



The logo for NIDays Engineer Next is centered on a blue gradient background. It features the text "NIDays" in white, enclosed within a white rectangular border. To the right of this, the words "ENGINEER" and "NEXT" are stacked vertically in a large, bold, white sans-serif font. A yellow graphic element, consisting of three parallel lines forming a stylized arrow or chevron shape, is positioned between the two words. The entire logo is tilted at an angle. The background is decorated with several diagonal stripes: a wide green stripe, an orange stripe, and a red stripe on the left side; and several blue stripes of varying shades on the right side.

NIDays
ENGINEER
NEXT

Practical Considerations for Connecting LabVIEW to the Industrial IoT

Claudio Cupini

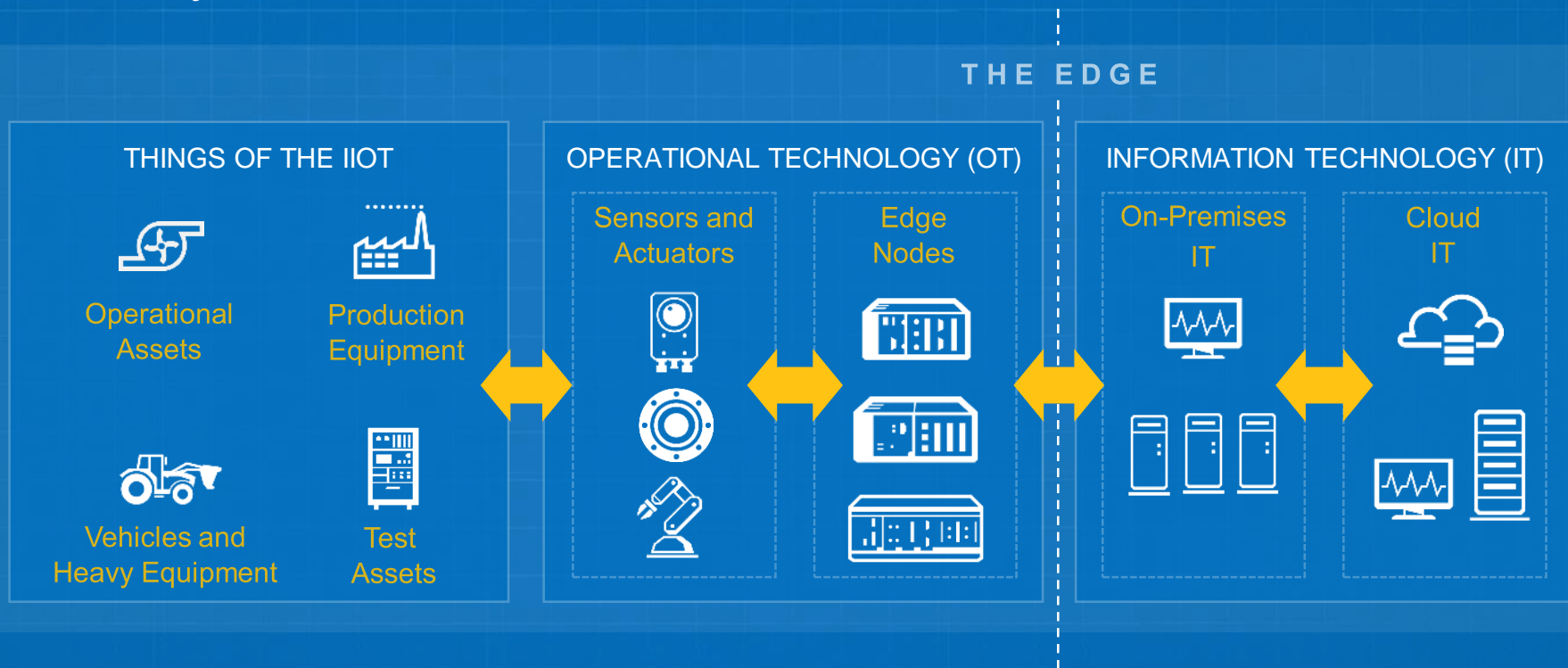
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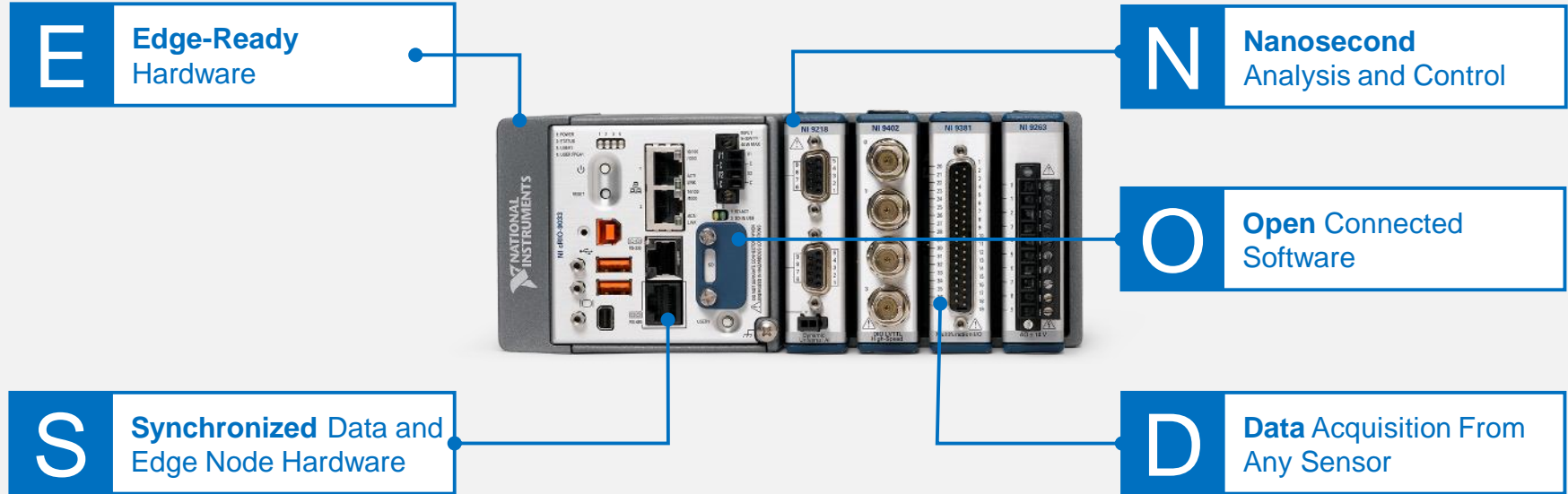
Today's Agenda

- Introduction to the Industrial IoT and NI Edge Nodes
- Speaking the IIoT “Lingo”
- Connecting to IoT Cloud Platforms From LabVIEW

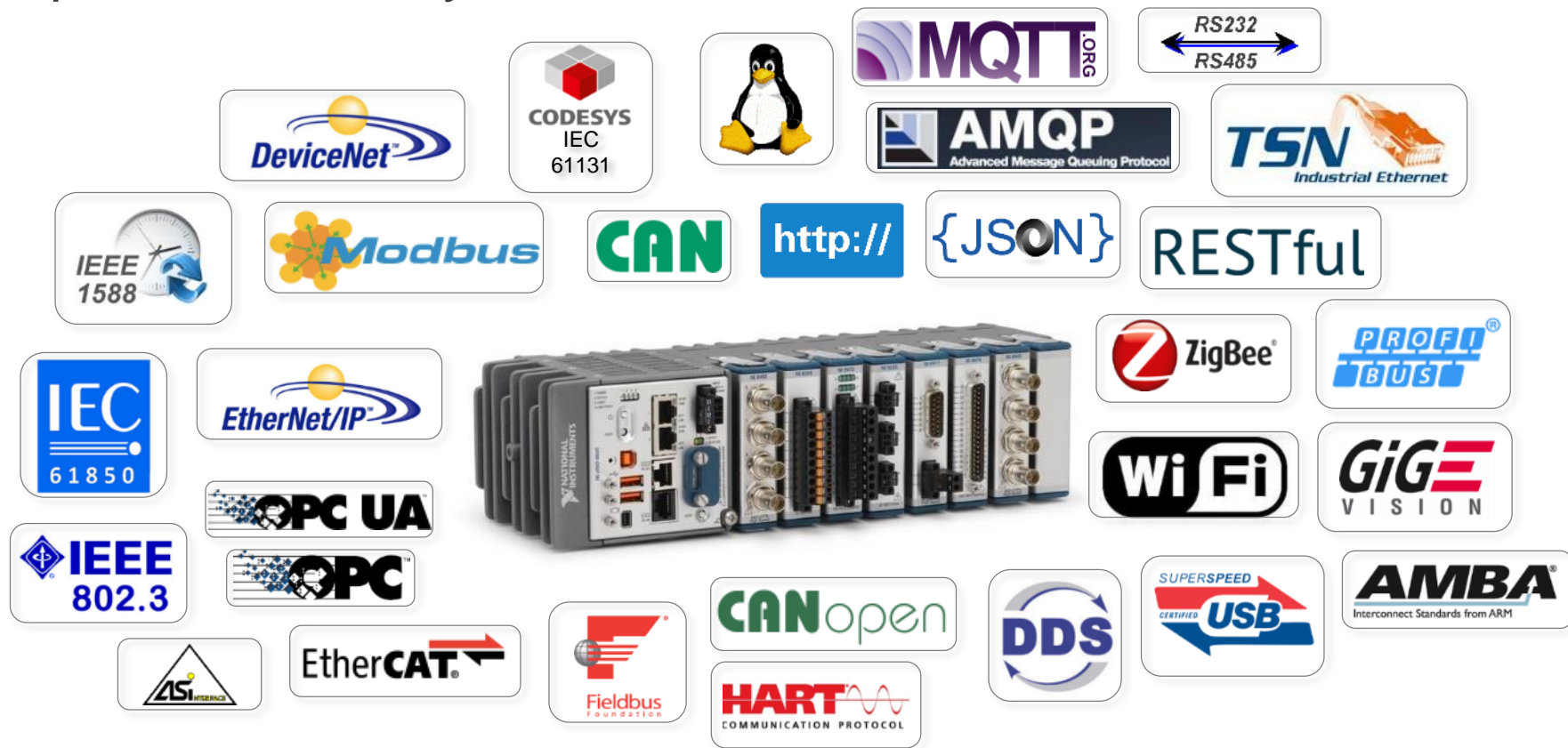
IIoT System Architecture



The NI Edge Node Advantage

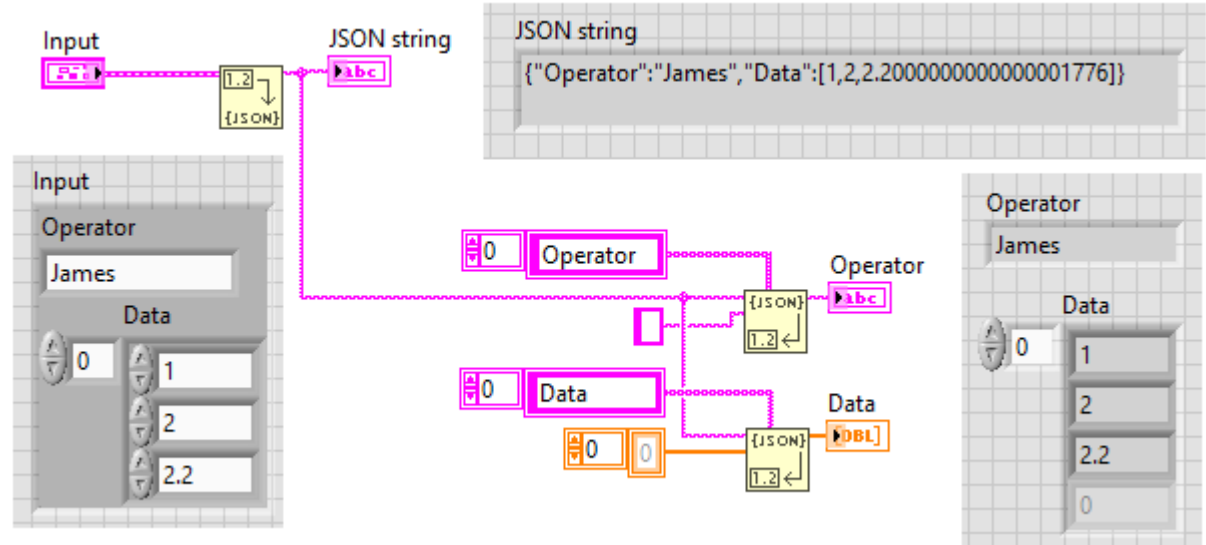


Open Connectivity to OT *and* IT

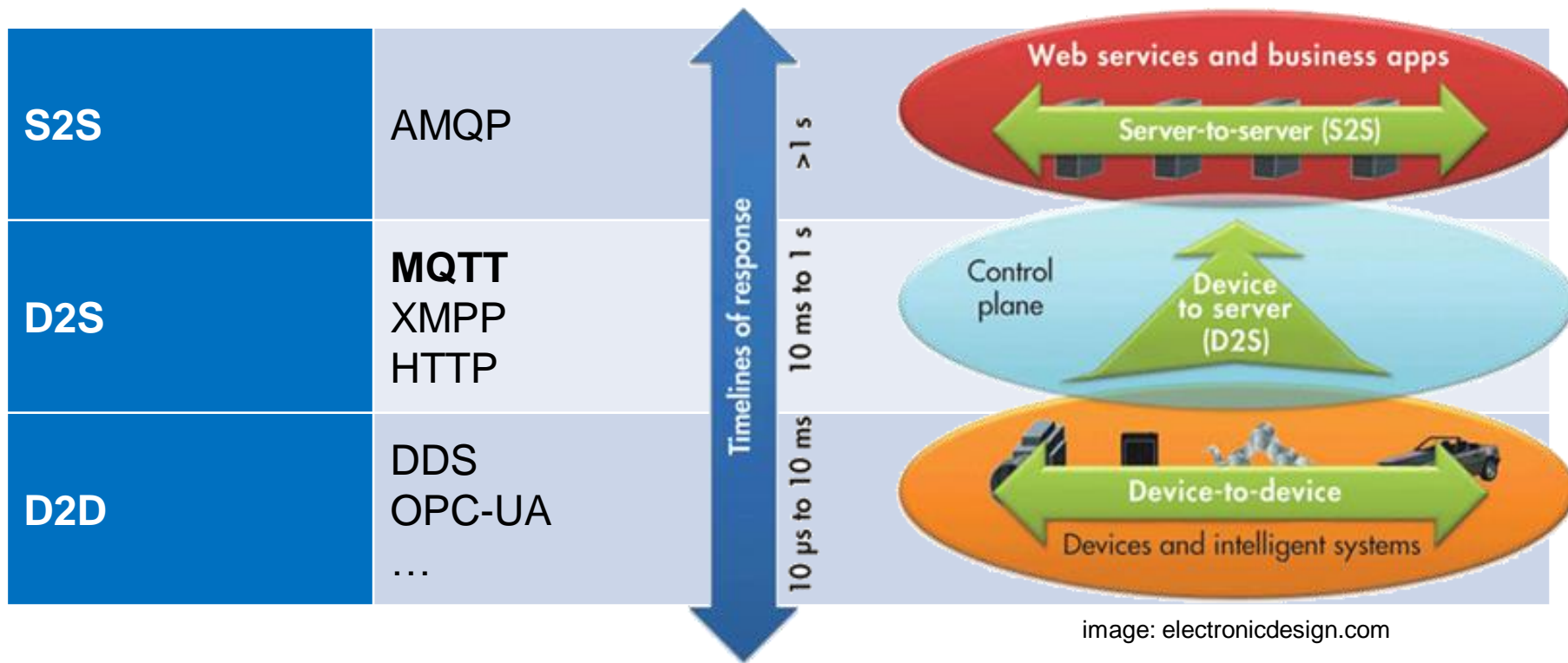


JSON—JavaScript Object Notation

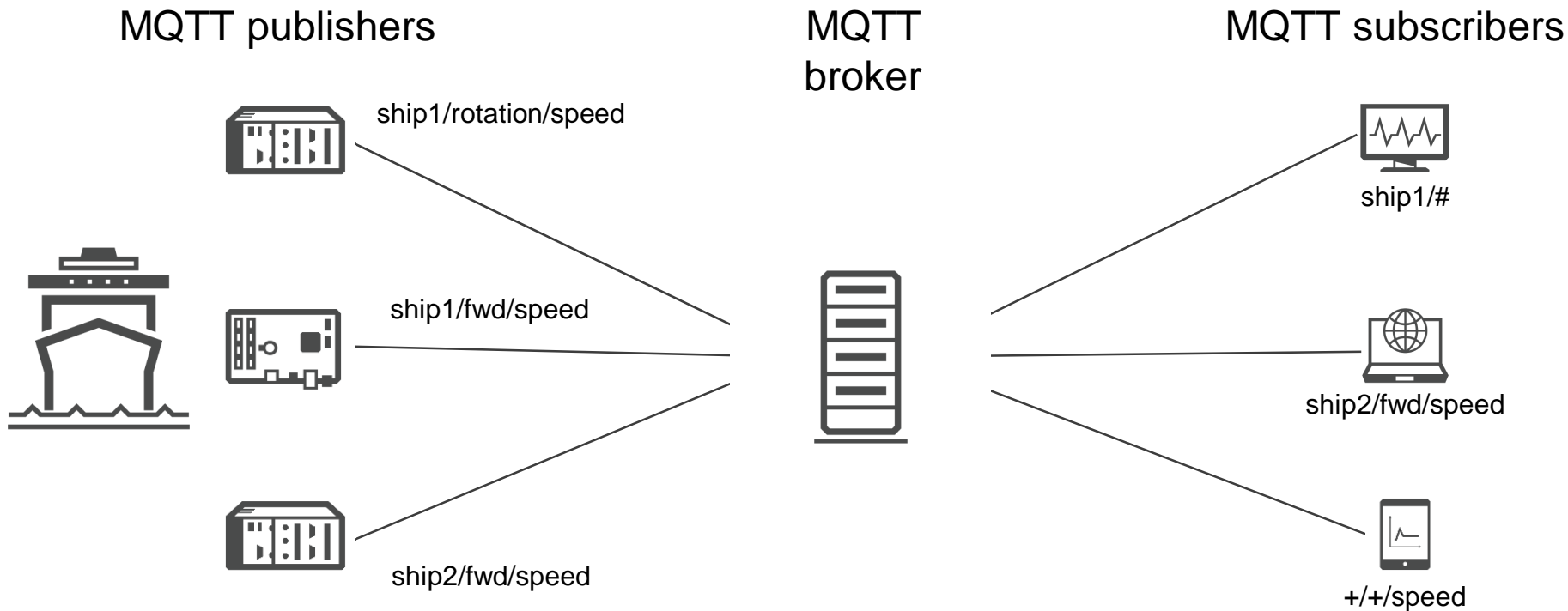
- Standard to store and send data
- Often used between browsers and servers
- Text format
- Self-describing



Common IIoT Protocols



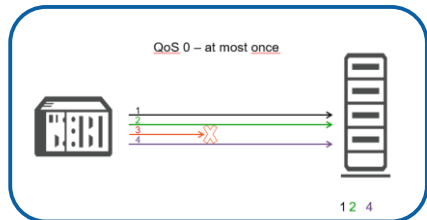
MQTT—Message Queue Telemetry Transport



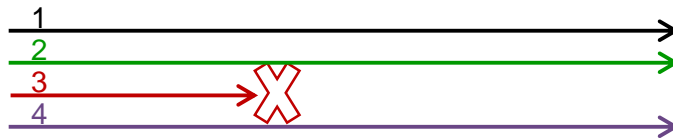
topic = "device/path/topic"



MQTT—Quality of Service (QoS)

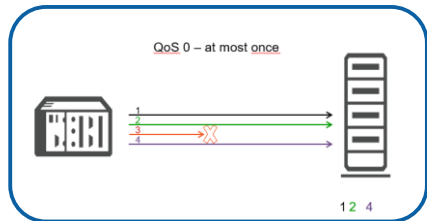


QoS 0—at most once

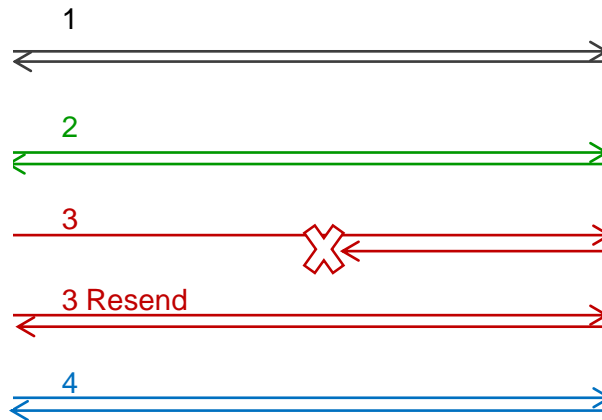
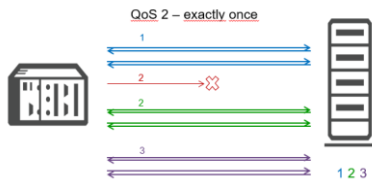


1 2 4

MQTT—Quality of Service (QoS)



QoS 1—at least once

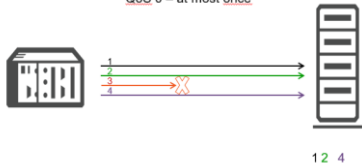


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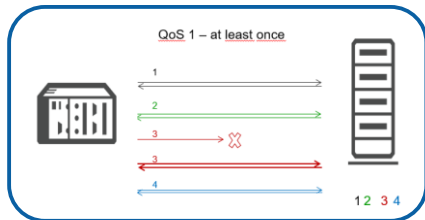
MQTT—Quality of Service (QoS)



QoS 0 – at most once



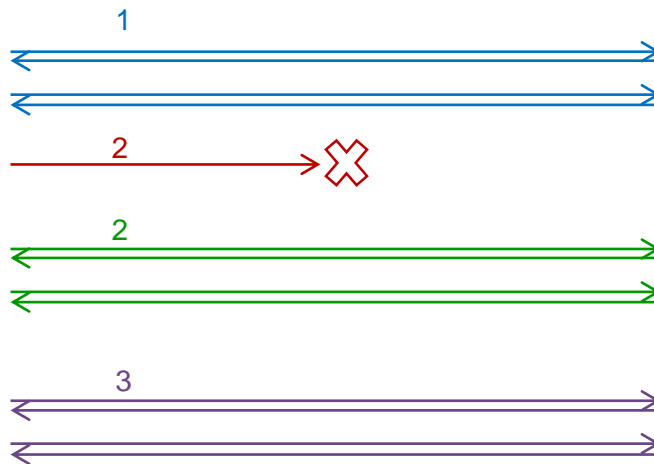
QoS 1 – at least once



QoS 2 – exactly once



QoS 2—exactly once

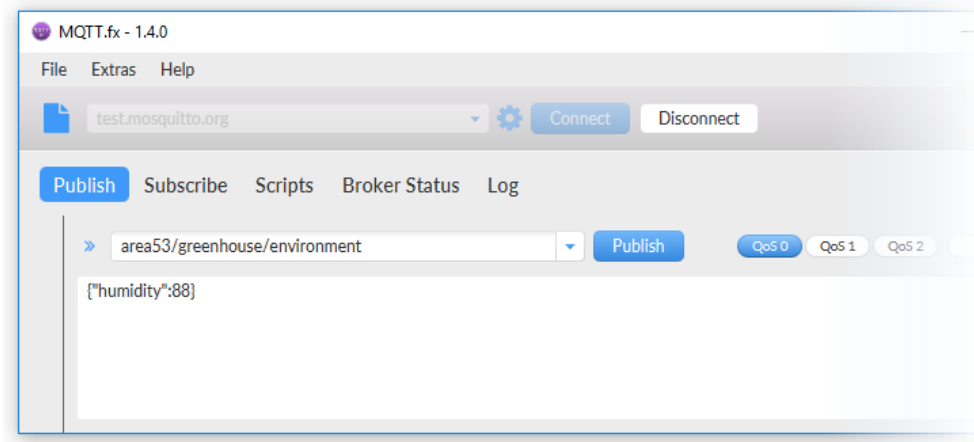


1 2 3

MQTT—Tips



- MQTT client
 - MQTT.fx
 - Linux, Mac, and Windows
 - <http://www.mqttfx.org/>
- MQTT broker
 - test.mosquitto.org
 - Linux, Mac, and Windows
 - Install your own MQTT broker
 - <https://mosquitto.org/download/>
- Use port 1883 for open and 8883 for encrypted data transfer (TLS 1.2/SSL)



LabVIEW MQTT APIs

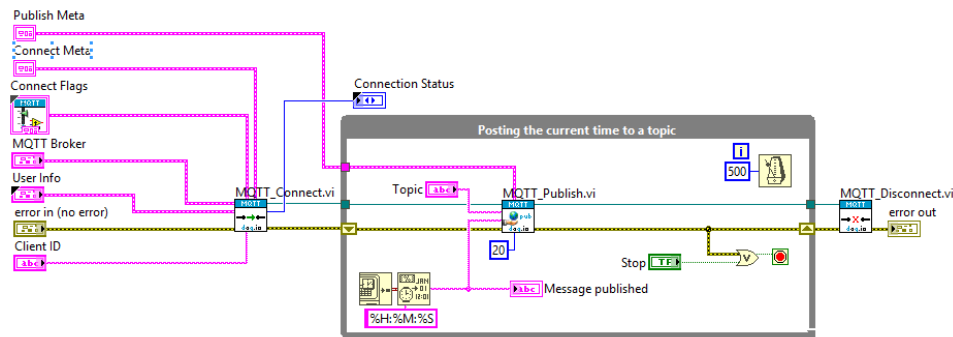


- Several public APIs:

- <https://github.com/DAQIO/LVMQTT>
- <https://github.com/Indie-Energy/AWS-IoT-RESTful>
- more

- LabVIEW Tools Network:

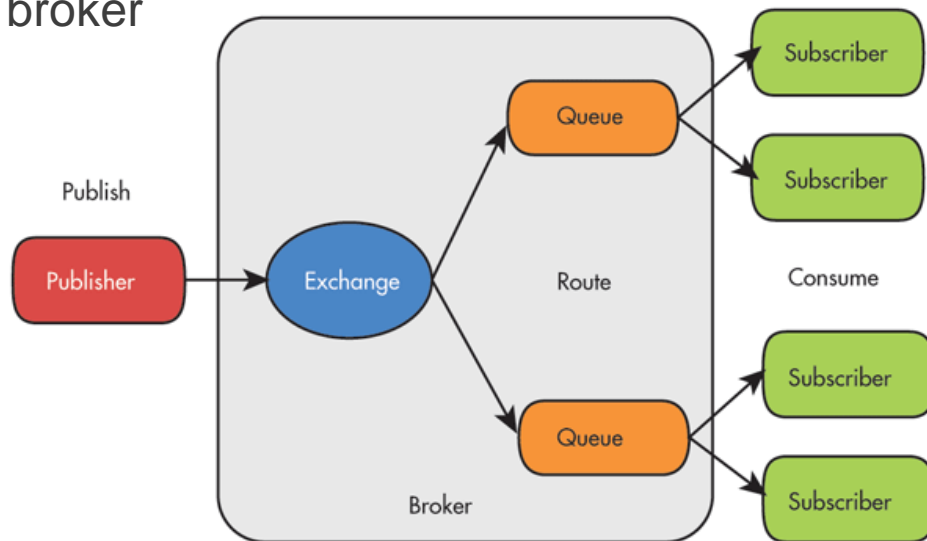
- [IOT Cloud Connector for LabVIEW by Etteplan](#)
 - SSL support on request
 - Focused on use with IBM Watson IoT for Bluemix
- [Wirequeue MQTT by WireFlow](#)
 - Broker runs on WireFlow servers
 - SSL support



AMQP—Advanced Message Queuing Protocol



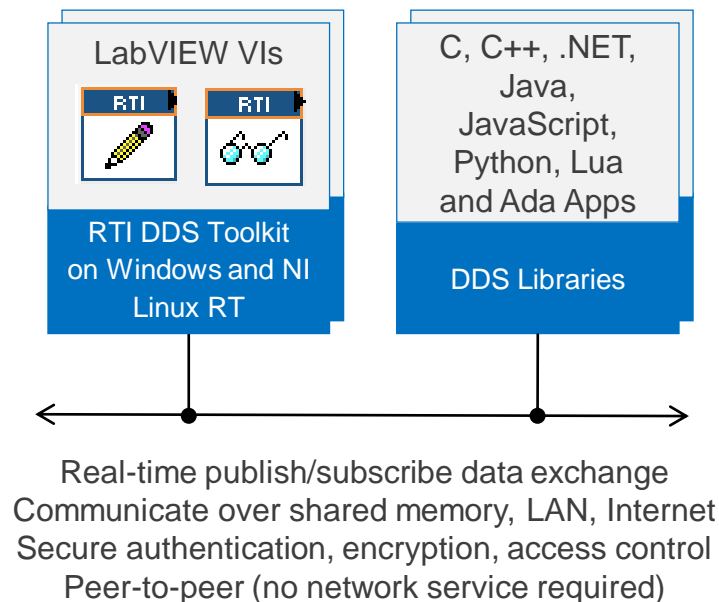
- Sends queues of data between servers
- Endpoints must acknowledge receiving data
- RabbitMQ—open source message broker
- LabVIEW APIs
 - LabbitMQ by Distrio
 - Github AMQP implementation



DDS—Data Distribution Service



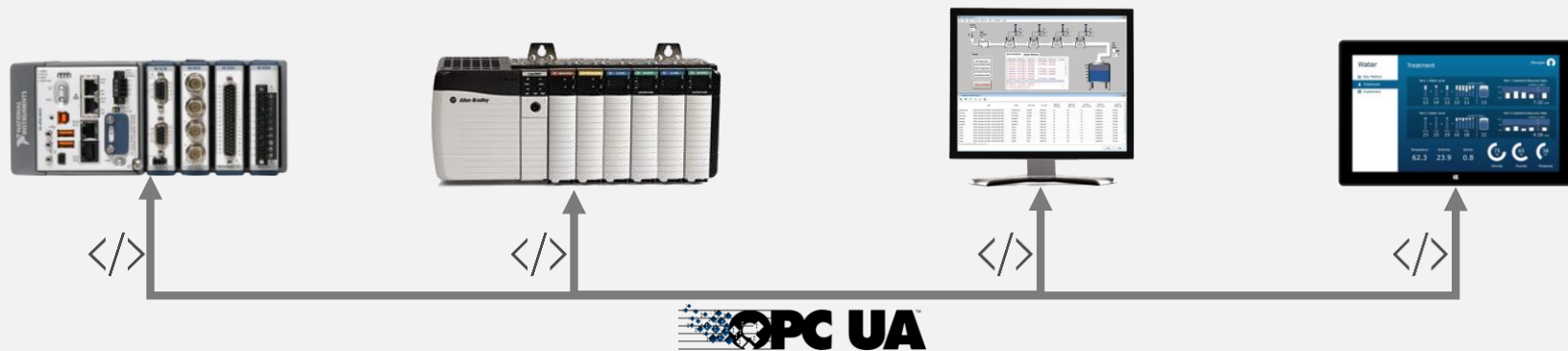
- Publish/subscribe communication model for distributed systems
- Native LabVIEW API that supports Windows and NI Linux Real-Time systems
- DDS compliance—interoperates with C, C++, Java, and C#/.NET applications
- Set quality of service requirements—latency, throughput, and reliability
- Ability to scale to thousands of nodes and millions of data points
- **DDS Security** enables per-topic read/write access control



LabVIEW 2017 OPC UA Toolkit

Semantic Interoperability with Third-Party Industrial Automation Devices

- Develop secure, reliable communications with OPC UA
- Supported on both Windows and NI Linux Real Time targets
- Supported Facets:
 - Data Access (DA)—Data communication and information models
 - Historical Access (HA)—Management of archived data and annotations
 - Alarms and Conditions (AC)—Management of state-driven notifications



Popular IIoT Platforms

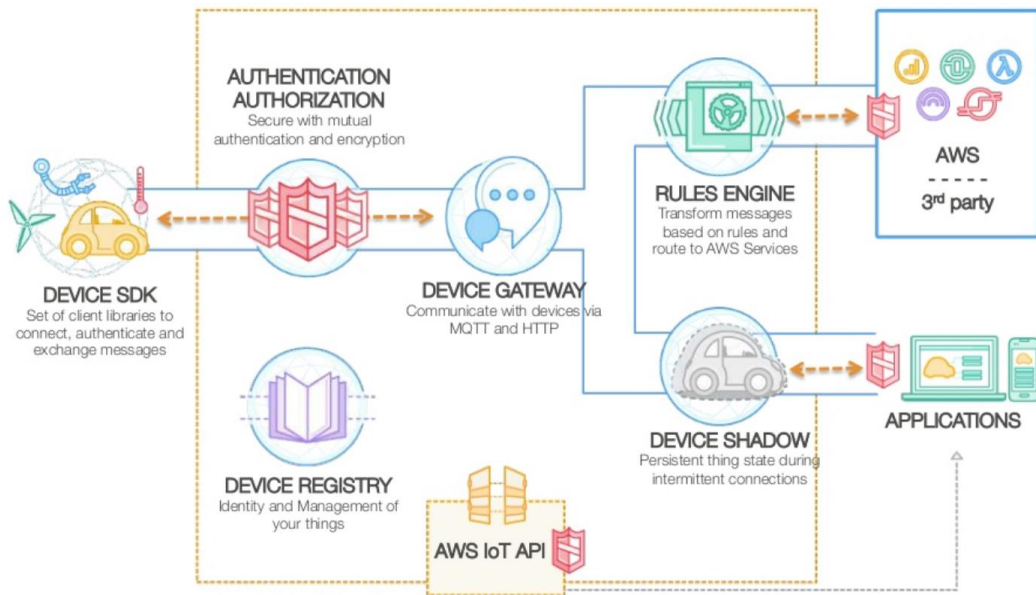
- Many platforms available
- Preference depends on
 - Service model (IaaS, PaaS, SaaS)
 - Company IT preferences
 - Experience
 - Capabilities and requirements
 - Cost model
 - And more



Connecting to Amazon Web Services IoT

Amazon Web Services (AWS)—IoT service

- Connect over MQTT
- Manage things
- Route messages to other services
- Debug
- <https://aws.amazon.com/iot/>

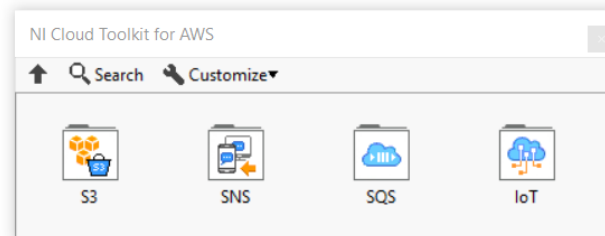
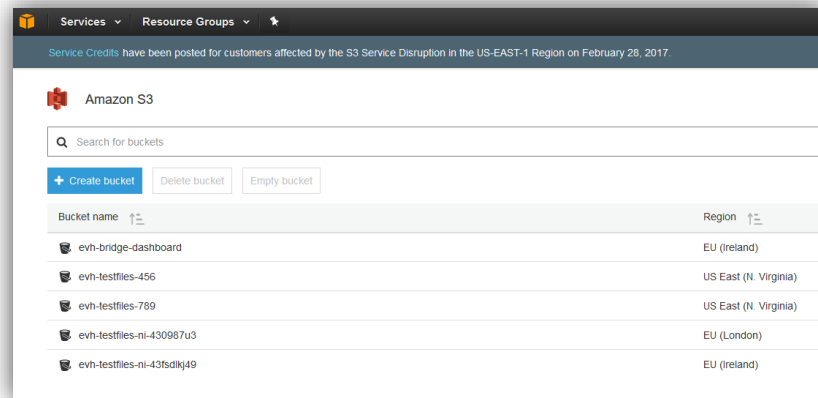


AWS IoT Rules and Services

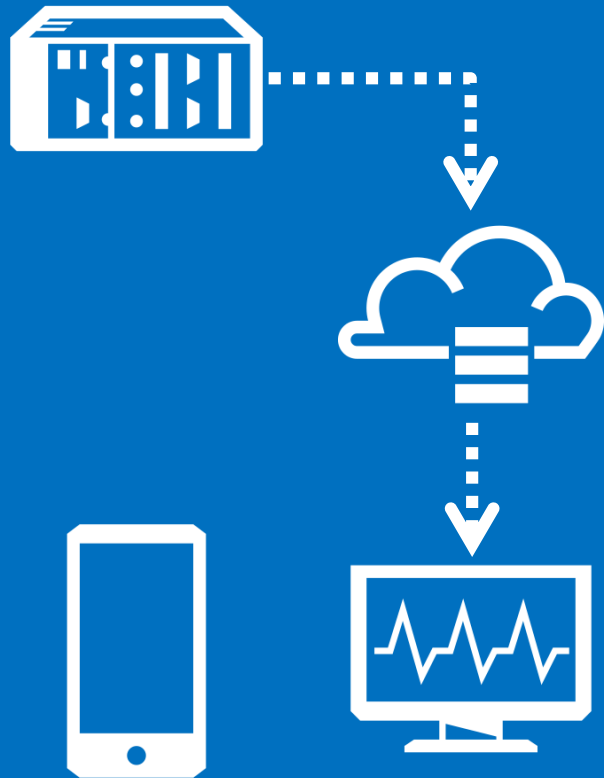


Amazon S3 Storage

- Simple Storage Service (S3)
 - Store and retrieve from anywhere
 - Store large files up to 5TB
 - S3 buckets (folders) and objects (files)
 - Regions
 - <https://aws.amazon.com/s3/>
-
- LabVIEW Cloud Toolkit for Amazon Web Services
 - HTTP and HTTPS
 - Large data uploads
 - Low-level VIs include source code
 - Run on desktop and real-time OS



DEMO



IoT Connections, Rules, and Monitoring

- Features
 - Amazon Web Services—IoT, DynamoDB, S3
 - MQTT
 - CompactRIO
- Requirements
 - Network connection
 - AWS account (free tier)
 - LabVIEW Cloud Toolkit for AWS

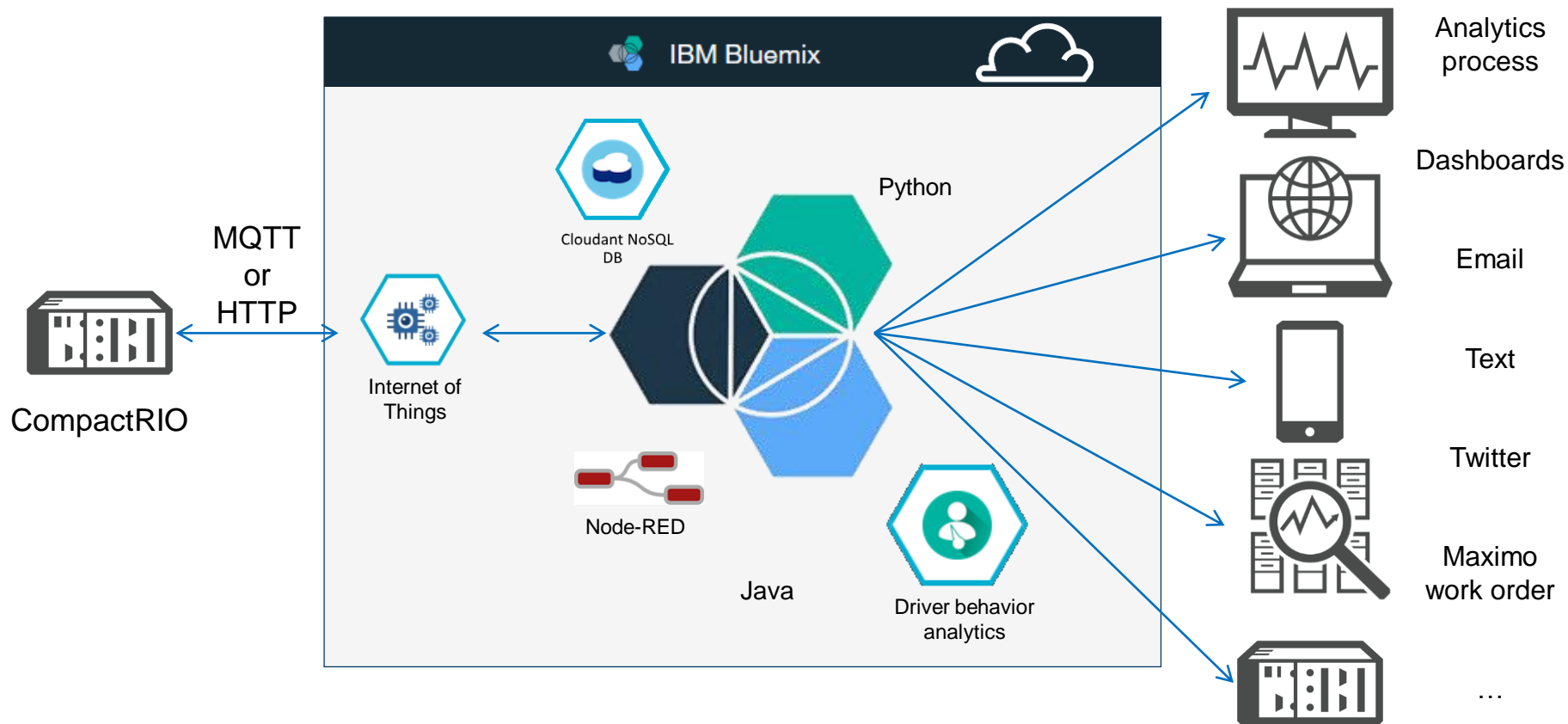
Connecting to IBM Watson IoT for Bluemix

IBM Watson IoT for Bluemix

- Build, run, deploy, and manage applications in the cloud
- Support for several programming languages
 - Java, Node.js, Python, PHP, Go, and so on
- Broad catalog of services
 - Data analytics, Watson, IoT, network, storage, and so on
- Communicate with devices via Watson IoT for Bluemix
- MQTT support
- <https://bluemix.net>



IBM Bluemix Concept



Connecting to PTC ThingWorx

PTC ThingWorx IoT Platform

- CAD industry
- Model-Based Design approach
- Things modeled in detail
- Connectivity:
 - REST API
 - Edge microserver
 - Device SDK
 - Kepware
 - AWS IoT
- LabVIEW Rest API available

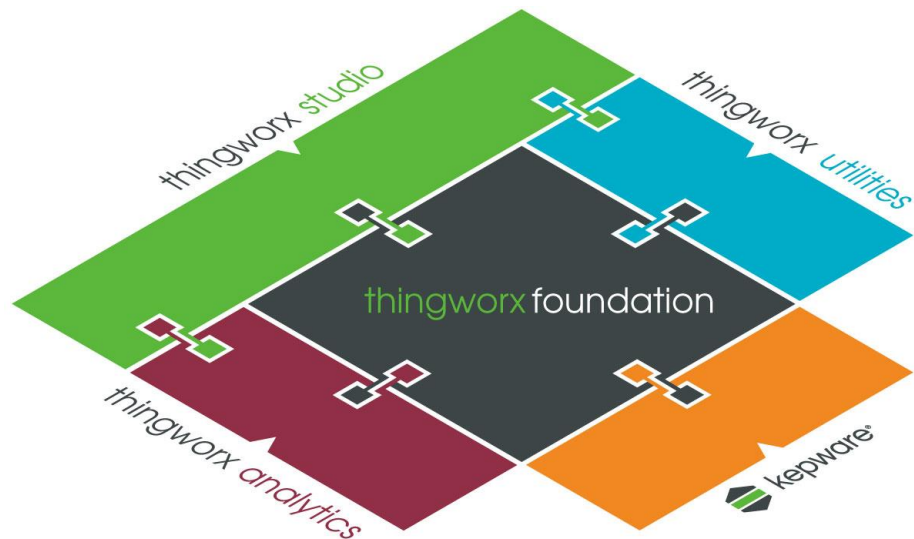
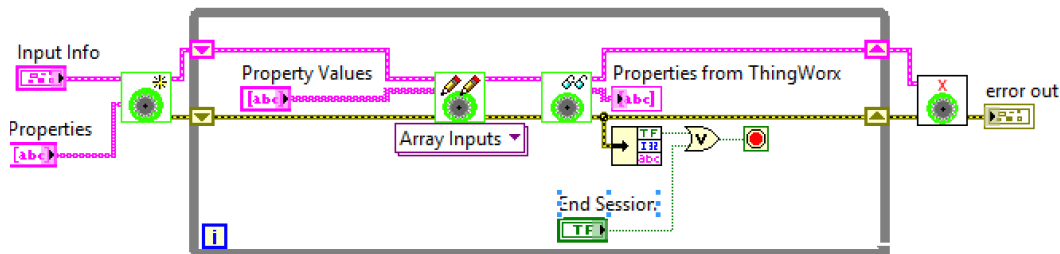
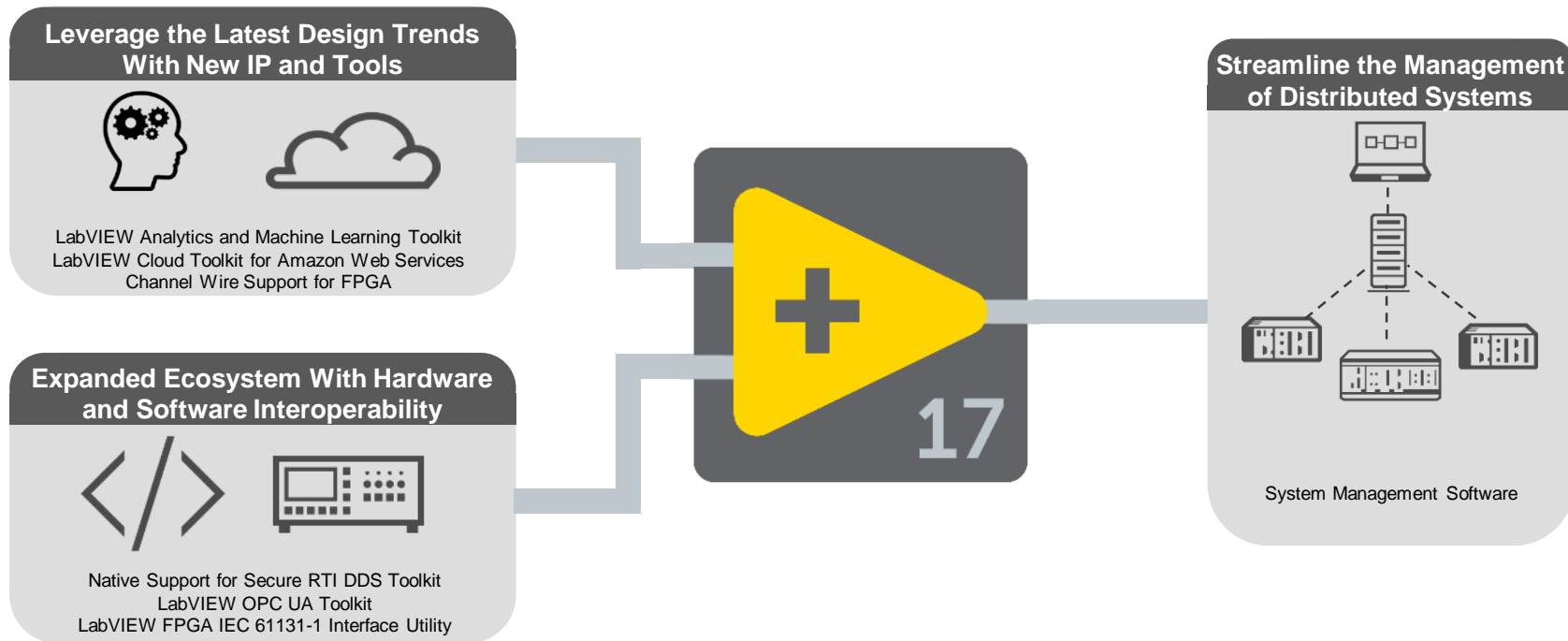


Image source: PTC



LabVIEW 2017

Complex applications. Distributed systems. Streamlined development.



SystemLink™—Product Overview

Manage distributed systems with software that provides mass coordination of device management, software deployment, and data transfer.

Web Application

Browser-Based: PC, Mac, Tablet

Systems Manager

NATIONAL
INSTRUMENTS

Dashboard

Managed Systems

Groups

History

Software

Restart

More

Name

IP Address

Model Name

Operating System

Serial Number

Connection

Monitoring Systems (4)

Ni-cRIO-9068-190CB7B

10.2.74.64

cRIO-9068

NILinuxRT 4.1

190CB7B

Connected

Ni-cRIO-9068-190D5D5

10.2.74.67

cRIO-9068

NILinuxRT 4.1

190D5D5

Connected

Ni-cRIO-9068-190D673

10.2.74.65

cRIO-9068

NILinuxRT 4.1

190D673

Connected

Ni-cRIO-9068-190DFD5

10.2.74.66

cRIO-9068

NILinuxRT 4.1

190DFD5

Connected

Test Systems (2)

PXIe-8840Quad-1

10.2.74.79

NI PXIe-8840 Quad-Core

Windows 7

030E1626

Connected

PXIe-8840Quad-2

10.2.74.80

NI PXIe-8840 Quad-Core

Windows 7

030D0B85

Connected



Server

Windows PC or Server



System and Data Security
User Authentication
Data Processing

Managed Systems

Windows and NI Linux® Real-Time



CompactRIO



CompactRIO



PXI



PXI

PRODUCT FEATURES

SOFTWARE DEPLOYMENT

- Mass deploy software to multiple remote hardware nodes
- Create and manage deployment packages for LabVIEW apps and non-NI software

DEVICE MANAGEMENT

- View and configure device settings; perform diagnostics such as restart and self-test
- Classify systems according to operational context

DATA TRANSFER SERVICES

- Automate data transfer using LabVIEW and Web APIs
- Use data viewers to administer data transferred from targets

Summary

- MQTT
 - Most common IIoT communication protocol for device to server
 - Feature extraction
 - MQTT through GitHub or native HTTP calls
- LabVIEW 2017
 - Cloud Toolkit for Amazon Web Services
 - RTI DDS Toolkit
 - Data storage to cloud
- NI's continual investment in IIoT technologies
- Resources:
 - White paper [A Practical Guide for Connecting LabVIEW to the Industrial IoT](#)
 - Examples in cloud toolkit

Desideri essere ricontattato dal personale NI?
Compila la contact card e inseriscila in una delle apposite teche oppure consegnala al personale presente in reception.

Please add your name, check your request and give it to the event staff:

Company: Full Name:
Mobile Phone: Email:

Need a call, visit, quote or solution?

☐ Call ☐ Visit ☐ Quote ☐ Solution

Notes: Please leave your comments or specific requirements here, thanks!

If filled out by the customer: I have been informed about and I agree to the processing (including transfer to the US) of my data by National Instruments for the purposes and under the circumstances detailed in NI's Privacy Statement (that I consulted or the content of which I was informed about). I understand that upon submitting my data I will receive periodic emails about products, events and trainings and that I can change my e-mail settings at ni.com/myni at any time.

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Cloud Data Storage

Using Amazon Web Services (AWS) S3