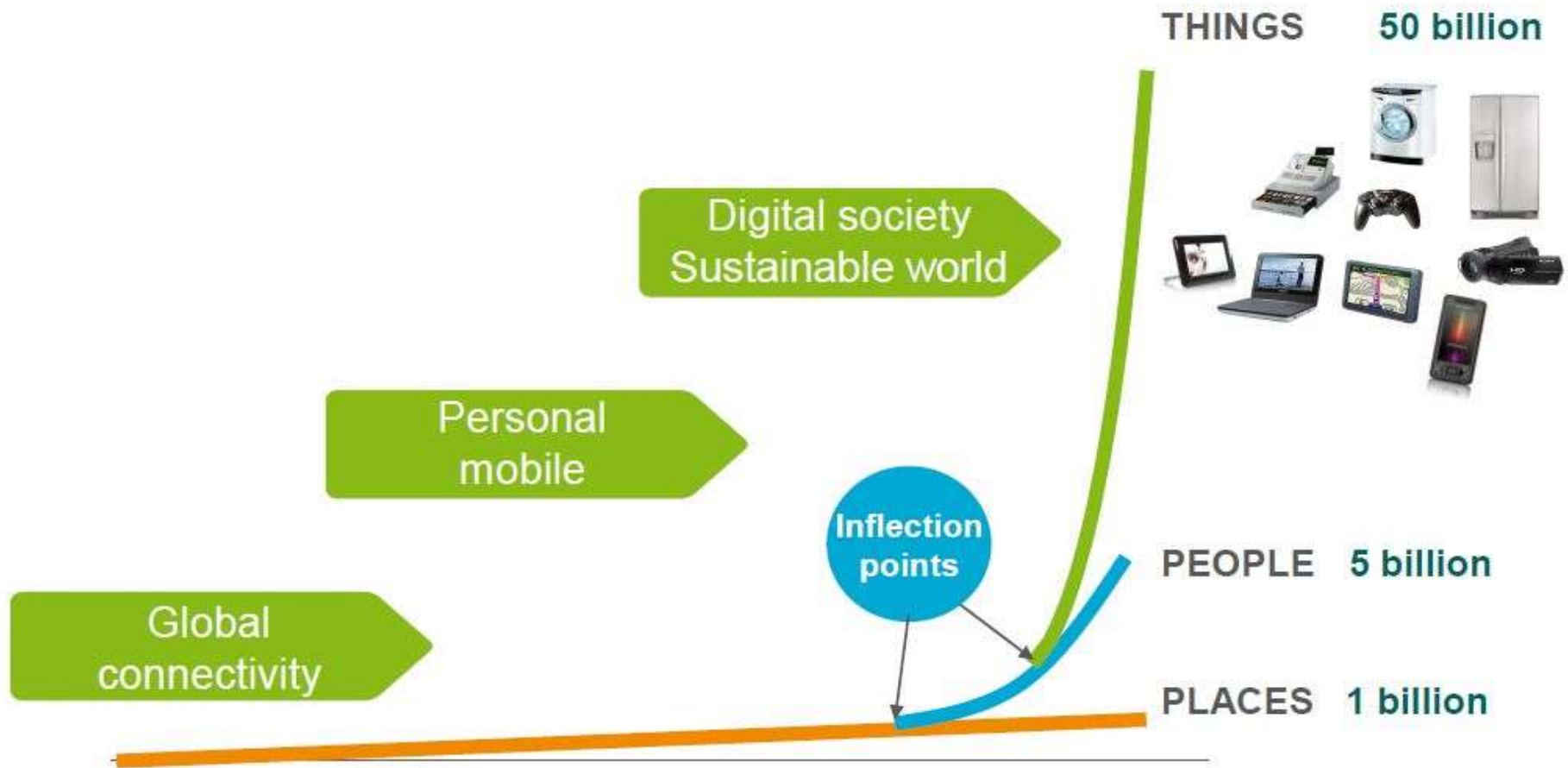# Why is DDS the Right Technology for the Industrial Internet?

The Real-Time Communications Platform for the Internet of Things™

Your systems. Working as one.

The Internet of Things

2014 Top Tech Trends

- **1) <u>Internet of Things</u>**
- The IoT promises to be the most disruptive technological revolution since the advent of the World Wide Web. Projections indicate that up to 100 billion uniquely identifiable objects will be connected to the Int... 2020, with en... technical, soci...economic, political, and even spiritual consequences.

IEEE

Gartner

Top Ten Strategic Technology Trends for 2014 :
- Mobile Device Diversity and Management
- Mobile Apps and Applications
- The Internet of Everything
- Hybrid Cloud and IT as Service Broker
- Cloud/Client Architecture
- The Era of Personal Cloud
- Software Defined Anything
- Web-Scale IT
- Smart Machines
- 3-D Printing

What is the Internet of Things?

- Cisco "Internet of Everything"
  - …the latest wave of the Internet -- connecting physical objects…to provide better safety, comfort, and efficiency
- IBM   "Internet of Things"
  - …a completely new world-wide web, one comprised of the messages that digitally empowered devices would send to one another. It is the same Internet, but not the same Web.
- GE "Industrial Internet"
  - …convergence of machine and intelligent data…to create brilliant machines
- RTI "Your Systems. Working as One."
  - RTI exists to enable and realize the potential of smart machines to serve mankind… The IoT is as profound as the cell network, GPS, or the Internet itself. The Internet of Things and the Intelligent Systems it enables will fundamentally change our world.
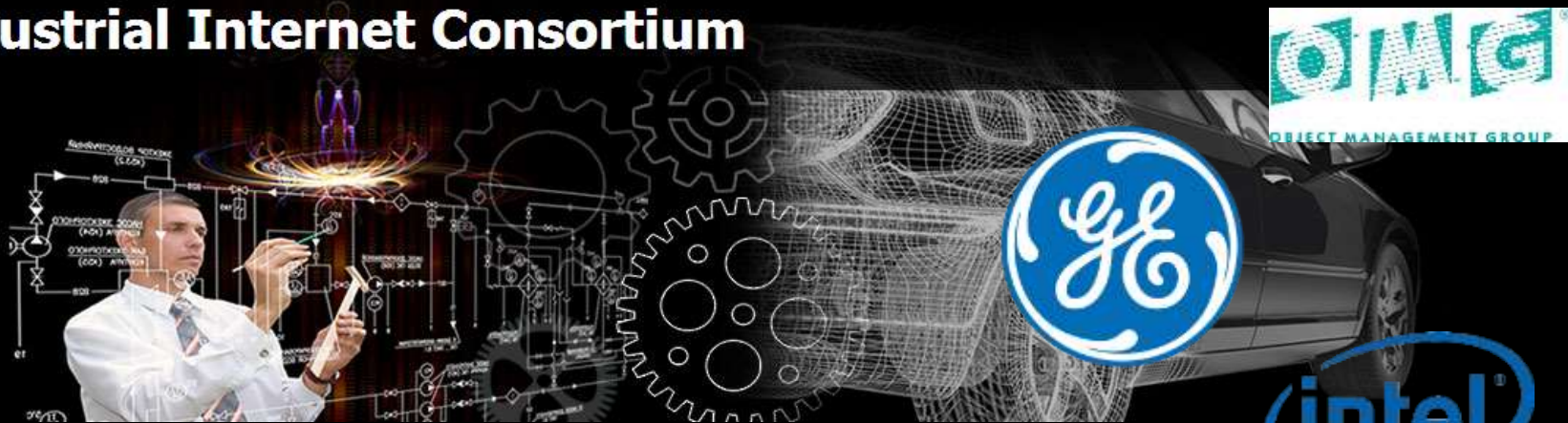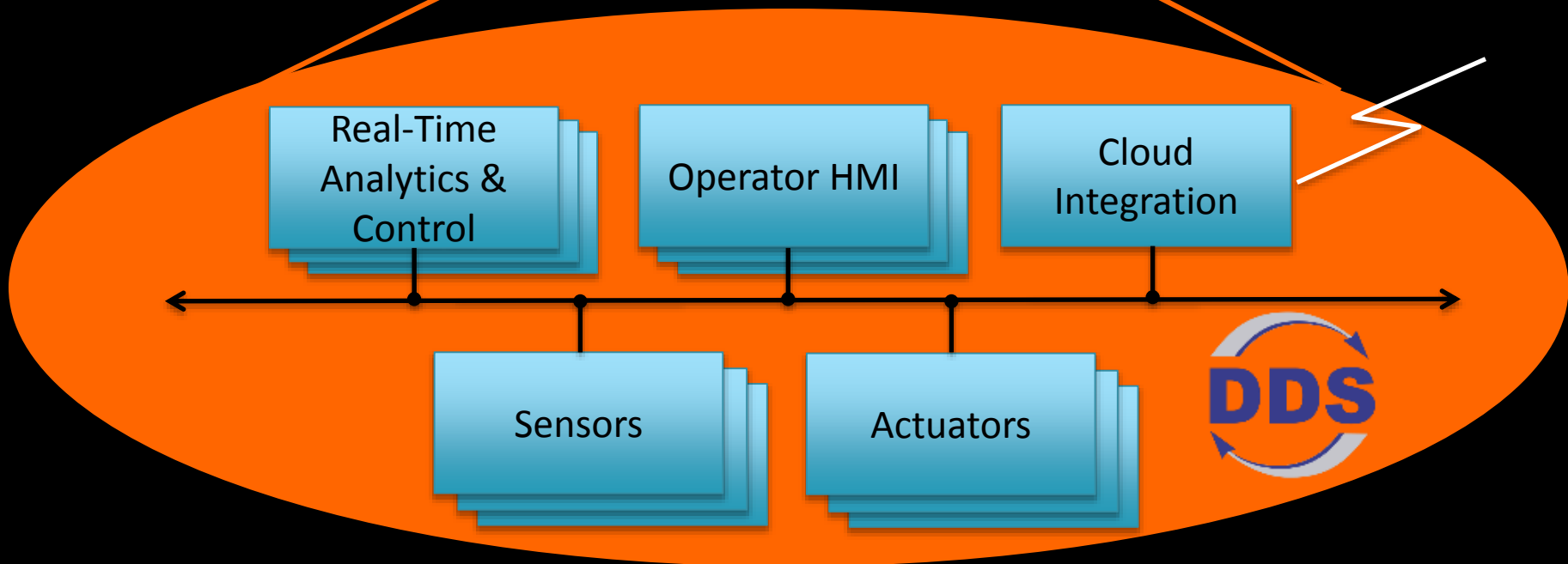
The OMG's Industrial Internet Consortium

- OMG manages the IIC
- Goal is to bring standards clarity to the Industrial Internet
- 5 large company founders, led by GE
- RTI is an IIC launch member & on OMG board

DDS Distributes Device Data

Data Distribution Service (DDS)

The Core Nervous System for the Industrial Internet of Things™

Your systems. Working as one.

Critical Infrastructure Trusts RTI

- World's largest Wind Power company
- World's largest Underground Mining Equipment company
- World's largest Navy (all surface ships)
- World's largest Automotive company
- World's largest Emergency Medical System company
- World's largest Medical Imaging provider
- World's 2nd largest Patient Monitoring manufacturer
- World's 2nd largest Air Traffic control system
- World's largest Flight Simulator company
- World's largest Broadcast Video Equipment manufacturer
- World's largest Launch Control System
- World's largest Telescope (under construction)
- World's 5th-largest Oil & Gas company
- World's 6th-largest power plant (largest in US)
- All of world's top ten defense companies

Over $1 trillion relies on RTI

What Can DDS do for the IIoT?

- Healthcare
- Transportation
- Communications
- Industrial
- Defense
- Energy
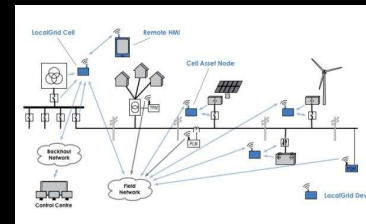
What can DDS do for the Industrial Internet?

Unite Real-Time, Mobile, and Cloud

- The largest EMS equipment provider supplies emergency response equipment to 60% of the world's emergency vehicles
- Uses RTI middleware for in-vehicle platform, mobile device bus, cloud connectivity

Deliver Fast Data On Time

- The Minimally Invasive Robotic Surgery (MIRS) system at DLR coordinates three robots to perform delicate heart surgery.

- The system closes a distributed loop between the robots and the remote surgeon's control at 3kHz.

- RTI enables new medical techniques

Connect Diverse Devices

- Hospital error is the 6th leading cause of preventable death
- DocBox integrates devices to improve patient safety
- RTI Connext ties together devices, services, and displays in real time

"RTI Connext DDS met all our needs – whether we're handling 12 patients, or 200."
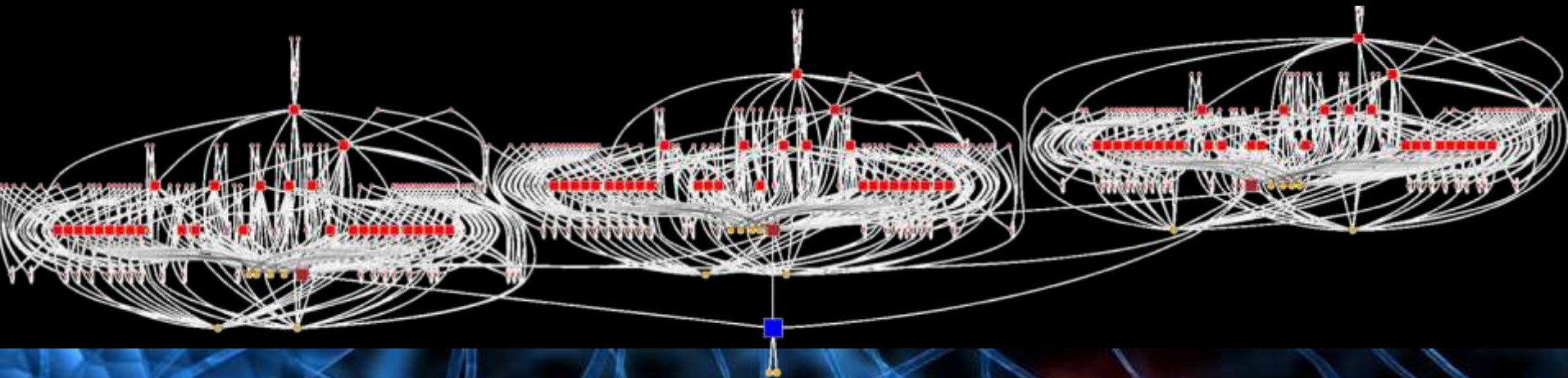-- DocBox Founder, Tracy Rausch

Integrate System of Systems

- Hospital net challenge
  - 1000s of patients, >100k devices
  - Wired/wireless/ISM
  - Moving patients
  - 100% uptime, security
  - Real-time waveforms

- RTI technology
  - Data centric addressing
  - Smart data filtering
  - Routed deployment
  - Optimized updates
  - Automated test harness

Transform Product Architectures

BK Medical
Ultrasound Products

bk medical

"BK Medical is truly redefining Medical Ultrasound Imaging where the traditional single user / single system approach is being replaced with fully scalable and distributed multi-user systems

This required a completely new way of gluing the individual components together. For this reason we selected the RTI Connext DDS middleware as this gives us all the flexibility and the abstraction layer needed for the future of Analogic Ultrasound"

-- Jesper Lomborg Manigoff, VP of Engineering, Analogic Global Ultrasound

Provide a Common Platform

"GE Healthcare chose the DDS standard because it can handle many classes of intelligent machines.
RTI Connext DDS satisfies the demanding requirements of our devices, and RTI has the depth and experience necessary to partner with us in order to meet our stringent standards.
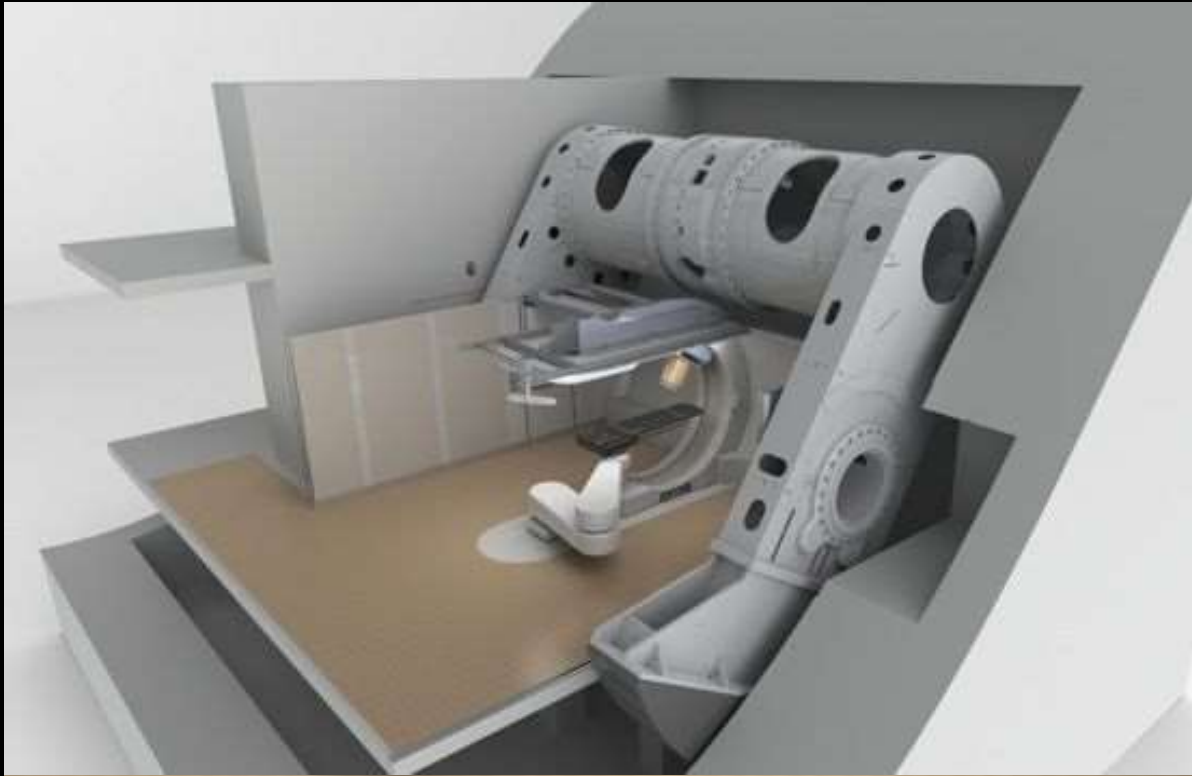Additionally, RTI's Connext DDS allows us to standardize on a single communications platform across product lines."

-- J Gustavo Perez, General Manager for MI&CT Engineering

Revolution®

Ensure Reliability for Complex Systems

First patient treated Dec 2013,
Siteman Cancer Center, St. Louis

- Mevion's Proton-Beam Radiation Therapy system zaps tumors with accelerated protons
- The treatment must be continuous for 30-40 days; downtime endangers treatment success

- With RTI Connext DDS, Mevion's PBRT delivers dependable treatment at low cost

Share Voice & Video

- Exelis (ITT) C4i provides command and control systems for military and civilian agencies (fire/police/emergency response)

- RTI Connext DDS connects GUIs to servers that route voice and video

- RTI met the critical needs: scalability, routing, recording

Enable Software Defined Machines

- RTI provides fast backplane communications for telecom equipment
- RTI & Cisco recently submitted an RFI for Software Defined Networking (SDN) to OMG
- RTI can update thousands of switches in one action
- RTI Connext DDS supports 1000s of apps, 50k+ namespaces

Drive Smart Reactive Systems

- The VW Driver Assistance and Integrated Safety system combines radars, laser range finders, and video to assist safe operation

- It helps avoid obstacles, detect lane departures, track eye activity, and safely negotiate bends

- RTI enables advanced reactive systems in transportation

Facilitate Plug-n-Play Across Vendors

- Audi hardware-in-the-loop simulation feeds realistic data to components for testing
- The system offers plug-n-play between simulation vendor solutions
- RTI middleware enables a modular test environment that scales to work with hundreds of devices

Ensure 24x7 Operation

RTI Connext DDS was selected for its extensive compliance with the Object Management Group (OMG) DDS standard; its high security rating; its wide support of tools and programming languages, and its reputation for performance, scalability, and 24/7 reliability

– Sid Koslow, Chief Technology Officer, NAV CANADA.

Air Traffic Control for Canada
2nd largest ANSP in the world
7 major centers

Work in Harsh Environments

- Joy Mining is the world's largest mining equipment manufacturer

- RTI Connext DDS connects the controller, operator GUI, and historian

- Reliable, fast connectivity enables control, debugging, and system health monitoring for continuous mining

Integrate Industrial PLCs

- Schneider is a global factory automation manufacturer

- RTI Connext DDS eases PLC integration, provides up-to-the-minute data

- Connext Micro works with limited memory and processing power on PLCs

- RTI middleware connects factory PLCs and IT systems

Connect Large SCADA

- NASA KSC's new Constellation launch control SCADA system
- RTI delivered 300k points, at 400k msgs/sec with 5x the required throughput, at 1/5 the needed latency
- NASA mitigated risk by parallel-tracking multiple DDS vendors

- RTI connects thousands of sensors and actuators

Truly Distribute Control

- Siemens Wind Power fields farms of 500 turbines with 100m blades
- Connext DDS implements fast control within turbines and gust control across the array

- RTI enables distributed intelligent machines

Move Intelligence to the Edge
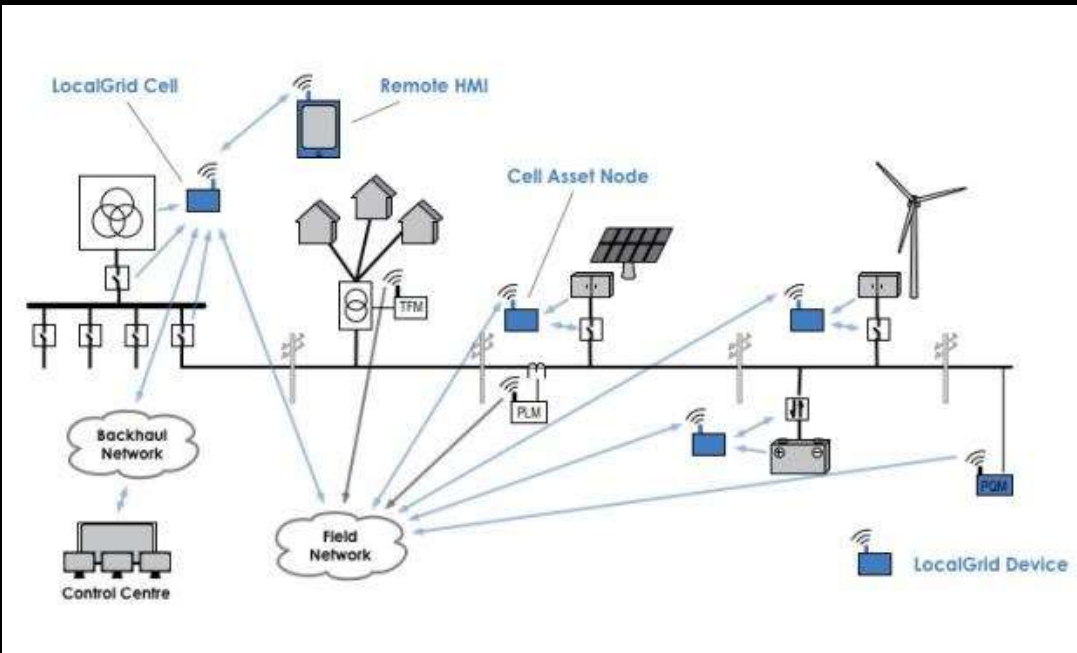
- MicroGrids connect generation, load, and storage to optimize usage and eliminate traditional grid infrastructure

- RTI Connext™ DDS middleware seamlessly integrates apps, enforces security, merges NI LabVIEW

Power Critical Infrastructure

- RTI Connext DDS controls the 6.8 GW Grand Coulee Dam
  - Largest power plant in North America
  - Fastest-responding major power source on the Western Grid
  - Requires 24x7 operation

- RTI met the challenges
  - Extreme availability
  - Wide area communications
  - Multi-level routing
  - High security
  - 300k data values
- RTI system live since Jan 2014

Choose DDS If...

✓ Disaster if offline for 5 minutes?

✓ Measure performance in ms or us? Or scale >100+ applications? Or 10k+ data values?

✓ Code active lifetime >3 yrs?

- 2 or 3 checks? => DDS

Control: DDS

End-to-End DataBus
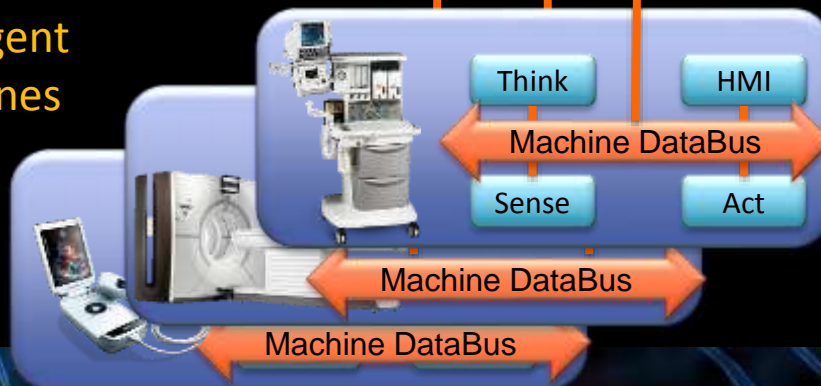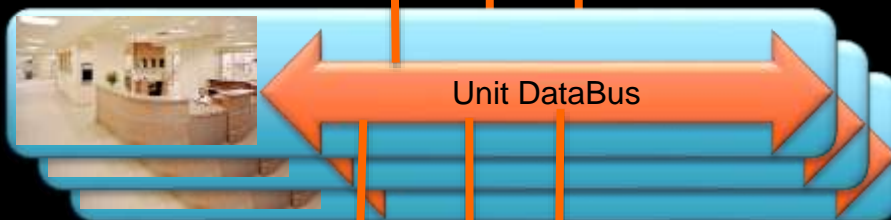

- Connect…
  - Fast
  - Seamless
  - QoS controlled
  - Secure
  - Data centric
- …80 Platforms…
  - Micro controllers
  - Certified systems
  - Embedded
  - Mobile
  - Desktop
  - Cloud
- …over 12 Transports
  - UDP or TCP
  - D/TLS (secure)
  - Wireless or wired
  - Shared memory
  - Backplane
  - Cloud virtual connect

Intelligent Industrial Internet
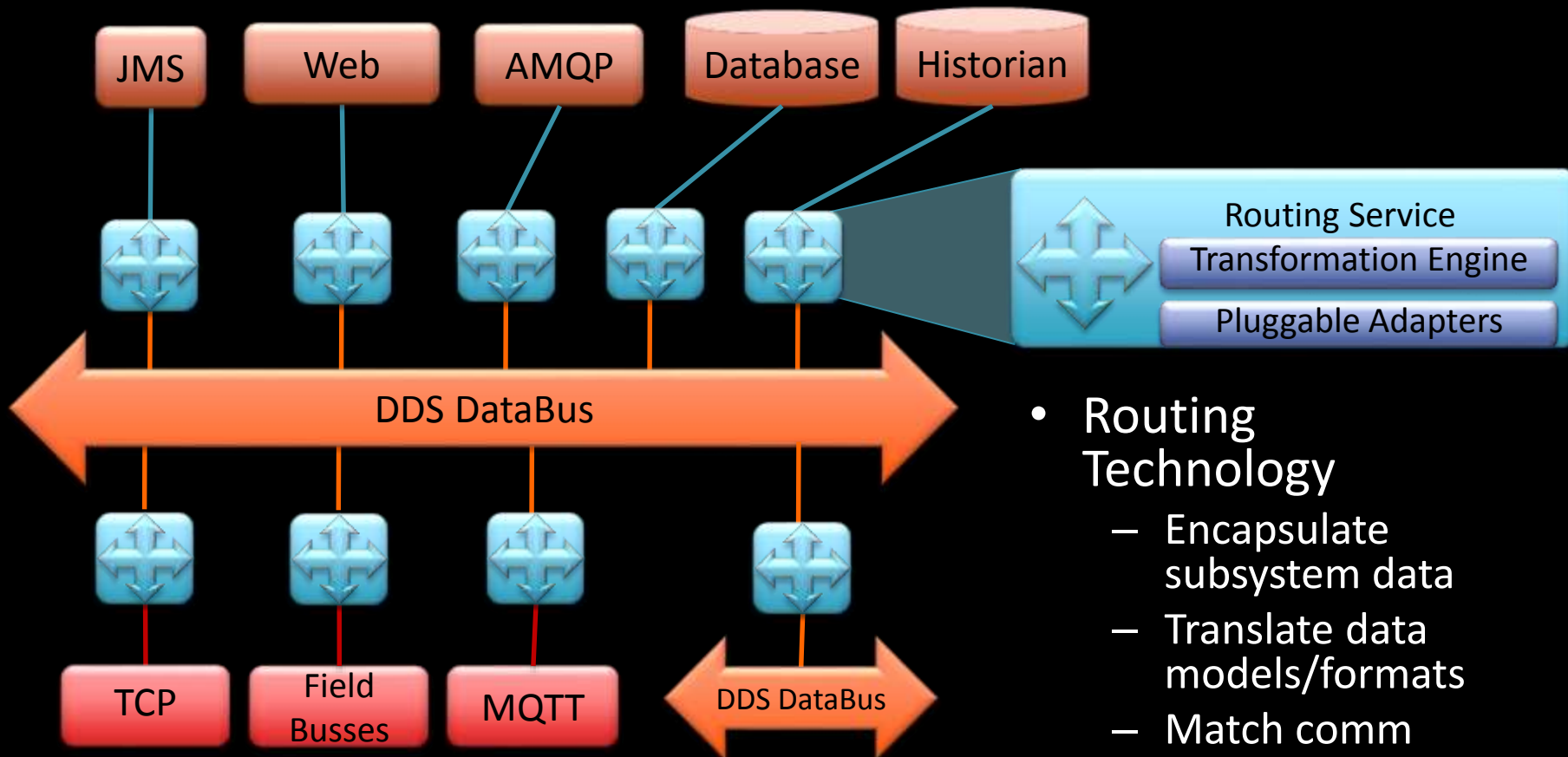
Intelligent System of Systems

Intelligent Systems

Intelligent Machines

Cloud DataBus

Site DataBus

Unit DataBus

Think   HMI
Machine DataBus
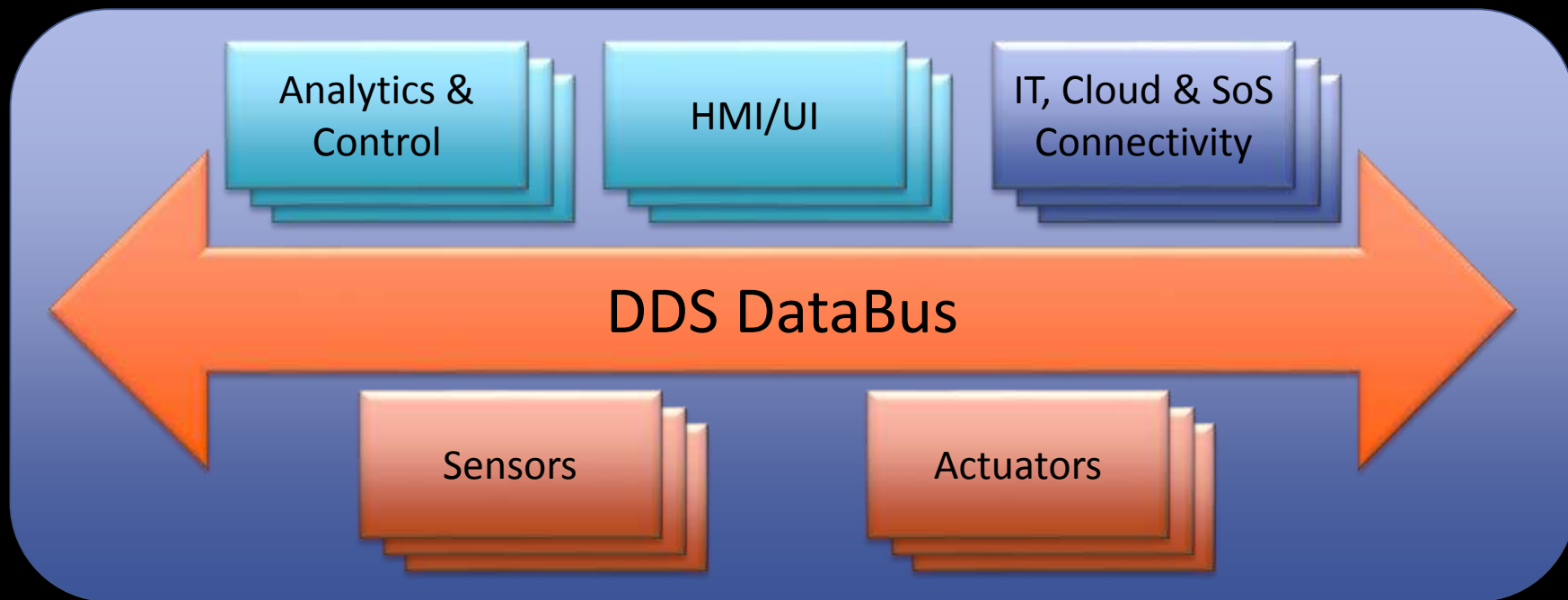Sense   Act

Machine DataBus

Machine DataBus

Connext

Route to Build Complete Hierarchy

- Routing Technology
  - Encapsulate subsystem data
  - Translate data models/formats
  - Match comm patterns

Strive For: One Logical Dataspace...

…Hiding Complex Network Topologies

Centralized analytics

Analytics & Control

HMI/UI

IT, Cloud & SoS Connectivity
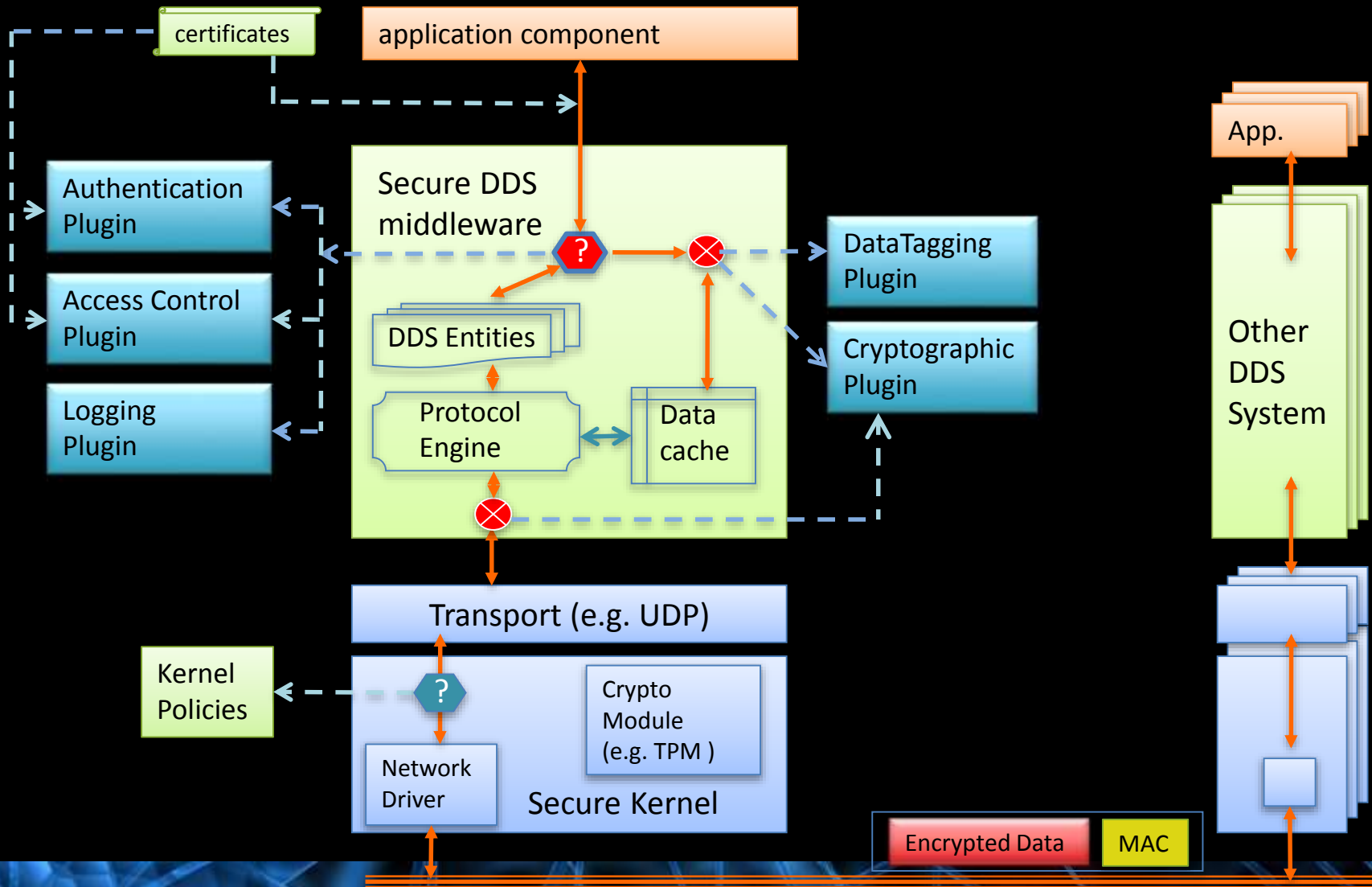
DDS DataBus

Sensors

Actuators

Decentralized devices, streaming analytics and control

Introducing: RTI Connext DDS *Secure*

...Just in Time

Standard Plug-in Architecture

certificates

application component

App.

Secure DDS middleware

Authentication Plugin

Access Control Plugin

Logging Plugin

?

DDS Entities

Protocol Engine ⟷ Data cache

DataTagging Plugin

Cryptographic Plugin

Other DDS System

Kernel Policies

Transport (e.g. UDP)

?

Network Driver

Crypto Module (e.g. TPM)

Secure Kernel

Encrypted Data | MAC

Network

Combine Protection and Detection

Transmission Substation

Control Station

Secure DDS

Attack Detector

Scada Converter (C++)

Anomaly Detector (Lua)

DDS

DDS

Slave Device

Slave Device

Display

Master Device

RTI Routing Service ComProcessor

RTI Routing Service ComProcessor
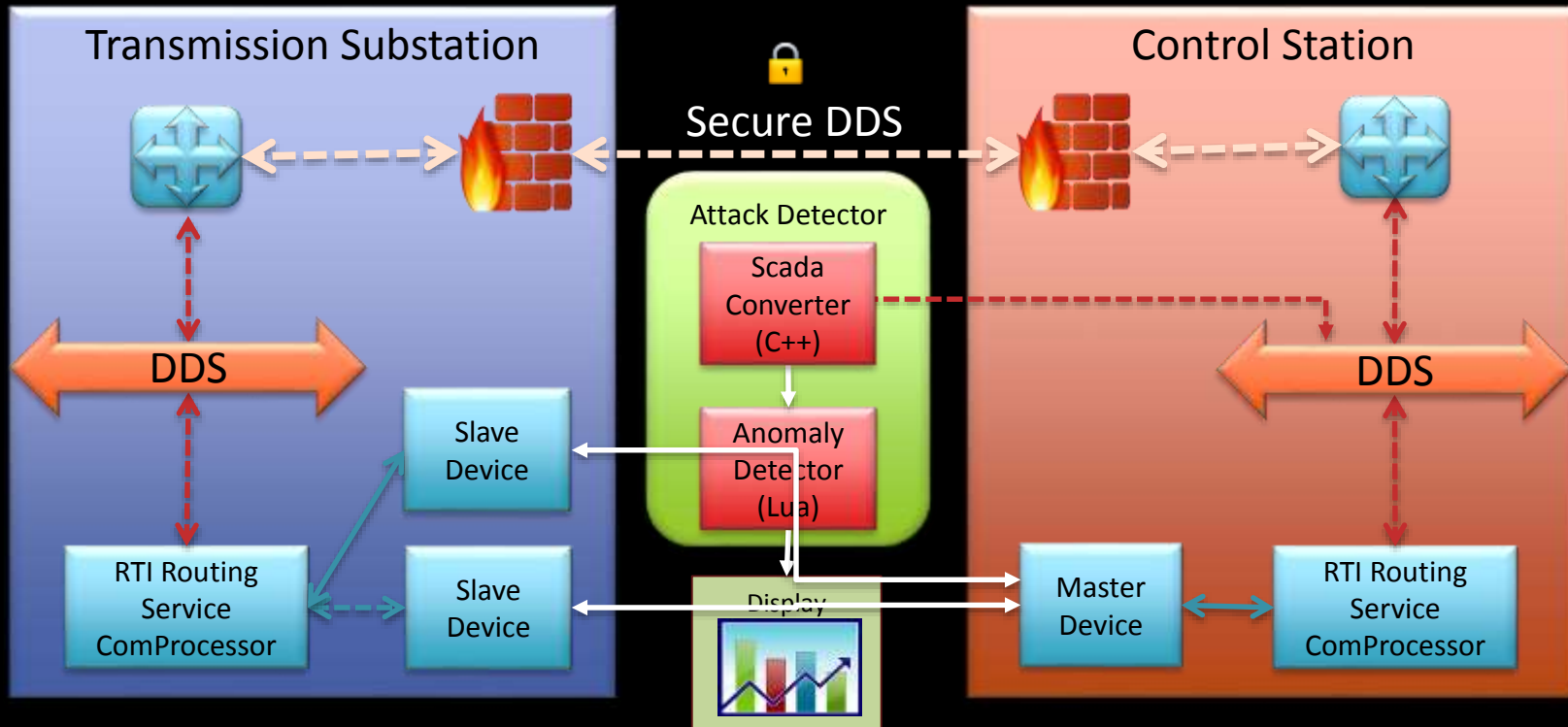
Existing DNP3

DNP3 over Ethernet
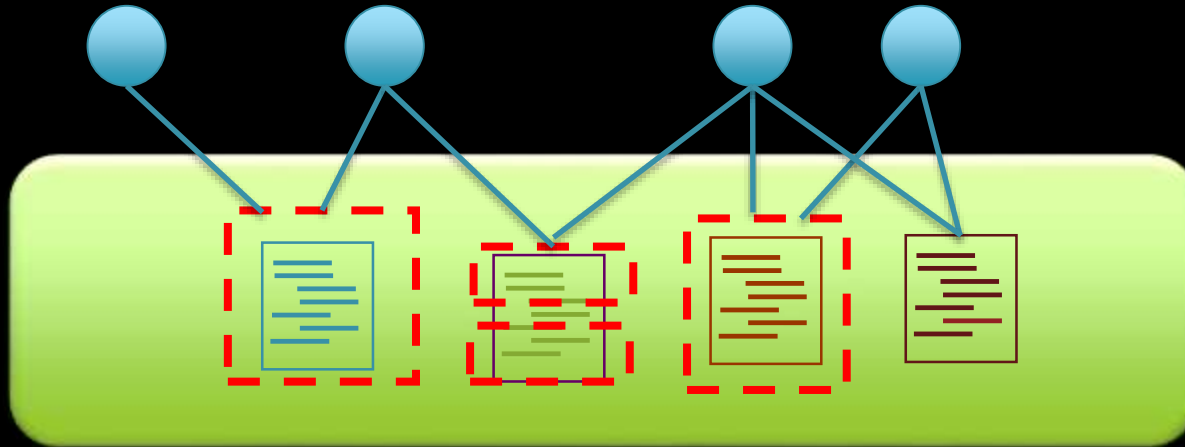
DNP3 over RS232/485

DNP3 over DDS

Secure DDS over UDP

Pacific Northwest
NATIONAL LABORATORY

Connext Makes Security *Practical*

- Complete Protection
  - Discovery authentication
  - Data-centric access control
  - Plug-in cryptography
  - Tagging & logging
  - 100% standards compliant

- Simple Detection
  - Easy retrofit to legacy
  - Facile data tapping
  - Detailed meta data access
  - Quick scripting detection

About RTI

- Market Leader
  - Over 70% DDS mw market share[1]
  - Largest embedded middleware vendor[2]
  - 2013 Gartner Cool Vendor for technology *and* Open Community Source model
- Standards Leader
  - Active in 15 standards efforts
  - OMG Board of Directors
  - DDS authors, chair, wire spec, security, more
  - Launch member of Industrial Internet Consortium
- Real-Time Pedigree
  - Founded by Stanford researchers
  - High-performance control, tools history
- Maturity Leader
  - 750+ designs; by far the most-used DDS
  - Used in TRL 9 systems

[1]Embedded Market Forecasters
[2]VDC Analyst Report

Global Support and Distribution

RTI Enables the Industrial Internet!

- Market-leading real-time platform
- Most extensive experience across industries
- Connects sensor to cloud

Connext DDS

The Future *is* Intelligent Machines