Delivering Smart and Open Building Applications for the IoT

- Renewable Energy
- Smart Cities Streetlighting
- Commercial & Residential Buildings
- Internet of Things
Speakers

Matthias Lürkens
- CTO Gesytec (Germany)
- LonMark
  - Board of Directors
  - Channel Standardization Committee
  - Web Services Committee
  - German Marketing Group
- DIN: CEN TC247

Rich Blomseth
- Product Management Director, Adesto Technologies, Echelon Division
- LonMark
  - Board of Directors
  - Channel Standardization Committee
  - Web Services Committee
  - Building Automation Systems Committee
- CTA: R7 Consumer Electronics Networking Committee
Agenda

- LonMark Web Services motivation
- IoT and cloud limitations today
- LonMark Web Services standardization
- Example use case—why BA only will fail
- IoT terms—MQTT, REST, and others
- LonMark Web Services overview
- Other Web service standardization efforts
- Cyber security
- How to participate
LonMark Web Services Motivation

- Leverage IoT services
  - Big data
  - Predictive analytics
  - Artificial intelligence
- Connect disjoint applications
  - In and outside of a building
  - Smart cities and smart grids
  - Industrial and commercial
- Stay open minded
IoT and Cloud Limitations Today

- Tall silo
- Multiple datamodels
- Local/remote
- Latency
- Reliability
- Authentication
- Encryption
IoT and Cloud with Standard Web Services

Diagram showing connections between buildings with protocols like Modbus RTU, BACnet MSTP, LON FT, and IAP.
LonMark Web Services Standardization

- Open-standard APIs for:
  - Local, remote, and cloud services
  - Edge devices
  - Web pages

- Planned standardization
  - LonMark (in process)
  - ANSI/CTA (proposed work item)
  - CEN
  - ISO

- Other standards bodies
  - Building automation anthology
  - W3C

- Secure IoT messaging with MQTT and REST
- Multi-protocol to the edge: LON, BACnet, Modbus, MQTT, and others
- Provision and maintain devices
- Connect datapoints
- Access data in edge devices
- Log and retrieve data
- Set and manage schedules
- Monitor and manage alarms
Sonema Headquarters Strasbourg, France

- Local climate generation
- Irrigation
- CO2 control
- EV charging
- Traffic control
- Nomad workers
IoT Terms

- **MQTT**
  - Message Queuing Telemetry Transport
  - Various IP protocols possible
  - Publish/subscribe model

- **REST**
  - Representational State Transfer
  - HTTP PUT/GET/POST/DELETE

- **JSON**
  - JavaScript Object Notation

```json
{
"receiver": "8000000012",
"data": [
{
  "sn": "0000015441",
  "value": "22.18",
  "type": "Temperature",
  "rssi": "78",
  "quality": "100",
  "battery": "100",
  "timestamp": "2017-09-26T14:43:04Z"
},
{
  "sn": "0000007989",
  "value": "-19.57",
  "type": "Temperature",
  "rssi": "66",
  "quality": "100",
  "battery": "99",
  "timestamp": "2017-09-26T14:43:06Z"
}
]
}```
Introduction to MQTT

- Any client can publish any message to any topic
- Any client can subscribe to any topic and receive messages tagged with that topic
- Other technologies with similar approach: LON NVs and Twitter
LonMark Web Services Topics

- MQTT clients publish and subscribe to messages with topics
- Topics have the following format:
  
  glp0/\{Segment\}/\{Channel\}/\{Resource_Type\}/\{Edge_Protocol_ID\}/\{Handle\}/\{Object\}/

  - Segment – identifies an edge server
  - Channel – identifies a request (rq), feedback (fb), or event (ev) channel
  - Resource_Type – one of the resource types on the next slide...
  - Edge_Protocol_ID – identifies the protocol, initially one of:
    - LON (lon), Modbus (mod), BACnet (bac), or any other
  - Handle – identifies an addressable item
  - Object – identifies an object within the addressable item—may be multiple levels

- Datapoint example:

  glp0/s1/rq/dev/lon/a/if/LightCntrl/0/nviLampValue/value
## LonMark Web Services Resource Types

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>about</td>
<td>Segment information</td>
</tr>
<tr>
<td>alarm</td>
<td>Alarms</td>
</tr>
<tr>
<td>app</td>
<td>Apps</td>
</tr>
<tr>
<td>cfg</td>
<td>Segment configuration</td>
</tr>
<tr>
<td>conn</td>
<td>Connections</td>
</tr>
<tr>
<td>dev</td>
<td>Devices</td>
</tr>
<tr>
<td>discovery</td>
<td>Discovery</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ev</td>
<td>Events</td>
</tr>
<tr>
<td>evnt</td>
<td>Scheduled events</td>
</tr>
<tr>
<td>grp</td>
<td>Groups</td>
</tr>
<tr>
<td>job</td>
<td>Jobs</td>
</tr>
<tr>
<td>res</td>
<td>Resource Meta Data</td>
</tr>
<tr>
<td>sch</td>
<td>Schedules</td>
</tr>
<tr>
<td>sts</td>
<td>Segment status</td>
</tr>
<tr>
<td>super</td>
<td>Supernodes</td>
</tr>
</tbody>
</table>
Node.js Example Code to Write a Datapoint

```javascript
let topic = 'glp/0/' + SID + '/rq/dev/lon/' + MyDeviceHandle + '/if.TempController/0';
let payload = '{ "SP": { "value": 20 }}';
mqttClient.publish (topic, payload);
```
Example REST Request

- Enter the following in a web browser address bar:

Other Web Services

- BACnet
  - REST replaced SOAP
  - Building automation only
- KNX
  - 3 standards
- oBIX
  - SOAP and REST
- OPC UA
  - Industrial automation focused

- BA players discordant
- Other standards bodies
  - CEN TC247WG7 BA webservice anthology
  - W3C ?
- Smart City is more than BA
  - Web services need to cover much more than BA
IoT Security Considerations

- Focus to the user
  - The weakest link
- Use certificates instead of user/password
- IP protocols allow encryption and authentication
- Use TLS 1.3
  - No more RSA
    - e.g. ECDHE-ECDSA-AES128-SHA256
- Build up certificate architecture
- Use signed updates
- Use recommendations
  - NIST cybersecurity framework
How to Participate

- Join a LonMark technical committee
  - LonMark Web Services Committee
  - LonMark Channel Standardization Committee
- Monthly meetings developing new standards
- E-mail: tech@lonmark.org