High-Speed Ethernet (HSE)

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Apresentação utiliza material da empresa Smar
**High Speed Ethernet**

- **High-Speed Ethernet (HSE)**
  - Based on Ethernet, IP and TCP/UDP
- **Four basic HSE device categories:**
  - Linking Device (LD)
  - Ethernet Device (ED)
  - Gateway Device (GD)
  - Host Device (HD)
High Speed Ethernet

HSE Devices

- HSE CLIENT
- 100 Mbit/s Switch
- High Speed Ethernet Switch
- Linking Device
- High Speed Ethernet Switch
- Gateway
- Field Device
- Ethernet Field Device
- Plant
- 100 Meters on Twisted Pair
- 2000 Meters on Fiber

High Speed Ethernet Architecture

The Host Device is the Operator Workstation, or a DCS.
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The Linking Device (LD) is a HSE node for connecting one or more H1 Fieldbus segments to the HSE.
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The Gateway Device (GD) is a HSE node for connecting one or more foreign network to the HSE.
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The Ethernet Device (ED) is a HSE node providing directly connected measurement/ control applications.
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Accessing H1 through the LAN-HSE

- **HSE Host**
  - Using Common 100baseT NIC (Software configured)
  - Using Common 10/100baseT Switch or HUB

- **100 Mbit/s Switch**
  - Linking Device

- **H1 Devices**

Using the same software to configure everything.

FF BRIDGES BETWEEN FIELDBUS NETWORKS

- **Linking Device**
  - FIELDBUS H1
  - FIELDBUS H1
  - Devices on different networks
• Star-topology divides the network in segments with only one device each limiting impact of wire damage.
High Speed Ethernet Redundancy

The system management can check the status of the network and request the network to select a good component over a faulty one. This allows repair and replacement of failed components.
Complete Network and Device Redundancy

Workstations with Dual NIC

Primary Switch

Secondary Switch

Redundant single port Linking device

Single dual port Linking device

Redundant dual port Linking device

Combo

Primary

Secondary
FFB is a “Wrapper” for an Application-specific Algorithm
Extends FB Model into Discrete Manufacturing

Examples:
- Multiple Analog Input - 8 Channels
- Multiple Analog Output - 8 Channel
- Multiple Discrete Input - 8 Channels
- Multiple Discrete Output - 8 Channels
- Application-specific Blocks - IEC 61131
The HIST tests each host against a complete list of features that should be available in a Foundation Fieldbus host.

**Host Interoperability Support Test**

**Host Already Tested:**

- ABB Host
- Centum CS - Yokogawa
- DeltaV - Emerson
- PlantScape - Honeywell
- System302 - Smar


**Host Interoperability - Integration**

- Operation
- Maintenance
- Plant Information
- Advanced Control

- Basic Control
- FF H1
- Safety Shutdown
- Chromatograph
- Compressors

**HSE Interoperability**

- Host Interoperability
- Subsystem interoperability
  - basic control
  - emergency shutdown
  - paper quality control
  - advanced control
  - compressor, turbine control
  - etc.
HSE Not The End of H1

<table>
<thead>
<tr>
<th></th>
<th>H1</th>
<th>HSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>31.25 kbit/s</td>
<td>10 Mbit/s or 100 Mbit/s</td>
</tr>
<tr>
<td>Distance (per segment)</td>
<td>1,900 m (1.2 miles)</td>
<td>100 m (300 ft)</td>
</tr>
<tr>
<td>Two-wire</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Multidrop</td>
<td>Yes</td>
<td>No (UTP)</td>
</tr>
<tr>
<td>Bus-power</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Intrinsically safe</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Redundancy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Deterministic</td>
<td>Yes</td>
<td>Yes (with switches)</td>
</tr>
</tbody>
</table>

- H1 used for field instruments
- HSE used at the host-level
- H1 and HSE complement each other

Compelling Reason to Use HSE

- Only HSE has full network redundancy
- Only HSE has device redundancy
- Only HSE has a programming language
- Built on standard Ethernet
- Networking hardware are extremely low cost compared to the proprietary.
- Wealth of options for media available including twisted pair, fiber optics and wireless.
- Commercial and industrial grades from many suppliers.
Conclusion

• Use HSE to benefit fully from H1.
• HSE simplifies the system architecture.
• HSE makes Ethernet open.
• HSE makes controllers interoperable.
• Device and network redundancy is required at the host-level.
• HSE provides interoperable network and device redundancy at the host level

High Speed Ethernet Summary

• High speed backbone at 100 Mbit/s (1 Gbit/s future)
• Uses standard COTS Ethernet equipment
• HSE field devices run standard function blocks
• Flexible Function Blocks for Discrete Control
• Redundant media and devices
• Interface to other protocols
• Wire and fiber optic media
• Low cost, high performance electronics driven by information technology and Internet demand
High Speed Ethernet como substituto de todos protocolos industriais?

- Vantagens HSE:
  - Custo
  - Grande número de fornecedores
  - Facilidade de comunicação: CSMA/CD

- Problemas:
  - Determinismo temporal (pior caso !!)
  - Taxa de comunicação vs. Taxa “útil” (detecção de colisões exige tamanho mínimo)

Cálculo rápido

- 10Mbps, com comprimento máximo de 2500 m, temos quadro mínimo levando 51.2 microseg, o que leva a um comprimento mínimo = 64 bytes
- Supondo que tenhamos que transmitir informação “on/off” (1 bit ou adicionando-se correção e detecção de erros 3 bits)

\[ \frac{3}{(64 \times 8)} = 5.810^{-3}, \text{ ou seja, considerando-se } 10\text{Mbps, taxa útil seria de } 10^{6} \times 5.8 \times 10^{-3} = 58 \text{ k bits } / \text{s} \]

- Considerando 1 GBps (quadro mínimo de 6400 bytes)
  Taxa útil de 58 kbits/s (pois 1G = 100 * 10M, mas 6400 é 100 * 64 !!)
High Speed Ethernet como substituto de todos protocolos industriais?

- Problemas:
  - Taxa de comunicação vs. Taxa “útil” (detecção de colisões exige tamanho mínimo)

  “Switched Ethernet” não é solução ótima:
  - Alto custo
  - Grande aumento no número de componentes (manutenção, instalação, ...)