

Ethernet

A Real-time Control Network?

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Ethernet: The Story So Far

- Worldwide Commercial Acceptance
- Factory Floor Responsibilities
 - Data Monitoring
 - Trending
 - Program Maintenance
- Many Predict:-
 - Ethernet for Mission Critical Control
- Others Contend:-
 - Ethernet has a long way to go.....

Requirements for Automation Applications

Interoperability

- Ethernet is not a complete standard
 - Application layers must exist on top and be compatible
 - With many different systems based on the same physical media conformance will be a big issue

Performance

- Ethernet is fast
- Ethernet is getting faster
- Is there a faster networking standard ready to sweep ethernet aside?
- Noise immunity?

Primary Services for Automation



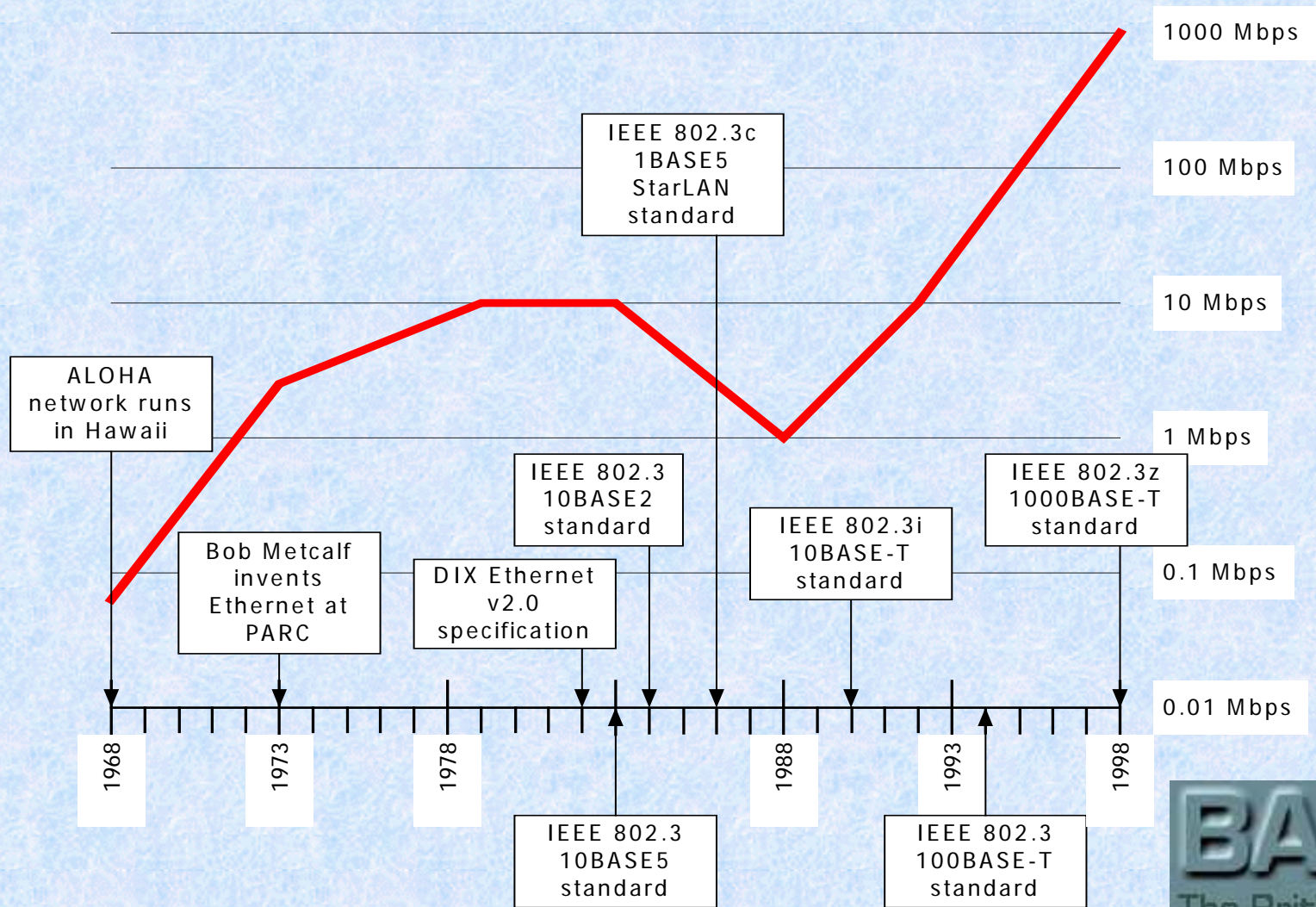
Performance - Ethernet Tomorrow

		DeviceNet	ControlNet	Ethernet today	Ethernet under development
1 Messaging Types					
	I/O Control (implicit)	✓	✓	★	✓
	Messaging (explicit)	✓	✓	✓	✓
	Both at the same time	✓	✓	★	✓
2 Node Relationships					
	Master/Slave	✓	✓	★	✓
	Multimaster	✓	✓	★	✓
	Peer-to-Peer	✓	✓	✓	✓
3 I/O Exchange					
	Polled	✓	✓	★	✓
	Cyclic	✓	✓	★	✓
	COS (Change of State)	✓	✓	★	✓
4 Delivery Mechanisms					
	One:One (point-to-point)	✓	✓	✓	✓
	One:Many (multicast)	✓	✓	★	✓
	One:All (broadcast)	✓	✓	★	✓
	Routable Protocol	✓	✓	✓	✓

 **Services Already Supported in the ODVA and CI specs**

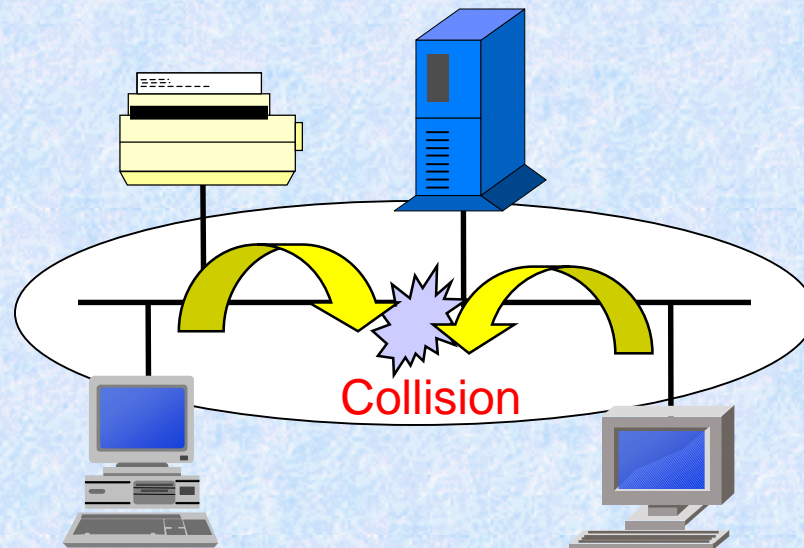
 **Services to be added**

Ethernet Evolution - Bandwidth



Ethernet Evolution - Switching

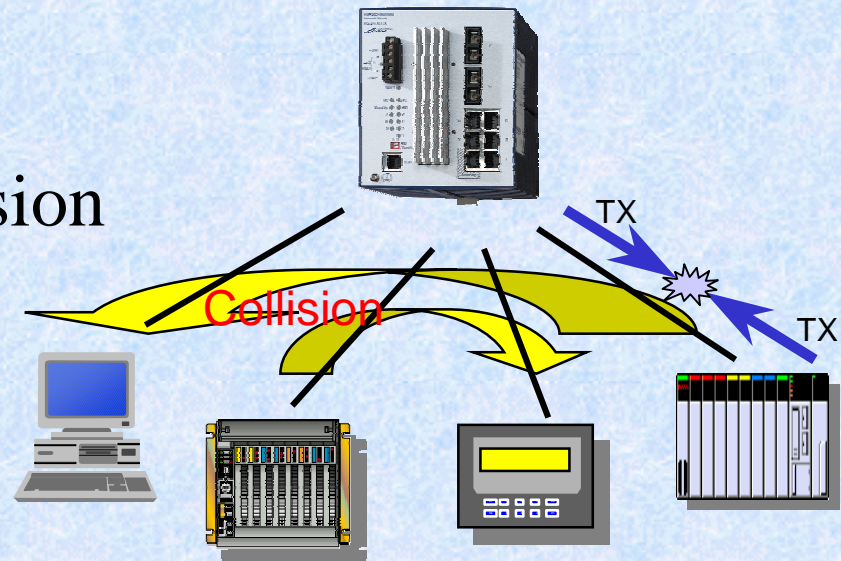
- Original Ethernet composed of one collision domain.
 - Only one device at a time can talk.



Ethernet Evolution - Switching

- Switched Ethernet has broken up the collision domains

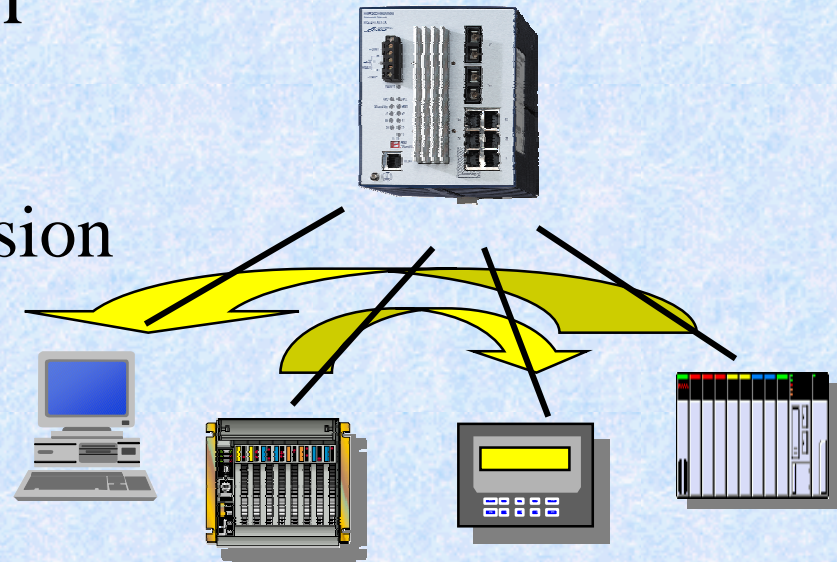
- Now lots of little collision domains.
- Still only half duplex.



Ethernet Evolution - Switching

- Switched Ethernet with full duplex communication

– Now there are no collision domains and hence no collisions!



Determinism

- Improve Determinism / Reduce Collisions
 - Star topology
 - Switched Ethernet
 - Full Duplex devices
 - 100Mb Ethernet
 - Control within a single Collision Domain
- Ethernet for control interlocking and I/O is acceptable for applications where response times can vary

Open

- Open systems are available from a number of sources

Internet Access

- Link to the rest of the world
- Integration with higher level systems simple

Security

- Access out makes access in easier
- IT issues become control issues
 - Firewalls
 - Secure servers
 - Hot backups

Copper or fibre

Copper

- Cheap
- Noise could be an issue at high speed
- Trusted and understood by electricians
- Equipment available with copper

Fibre

- Cheap
- Noise immunity
- Termination issues
- Some equipment not available direct fibre

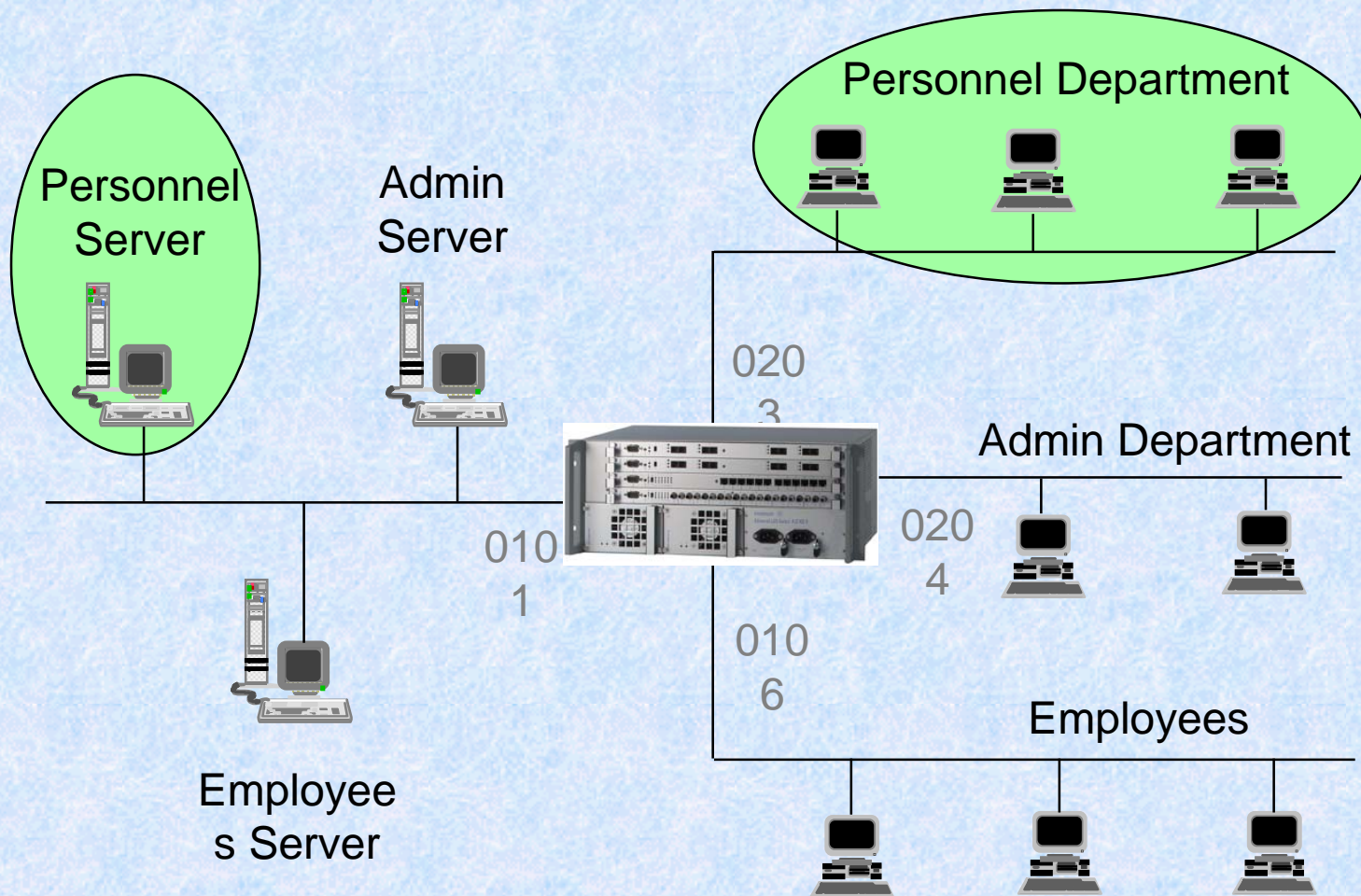
Environment

- Electrical noise
 - Higher cost media
 - Reduced speeds
 - Loss of performance

Ethernet Evolution - VLANs

- Virtual Local Area Networks.
 - Filter out data not belonging to a virtual LAN.
 - Any traffic for something outside of that VLAN will not broadcast outside.

Ethernet Evolution - VLANs



How will we use Ethernet in the future

- PLC's exchanging time-critical messages over Ethernet (Interlocking)
- PLC's, or Soft-PLC's controlling I/O over Ethernet
- I/O modules connected to Ethernet via an Ethernet I/O adapter
- I/O devices direct connected to Ethernet

My View

- Ethernet will be used more and more for
 - Monitoring large systems
 - Synchronisation where seconds don't matter
 - Control where seconds don't matter
- IT and control engineers will become interchangeable
- New technologies will blow ethernet away

Summary

- It can work
- You need to know what you are doing
- The knowledge and skills required are not possessed by most control engineers
- Many of the costs are hidden
 - There may be better ways of doing it