PROFINET – the Industrial Ethernet standard
PROFINET is 100% Ethernet

PROFINET is Ethernet

- Ethernet is the established standard in the IT world for fast exchange of data (IEEE 802.3)
- PROFINET is always full duplex → simultaneous communication in two directions
- PROFINET is always "switched Ethernet"

- Distribution of network load can be influenced using topology

As comparison: PROFIBUS

- One line to which all nodes are connected
- Performance directly dependent on number of nodes

PROFINET completely uses all possibilities offered by Ethernet
The basic principle of Ethernet communication: nesting of data in message frames

The OSI layer model for structured communication

Layer: Application, Presentation, Session, Transport, Network, Data link, Physical

Services: Ethernet, LLDP, TCP, UDP, IP, HTTP, FTP, SMTP, SNMP, etc.

Web pages, mails, live pictures, network information, etc.

Maximum performance with retention of Ethernet standards
Mechanisms for real-time communication in PROFINET

Separate channels for IO data and TCP/IP
- Performance and deterministic behavior through priority assignment of I/O data
- Openness for every type of Ethernet communication
  - TCP, UDP, IP, etc.
  - Integration of Ethernet devices in machines and systems (Webcam, network printer, etc.)

Real-time and standard on one cable = totally integrated uniformity
"PROFINET – This is my way"

PROFINET...

… provides more flexibility, efficiency and performance in your application

Flexibility
- Tailor-made plant concepts
- Industrial Wireless LAN
- Safety
- Flexible topologies
- Open standard
- Web tools
- Expandability

Efficiency
- Optimal use of resources
- One cable for all purposes
- Device/network diagnostics
- Energy efficiency
- Easy cabling
- Fast device replacement
- Ruggedness/stability

Performance
- Increased productivity
- Speed
- High precision
- Large quantity structures
- High transmission rate
- Media redundancy
- Fast start-up

"With PROFINET we are able to implement new machine and plant concepts, making us more competitive – This is my way!"
"PROFINET is pure flexibility."

"We have a large number of moving sections in our production plant. I need maximum flexibility for this and that's what PROFINET guarantees."

**Highest flexibility…**

**… for tailor-made plant concepts**

- Flexibility
  - Tailor-made plant concepts
    - Industrial Wireless LAN
    - Safety
    - Flexible topologies
    - Open standard
    - Web tools
    - Expandability

Diagram:
- (Redundant) Ring
- Line
- Star
- Tree
- Wireless communication (IWLAN)

- PROFINET
- PROFIsafe

© Siemens AG 2013. Alle Rechte vorbehalten.
What flexibility stands for

**Industrial Wireless LAN**
- Wireless connection of remote or mobile machine and plant components
- Support of Safety communication
- Mobile operating concepts

**Flexible topologies**
- Line topology and redundant ring structures for less cabling and easy commissioning
- Innovative new concepts like I-Device and Shared Device for intelligent architectures

**Web tools**
- Direct access to diagnostic information via standard web browser (without Step7)
- Individually adaptable maintenance concepts due to user-defined web pages
"Everything runs through one cable with PROFINET and that is very efficient."

More efficiency...

... ensures optimum use of resources

Efficiency

Optimal use of resources

- One cable for all purposes
- Device/network diagnostics
- Energy efficiency
- Easy cabling
- Fast device replacement
- Ruggedness/stability

Diagnostic data

Safety-oriented data

IO data

Data for energy efficiency

TCP/IP data (Web)
What efficiency comprises

One cable for all purposes
- Integration from control level to field device with Ethernet
- Cost reduction due to less cabling overhead

Energy efficiency
- Significant energy savings even in short breaks due to selective switching
- Full availability created at end of break

Fast device replacement
- No programming tool and engineering personnel required for device replacement in case of maintenance
- Reduction of standstill time

Efficiency
- Optimum utilization of resources

PROFINET
- One cable for all purposes
- Device/network diagnostics
- Energy efficiency
- Easy cabling
- Fast device replacement
- Ruggedness/stability
"I only get real performance with PROFINET."

High performance... increases your productivity.

- Speed
- High precision
- Large quantity structures
- High transmission rate
- Media redundancy
- Fast start-up

**Performance**

Increased productivity

**Application**

- Robot
- Presses
- Warehouse and logistics
- Packaging machines
- Printing presses
- Machine tools
- Production lines
- Power reserve

**Bus cycle**

- 10ms
- 1ms
- 100µs
- 10µs

**Communication mechanisms**

- TCP/IP
- Real Time
- Isochronous Real Time
- PROFINET

TCP/IP up to 250µs

Real Time

Isochronous Real Time

PROFINET up to 31.25µs

"High speed by itself is not everything. PROFINET is not only faster but can also do more."
What performance means to us

**PROFINET**

**Performance**

- Speed
- High precision
- Large quantity structures
- High transmission rate
- Media redundancy
- Fast start-up

**Increased productivity**

**PROFINET**

**Speed**
- Isochronous real-time mode for time critical and precise applications
- Capability to reduce the cycle time down to 31.25 µs

**High transmission rate**
- By using Ethernet, significantly higher transmission rate than previous fieldbuses
- Parallel operation of data-intense applications without effect on I/O data transfer

**Fast start-up**
- Modular concept without waiting periods due to faster detection of PROFINET devices by the controller
- Faster and more productive tool changers
“My PROFIBUS experience also enabled me to set up the PROFINET solution without problems. In doing so, I discovered the many benefits of PROFINET.”
...and cost savings at the same time

### Transition from PROFIBUS to PROFINET

<table>
<thead>
<tr>
<th>Interface</th>
<th>Devices</th>
<th>Bitrate</th>
<th>Cycletime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: DP</td>
<td>28x ET200S</td>
<td>12MBit</td>
<td>10ms</td>
</tr>
<tr>
<td>2: MPI/DP</td>
<td>17x ET200S</td>
<td>1,5MBit</td>
<td>7,8ms</td>
</tr>
<tr>
<td>3: IF</td>
<td>28x FU</td>
<td>12MBit</td>
<td>10ms</td>
</tr>
<tr>
<td>4: IF</td>
<td>20x FU</td>
<td>12MBit</td>
<td>10ms</td>
</tr>
<tr>
<td>5: CP ext</td>
<td>23x FU</td>
<td>1,5MBit</td>
<td>7,9ms</td>
</tr>
</tbody>
</table>

PROFINET Configuration

<table>
<thead>
<tr>
<th>Interface</th>
<th>Devices</th>
<th>Cycletime</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: PN</td>
<td>45x ET200S</td>
<td>1 and 2 ms</td>
</tr>
</tbody>
</table>

1-2 ms

7-10 ms
PROFINET – the best of PROFIBUS and Ethernet

PROFINET combines proven principles of PROFIBUS with new features of Ethernet

Strengths of Ethernet
- High data rate
- Wireless
- Flexible topologies

Strengths of PROFIBUS
- IO communication
- Safety
- Diagnosis
New possibilities increase efficiency thanks to PROFINET

Increase of efficiency with new innovative architectures and real networks

Savings on Hardware
- Shared Device – 2 Controllers have access to 1 IO Device

Simplified Engineering
- I-Device – Intelligent IO device
  - Controller 2 is device for Controller 1
  - Hierarchical structures

Combined Advantages
- I-Device + Shared Device
Easy access to diagnosis information with web tools

- Easy access via browser
- No engineering tool needed
- Online network diagnosis
- Read/write process variables (quick machine parameters setting)
Isochronous real-time
Reservation of bandwidth for Ethernet

- Separate time window reserved only for IRT frames
- Standard frames cannot interrupt IRT cycle
- Additional communication planning through topology for maximum performance with isochronous applications
Unique selling proposition of PROFINET: real-time and TCP/IP
PROFINET uses the full bandwidth with full duplex

Simultaneous sending and receiving
- Almost complete utilization of physically possible transmission bandwidth
- Extremely short cycle times with consideration of topology
Isochronous mode
Perfect synchronism

- Isochronous recording of actual position values
- Isochronous activation of setpoints

IRT channel
- Synchronization of control cycles with the bus cycles
- Closing of the control loops over the bus
- Distributed motion control tasks (longitudinal shaft, axis synchronization, multi-axis applications)
Timing with isochronous mode – absolutely deterministic

**T<sub>i</sub>:**
Read inputs at fixed point in time

**OB:**
Process data in the CPU

**T<sub>o</sub>:**
Write outputs at fixed point in time

All time windows coordinated in the appropriate sequence
Thank you for your attention!

Wolfgang Schroeder
Product Manager PROFINET Technology
I IA AS FA SB-PRM6

Telefon: +49 911 895-4633
E-Mail: wolfgang.schroeder@siemens.com