



ENGINEER  
NEXT

NIDays

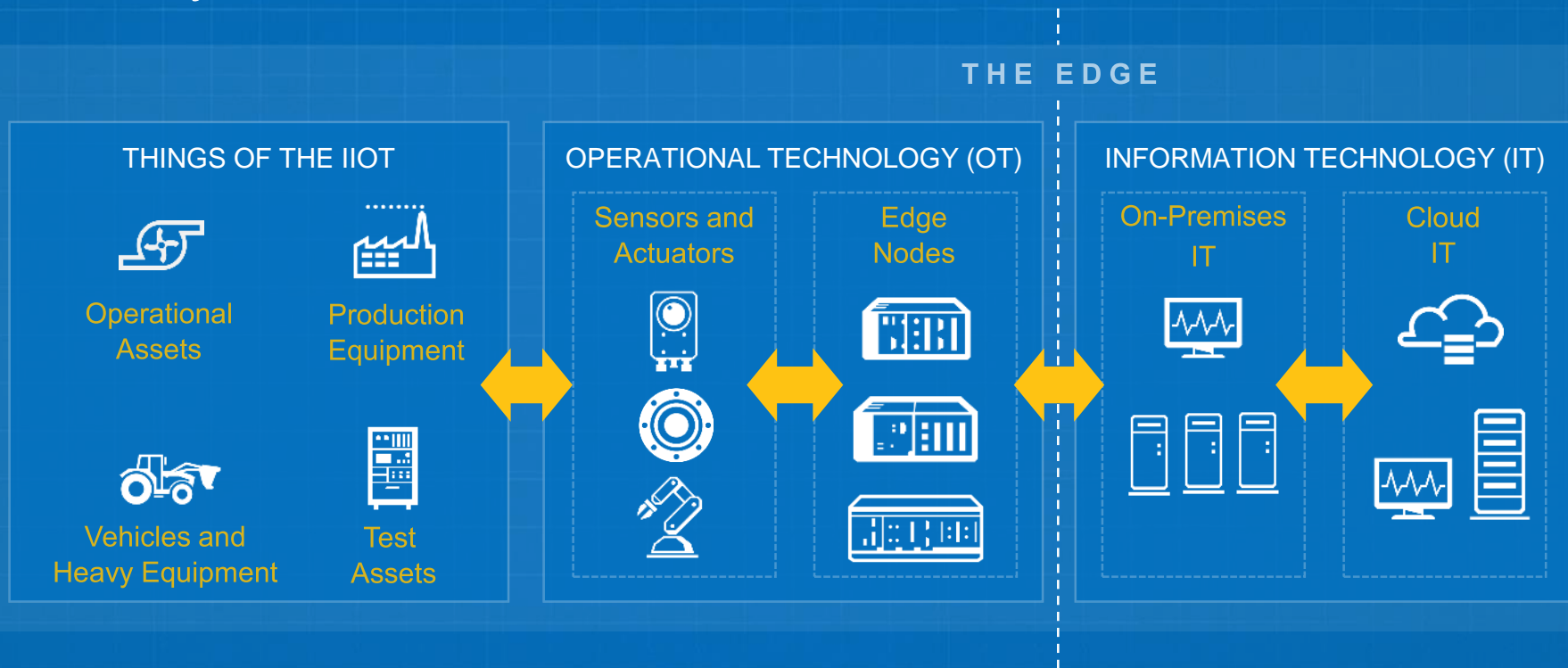
The logo features the words "ENGINEER" and "NEXT" in a bold, white, sans-serif font, stacked vertically. A yellow graphic element, resembling a stylized 'X' or a folded ribbon, is positioned between the two words. To the left of this text, the word "NIDays" is written in a smaller, white, sans-serif font, enclosed within a white rectangular border. The entire logo is set against a blue background with diagonal stripes in various shades of blue, orange, and green.

# Considérations d'ordre pratique pour associer LabVIEW aux plates-formes de l'Internet industriel

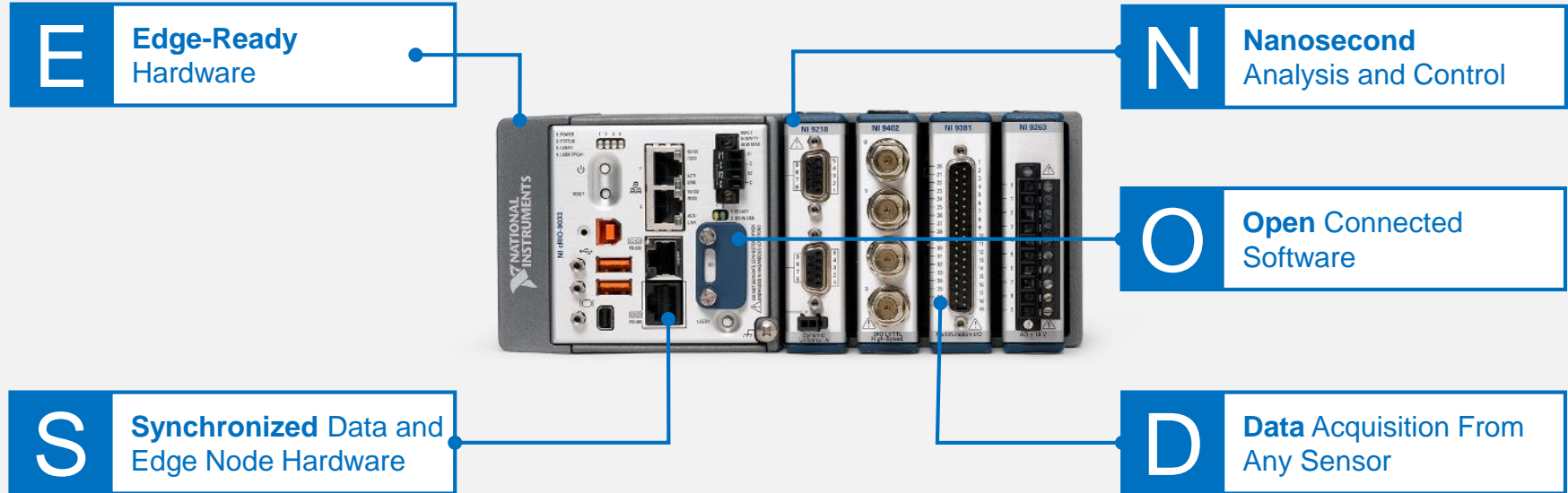
# Today's Agenda

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

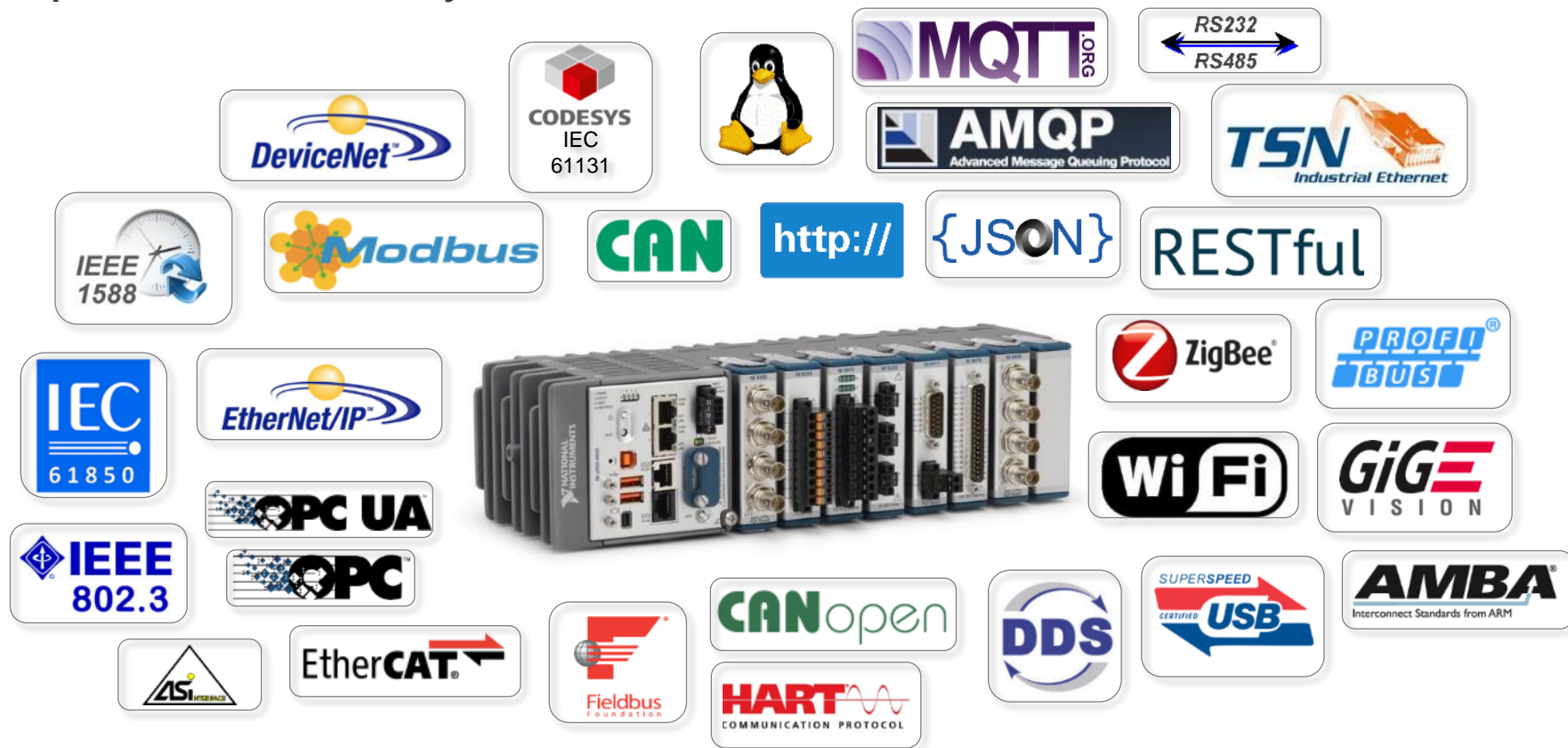
# IIoT System Architecture



# The NI Edge Node Advantage



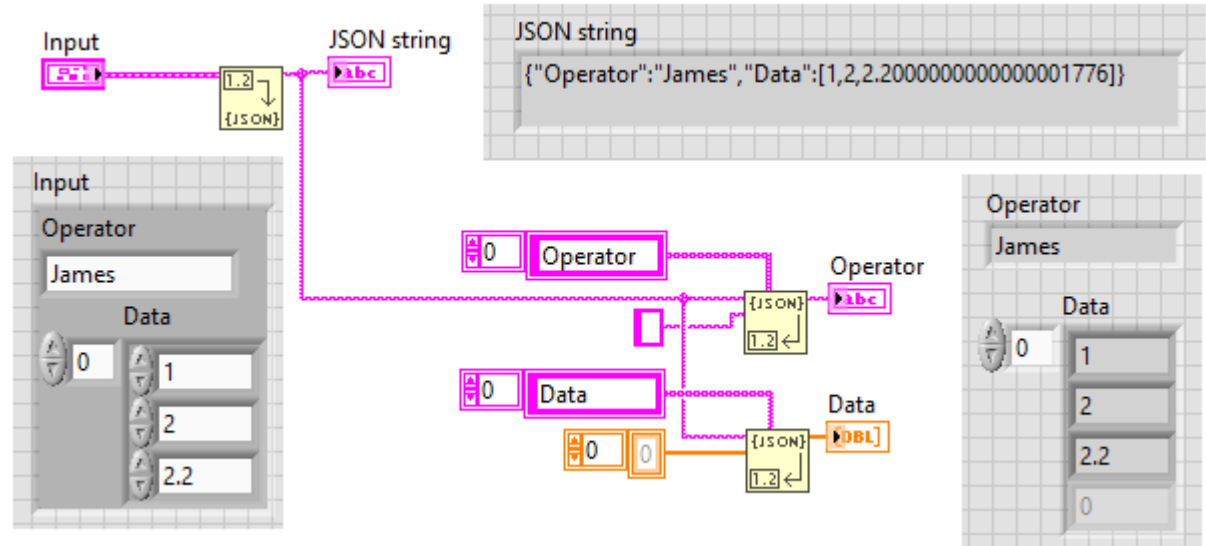
# Open Connectivity to OT *and* IT





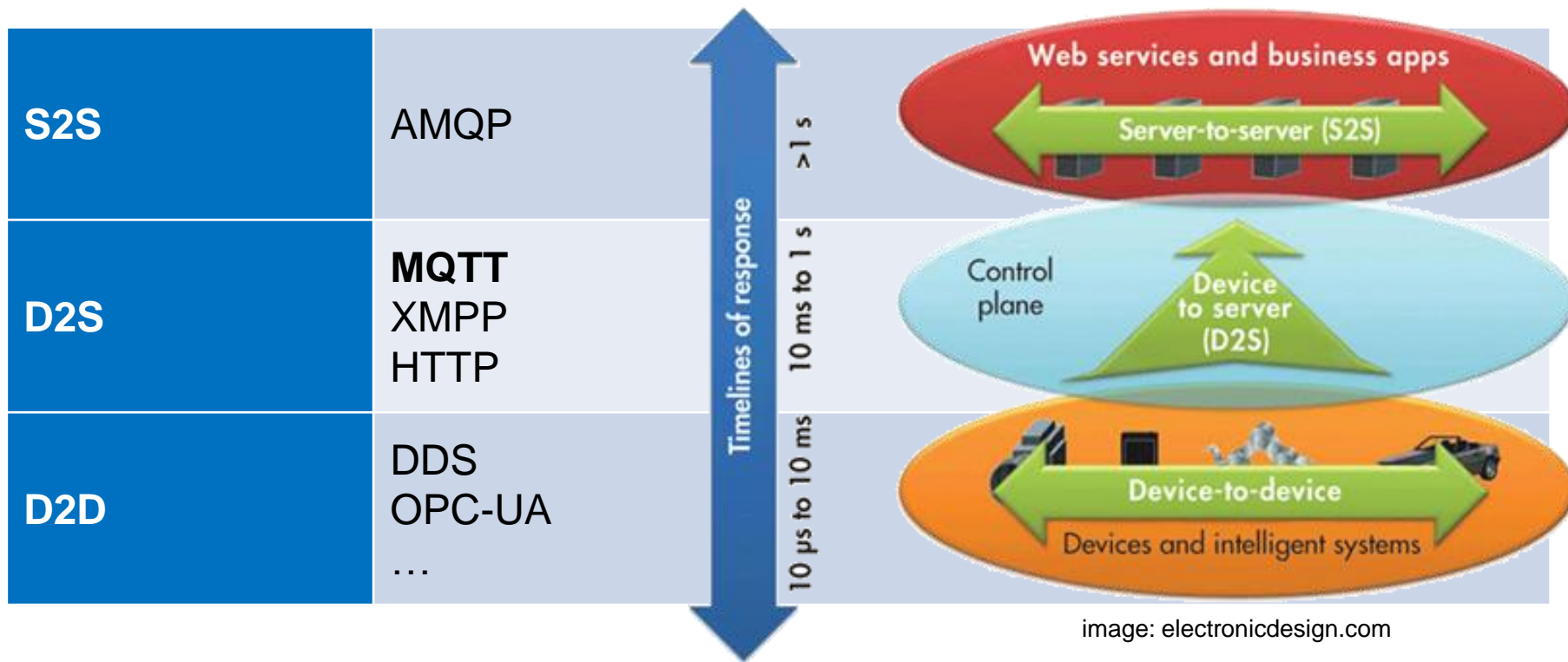
# JSON—JavaScript Object Notation

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





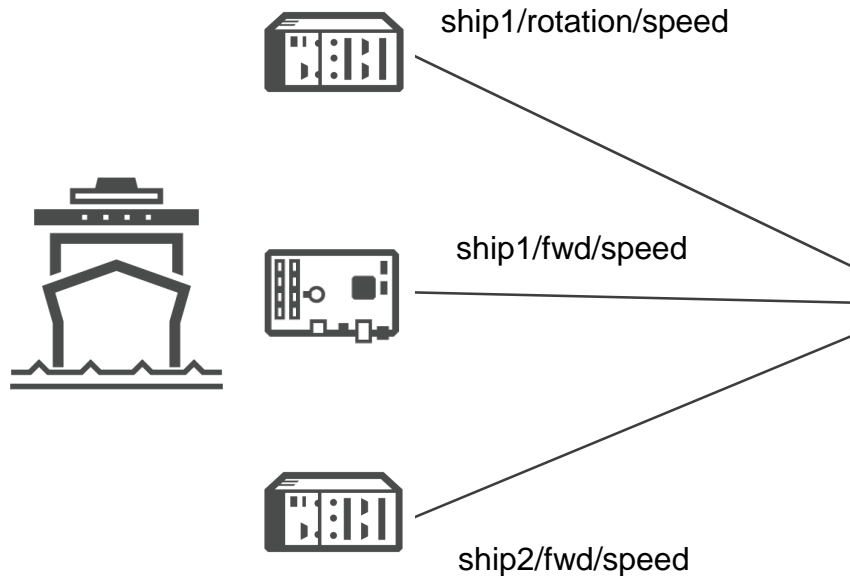
# Common IIoT Protocols



# MQTT—Message Queue Telemetry Transport



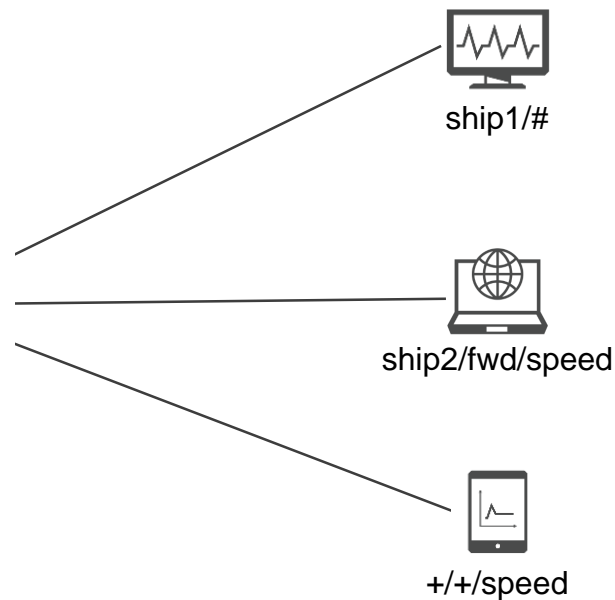
## MQTT publishers



## MQTT broker



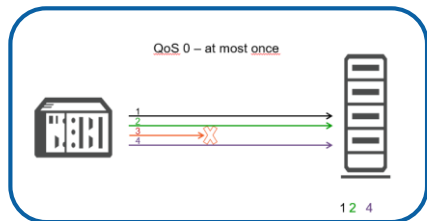
## MQTT subscribers



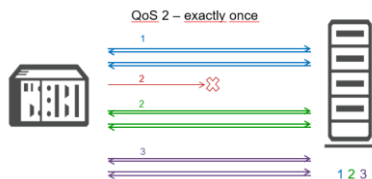
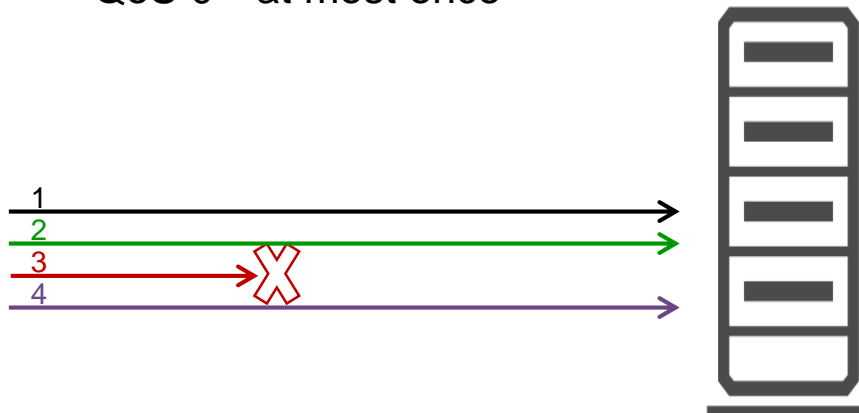
topic = "device/path/topic"



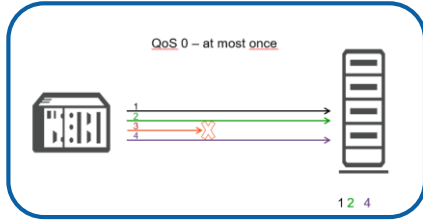
# MQTT—Quality of Service (QoS)



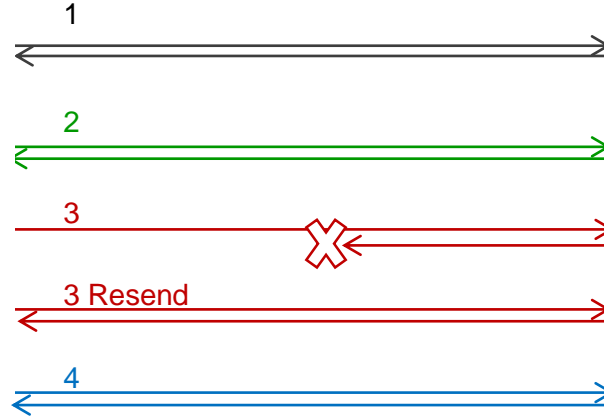
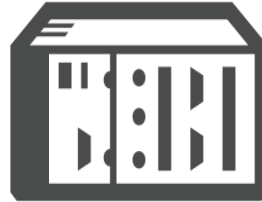
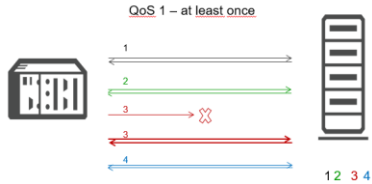
QoS 0—at most once



# MQTT—Quality of Service (QoS)



## QoS 1—at least once

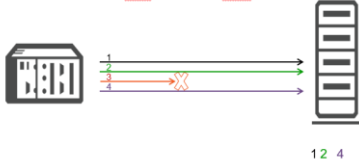


1 2 3 3 4

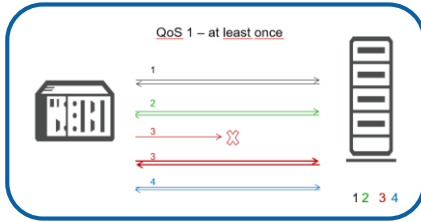
# MQTT—Quality of Service (QoS)



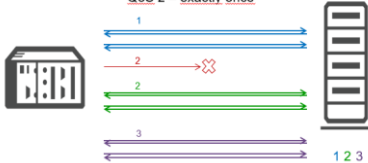
QoS 0 – at most once



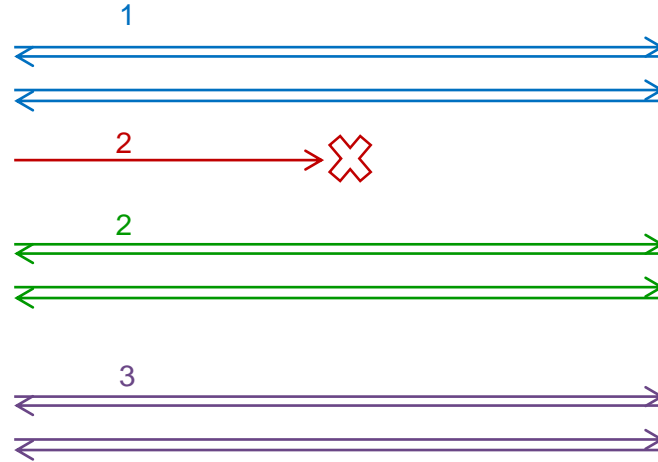
QoS 1 – at least once



QoS 2 – exactly once



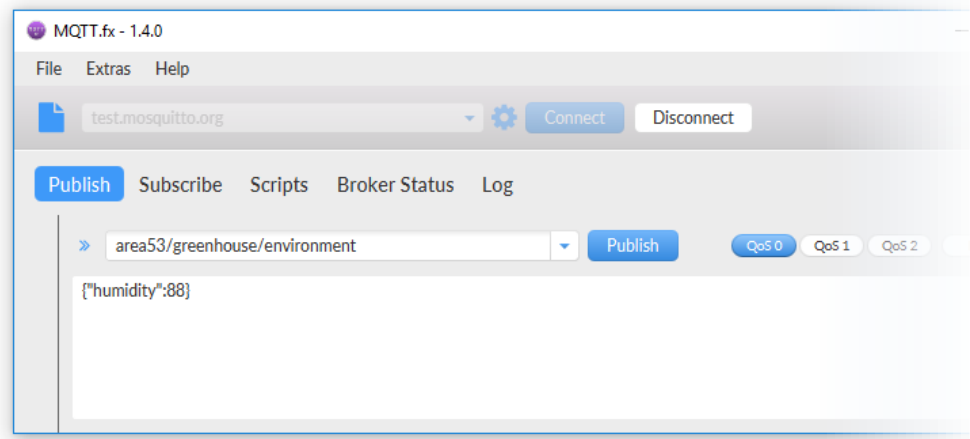
QoS 2—exactly once



# 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

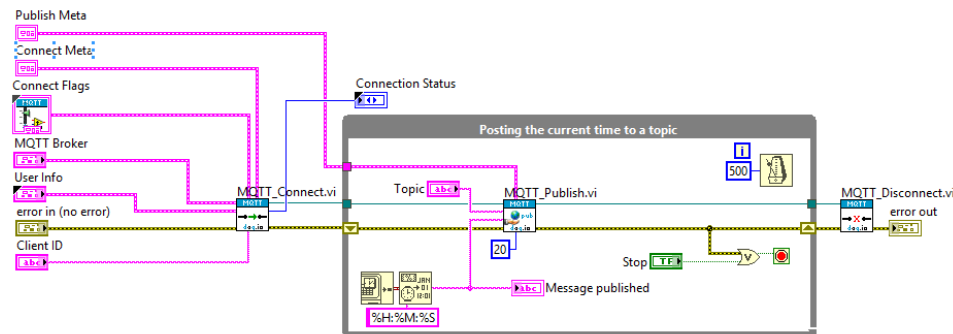


- Several public APIs:

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

- LabVIEW Tools Network:

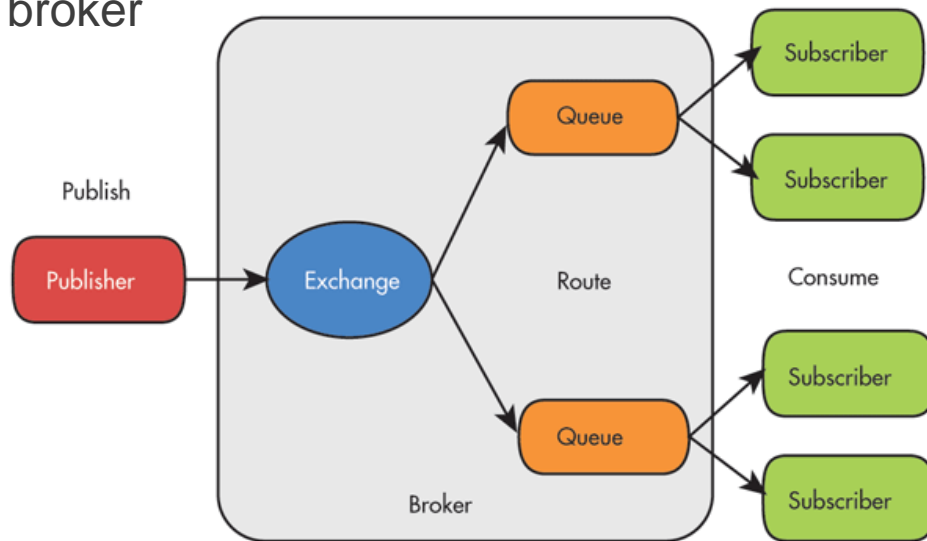
- [IOT Cloud Connector for LabVIEW by Etteplan](#)
  - SSL support on request
  - Focused on use with IBM Watson IoT for Bluemix
- [Wirequeue MQTT by WireFlow](#)
  - Broker runs on WireFlow servers
  - SSL support



# 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

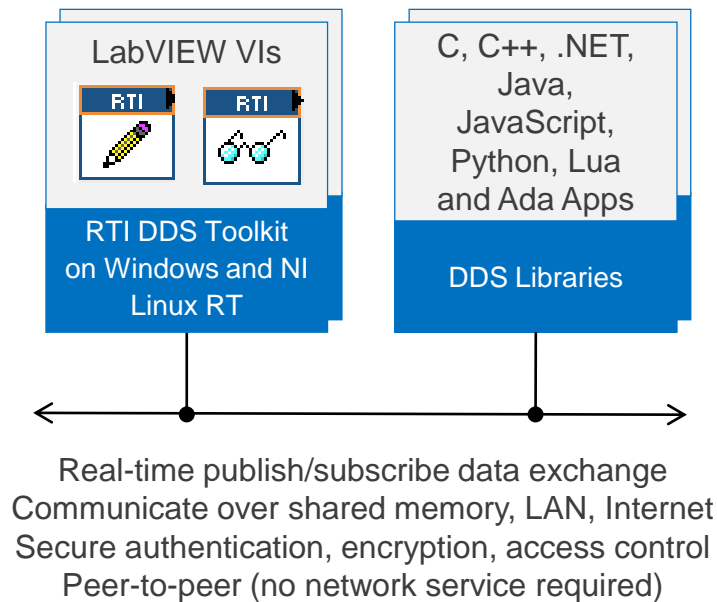




# DDS—Data Distribution Service



- 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



# Popular IIoT Platforms

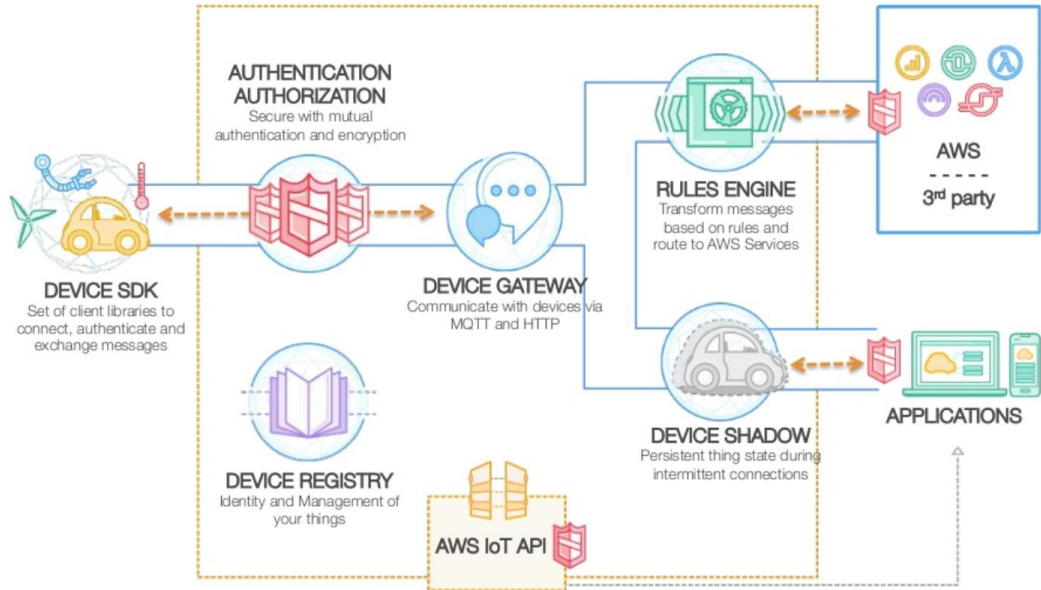
- Many platforms available
- Preference depends on
  - Service model (IaaS, PaaS, SaaS)
  - Company IT preferences
  - Experience
  - Capabilities and requirements
  - Cost model
  - And more



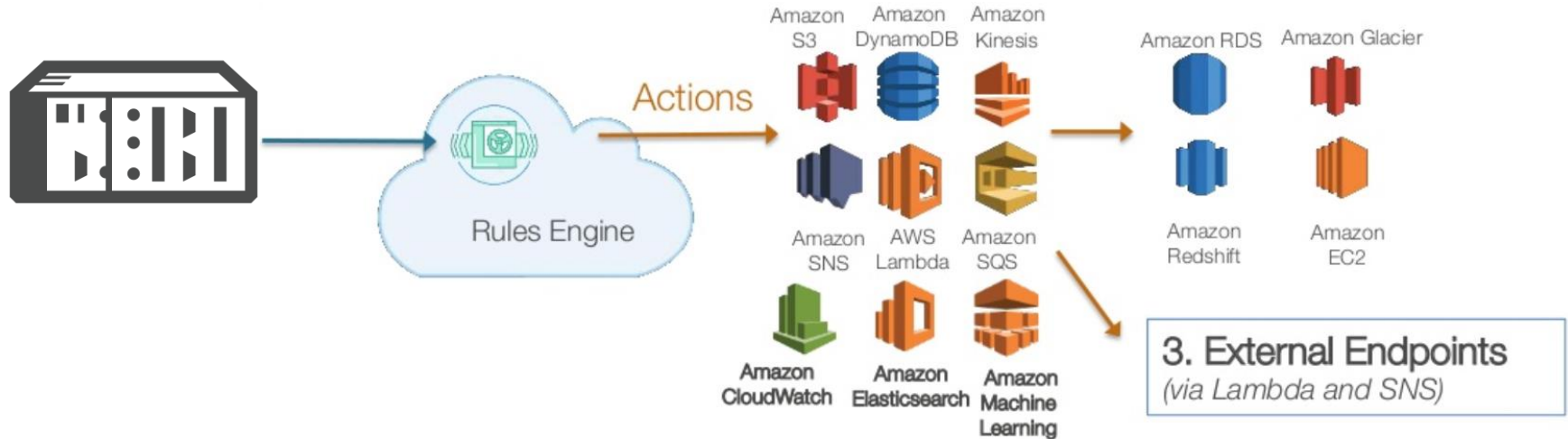
# Connecting to Amazon Web Services IoT

# Amazon Web Services (AWS)—IoT service

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

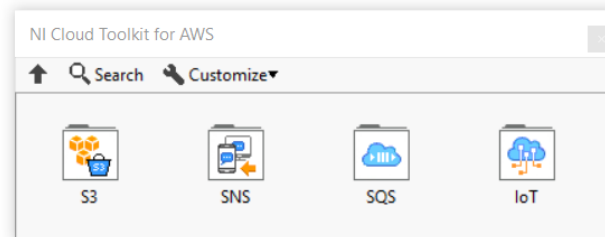
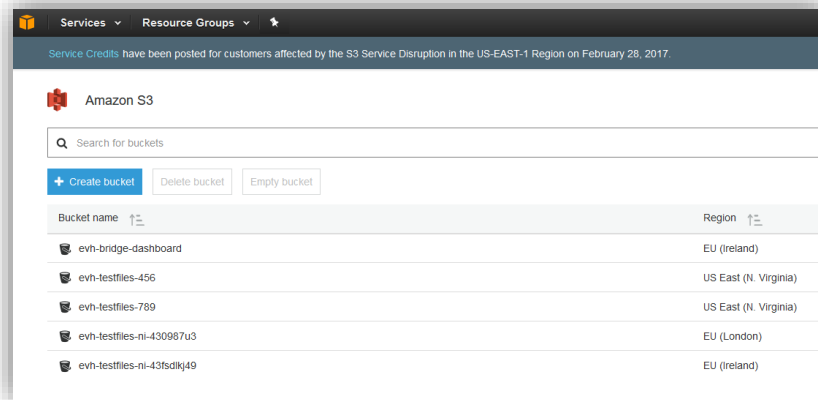


# AWS IoT Rules and Services



# 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

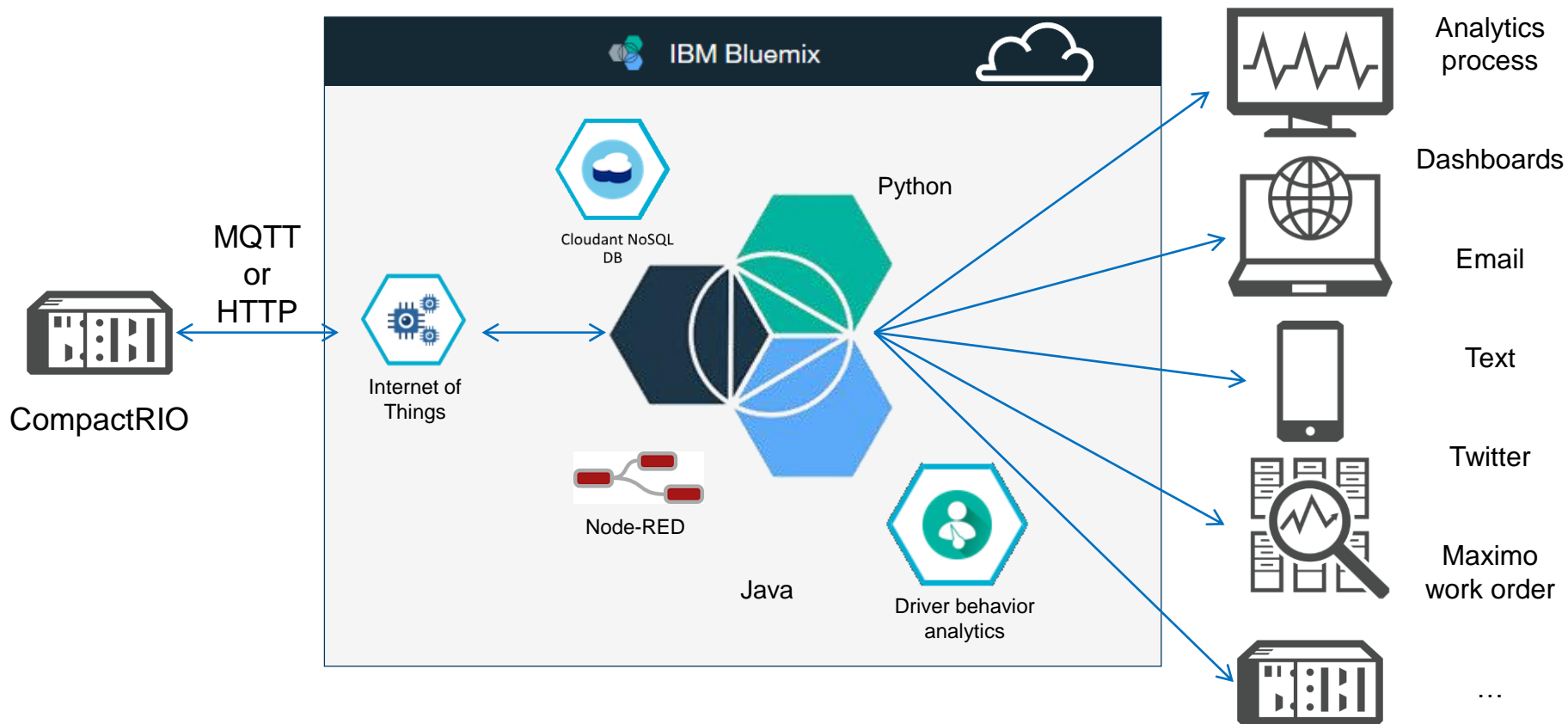


# IBM Watson IoT for Bluemix

- 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

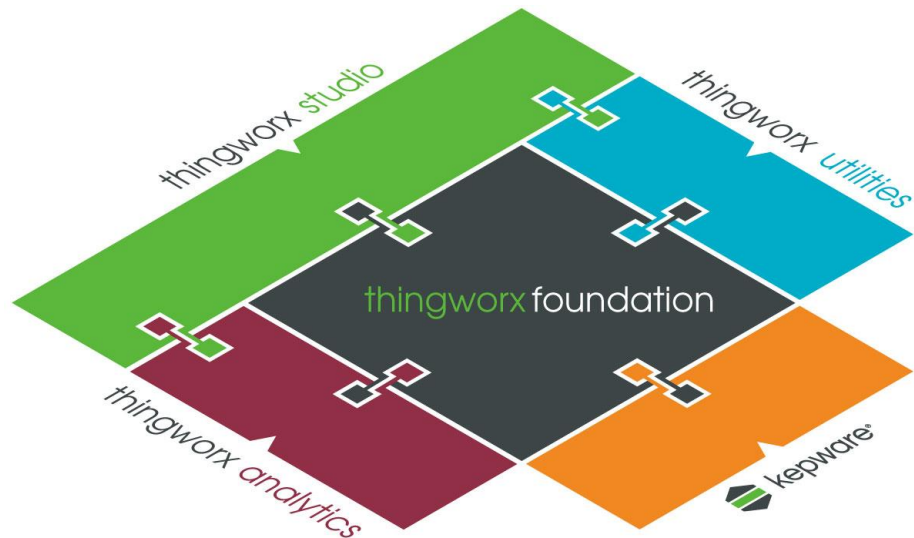
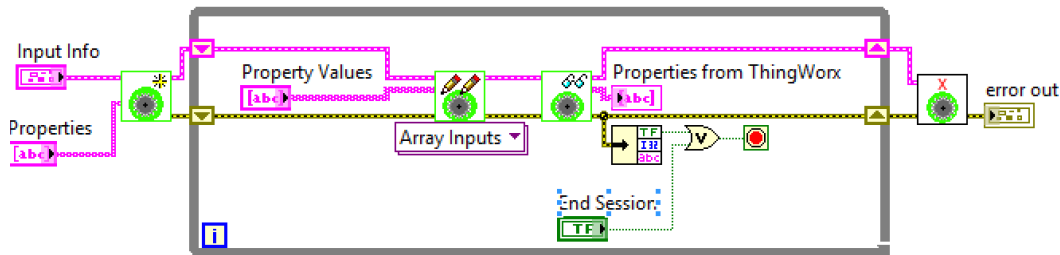
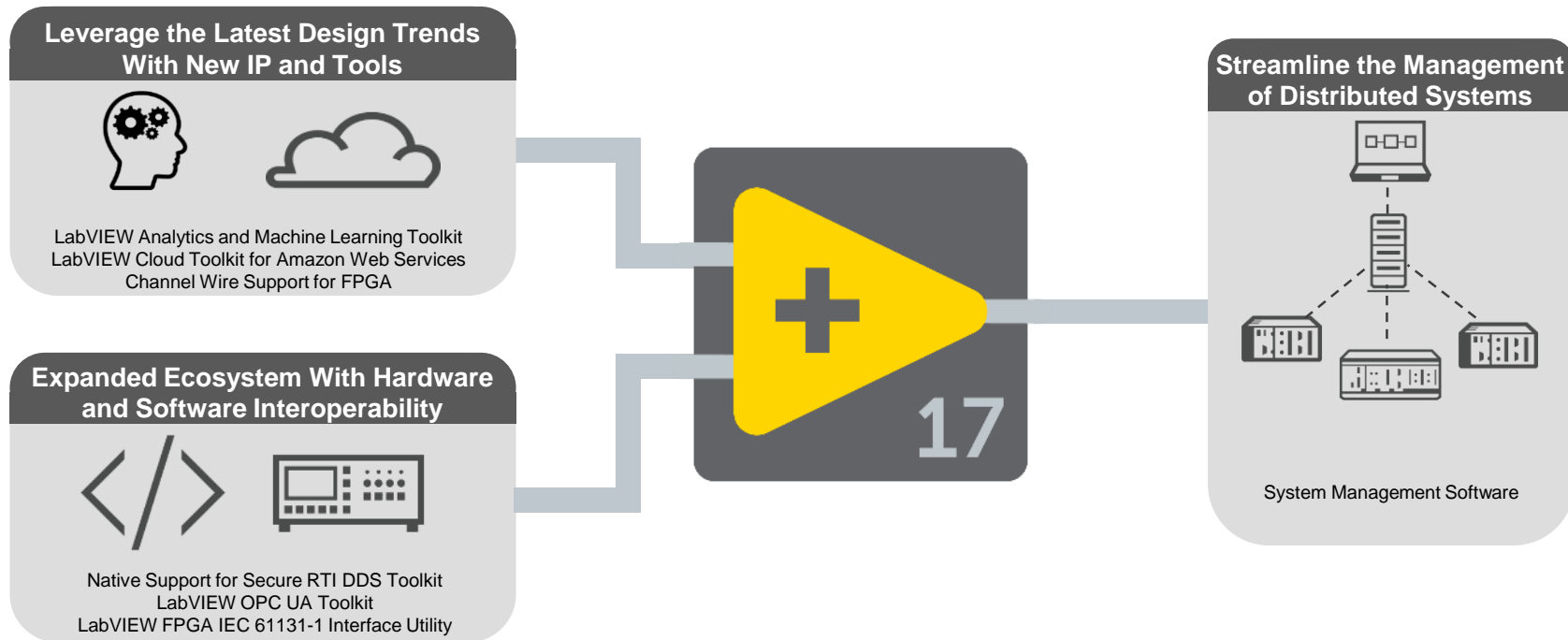


Image source: PTC



# 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

<input type="checkbox"/>	Name ↑	IP Address	Model Name	Operating System	Serial Number	Connection
<input type="checkbox"/>	Monitoring Systems (4)					
<input type="checkbox"/>	 Ni-cRIO-9068-190C87B	10.2.74.64	cRIO-9068	NILinuxRT 4.1	190C87B	Connected
<input type="checkbox"/>	 Ni-cRIO-9068-190D5D5	10.2.74.67	cRIO-9068	NILinuxRT 4.1	190D5D5	Connected
<input type="checkbox"/>	 Ni-cRIO-9068-190D673	10.2.74.65	cRIO-9068	NILinuxRT 4.1	190D673	Connected
<input type="checkbox"/>	 Ni-cRIO-9068-190FDF5	10.2.74.66	cRIO-9068	NILinuxRT 4.1	190FDF5	Connected
<input type="checkbox"/>	Test Systems (2)					
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<input type="checkbox"/>	 PXIe-8840Quad-2	10.2.74.80	NI PXIe-8840 Quad-Core	Windows 7	030D0B85	Connected



## Server

Windows PC or Server

## Managed Systems

Windows and NI Linux® Real-Time



System and Data Security  
User Authentication  
Data Processing



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

## Stay Connected



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# Cloud Data Storage

## Using Amazon Web Services (AWS) S3