Evolution of the Internet of Things (IoT) for NDT Applications

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Management Session II
February 15, 2018
Today’s Agenda:

1. What is the IoT?
2. Examples of real-world apps
3. Inspection / NDT apps
4. Conclusions
But first a “Thank you” to:

- Hugh Doran (MQS)
- George Moran & Tony Sansavera

Contributors:
- LinkLabs
- Libelium
- Olympus Corp.
- Mistras Group

Mr. Jim Treat for ……. 
Internet: Created, as ARPANET in 1971 by US DoD.

Internet’s First Wave:
- 1985 - 1999
  - Email (AOL), basic websites.

Second Wave:
- 2000 – 2015
  - Google Search
  - Ecommerce, apps & mobility

Third Wave:
- > 2016
  - Internet of Things – IoT
  - A tsunami by comparison due to distribution of “things” with many smaller players
IoT

THING

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## IoT Steps

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<td>UT Thickness</td>
<td>25% HW/75% SW</td>
<td>25% HW/75% SW</td>
<td>Raw Data / Predict</td>
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<td>Other UT</td>
<td>Zigbee</td>
<td>DCS</td>
<td>Hierarchy / Alarm</td>
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<td>Acoustic / AE</td>
<td>Wifi</td>
<td>Cell</td>
<td>Image / Control</td>
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<td>Other NDT</td>
<td>Custom</td>
<td>Cloud</td>
<td>Process Variable / Knowledge</td>
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<td>Vibration</td>
<td>WiHART</td>
<td>Security</td>
<td>KPIs / Closed-loop</td>
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<td>Location GPS</td>
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<td>Micro-GPS</td>
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<td>Radiation</td>
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<td>Temp</td>
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<td>Pressure</td>
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<td>InfraRed</td>
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<tr>
<td>Position</td>
<td>Low power</td>
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<td>Proximity</td>
<td>Long range</td>
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<td>Current / CP</td>
<td>Bandwidth</td>
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<td>Acoustic / Tank</td>
<td>Low cost</td>
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<td>Air / Hazard</td>
<td>Small size</td>
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<td>On / Off</td>
<td>Integrated with sensor</td>
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<td>Hydrocarbons</td>
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IoT Connectivity : Asset to Desktop

IoT is mainly about continuous data feeds and global access while leveraging the ubiquitous and essentially free backbone of the Internet!
Many IoT apps serving all segments
What is the Olympus Scientific Cloud?

- Device Location
- Enhancements to the performance of Olympus Scientific Products
- Device Information / Fleet Management
- Software Updates And Better Support
- Inspection Data Management
- Collaboration Tools
Remote Acoustic Emission Monitoring of a Bridge through the internet

Acoustic Emission Instrument

Bridge inspector mobile devices

Internet

Bridge operators and administrators
Remote Ultrasonic Thickness Monitoring with IIOT

Plant Personnel Displays

Calculations, Corrosion Rate, RBI, etc.

Gateway

Plant View, & Corporate Asset Dashboards

Programed to turn on/off at any user interval.

Long-life, lithium batteries can last for >5 yrs.
LoRa is a Long-Range, Industrial IoT wireless protocol (900 MHz). Low-power, low-cost w’ small footprint and a range of > 1 mile.
Web Portal as common back end

A cloud-based web portal can be used to:
- Compile, archive, analyze & trend
- Allow easy access across an organization
- Push software updates to multiple devices
Network-distributed Ultrasound: 3 into 1

Multiple network connectivity schemes, including manually-collected data can all be stored and accessed in one common secure portal.
CASE STUDY: Manual vs. Installed Sensor Data

Manual UT Results
Precise: No  |  Accurate: Maybe  |  Repeatable: No
Corrosion Rate: Undiscernible
6 readings x $75/CML = $450 for 1 yr

Installed Sensor Results
Precise: Yes  |  Accurate: 0.001" (1 mil)  |  Repeatable: Yes
Corrosion Rate: ~20mpy (~10mils loss in Sept-Oct)
6 readings x $75/CML = $450 for 1 yr

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INSTALLATIONS

**LT Singles**
- Temporary: Stopaq (up to 150F/65C)
- Permanent: Epoxy (up to 150F/65C)
- Each probe can be mounted using magnetic housing, strap, or band
- Insulate over top or buried

**Mid Range Duals**
- Temporary: Stopaq (up to 200F/93C)
- Permanent: Epoxy (up to 300F/150C)
- Each probe can be mounted using magnetic housing, strap, or band
- Insulate over top or buried

**HT Singles**
- Temporary OR permanent: Dry couple using foil, probe housing & band clamp
- Temperature ranges: -40°F-900°F/480°C
CASE STUDY

Pipeline Integrity | Liquid Line

Operator performed ILI using a smart pig to inspect a segment of their crude oil pipeline.

The ILI report showed a number of pits which were not present the last time the ILI was completed.

The operator wanted to know if the pits were episodic in nature or were growing (if so, at what rate

Application
Asset integrity post inspection
ILI run was performed, DA is executed, inspection company evaluated and marked pits
SNI installed probes on exact pits called out by inspection

Product Used
smartPIMS Modbus configuration w/ 8 dual element probes permanently attached to monitor pits
smartPIMS systems are completely buried after DA is complete
Operator will send personnel to defined locations quarterly to collect data w/ tablet

Outcome
Operator did NOT have to fix / repair, kept line running and continue normal ILI inspection intervals
Saved $750K material/labor & ZERO downtime
**Low-spot Pit Tracking™**  
With 3 mm-beam spot size

**Vessel Monitoring**  
Sulfuric Acid Alkylation unit routine inspection discovered significant pitting which was near T-min

Operator was sending UT technicians daily to map low spots to determine rate they were thinning

Was costly, putting inspection group behind schedule, and readings were not consistent/reliable operator to operator

**smartPIMS Cellular**  
8 temporarily installed dual element probes

Readings once every four hours

Installation took two hours

**Outcome**  
Saved >$100K in inspection  |  Kept unit safely operating until scheduled shut down  |  Was able to redeploy smartPIM equipment on different asset
IoT is evolving quickly.

Embrace it for your business.

Thank you for attending this session of NDTMA’s 2018 Annual Conference