Myths and Actual Practice with Industrial Data Communications and Hazardous Areas

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Myths and Best Practice

Practical examination of data communications systems in hazardous areas for Ethernet, Foundation Fieldbus, Profibus or RS-485.

Practical guidelines for best practice in designing your next industrial data communications system in a hazardous area.

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Topics

1. Survey of Wireline/Wireless global market
2. Hazardous areas and data comms practical issues and guidelines
   - RS-232 & RS-485
   - Foundation Fieldbus
   - Profibus
   - Ethernet
   - Fibre
   - Wireless
3. Case Study
4. Conclusion

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1. Survey of Global Market

- Wireline devices and Wireless in Intrinsic Safety in 2006
- Intrinsically safe devices thought to be mainly European but not according to this survey
- Explosion-proofing and encapsulation – popular in America for hazardous areas protection does not apply to mobile or wireless devices (see survey)

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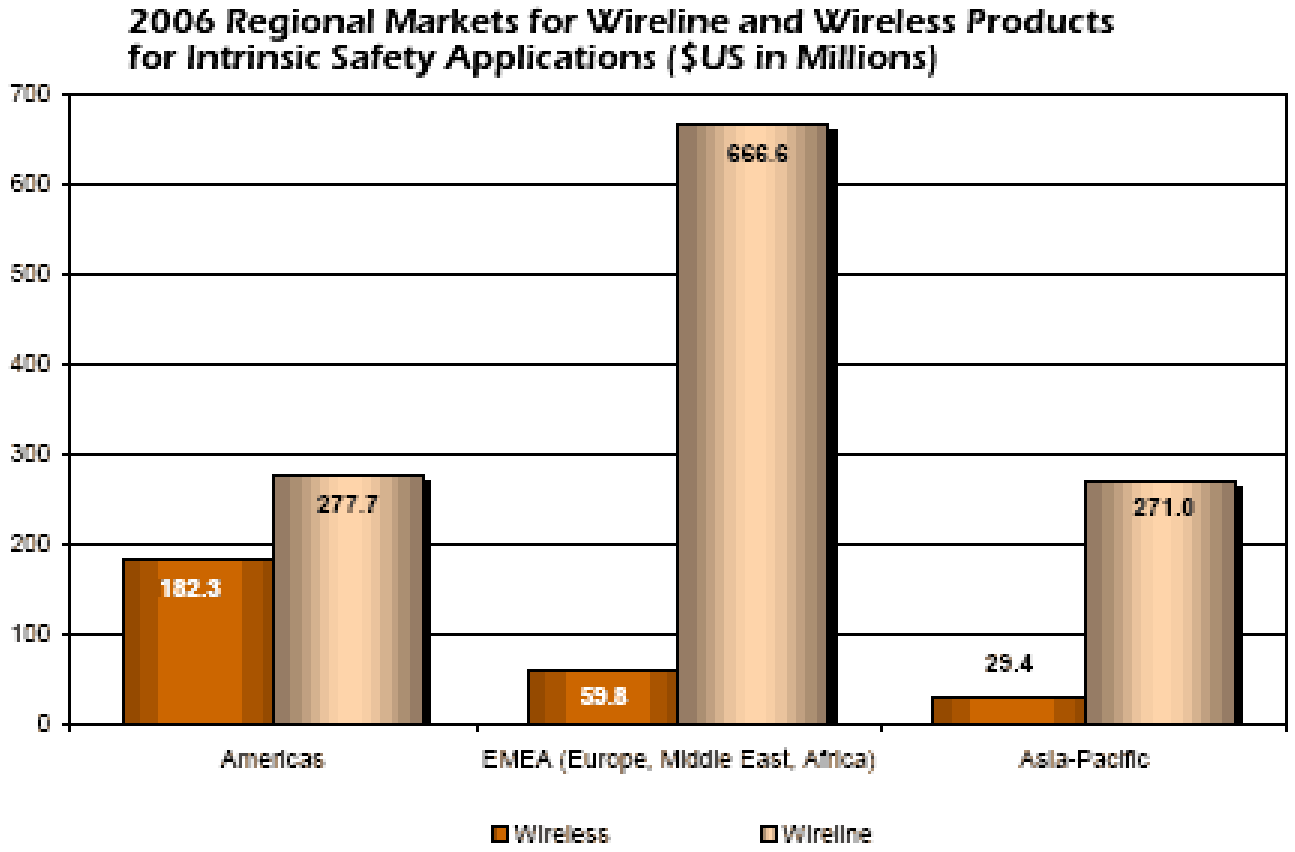
Wireline and Wireless Products for Intrinsic Safety Applications



The Industrial Wireless Book - VDC Survey 2006

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Wireline in Intrinsic Safety

- Profibus – majority
- Field instruments – mostly bus oriented
- HART still the leading bus/network
- Highest growth (9%pa) IS safe distributed/remote I/O

Wireless in Intrinsic Safety

•IEEE 802.11 shipment share 68% (eg wireless Ethernet)
•Highest growth (35%pa) intrinsically safe wireless transmitters
•Proprietary networks dominant for safe monitoring and control components

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2. Hazardous Areas & Data Comms

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)

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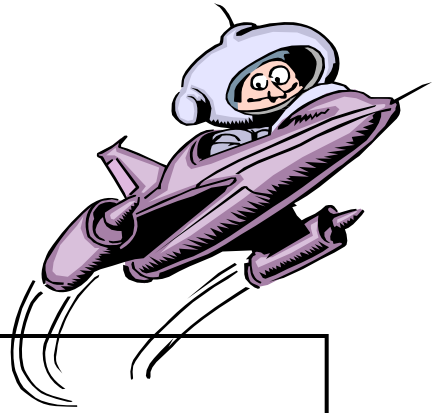
Generic Fieldbus Advantages: Let's Take Off!



- **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**

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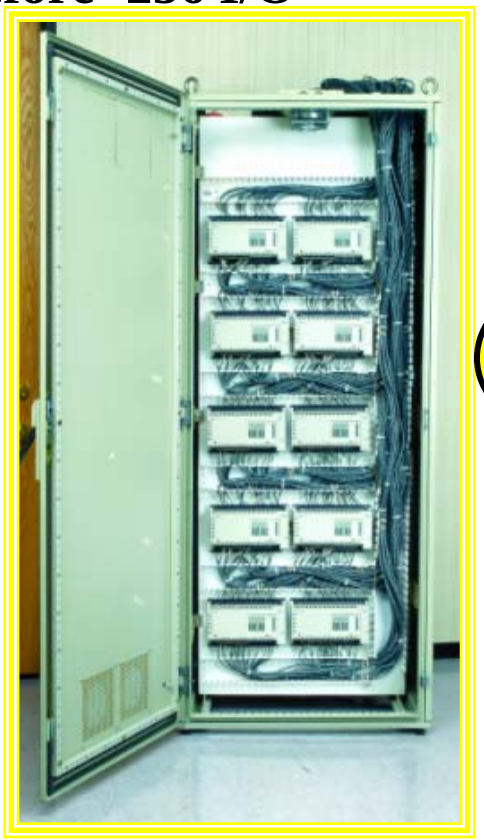
“Footprint” Space Savings

Before- 256 I/O



Fieldbus -4000 I/O

(Slide Compliments of Emerson & Jim Russell)

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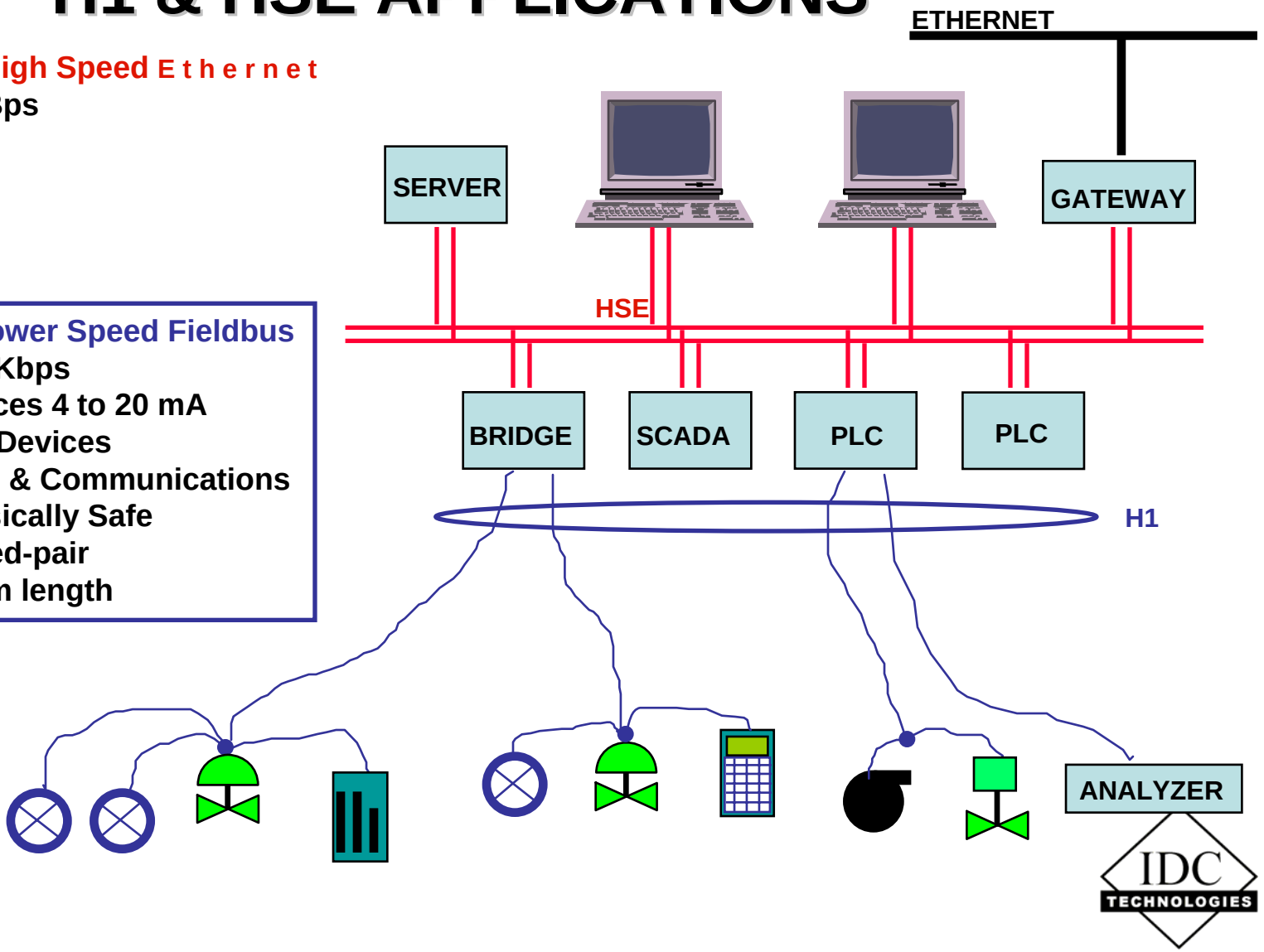
Foundation Fieldbus
PHYSICAL LAYER WIRE MEDIUM
H1 & HSE APPLICATIONS

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



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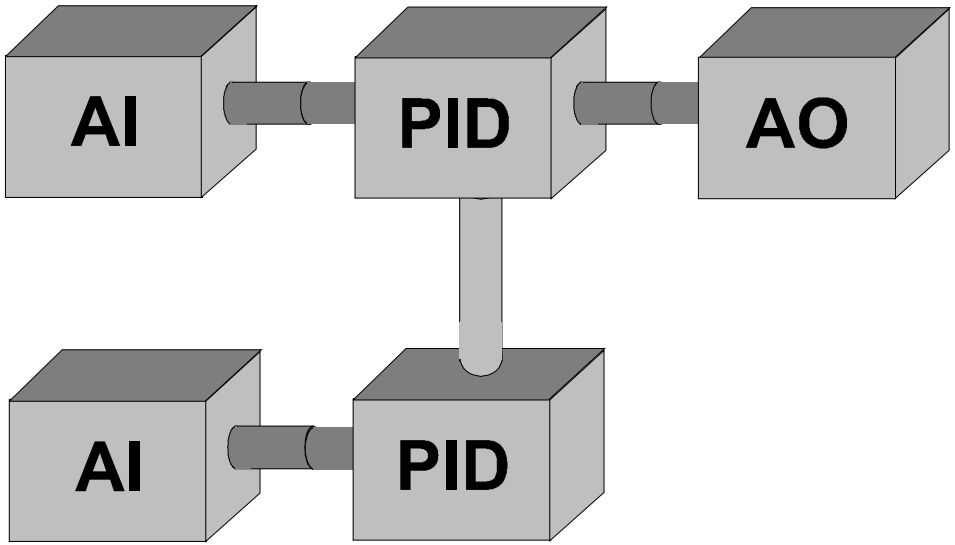
Playing Lego



FIELDBUS CASCADE CONTROL

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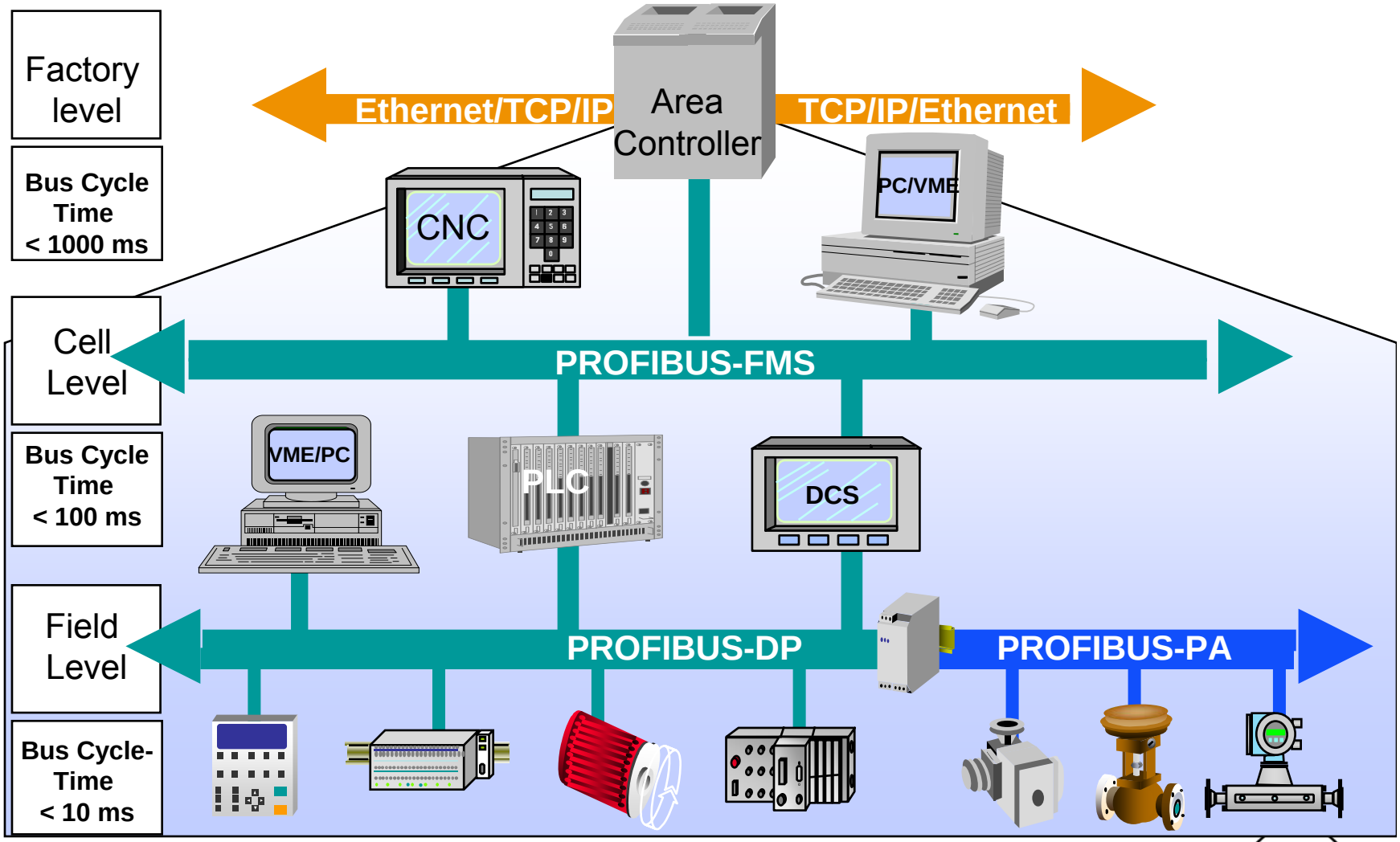
Profibus



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Bus and Intrinsic Safety

Name of Bus	Intrinsic Safety	Bus powered
FF H1	√	√
FF HSE & Ethernet		
Profibus DP		
Profibus PA	√	√
ASi		√
Ethernet PoE		√
LONWORKS	√	√
CAN		
HART	√	√

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Engineering & Installation in Hazardous Areas

Methods include:

Explosion proof, purging, oil immersion, encapsulation, intrinsically safe and non incendive.

To eliminate one of three parts of the combustion triangle: fuel/oxygen and heat

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Different Implementation Methods

- Explosion proof
- Intrinsically safe (ENTITY)
- Intrinsically safe (FISCO)
- Nonincendive (FNICO)
- Hybrid (HPT)
- And others

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Key Issues to Weigh Up

- Area classification
- Size and Scalability
- Technology/product selection
- Safety consideration
- Maintenance and downtime
- Engineering considerations
- Control System considerations
- Acceptance and ownership
- Calibration

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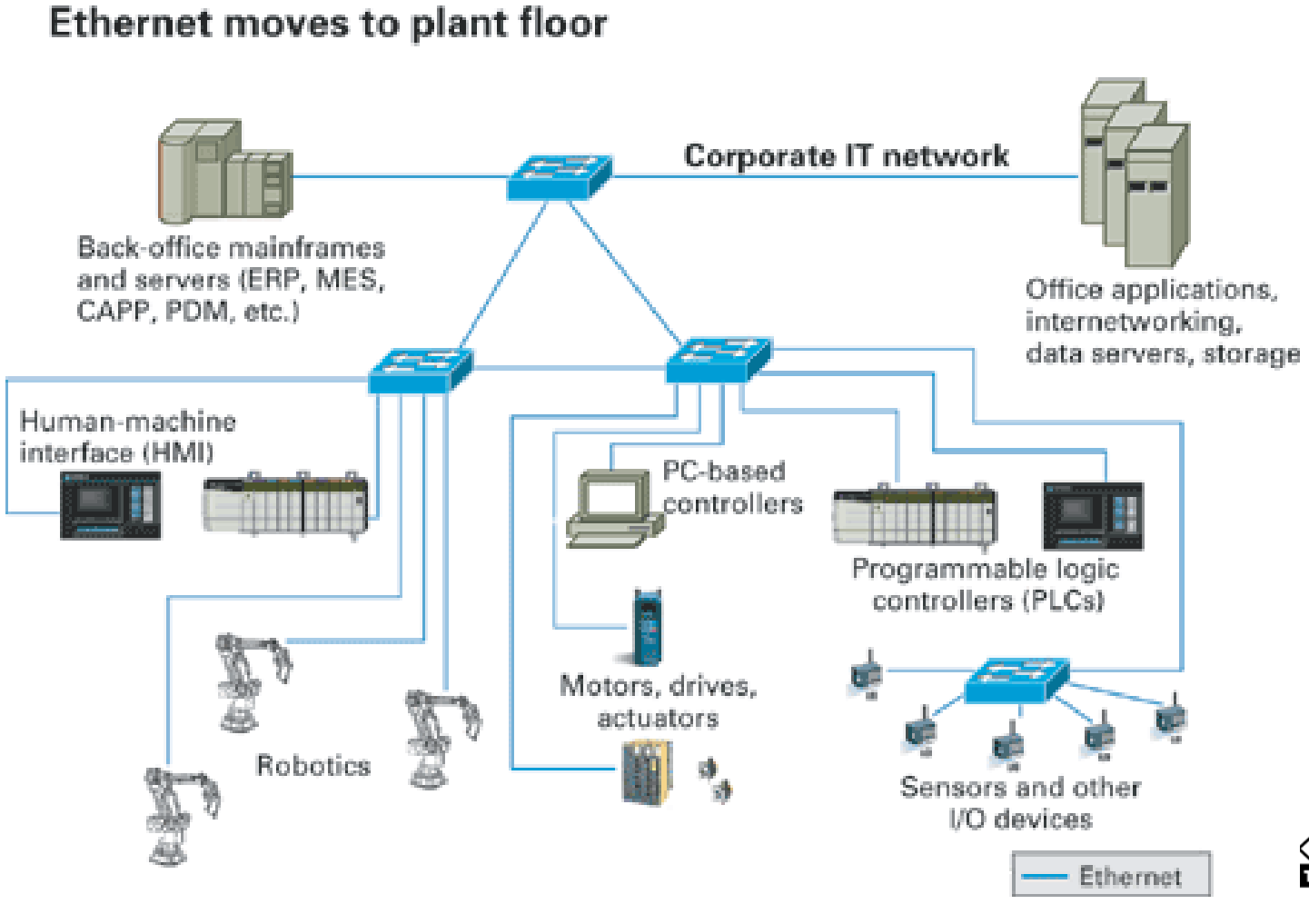
Ethernet vs Device Level Bus

- Device-level – trunk-and-drop system

Ethernet – star topology



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Functionality Required of Bus and Ethernet

- Standardised profiles for different applications
- Bus powered communications to process instruments in hazardous areas
- Safety communications
- Motion control
- Extensive diagnostics
- Simple cost effective connection to I/O

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The IEEE802.3af Standard

- IEEE ratifying 802.3af to supply power to Ethernet based devices.
- Primarily driven by need to power Ethernet telephones (Industrial needs not considered at this time).
- Source device (a hub or switch) will supply a minimum of 300 mA at 48 Volts to the field device. (In same range as FF and DeviceNet).

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Fibre

Harsher environmental conditions such as extreme temperature ranges, lightning strikes, electromagnetic interference, ground loops and hazardous locations handled by fibre.

Fibre versus Twisted Pair

Fibre a good choice for hazardous areas but:

Cons

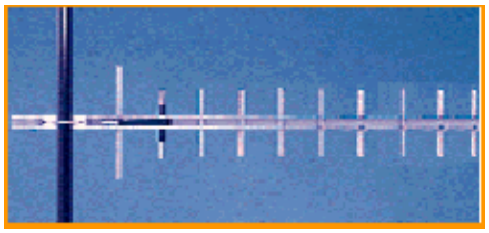
- Costs more
- Bend radiuses
- Twisted pair can be impervious to certain types of noise

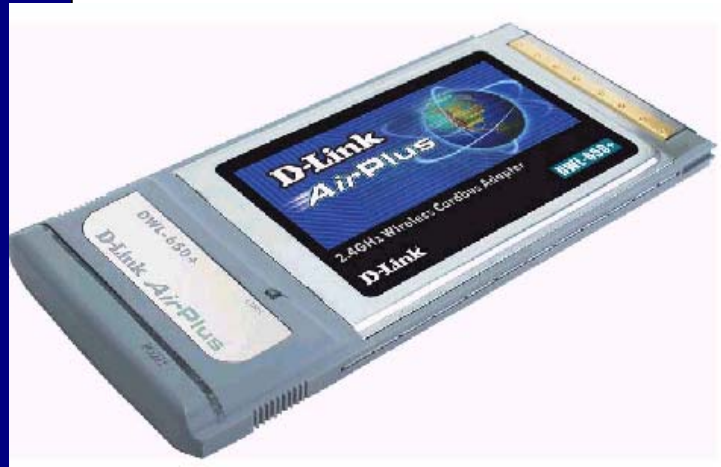
Pros

- Impervious to noise and lightning
- No ground loops
- Security of data better
- Longer distances (2kms)

For both consider cable jacket for weld splatter, moisture and UV.

Wireless





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Intrinsic Safety with Wireless

- Explosion proofing and encapsulation, the North American approach is not easy to apply to mobile devices (eg steel-encased cell phone !)
- Intrinsic Safety used where incapable of releasing sufficient electrical or thermal energy to cause ignition of a hazardous atmosphere
- Wireless intrinsically safe transmitters can be particularly cost-effective for remote monitoring

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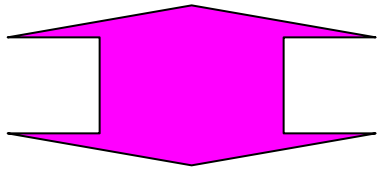
802.11 Standards

IEEE Standard Band	Speed	Frequency
802.11	1 and 2 Mbps	2.4GHz
802.11a	Up to 54 Mbps	5 GHz
802.11b	5.5-11 Mbps	2.4 GHz
802.11g	6 to 54 Mbps	2.4GHz



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3. Case Study

You have ten minutes in your groups to assess the best approach to a case study of a plant (details supplied) with various Hazardous Areas where you need to apply Ethernet, Fieldbus, Fibre and Wireless effectively.

4. Conclusion

- Foundation Fieldbus H1 and Profibus PA appropriate for instrument level hazardous areas
- Ethernet with fibre appropriate for high level comms in hazardous areas; growing rapidly in importance
- Wireless growing fast but some unpredictability – but the horse to back over the next few years

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References

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- Iceweb resources by Jim Russell and Ian Verhappen from www.iceweb.com.au

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THANK YOU
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