to GSD (optional)
- Exchange of additional information with the master for e.g. diagnostics or asset management

Device Data Base File (GSD)

The GSD

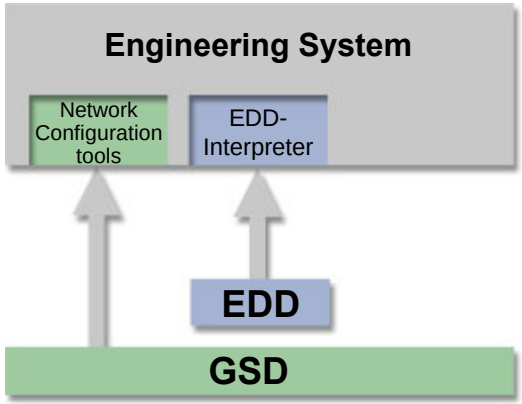
- is an electronic data sheet made available by the device manufacturer
- is a *simple* text description of device properties for PROFIBUS communications
- is the basic description of a PROFIBUS device for its cyclic communications
- is used and interpreted in the network configuration tool of the engineering system



The GSD on its own is sufficient for device integration for the exchange of measured values and manipulated variables between field device and automation system

Electronic Device Description (EDD)

The EDD



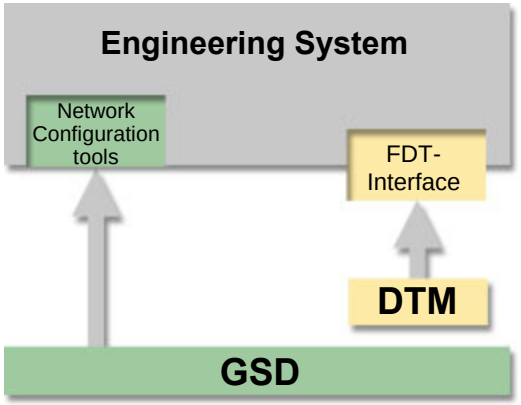
- is a text device description using a special language (EDDL) and is used parallel to GSD
- describes the *acyclic* communicated (application-orientated) functionalities, including graphical options
- is independent of the operating system of the engineering system
- is made available by device manufacturer
- is the basis for processing and presentation through an EDD interpreter

Preferably used for

- devices with standardized functionality
- a user interface with a uniform look and feel independent of device family and manufacturer

DTM (Device Type Manager)

The DTM



- is a device operating program in the form of a *software component* and is used parallel to the GSD
- has the standard interface FDT (Field Device Tool) to a frame application
- can run in all FDT frame applications (engineering tools) - like printer drivers
- is device-specifically programmed by the device manufacturer and forms a unit of responsibility with the device
- offers a device-specific user interface

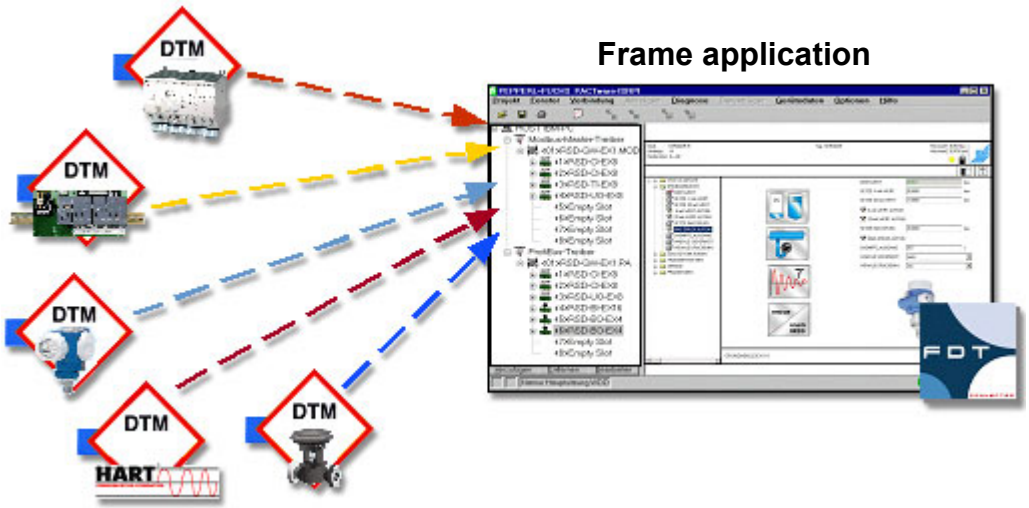
Preferably used for

- utilization of specific device properties through individual program planning
- an individual and device-specific user interface
- routing through different networks using Com DTM

FDT (Field Device Tool) Interface

FDT

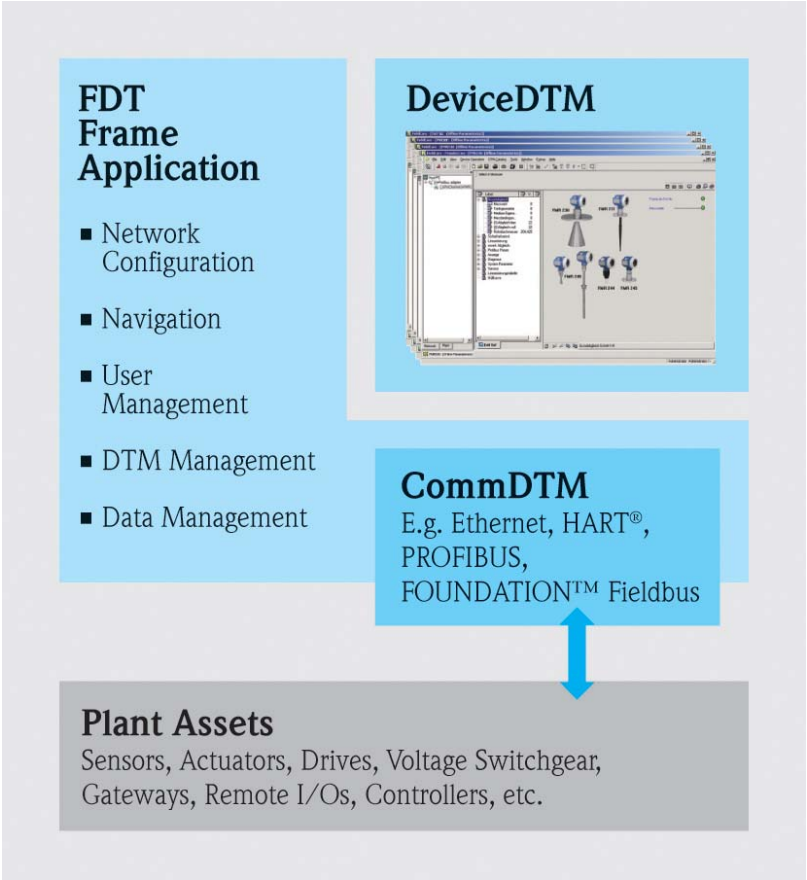
- is a vendor-independent, open interface specification (not a "tool")
- serves as the interface for the open connection of field devices of different manufacturers to tools and control systems using DTM
- defines the interaction between the DTMs and an FDT frame application in the engineering system



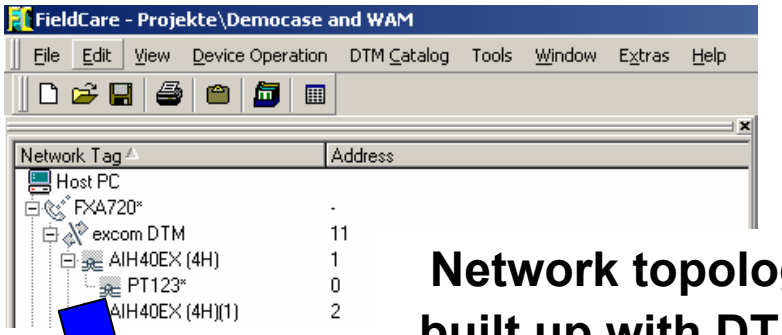
FDT (Field Device Tool) Interface

Field Device Tool (FDT)

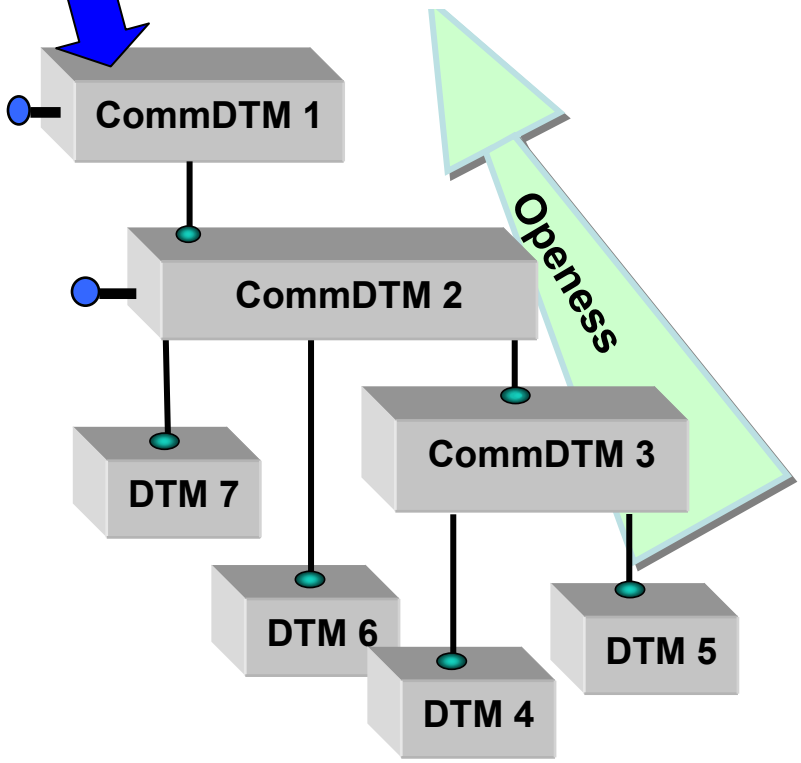
- **Open standardized technology** independent of device or system supplier
- **Independent of device type** sensor, actuator, remote I/O, drives, etc.
- **Full support of installed base**
- **Full device functionality**
- **Independent of communication protocol** Ethernet, HART, PROFIBUS, Foundation Fieldbus (pending), etc.
- **Vertical integration by nested communication**

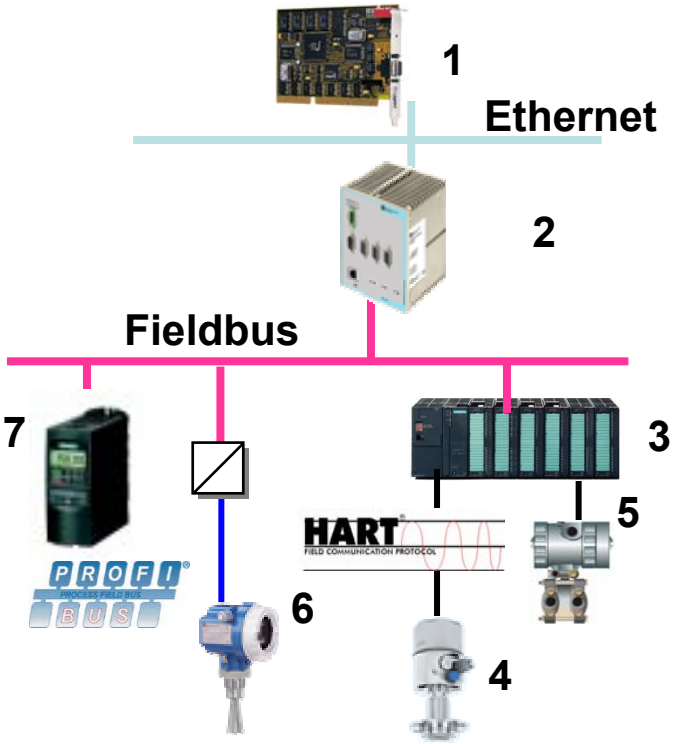


FDT/DTM – How it Works



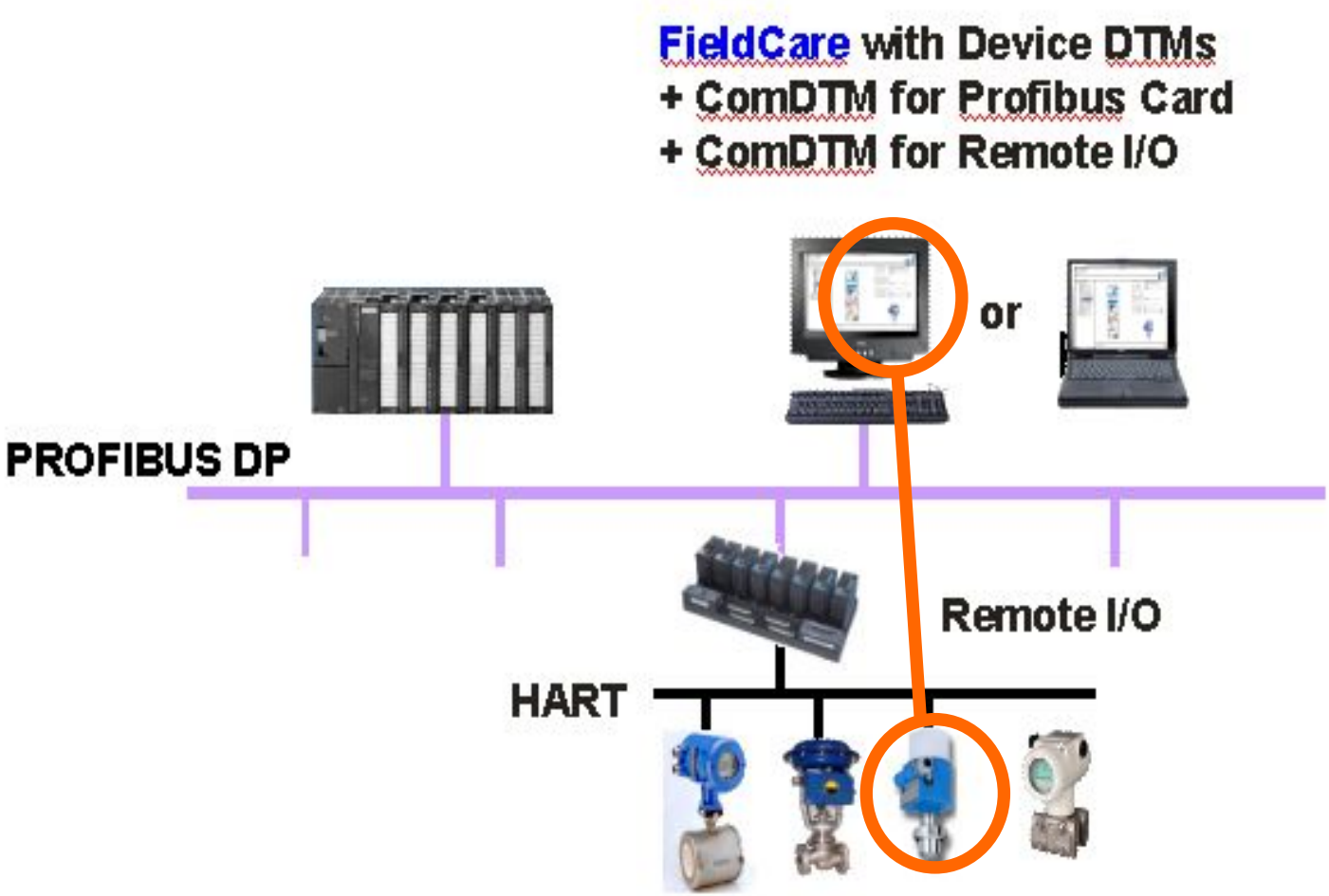
Network topology built up with DTMs





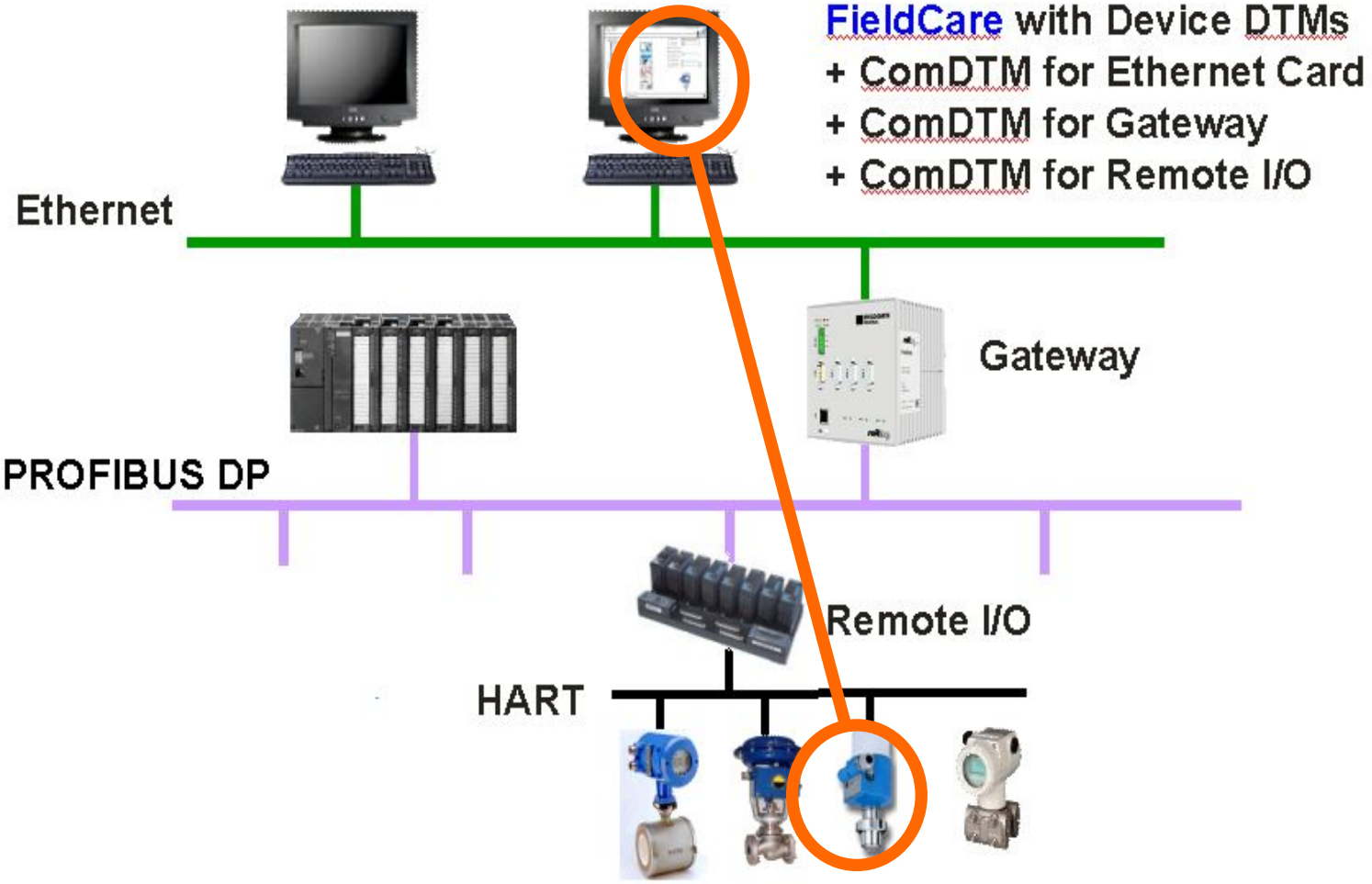
FDT/DTM – HART via Profibus

- The same device, the same DeviceDTM
- Different infrastructures



FDT/DTM – HART via Profibus via Ethernet

- The same device, the same DeviceDTM
- Different infrastructures



FDT (Field Device Tool) Interface

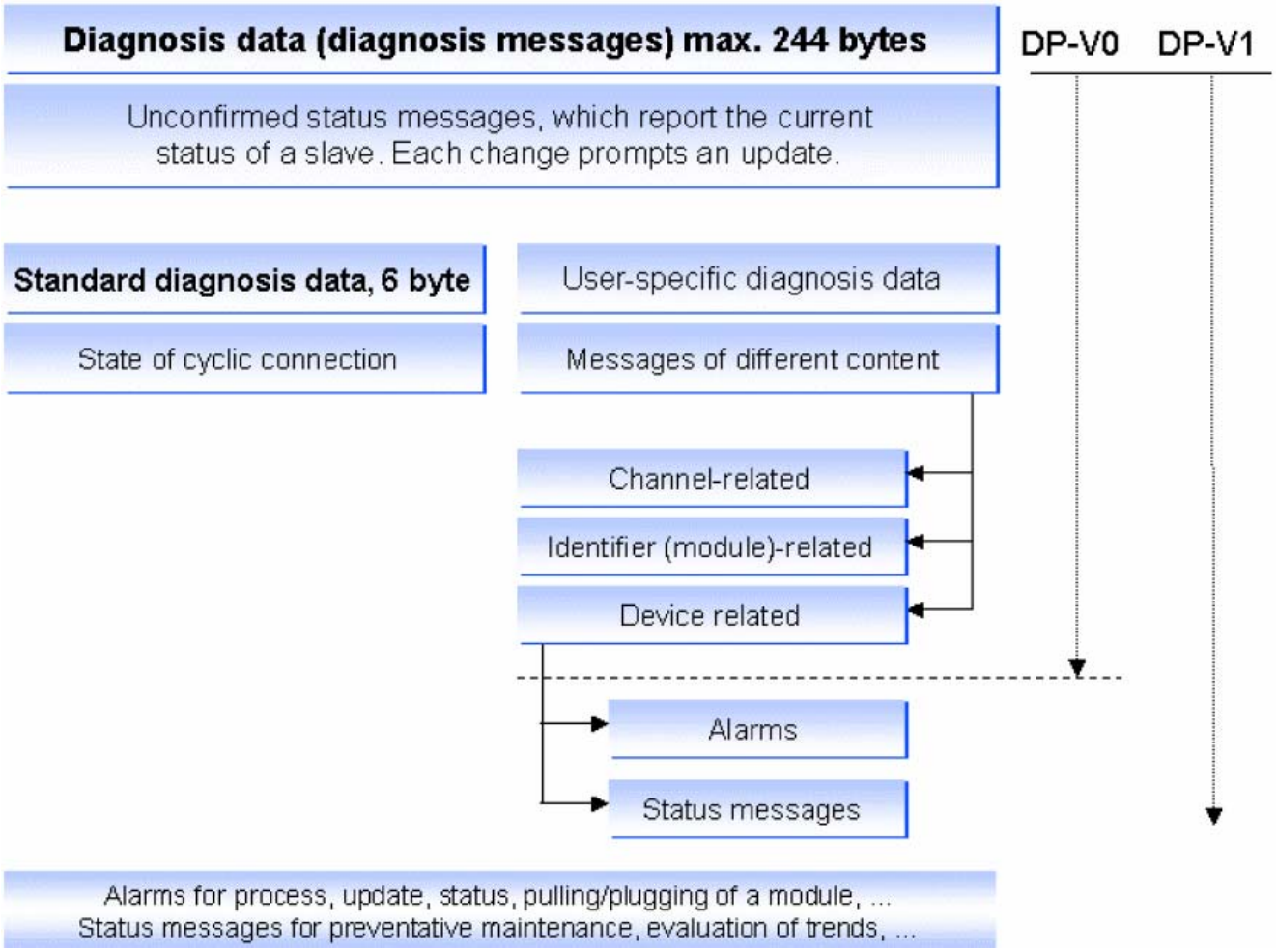
Field Device Tool (FDT)

- The specifications and the direction of FDT/DTM are guided by the FDT Joint Interest Group which includes a broad range of companies:

Joint Interest Group
FDT

ABB
COMSOFT
auma
BARTEC
BECKHOFF
code WRIGHTS
CEAG
Endress+Hauser
People for Process Automation
hilscher
COMPETENCE IN COMMUNICATION
ifak system
infoteam
Software-Experts for...
invensys
KH-Automation Projects
Perfect in Process
KROHNE
The Level and Flow Company
MESCO
Engineering
metso
automation
M&M
Software GmbH
MOELLER
OMRON
PEPPERL+FUCHS
PHOENIX CONTACT
Rockwell
Automation
SICK
SIEMENS
smar
FIRST IN FIELDBUS
softing
STAHL
Trebing + Himstedt
Prozeßautomation
TURCK
Industrial Automation
tyco
VEGA
Woodhead

PROFIBUS Diagnostic - Standard Device



PROFIBUS Status Signal

Every PROFIBUS PA device transmits its process value in a floating point format conform to IEEE 754 with 4 Byte and an additional status byte.

	Process Value			
Byte 1		**process value range conform IEEE 754** decimal: ~ $\pm 10^{38.53}$ binary: $\pm (2-2^{-23})^{127}$		
Byte 2				
Byte 3				
Byte 4				

	Status Signal							
	Bit 2^7	Bit 2^6	Bit 2^5	Bit 2^4	Bit 2^3	Bit 2^2	Bit 2^1	Bit 2^0
Byte 5	**quality**		**quality + sub-status**				**limits**	

PROFIBUS Status Signal

Status Signal (Byte 5)							
Bit 2^7	Bit 2^6	Bit 2^5	Bit 2^4	Bit 2^3	Bit 2^2	Bit 2^1	Bit 2^0
quality		**quality + sub-status**				**limits**	

00 = BAD -> value can´t be used

- **0010 = Device Failure** -> device failure
- **0100 = Sensor Failure** -> sensor failure
- **0101 = No-Communication** -> communication failure

01 = Uncertain -> value is still utilisable

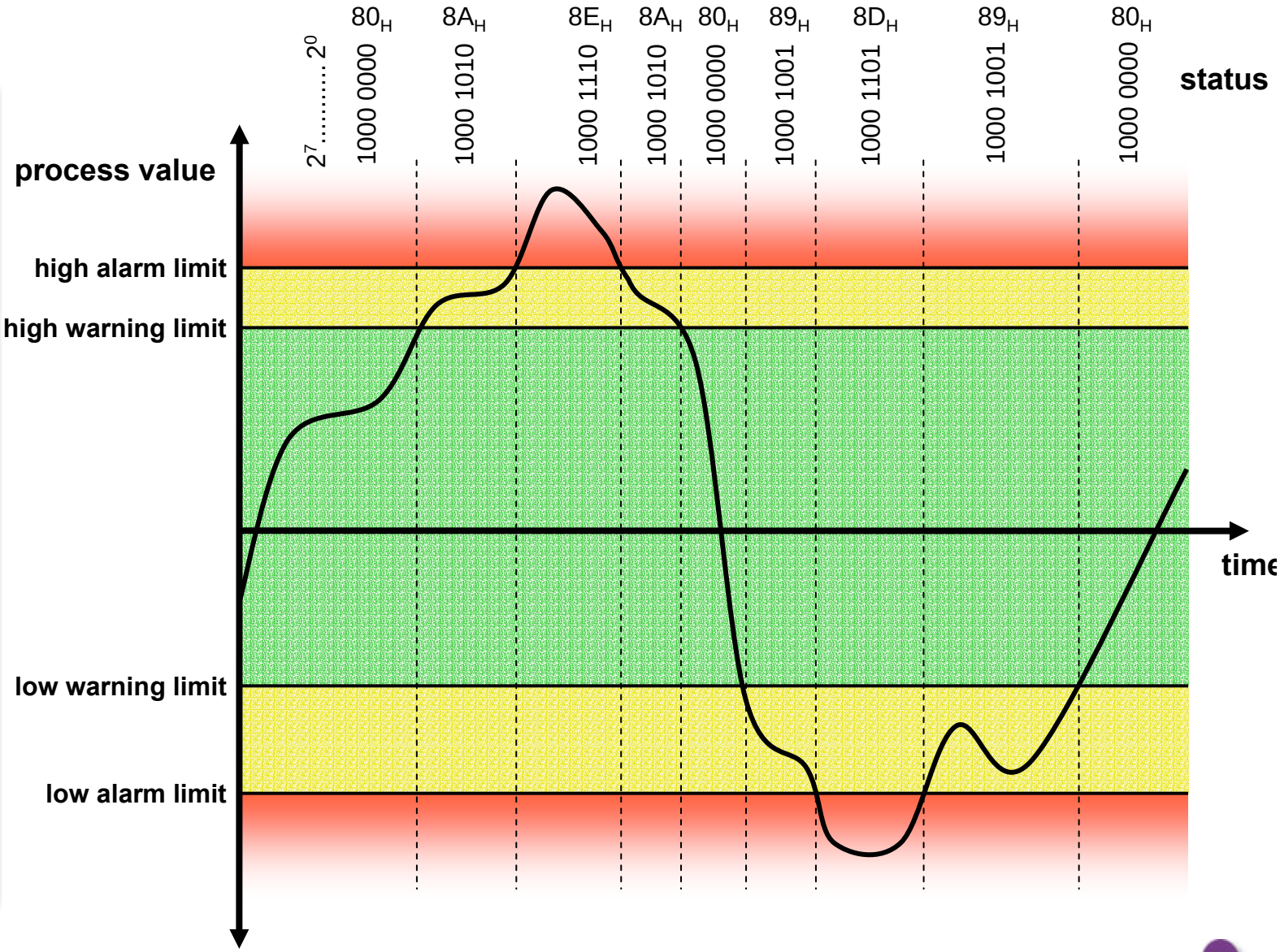
- **0001 = Last Usable Value** -> last usable value (no actualisation)
- **0100 = Sensor Conversion Not Accurate** -> sensor conversion inaccurate (sensor limit reached)

10 = Good -> value is good

- **0000 = OK** -> ok
- **0010 = Active Advisory Alarm** -> active advisory alarm (warning limit exceeded)
- **0011 = Active Critical Alarm** -> active critical alarm (alarm limit exceeded)

- **00 = Not Limit** -> no limit
- **01 = Low Limit** -> low limit
- **10 = Active Critical Alarm** -> high limit
- **11 = constant** -> constant (process value independent)

PROFIBUS Status Signal



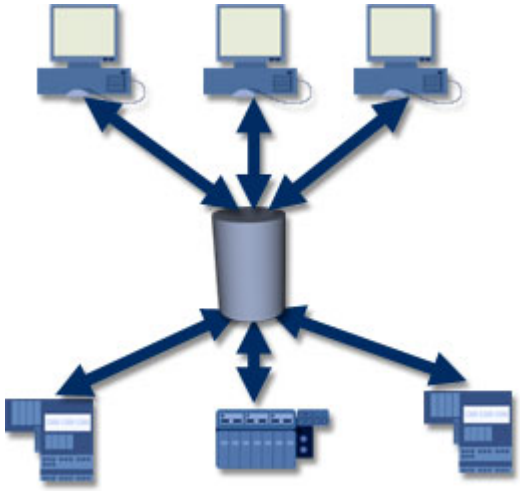
Plant-Wide Data Consistency

Information and data are continuously needed in a plant from the field devices

- at different times in the life cycle of the plant
- for the execution of different tasks (engineering, operation, asset management)

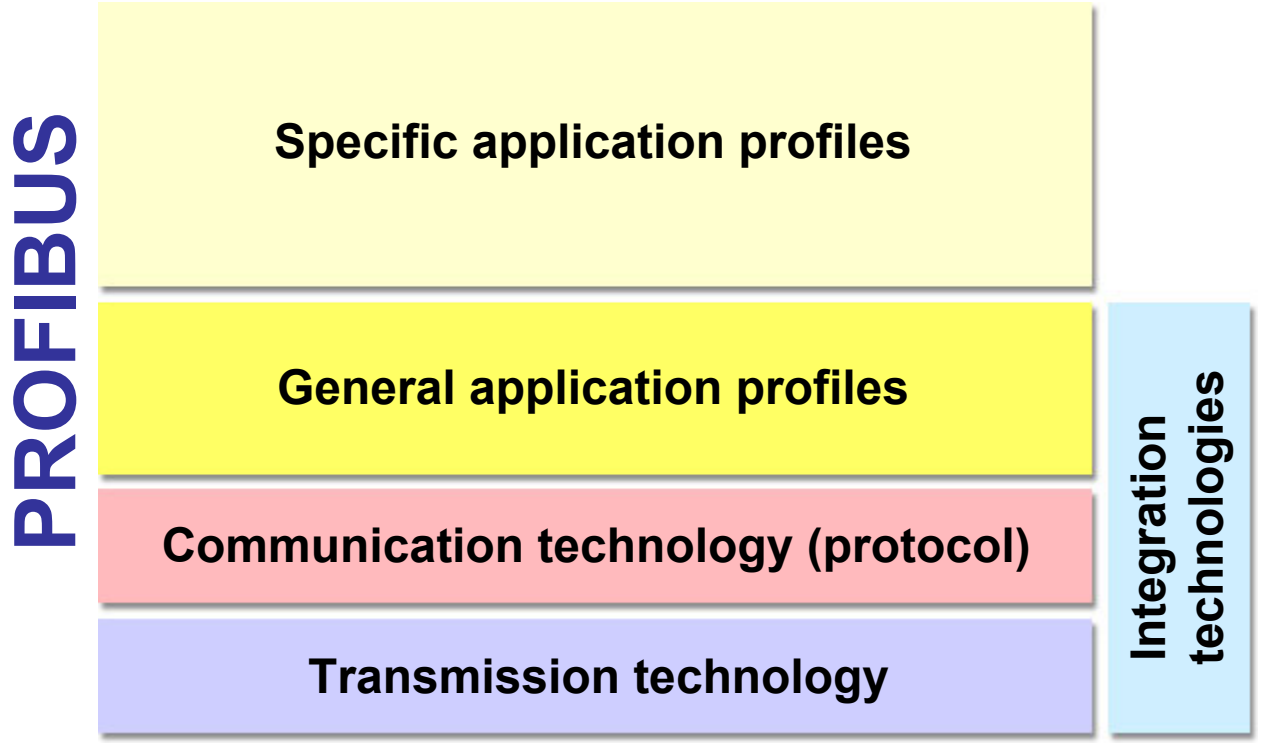
This requires

- Plant-wide data consistency
- Access to integration tools on this data management system



The integration tools of PROFIBUS fulfill these requirements

PROFIBUS Structure



→ The modules in their entirety make PROFIBUS automation technology

Key Applications

Typical designations have become standard on the market for specific module combinations

Typical designation	PROFIBUS PA	PROFIBUS DP	PROFIsafe	Motion Control
Application	Profile PA Devices	Profile None or e.g. Ident	Profile PROFIsafe	Profile PROFIdrive
Communication	DP-protocol	DP-protocol	DP-protocol	DP-protocol
Transmission technology	MBP-IS	RS485	RS485 MBP-IS	RS485

Overview PROFIBUS Technology

Welcome 18.45 – 19.00

- Mr. Jacky Chan – GM Siemens Pte Ltd – A&D
- Mr. TJ Kang – President ICS & MD Cegelec Pte Ltd

PROFIBUS Organization 19.00 – 19.45

Standard & Technology

- Mr. Andreas Agostin – PM Pepperl+Fuchs Pte Ltd

Break 19.45 – 20.00

Application Profiles 20.00 – 20.45

Integration Technology

- Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd

PROFINET 20.45 – 21.15

References

- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

Q&A Lucky Draw 21.15 – 21.30

Speaker – Volker Schulz

Technological Knowledge

- In-depth knowledge about PROFIBUS due to 2 years of experience in G.E.P. Instruments in Thailand
- 6 ½ years with Endress+Hauser S.E.A. - Business Development Manager for Fieldbus and Solutions
- Technical Marketing Manager – PROFIBUS Siemens Pte Ltd
- Certified PROFITech Engineer (2003)
- Member of PCC Singapore

Society experience

- Founding Member of PROFIBUS Singapore Organization 1998
- Secretary of RPA S.E.A. since 2001
- Member of RPA S.E.A. Technical Committee
- Member of FF Marketing Society Singapore 1999 - 2002
- Vice President ISA Chapter Singapore (i.F.)

Public Relations

- Over 50 Fieldbus seminars in Vietnam, Singapore, Malaysia, Thailand, Philippines and Indonesia
- Seminars at ICS, CIA and many other societies and organizations
- Numerous publications for marketing and promotion

Overview PROFIBUS Technology

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PROFIBUS

Standard &
Technology

Application
Profiles

Integration
Technology

PROFINET

References

History, organization, market position

With wide range of application

- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology

- Transmission Technology
- RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles

- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

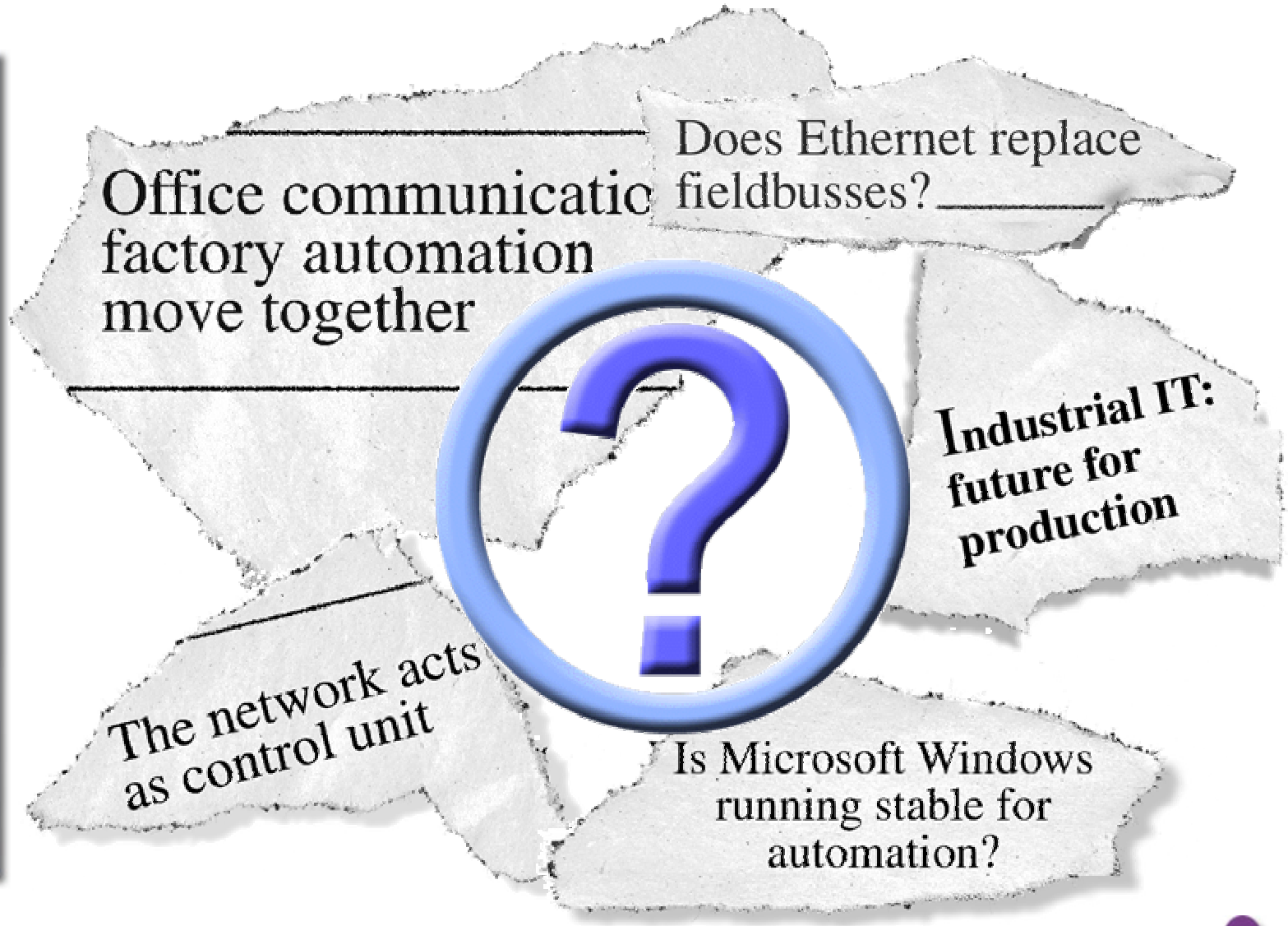
Integration Technology

- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References

Quo Vadis Automation

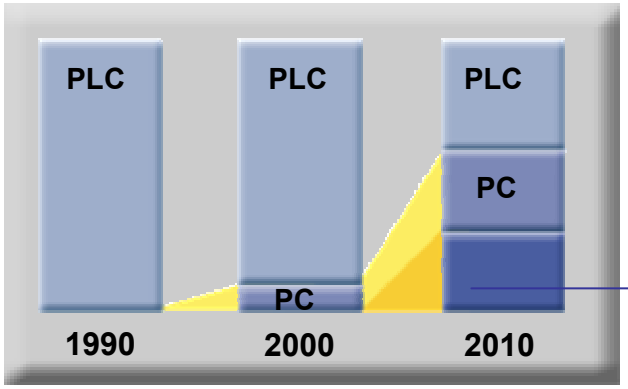


Why Ethernet in automation?

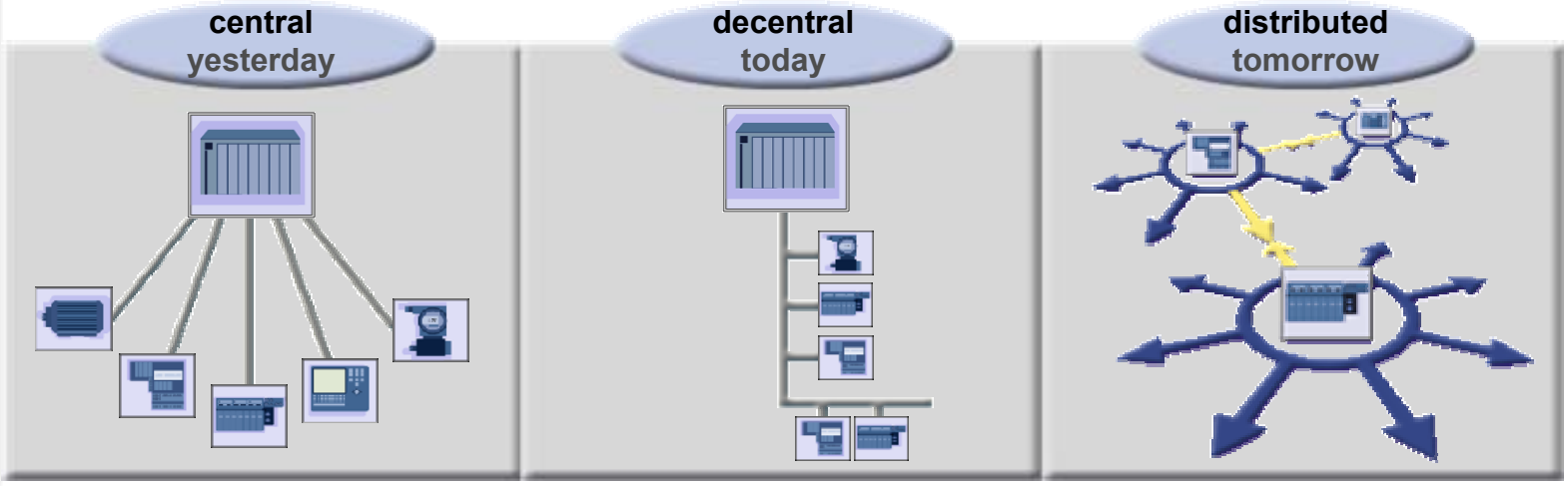
- Ethernet is already the office world standard
- Ethernet is already used for higher level communications in the automation world
- Ethernet may also be used for communication between controllers and field devices
- IT functionality could also be applicable to automation applications
- **Advantage**:
- Vertical integration of field communications with Manufacturing Execution Systems (MES)
- **Challenge:**
- Protect existing PROFIBUS investment
- Bring real time functionality to Ethernet

Mega Trends in Automation

Trend I: Control Systems



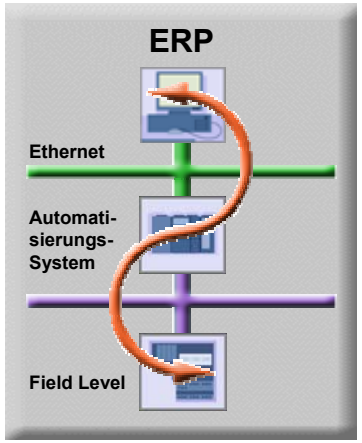
Trend II: Automation Structures



Mega Trends in Automation

Trend III: IT technologies and automation grow together

- Conistent communication for vertical integration
- Data access from the corporate management level (ERP) through to fieldlevel



Trend IV: Use of open standards in automation

- Fieldbus PROFIBUS
- Ethernet TCP/IP, UDP
- OPC, XML, COM/DCOM, ActiveX
- Object Oriented Design
- MS Office Applications

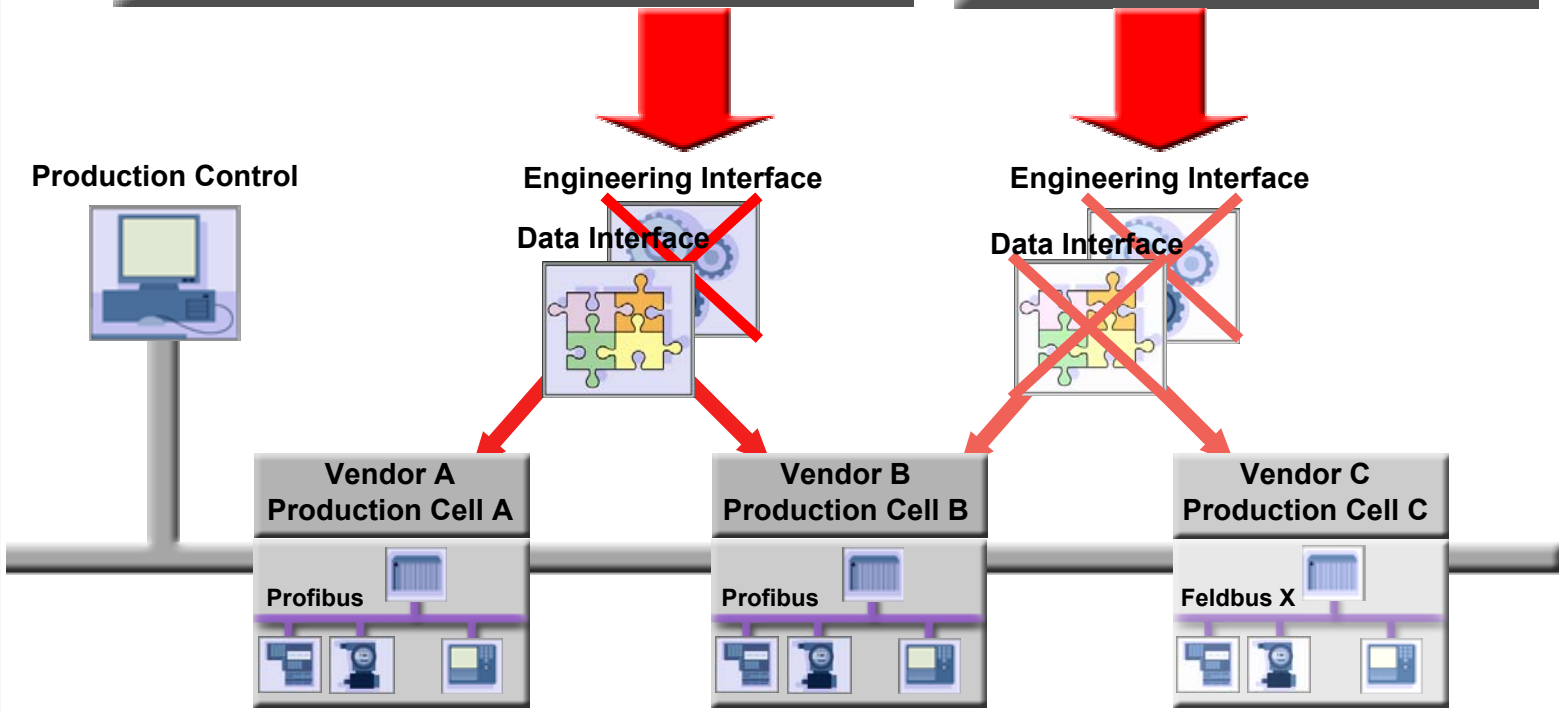
The Meea Trends are the Basis for PROFINET

Engineering-Situation today

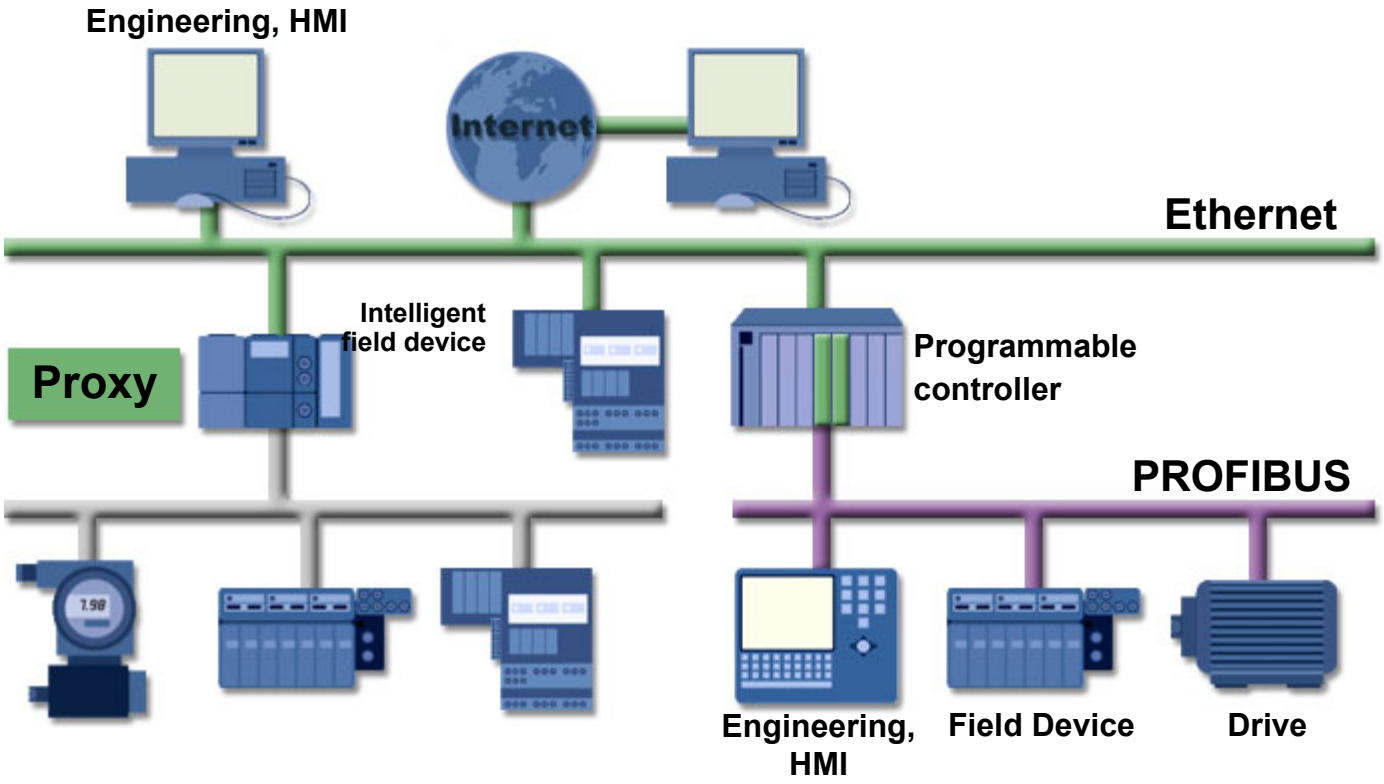
Fieldbus technology defines the interface for data exchange,

but no interface for engineering is defined

No data and engineering interface at different bus systems available



Integration of PROFIBUS and PROFINET Segments



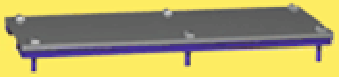
➔ **PROFIBUS and PROFINET are two complementary parts of PROFIBUS International automation technology**

How PROFINET Acts

Process Module

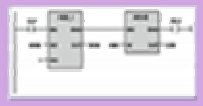
Object Model for a PROFINET Component

Mechanical



Electrical/Electronics

Logic/Software



Filling

Reset	Run
Clock	End
Ready	Start
Start	Error

Generation and Interconnection of Components

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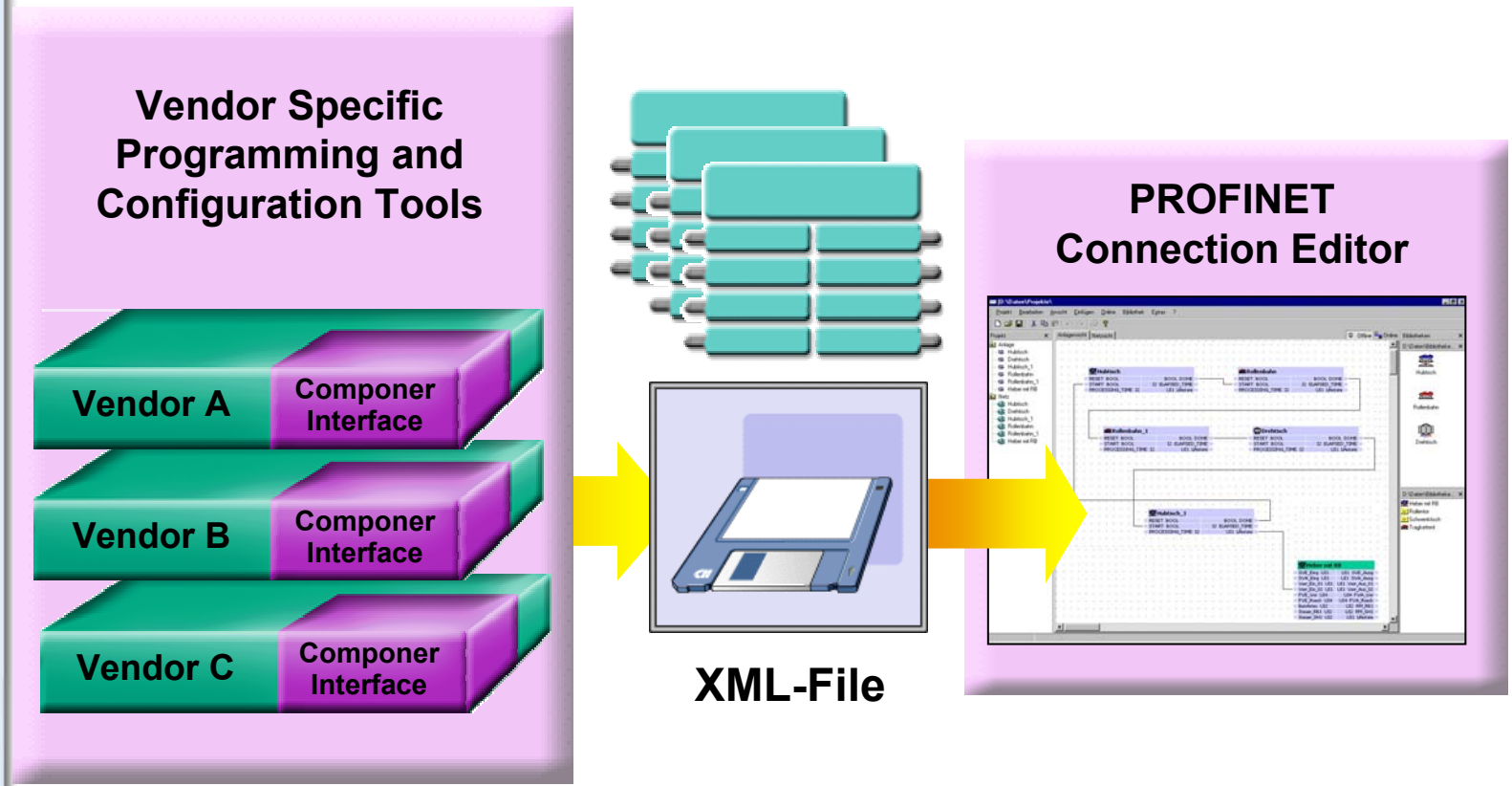
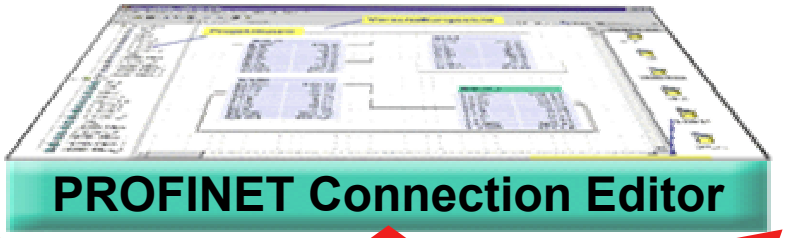
- Standard & Technology
- Application Profiles
- Integration Technology
- PROFINET
- References



The PROFINET Engineering: vendor independent, centralized, plant wide



PROFINET Connection Editor

Vendor independent

Vendor specific

Vendor specific

Vendor specific

Programming

Configuration

Parametrization

Programming

Configuration

Parametrization

Programming

Configuration

Parametrization

Vendor B

Interbus

Vendor A

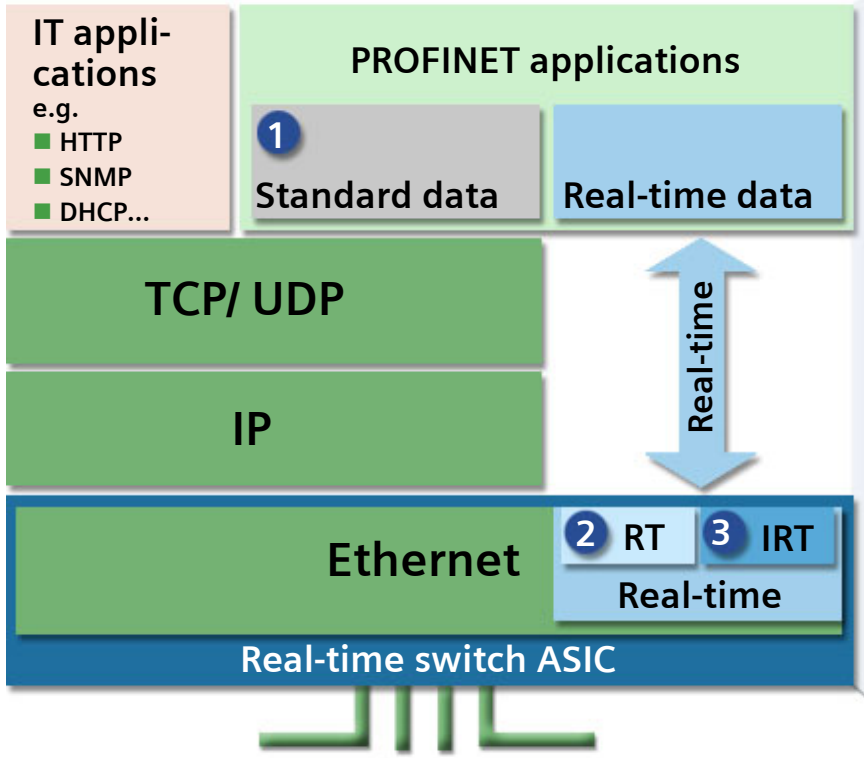
PROFIBUS

Vendor C

Fieldbus

X

How does PROFINET work



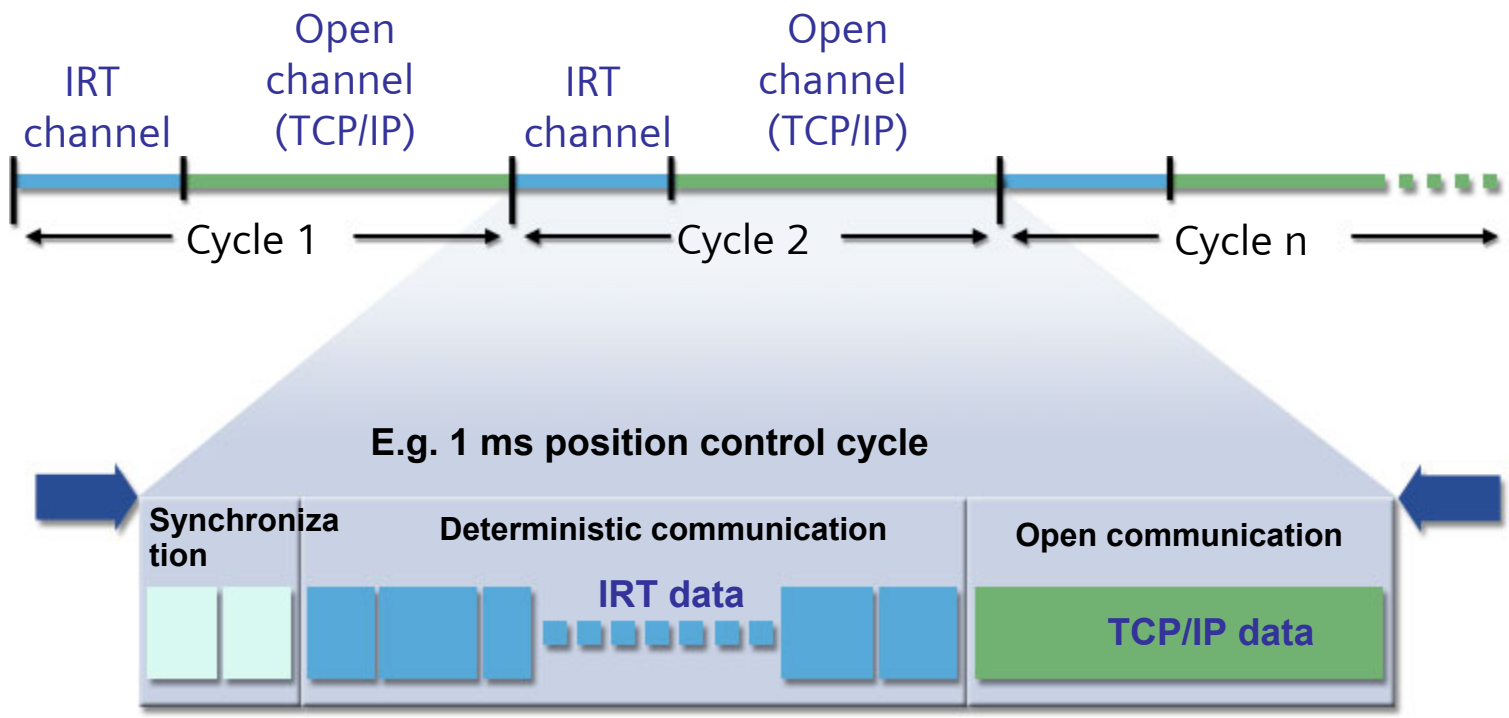
1 Open TCP/IP channel
- Device parameterization
- Reading of diagnostics data
- Loading of interconnections
- Negotiation of the communication channel for user data

2 Real-time channel RT
- High-performance transfer
- Cyclic data
- Event-controlled signals

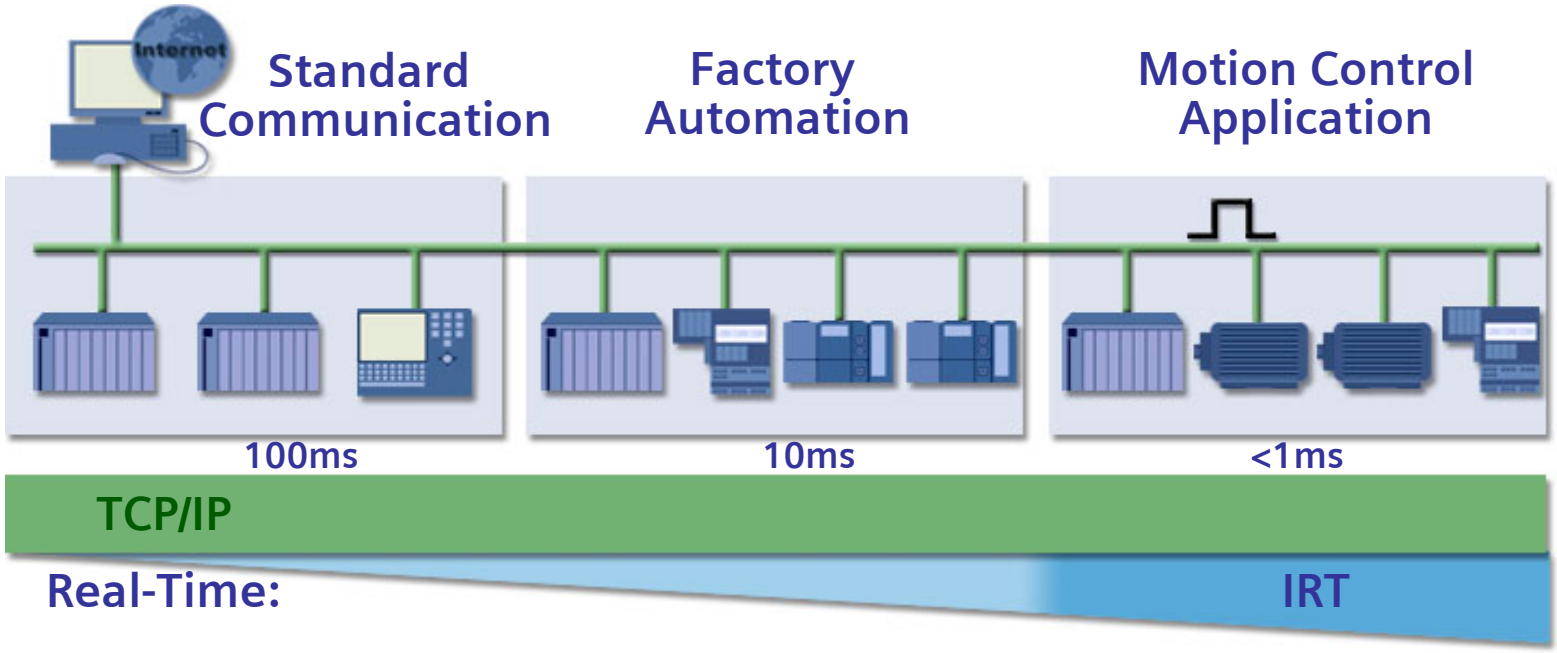
3 Real-time channel IRT
- High-performance transfer
- Data in isochronous mode
- Jitter <1µsec

Real-time Ethernet in isochronous mode

Motion Control applications use separate time domains in one cycle for real-time and non-real-time data



Real-time requirements for Automation



- Coexistent use of real-time and IT communication on one line
- Uniform real-time protocol for all requirements
- Scalable real-time communication from high-performance to isochronous

Performance parameters IRT functionality

Cycle time	1 msec		250 µsec
Jitter	<1µsec		<1µsec
Number of nodes	70	150	35
Simultaneously transferable TCP/IP data *)	9 MB/ sec	6 MB/ sec	6 MB/ sec

*) Standard length of the TCP/IP data packets from 64 to 1536 bytes
Max. data transmission rate on Fast Ethernet: 12 MB/sec

How does PROFINET compare?

	Ethernet/IP	FF HSE	Modbus TCP	PROFINET
Fit for Factory Automation*	✓	–	✓	✓
Fit for Process Automation	–	(✓)	–	(✓)
Fit for Motion Control	–	–	–	✓
Integration of different Fieldbus systems	–	–	–	✓

*** real-time functionality for cycle times in the range of 5 to 10 msec**

Current Market Situation

- **The market penetration of Ethernet based systems will take some time due to the fact that Fieldbus systems …**
  - are still cheaper
  - are well proven
  - have users trained to handle the technology
- **Also …**
  - it needs time to adopt the advantages of Ethernet based systems like web technology, etc.
  - some technical aspects still need to be solved (e.g. intrinsic safety)

Functionality and development of prices

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- Standard & Technology
- Application Profiles
- Integration Technology
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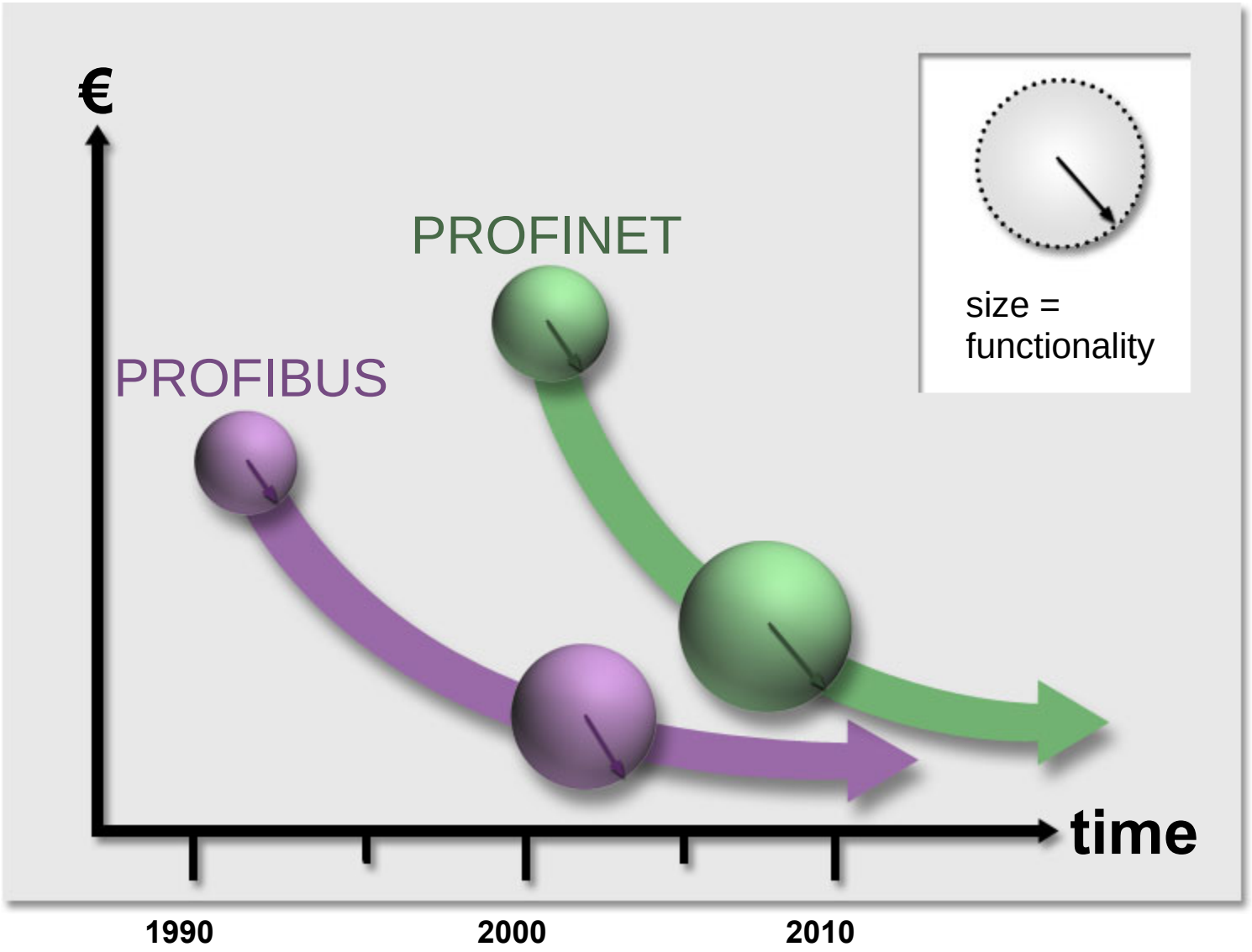
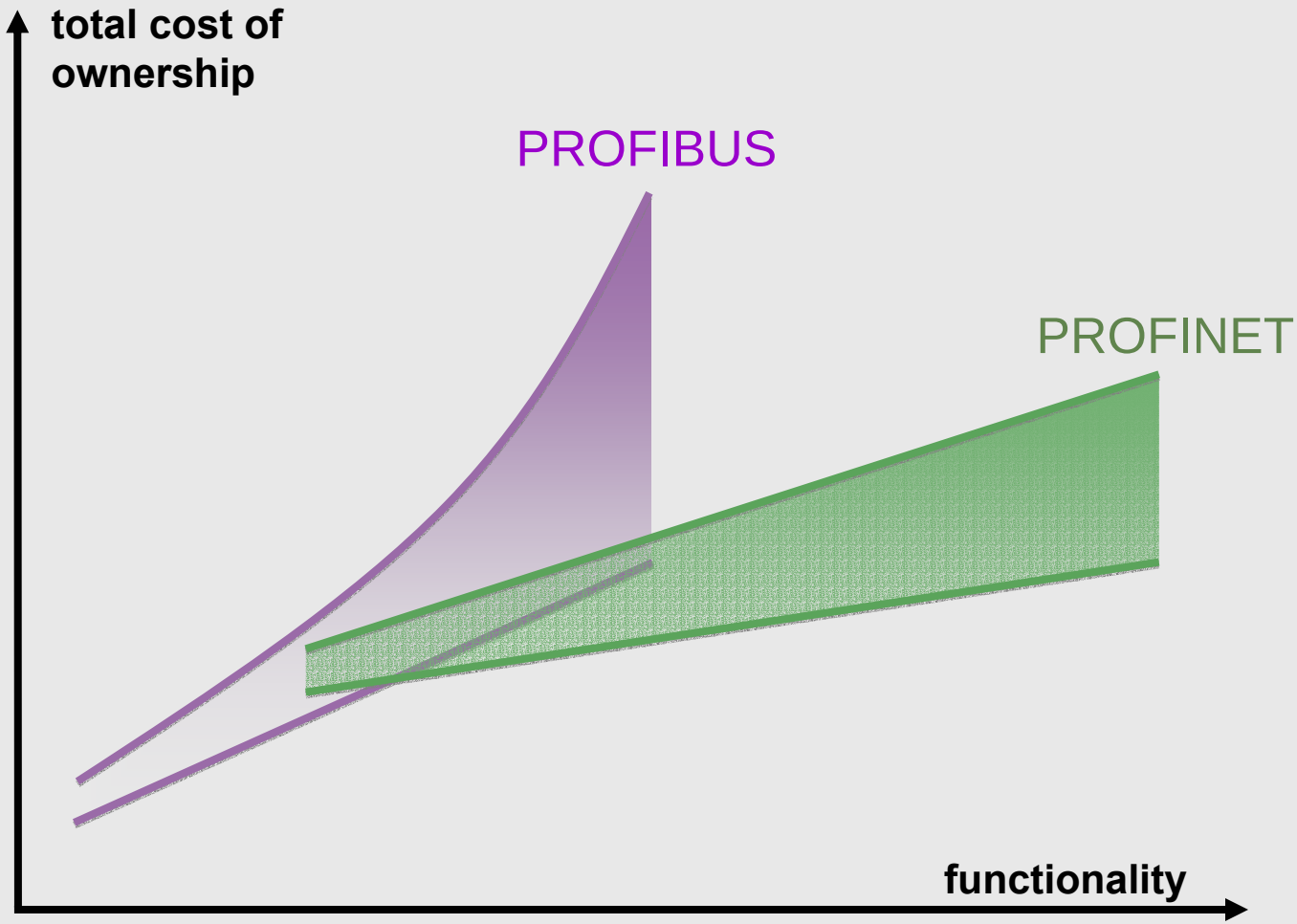
- References



Total cost of owner ship



Functionality and Milestones

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- PROFINET
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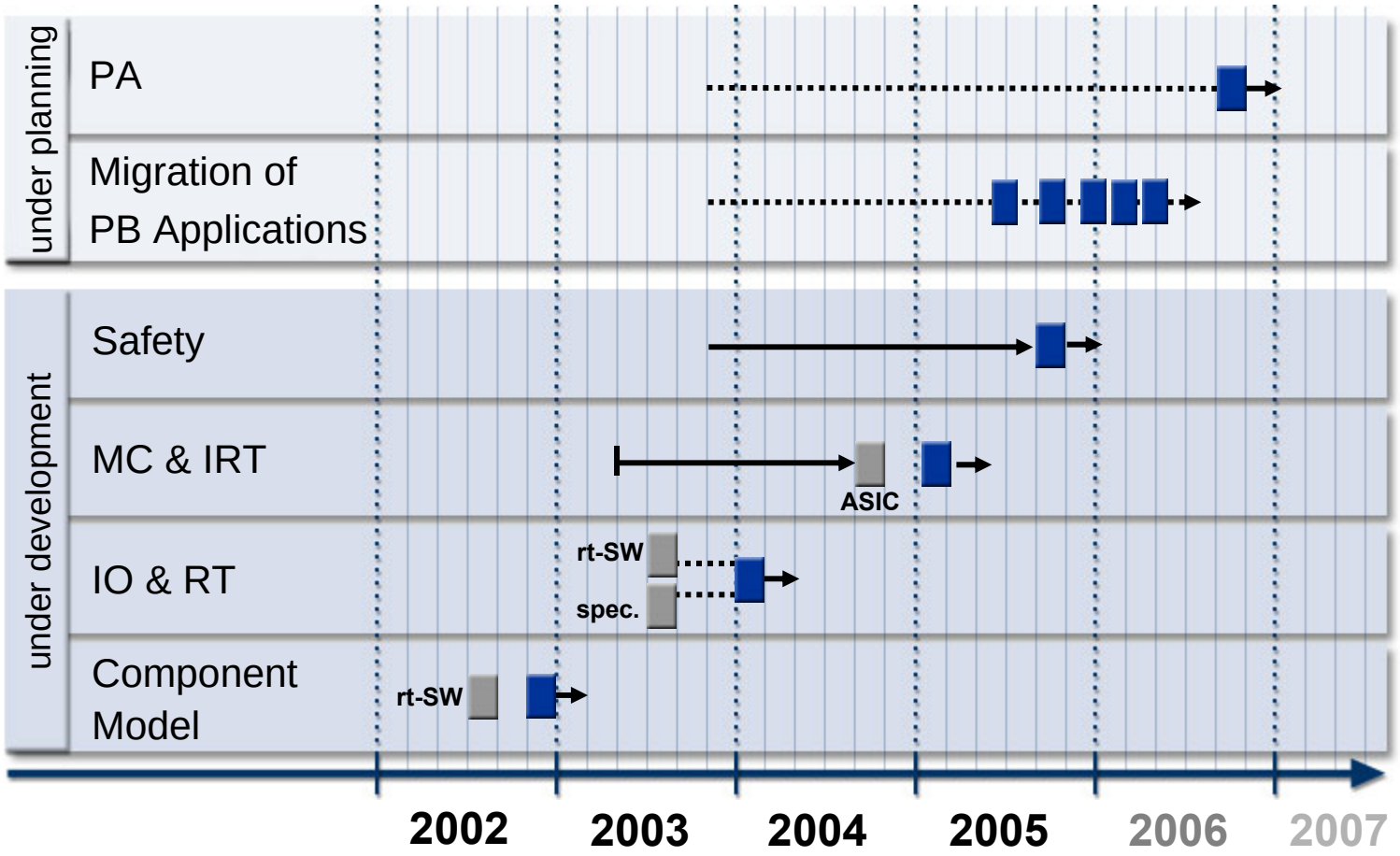
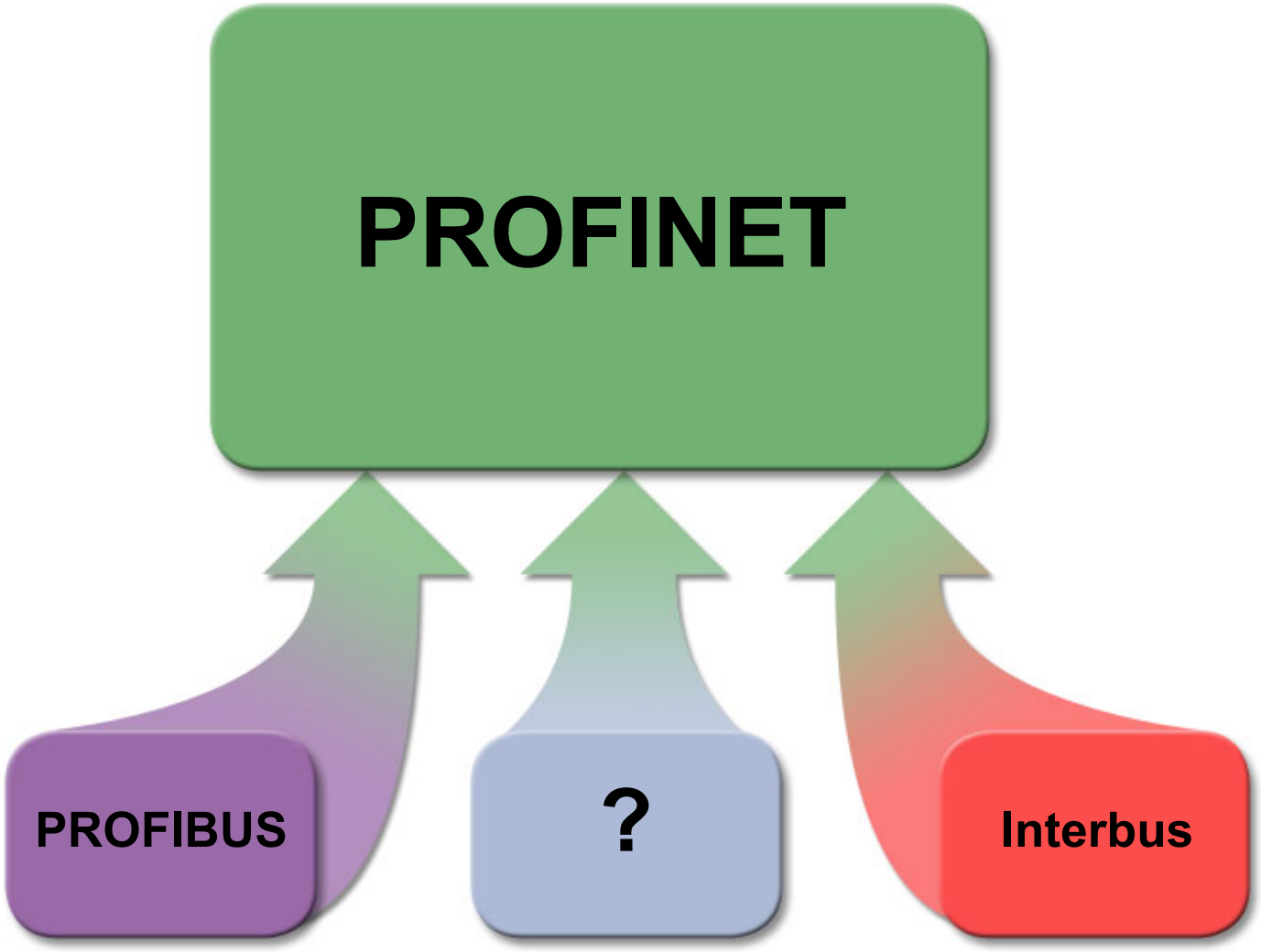


availability of runtime-SW, specifications or ASIC

availability of first products

Fieldbus commitment to PROFINET



Success factor for an Ethernet solution

- The market will accept only those Ethernet solutions which are able to integrate existing Fieldbus installations!
- Thanks to open architecture and open standards, PROFINET allows this integration using PROXY technology.
- PROXIES can be developed to integrate PROFIBUS *and* every other Fieldbus solution!

Overview PROFIBUS Technology

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Integration
Technology

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References

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With wide range of application
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- Process Automation
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- Safety Application

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- HART on PROFIBUS
- PROFIdrive
- Process Application

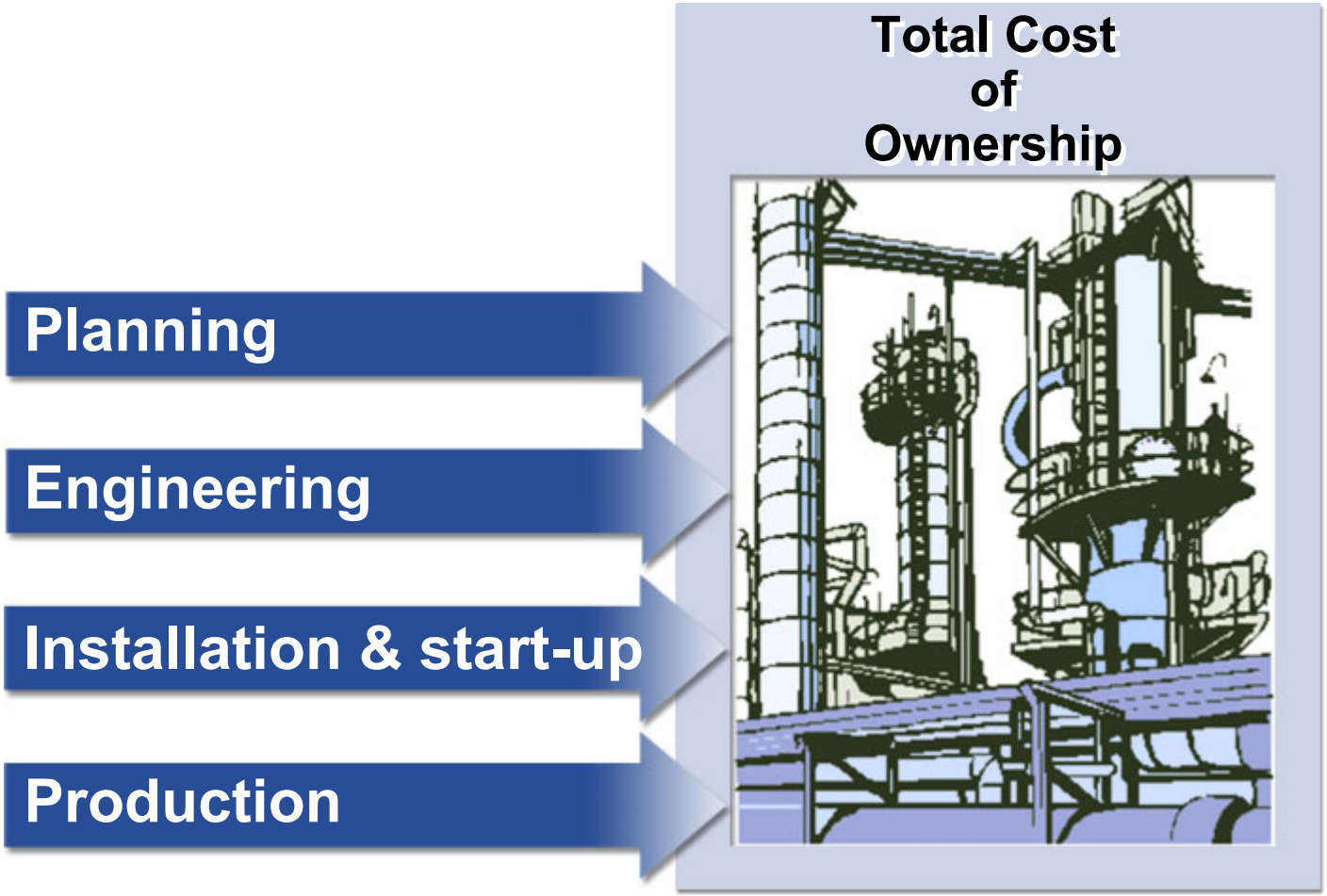
Integration Technology
- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

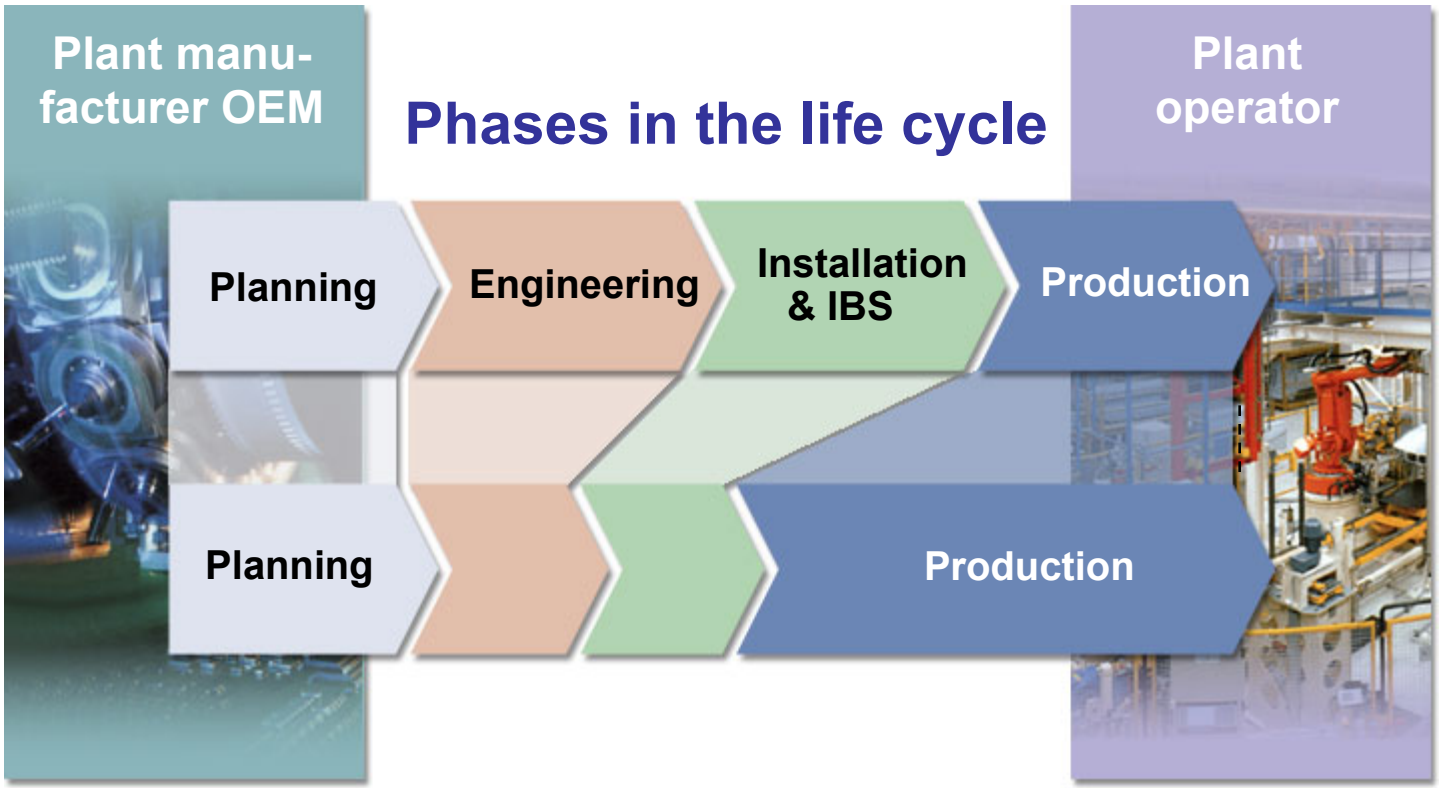
References

User Benefits

Total Cost of Ownership (TCoO)



Faster Planning to Operation



Savings in the life cycle

- Reduction of time prior to start of production
- Reduction of costs
- Reduction of failure risk

Palleting Plant of a Packaging Machine

Production automation

Palleting plant

Netherlands

Master: 1

Slaves: 40 DP

CSi

Drinking Water Plant

Process automation

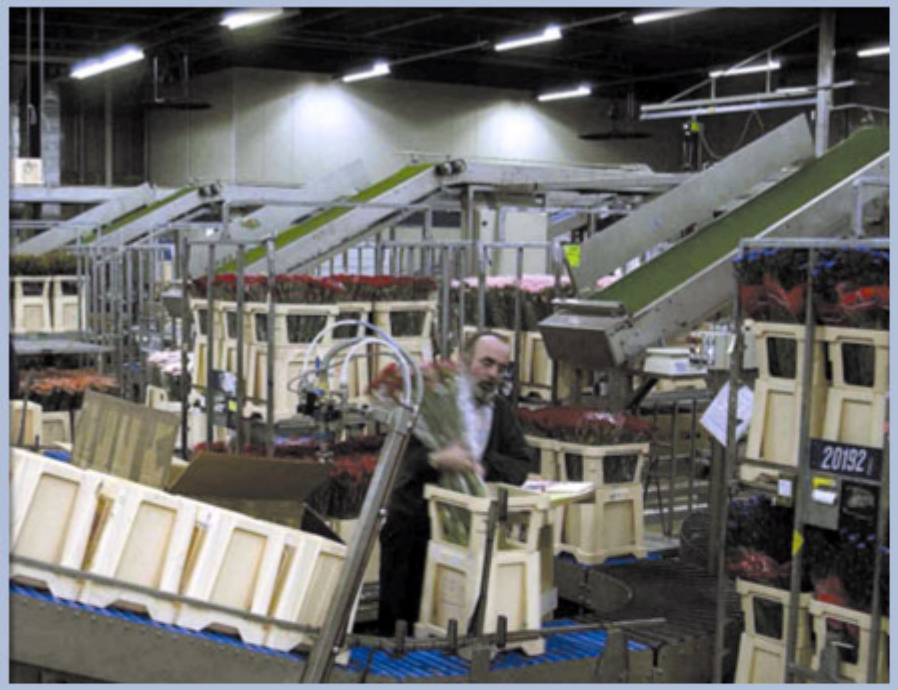
Water works

Netherlands

Master: 2
Slaves: 40 DP
Cable : standard + FO

Nuon Water

Flower Conveyor



Production automation

Conveyor

Netherlands

Master: 1

Slaves: 22 DP (app 1400 I/O)

Cable : 120 m

Bloemen-veiling Flora

PROFIBUS and the environment

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References

Process automation

Sewage plant

Netherlands

Master: 1

Slaves: 36 DP / 15 PA

Rijkswaterstaat

PROFIBUS in Paint Manufacture

Process automation

Paint manufacture

Germany

Master: 2 x 11 (redundant)

Slaves: app 1100

Merck

PROFIBUS in Chemical Engineering

Process automation

Chemical plant

Germany

Master: 1

Slaves: 4 DP and app 110 PA for 1 reactor

Application profiles: PA-Devices

Wacker

PROFIBUS *is* No. 1!

and, “10 Million nodes … and counting”

Why are we No.1?

- 10 Million installed nodes (2 Million in 2003)
- Great engineering solution
- Great configuration and diagnostic software
- Great Production Automation solution
- Great Process Automation solution
- Great Safety solution
- Great Drives + Motion Control solution
- Great organization
- Great Ethernet solution that embraces all the above

RPA S.E.A. – our next events in Singapore

PROFIBUS 30.09.2004

- FuRIOS (Fieldbus Remote I/O Study)
- PROFIBUS Design Standard & Technology
- Sponsored by Pepperl+Fuchs Pte Ltd

PROFIBUS 18.11.2004

- DP/PA integration with Diagnostic
- FDT/DTM Technology
- Sponsored by Endress + Hauser S.E.A. Pte Ltd

PROFIBUS 13.01.2005

- PROFIsafe
- Applications and technology
- Sponsored by Siemens Pte Ltd

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