
SMART
INSTRUMENTS,
FIELDBUS, ETHERNET
AND INDUSTRIAL
WIRELESS

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EIT ENGINEERING INSTITUTE OF TECHNOLOGY

- ACCREDITATION
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- WHY CHOOSE EIT?

SEARCH

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News & Events

Free Online Course: Troubleshooting Conveyors and Chutes

Wednesday 18th May 2011 - 2 Sessions Conveyers and chutes are a key part of every company's material transport strategy. Attend this complimentary session for a ...

Free Online Course: Functional Safety for Managers

Wednesday 4th May 2011 - 2 Sessions Recent events such as the Deepwater Horizon disaster and the Montara blowout are causing more emphasis to be placed ...

Read more

HELP DESK

Pre-Course | In-Course | FAQs

Why choose EIT ?

Recognition, endorsement and/or accreditation from

Nationally Recognised Training | Training Accreditation Council Western Australia | IET | ACPET Australian Council for Private Education and Training | SAIMC | Celebrating 175 Years Engineers Ireland cpd | IEEE | PMI R.E.P. Project Management Institute | Institute of Measurement and Control Companion Company

Welcome to the Engineering Institute of Technology (EIT)

The Engineering Institute of Technology (EIT) provides endorsed engineering Diplomas and Certificates (Masters Degrees accreditation pending), designed for students working in industry who need a practical, relevant education that is delivered efficiently. Our students work in the fast-moving engineering and technology fields where time is precious. They choose the EIT online delivery because it provides many of the benefits of live classroom based study without the inconvenience of travel. EIT courses are run by expert instructors who present in a friendly, interactive manner.

The EIT offers engineering Diplomas and Certificates (Masters Degrees accreditation pending) in the areas of;

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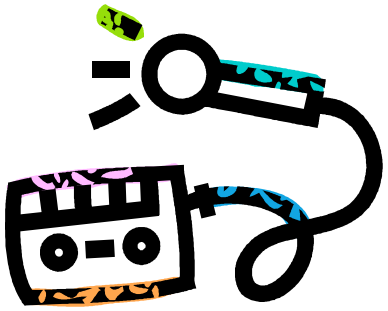
Steve Mackay

- Dean of Engineering
- Worked for 30 years in Industrial Automation
- 30 years experience in mining, oil and gas, electrical and manufacturing industries

Start recording!



The Nuts and Bolts of smart instrument standards

Some Additional Docs

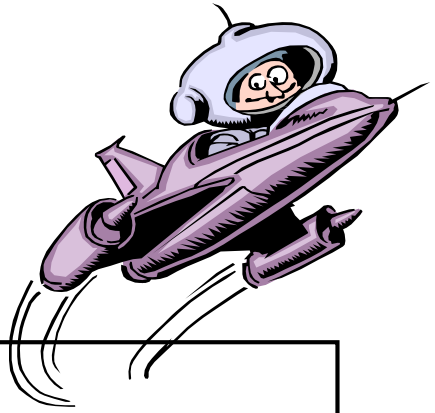
- Ethernet vs Fieldbus: the Right Network for the right application (Control Design 2016)
- Guide to Implementing Foundation H1 Devices (Foundation Fieldbus)
- Fieldbus Myths Busted (Foundation Fieldbus)

Digital Technologies- Summary

Bus	Ease	Field Intelligence	Acceptance	Knowledge Base	Price
AS-I	●	○	◎	◎	●
Devicenet	◎	◎	◎	◎	◎
Profibus DP	◎	◎	◎	◎	◎
Profibus PA	○	◎	◎	○	◎
FF	◎	●	◎	◎	◎
HART	●	◎	●	●	◎
Ethernet	●	○	●	●	●

(Slide compliments of Emerson)

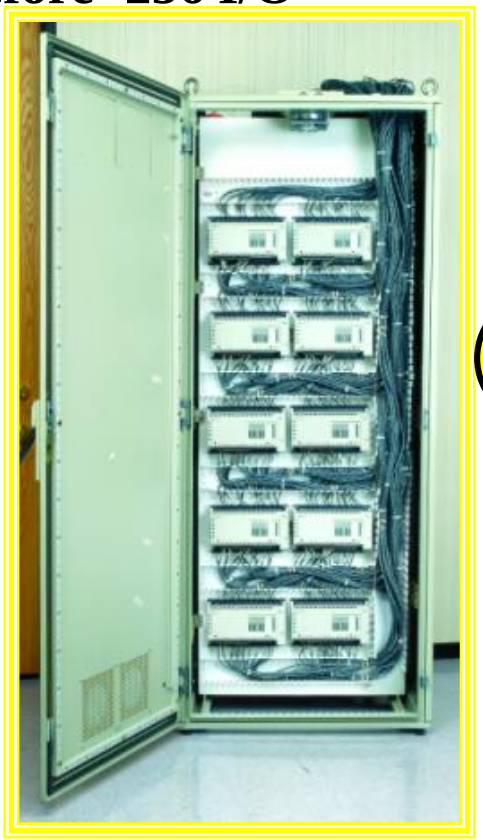
Generic Fieldbus Advantages: Let's Take Off!



- **Wiring savings**
- **Hardware savings - fewer devices (instruments barriers and I/O)**
- **Documentation savings - Simpler layout and drawings**
- **Reduced Engineering costs**
- **footprint savings**
- **Multi-variable field devices**
- **Interoperability and freedom of choice**
- **Reduced Commissioning and startup costs**
- **Reduced downtime**
- **Integrity improved**
- **DCS future capacity savings**

“Footprint” Space Savings

Before- 256 I/O



Fieldbus -4000 I/O

(Slide Compliments of Emerson & Jim Russell)

Which fieldbus to Select?

There is ONE RIGHT fieldbus for YOU

- **Engineer must decide based on: Technical Profile, budget, NPV including LONG TERM COST OF OWNERSHIP**
- **Business Requirements**

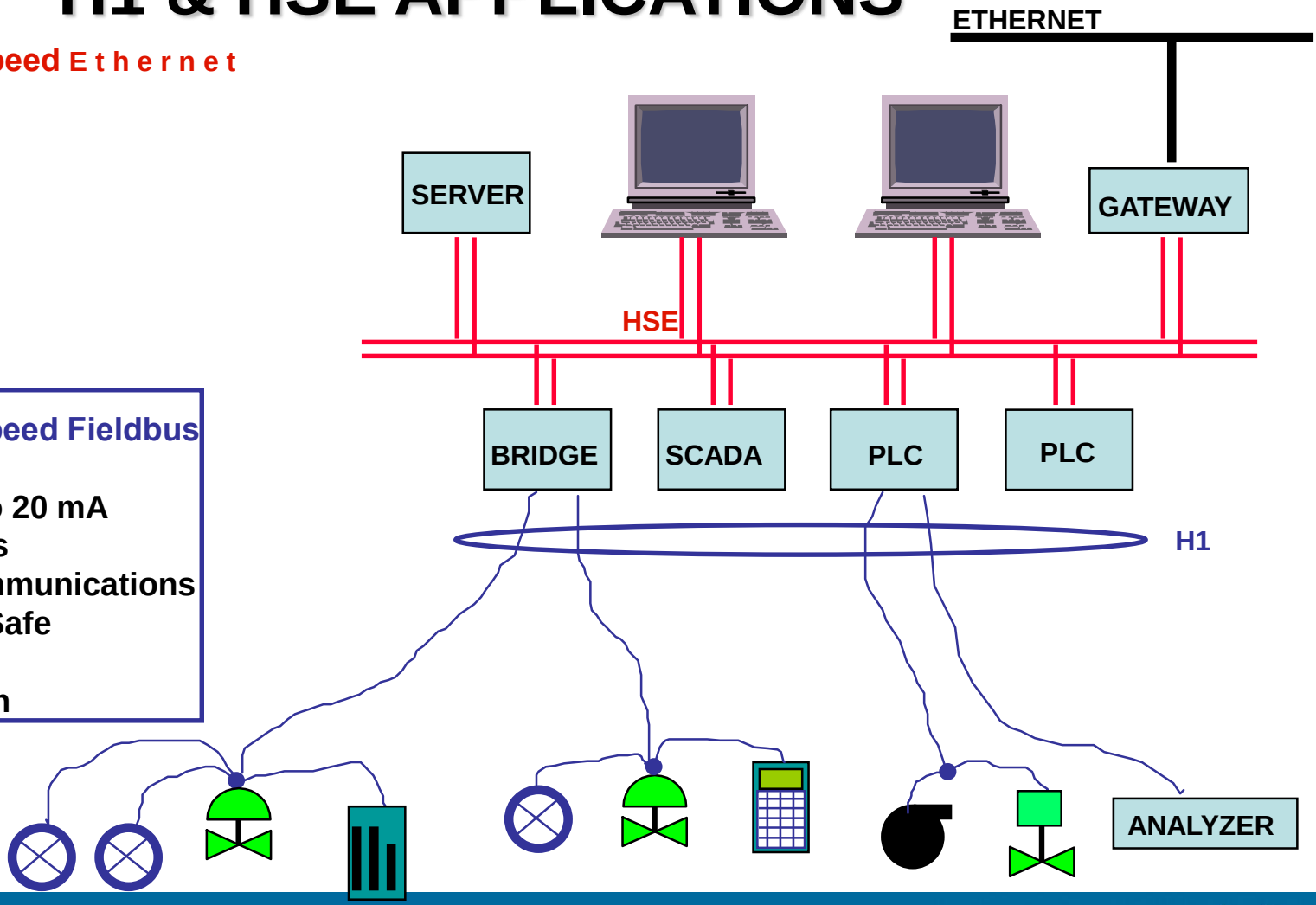
- **DISCRETE -** Bottling plant would be mainly discrete-most effective solution ASi- Same may be the case for building automation

- **DISCRETE+CONTINUOUS**-Motor Vehicle Manufacturing Plant or Electrical Motor Control Centre- Profibus DP

- **CONTINUOUS PROCESS PLANT** - Hybrid approach likely- MCC (Profibus DP), PLCs (Modbus) and CPP Foundation fieldbus or Profibus PA. (Foundation fieldbus is being selected by major CPP Operators because of its advanced features)

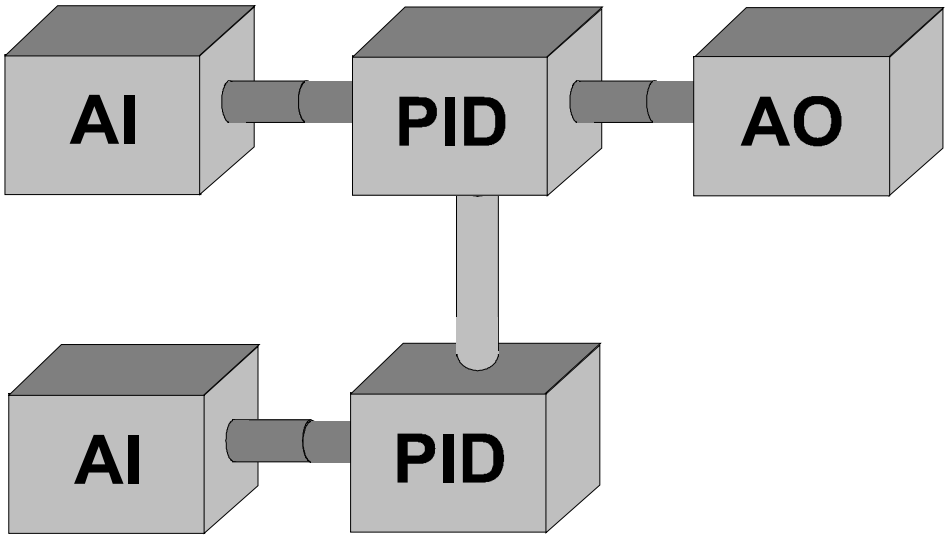
Foundation Fieldbus
PHYSICAL LAYER WIRE MEDIUM
H1 & HSE APPLICATIONS

HSE… High Speed Ethernet
- 100 MBps



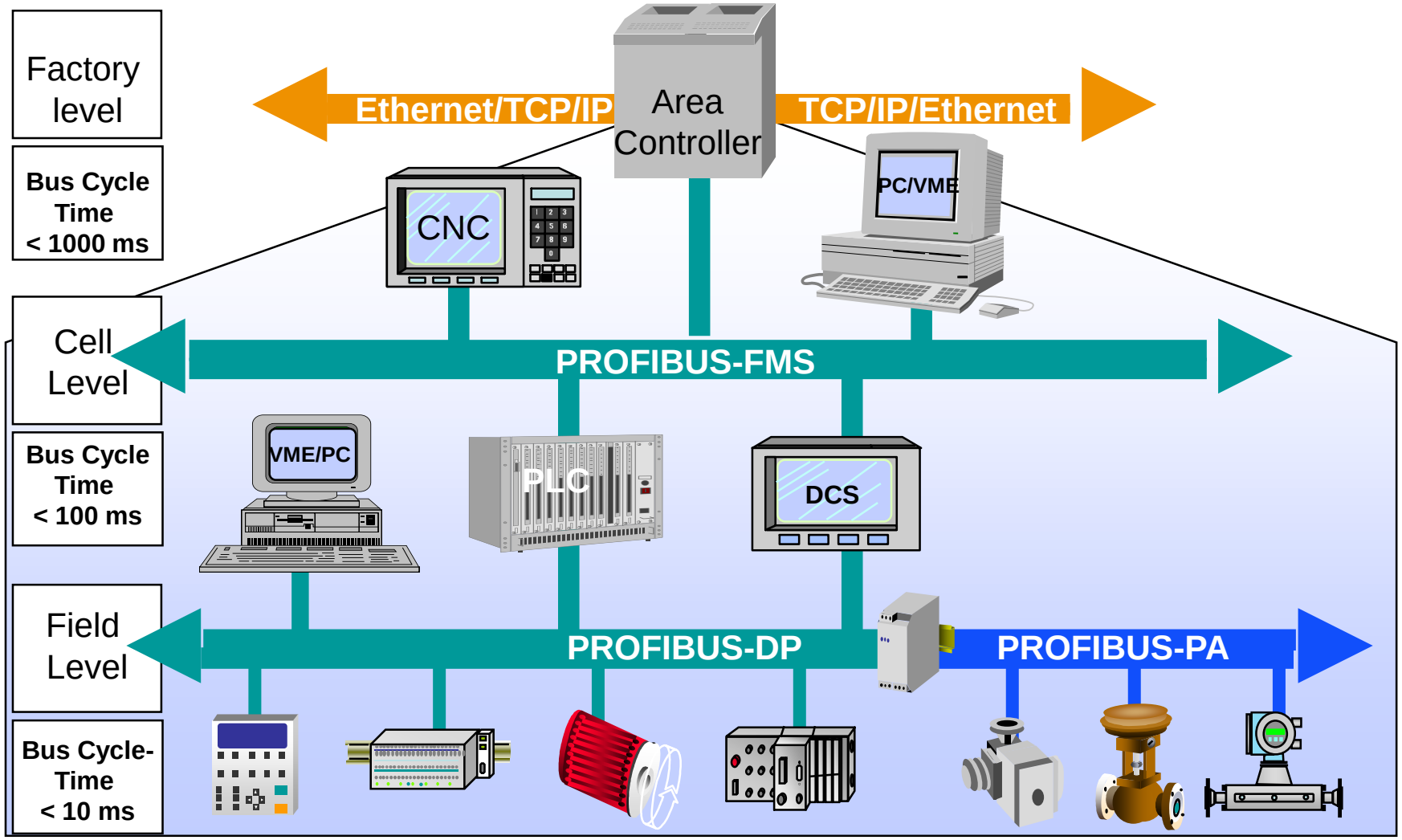
H1… Lower Speed Fieldbus
- 31.25 Kbps
- Replaces 4 to 20 mA
- 2 - 32 Devices
- Power & Communications
- Intrinsically Safe
- Twisted-pair
- 1900 m length

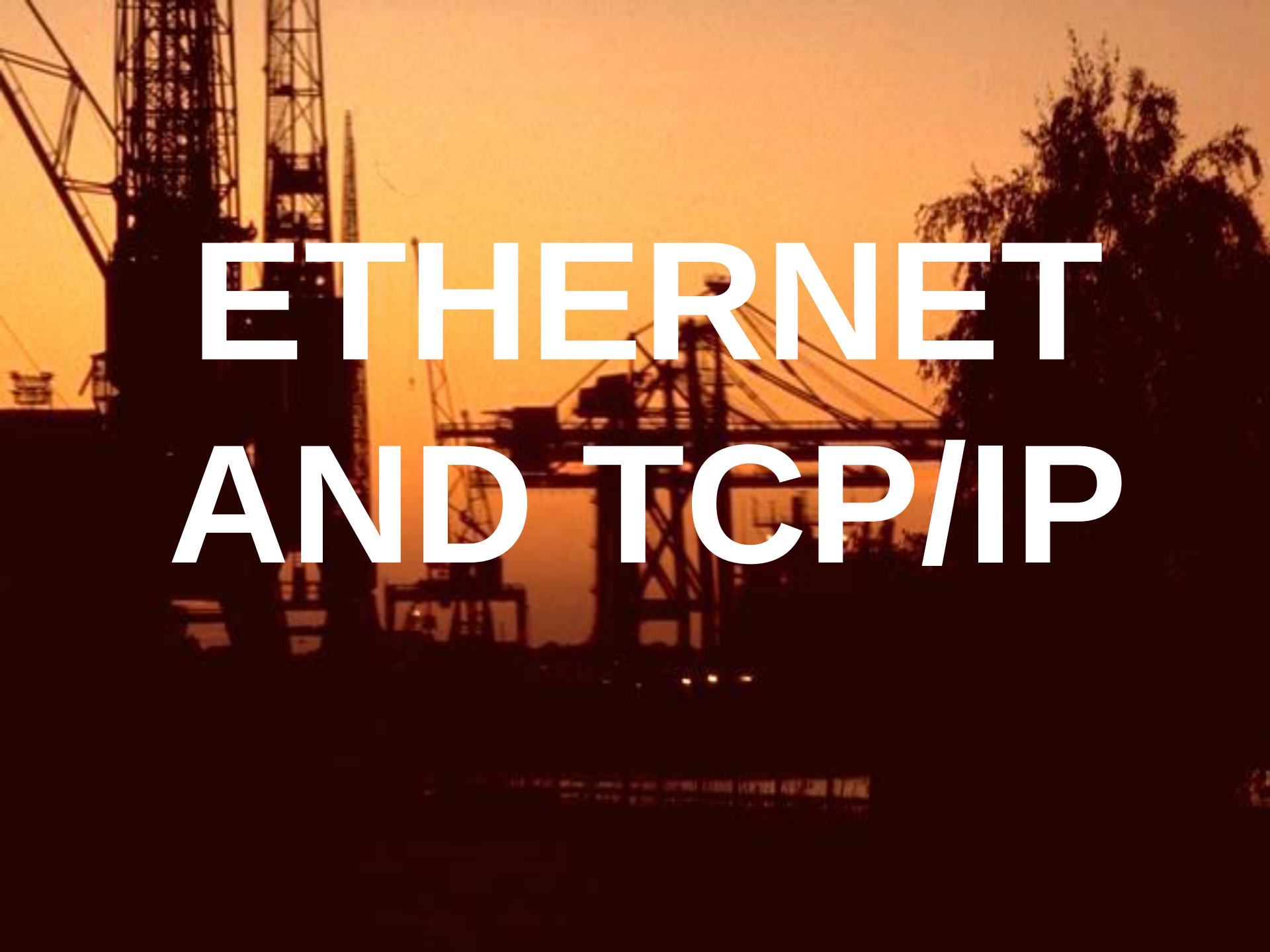
Playing Lego



FIELDBUS CASCADE CONTROL

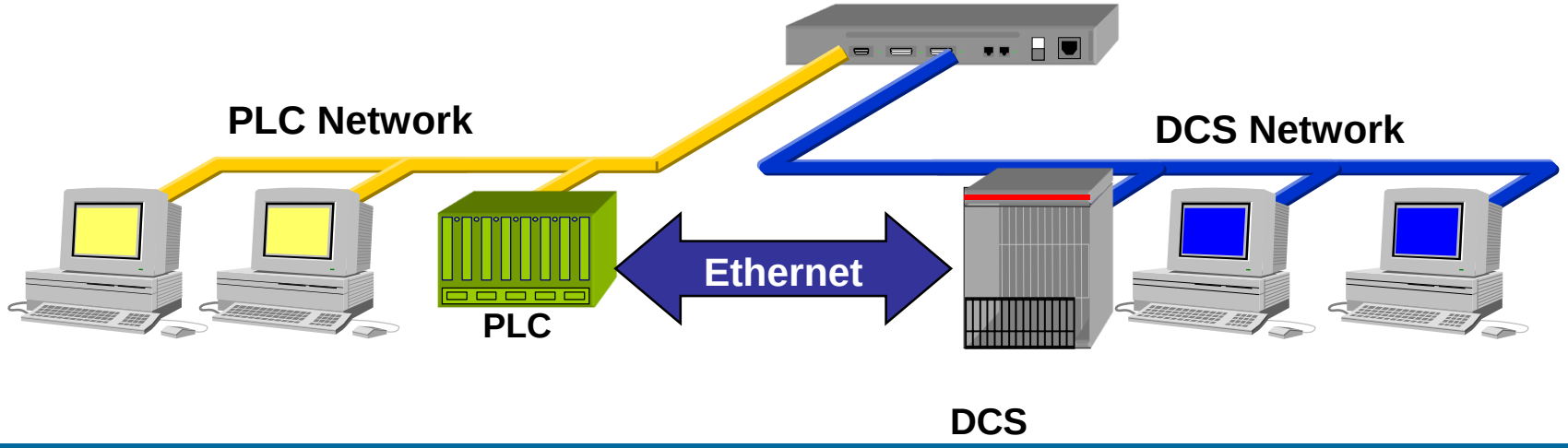
Profibus




ETHERNET
AND TCP/IP

Ethernet – The New "RS-232" for Process Control

- Ethernet has become the preferred method to connect controllers from competing vendors.



Ethernet vs Fieldbus

- Fieldbus has 58% of market
- Ethernet has 40%
- Commercial off the shelf Ethernet – cheap
- Manufacturing and commercial networks separated
- Ethernet faster even with overhead

Ethernet vs Fieldbus

- End devices don’t support Ethernet
- No need for bandwidth
- Need for power and signal in same cable
- PoE is good but different mA and V to field
- Distance for Ethernet means more work
- Ethernet well known and widely supported

Time Sensitive Networking

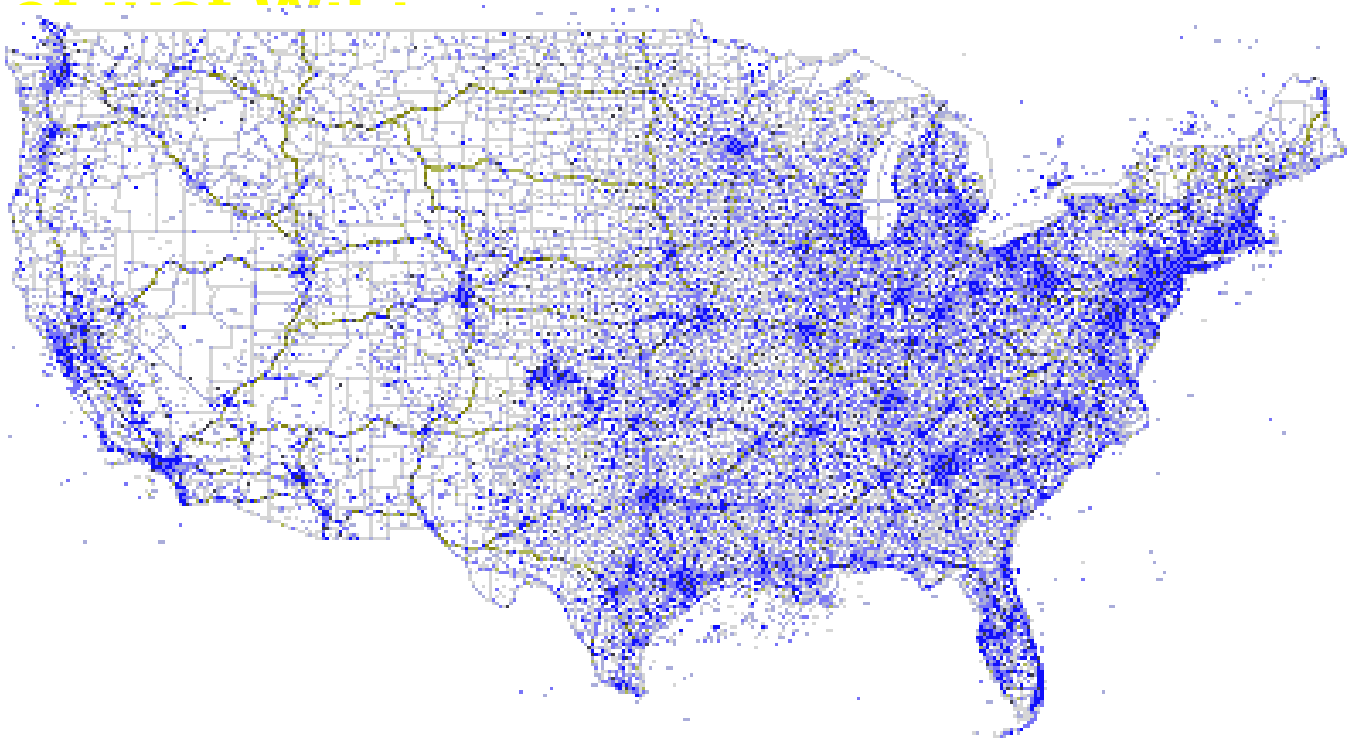
- Add-on to 802 standard
- Critical time-sensitive messages
- Real-time Control and Synchronisation
- Used with OPC UA publisher/subscriber model

Industrial Wireless Networks – what works and what the future holds

Wireless Sensor Networking

…it's not cellular telephony

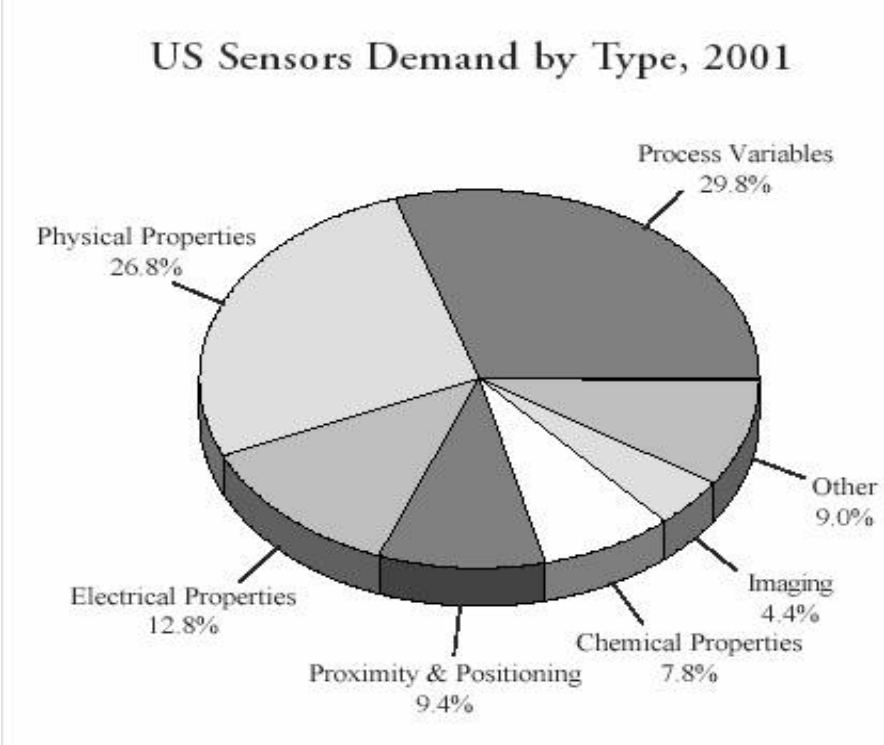
…it's not just WiFi



Wireless devices circa 1930

Each dot represents one cell phone tower.

Sensor Market: $11B in 2001
Installation (wiring) costs: >$100B



- Fragmented market
  → platform opportunity

- Installation cost limits penetration
  → reducing installation cost increases market size

Highly Fragmented Sensor Market

Freedonia Group report on Sensors, April 2002

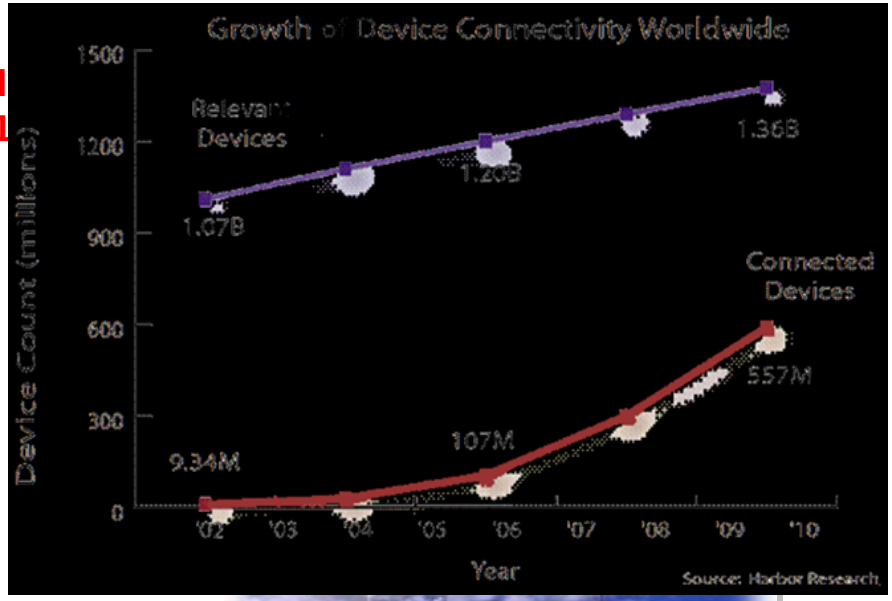
Slide courtesy of Rob Conant, Dust

Industrial Market Sizing
Sensor Networking Products

- **North American Market for Wireless products used in Applications where transmission distances are 1 mile or less:**
  - 2002 Total: $107 million
  - 2006 Forecast: $713 million
  - 2010 Estimates: $ 2.1 billion

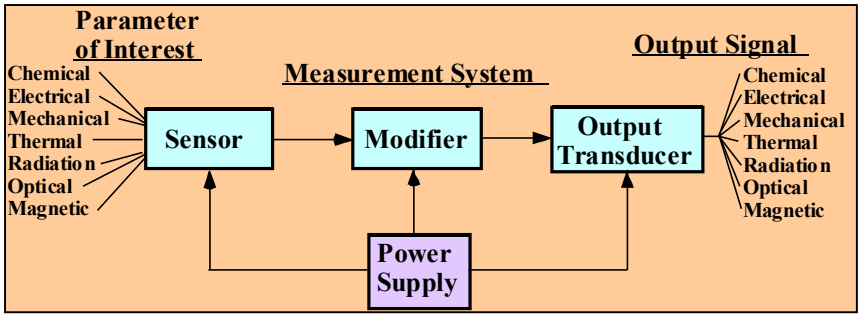
- **Largest Application areas:**
  - 2002: Tank Level Monitoring, Asset Tracking, Preventative Maintenance
  - 2006: Tank Level Monitoring, Preventative Maintenance, Environmental Monitoring

- **Conclusions:**
  - Rapid Growth in Industrial markets
  - Tank Level Monitoring will remain a significant opportunity
  - Key ‘ User’ Needs:
    - Lower Costs over Wired (or Manual) Solutions
    - Education of Potential Customers on the Technology
    - Demonstration of Operational Reliability & Application ‘ Domain’ Knowledge



Slide courtesy of Rick Kriss, Xsilogy

What to do with the data?

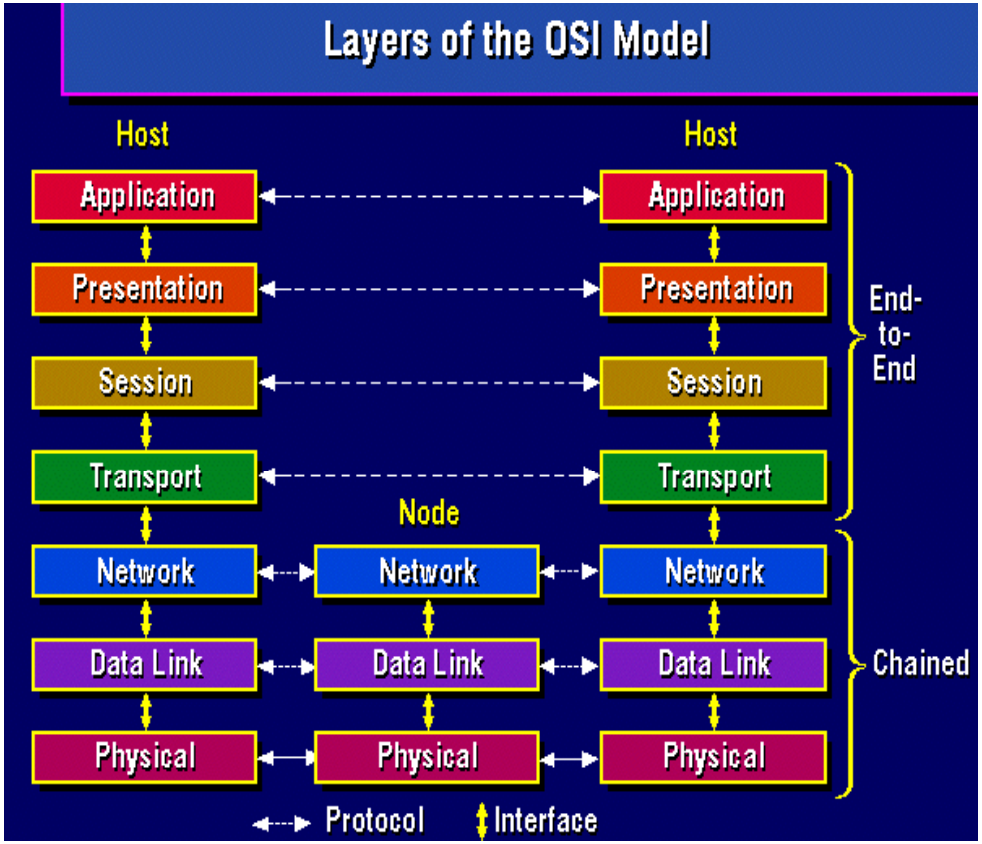


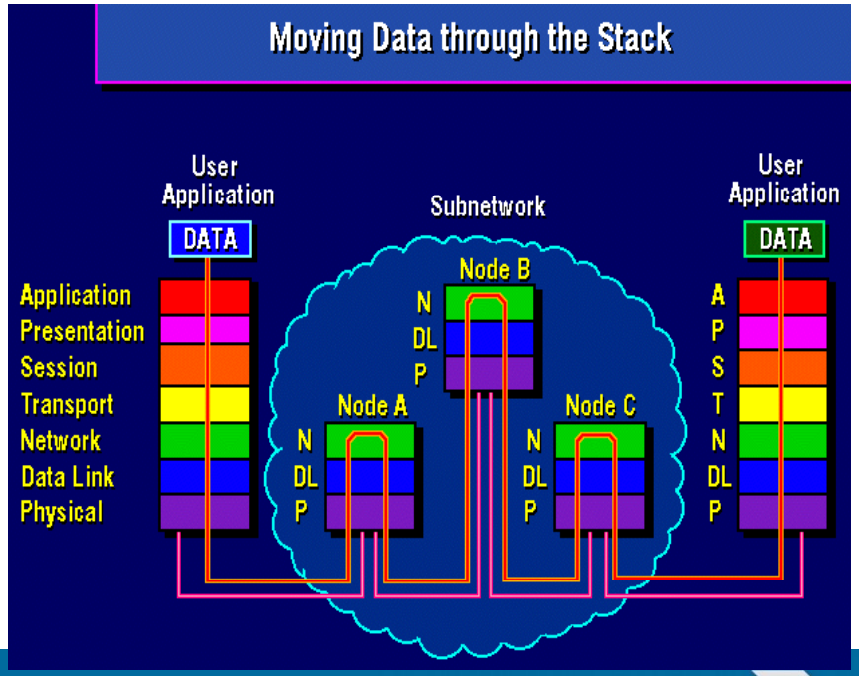
Great! But how do you get the output signal from the sensor to the location where the information will be interpreted (used)?

Traditionally the output of the sensor was hardwired to some form of interpretive device (e.g., PLC) perhaps relying on a 4-20mA signal…

Layered Communications

A few details…





Standards

- ZigBee
- WirelessHART
- ISA 100a

ZigBee and WirelessHART

- Based on similar underlying RF Technology
- IEEE 802.15.4
- Limited power consumption
- Low Throughput requirements
- Direct Sequence Spread Spectrum (DSSS)

ISA 100a

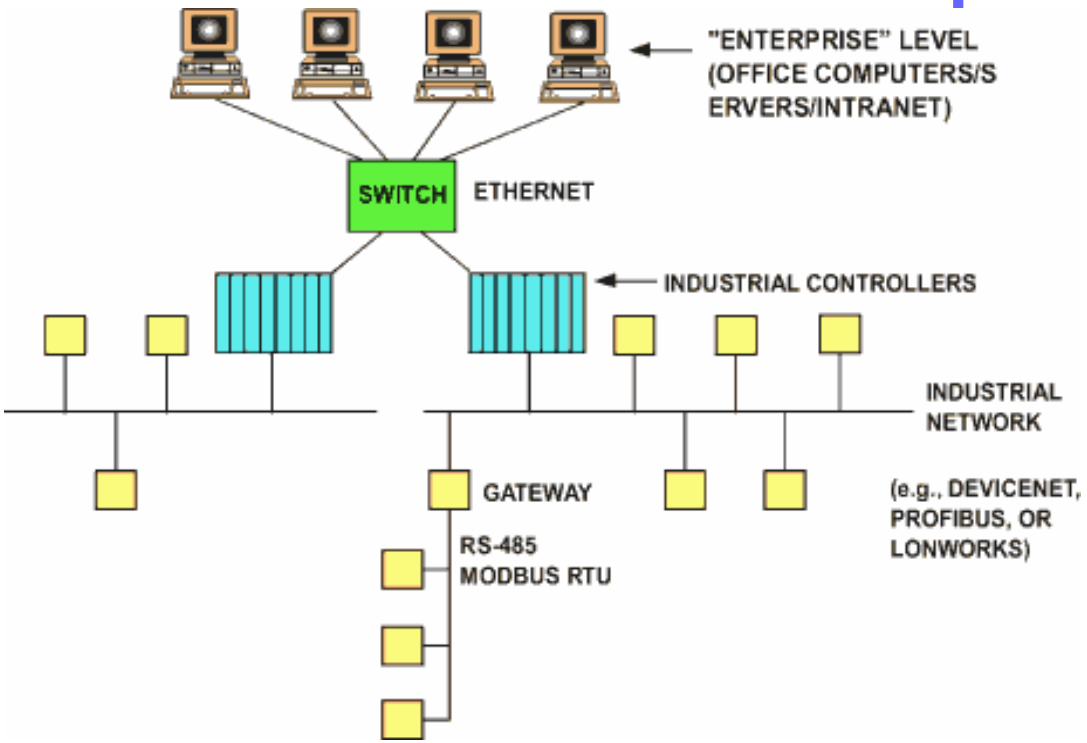
- Based on IEEE 802.15.4
- Operating in the 2.4-GHz band
- Data rate of 250 kbits/s
- Variant of ZigBee supports star/tree, mesh, and alternative routing networking
- Supports other industrial network technologies like Foundation FieldBus, ProfiBus, HART, and Ethernet.
- Recently ratified

There are SO many technical questions: such as…

Integrated Industrial Networks?

If the sensor network is to integrate into an industrial setting, then you should be cognizant of the Industrial Networking arena.

Industrial Device Network Topology



- Typically, three layers of networking make up enterprisewide networks. Ethernet acts as the company's intranet backbone, and it's linked to controllers or industrial PCs, which supply strategic data to the enterprise. An industrial network, or fieldbus, links sensors and smart devices. A gateway (not uncommon in a large system with lots of devices) links devices that have only RS-232 or RS-485 ports to the fieldbus system.

Thanks to….

- Dr Peter Fuhr for supporting slides
- and
- the WINA organisation


Q&A