Industrial Internet Fabric

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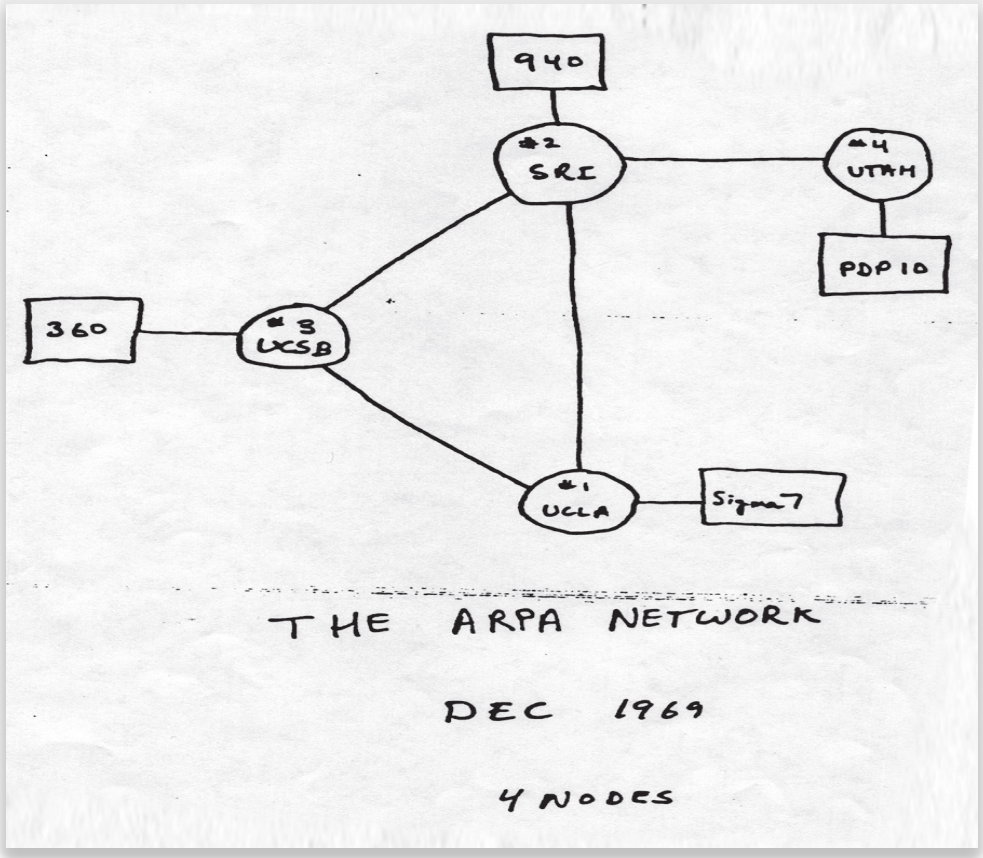
“Birth” and Growth of the Internet

More than 99% of things in the physical world are unconnected

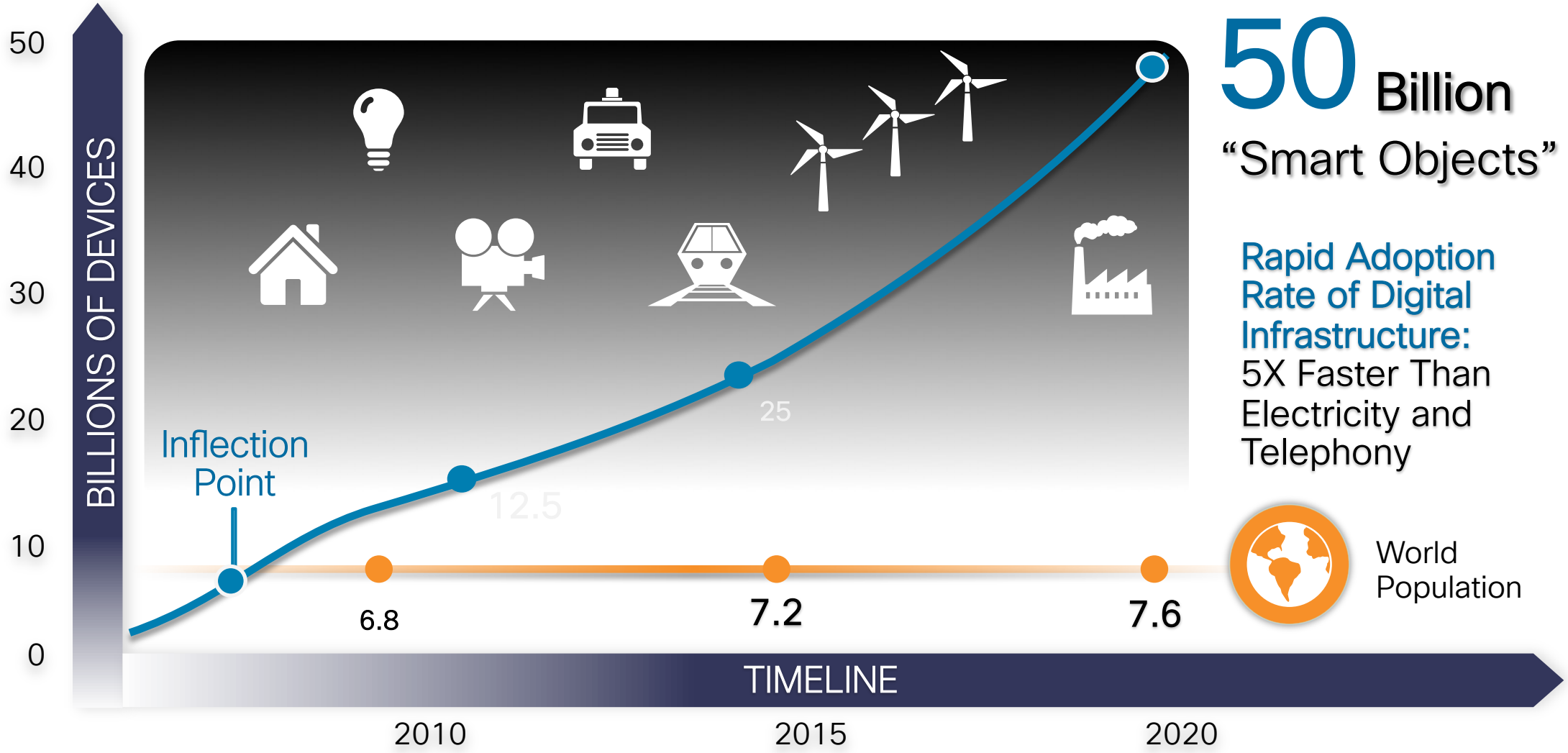
The Internet is “born”



The Internet in 1998

Sources: Computer History Museum, 2012; *Wired Magazine,* December 1998

IP Network Technology Enables IoT



50 Billion

"Smart Objects"

Rapid Adoption Rate of Digital Infrastructure: 5X Faster Than Electricity and Telephony

World Population

Source: Cisco IBSG, 2011

Why Customers Care

The enablement of enterprises to more **intelligently** and **responsively manage industrial operations** globally

Industrial Intelligence

Growth	1	Capex to Opex shift Increase production with same staff
Market Transitions	2	Flexibility to migrate production React to shifting markets
Innovation	3	New business models based on servicing field and production assets and processes
Risks	4	Remote Connectivity to operations in harsh environmental conditions
Governance	5	Ensuring security, safety, and compliance

Industrial Internet
Addressing Business Challenges

IIC Founder Companies

INDUSTRIAL INTERNET CONSORTIUM

An Open Membership Consortium **now 81** companies strong

As of 9-12-2014

Industrial Internet Consortium Focused Areas

The goal of the IIC is to improve integration of the physical and digital worlds, to help drive adoption of Industrial Internet applications.

Testbeds

Innovation to drive new products, processes, services

Technology & Security

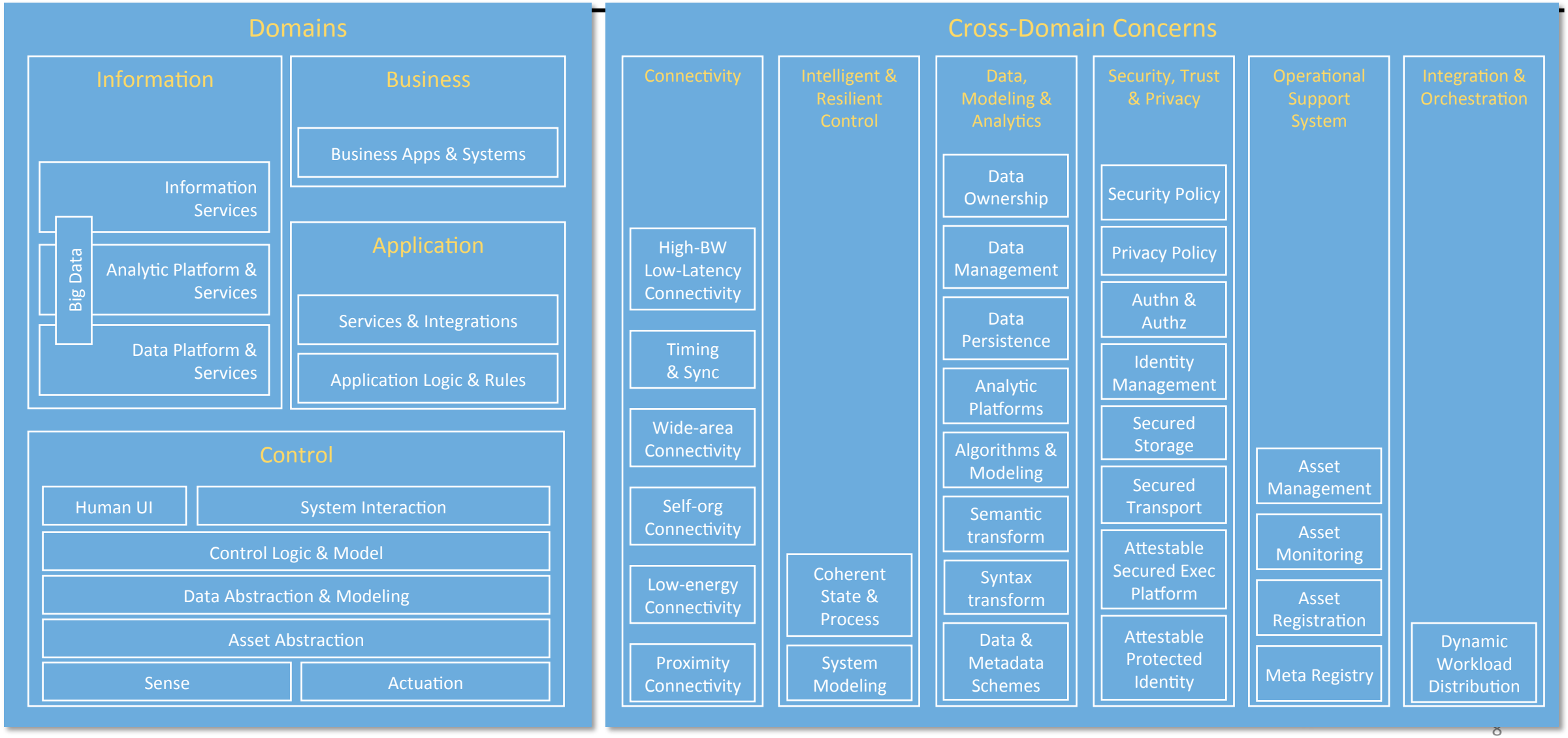
Architectural frameworks, interoperability, privacy & security of Big Data

Thought Leadership

Community to advance innovation, best practices and insights

A Functional Model

Under Refinement

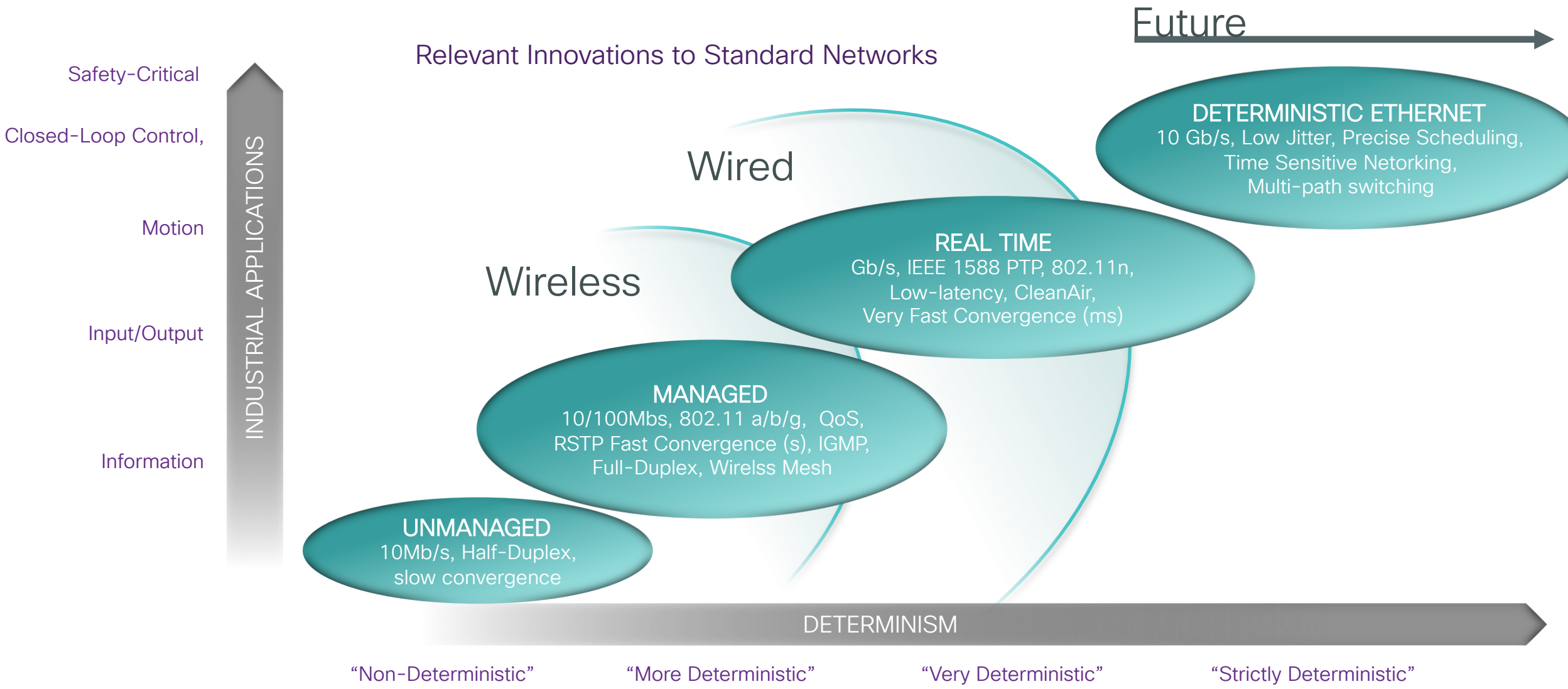


Industrial Internet Characteristics

Industrial Characteristics for Standard Networks

- Converged
- Easy to use
- Secure, Private
- Guaranteed Deterministic
- Scalability

Industrial Intelligence Requires Evolution



Evolution of Ethernet

Initial 10b2 Ethernet: CSMA/CD Collisions

The reason Ethernet got a bad rep with determinism…

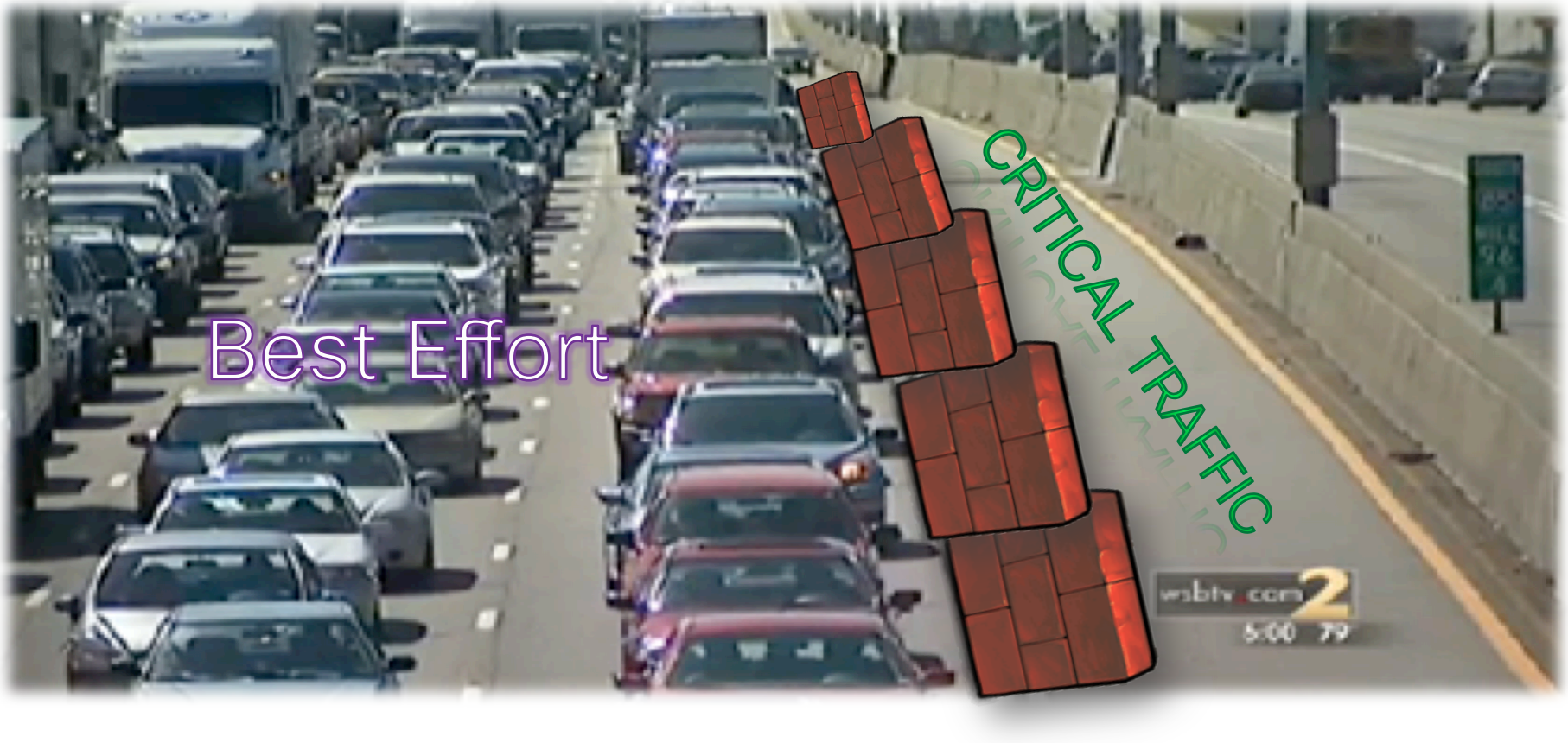
Evolution of Ethernet

Full Duplex Switched

Major Improvement – but still not converged or (necessarily) deterministic…

Cisco Deterministic Ethernet: Safe, Secure, Scalable, Converged

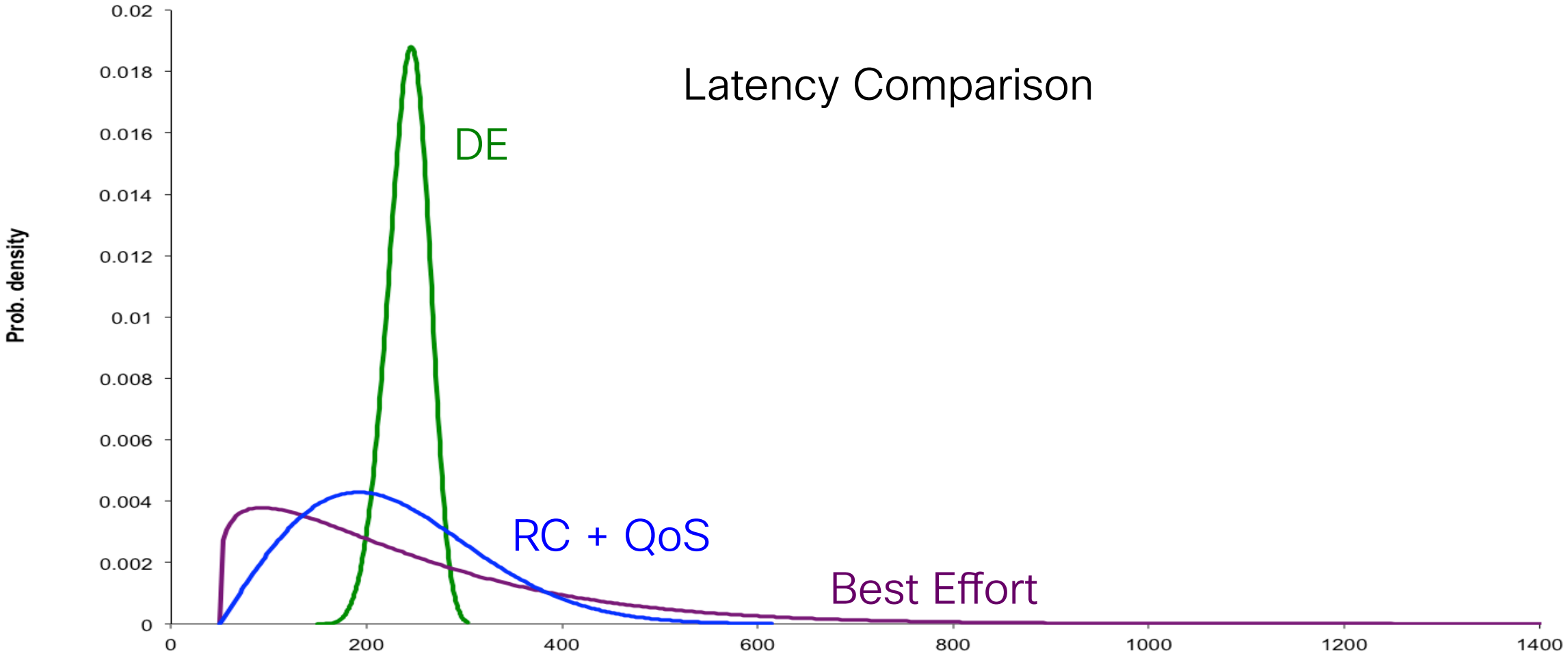
Time Triggered Ethernet – Converged BE + Critical



What is Deterministic Networking?

- Time synchronization
  - Every switch/router/end station time synchronized < 1µS error
- Multiple paths for critical data
  - Data paths are nailed up, not controlled by spanning tree, OSPF, etc.
  - Multiple paths used simultaneously by replicated data
  - Data may be replicated/discarded multiple times for multiple errors
- 100% guarantees for critical data: 0 congestion loss, max latency
  - Biggest cause of packet loss is eliminated by Time-Division Multiplexing
  - Both Control Loop and Fast Stream traffic require both features
- Convergence
  - Multiple critical applications sharing same infrastructure
  - Critical traffic virtualized into enterprise and data center networks
  - Background data, infotainment, code downloads, etc., on critical networks

Latency Comparison



Thank you.