IoT Standards and Protocols

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Agenda



Characteristics

- Everyday objects with embedded technology to sense, connect, and communicate.
- Empowered by:
 - Sensors, cheap and accessible compute power (microcontrollers), ubiquitous connectivity, networking and internet protocols.
- Transforms isolated, passive things to connected things with compute power.
- Collaborate to enable ground breaking applications.

More Characteristics



Fundamental parts for IoT

Devices	 Send and Receive data
Network	 Data is transmitted, routed
Edge Computing	 Data is normalised, filtered,
Storage	 Databases and data stores
Applications	 Process and use data
People	 Act and collaborate

IoT Reference Model



IoT Reference Model

IT/OT convergence is the integration of information technology (IT) systems used for data-centric computing with operational technology (OT) systems used to monitor events, processes and devices



IT/OT Integration

 "IT/OT integration is the end state sought by organizations (most commonly, assetintensive organizations) where instead of a separation of IT and OT as technology areas with different areas of authority and responsibility, there is integrated process and information flow." – Gartner



http://www.gartner.com/it-glossary/it-ot-integration

How to link IT and OT

- Edge computing "layer":
 - Device Control
 - Configure & Status
 - Device Interactions
 - Discovery, addressing, Protocol Conversion
 - Middleware
 - MQTT, Zigbee
 - Data manipulation
 - Normalise, Filter, Aggregate, Notify
- Combining the above allows for interaction with devices



IoT Issues

- OT Layer
 - Lots of "Data in Motion"
 - Sensors constantly producing data.
- IT Layer
 - Lots of "Data at Rest"
 - Apps tend to query data in databases and data stores
- Devices (OT) can generate data faster than apps(IT) can consume it.



IoT Issues

- Need to decouple the IT layers (Applications etc.) from OT layers (devices and sensors)
- Need protocols and standards that allow for scalable, interoperable integration between the IT and OT world
- That's why we need Open, Accepted Standards and Protocols for IoT application.
 - Enable middleware, edgeware, applications and devices from different vendors to interact.
- We need IoT Standards and Protocols.



IoT Protocol Stack?

- many protocols, many standards. Starting to consolidate
- Some strong standards starting to emerge that address the IT/OT link
- We will try to look a protocol in each layer, building a reference app that combines several.



IoT Stack Protocols.

- **Connectivity layer:** The Actual physical connectors. RJ45 (usually for Ethernet), RS-232, ModBus, USB (as a connector type, not the communication protocol), SPI, ODB2 (in Cars), and Wireless (no connector!). Gateways can convert physical connectors into wireless.
- Link Protocol: How do those device actually send the data. Ethernet 802.3, Wifi 802.11a/b/g/n, BlueTooth, BLE, ZigBee, Rfid, 6LoWPAN, 802.14.5e, CAN, SigFox, LoRa
- Transport: IPv4 and IPv6
- Session / Communication: MQTT, a subscribe and publish protocol that is used by Facebook for its mobile app, XMPP and AMQP, FTP, Telnet and SSH,
- Data Aggregation / Processing: When device send data, lots of data, you need an end point to do something with it. Storm, RapidMQ, Scribe
- Data Storage / Retrieval: The realm of Big Data backend and NoSQL solutions. Hadoop, HBase, MongoDB and Cassandra dominate the field.



Plan for the Future...

- Idea is to realise a prototypical full stack IoT solution which uses open standards and protocols to integrates IT and OT.
- Project style approach
 - Have a working artefact that demonstrates skills from other modules on the course.
- Use things
 - Raspberry pi, Arduino, SiPi...
- Use languages
 - Java, Python, scripting
- Use cloud platforms
 - Amazon AWS IoT, Thingspeak

