

Mortar.io – Open BAS Platform

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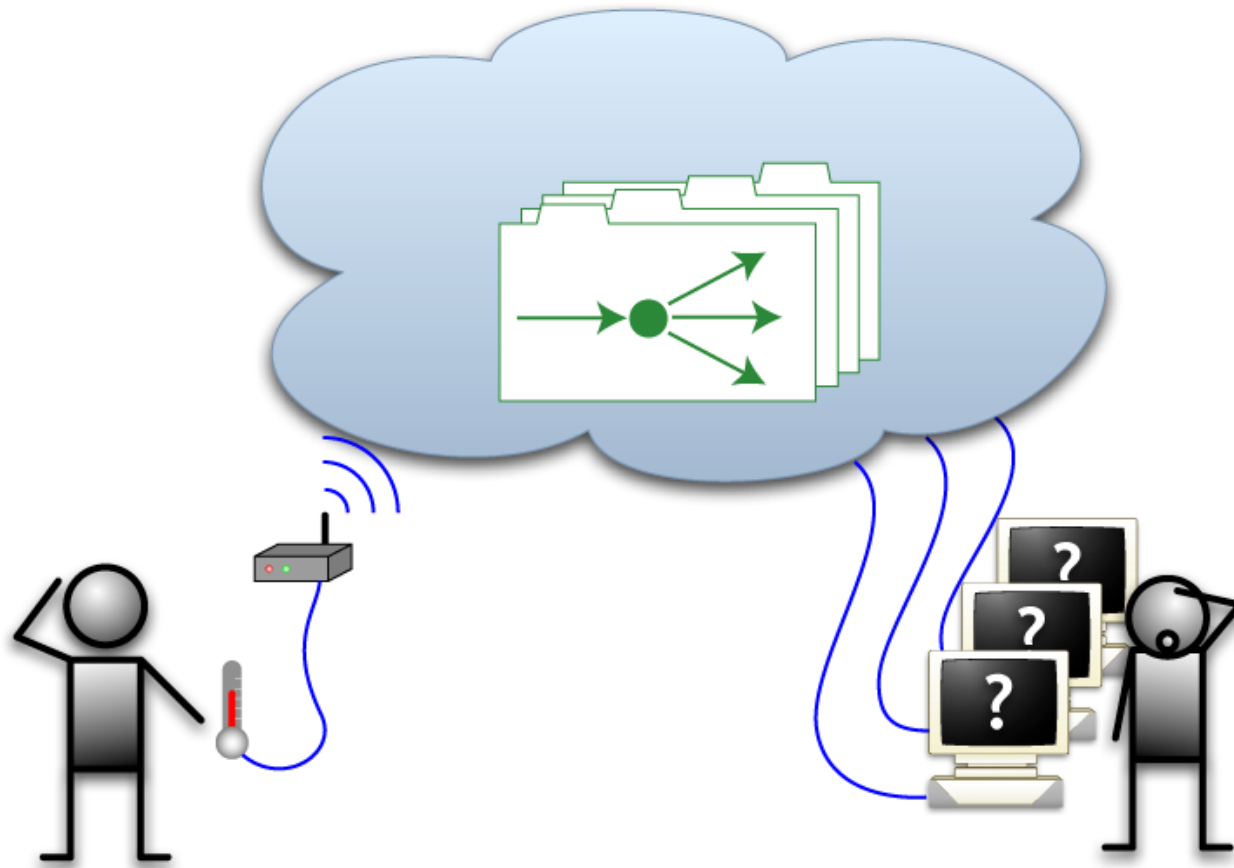
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Electrical and Computer Engineering Department¹
Carnegie Mellon University

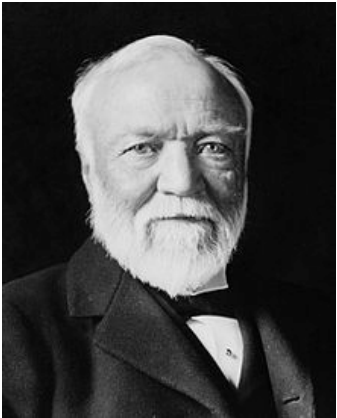
Civil and Environmental Engineering Department²
Carnegie Mellon University

Bosch Research and Technology Center³

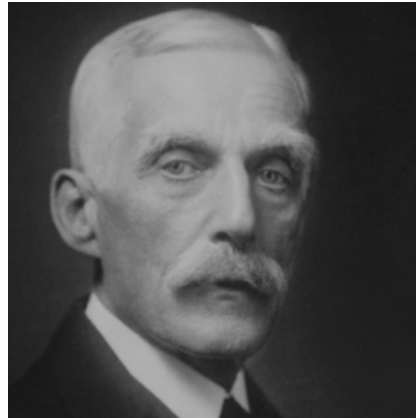
Sensor Andrew



What's in a name?



+



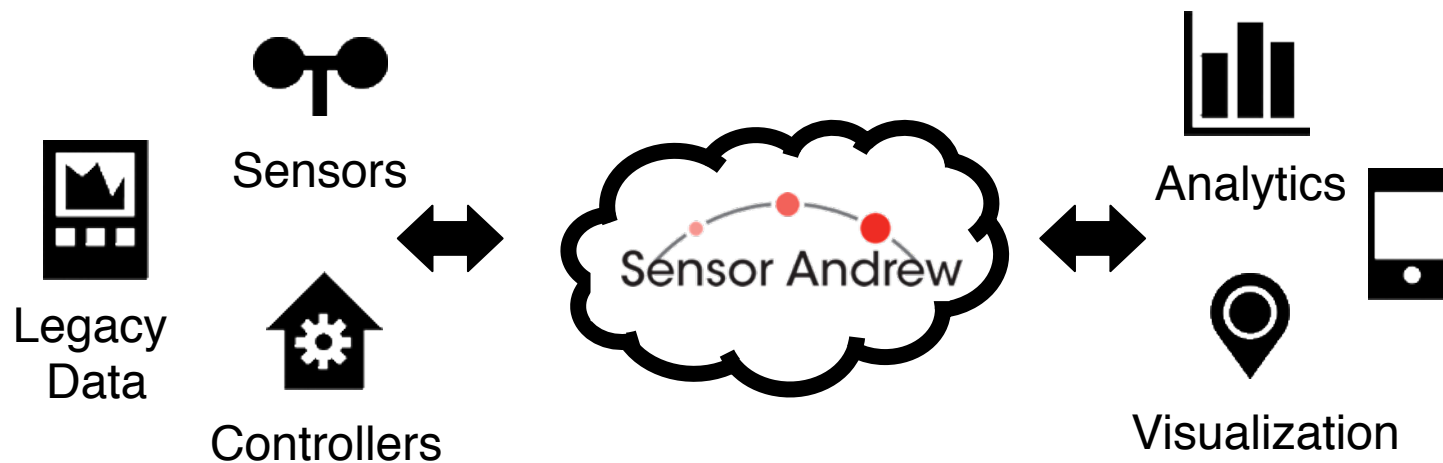
Andrew File System
Wireless Andrew
Sensor Andrew

Andrew Carnegie

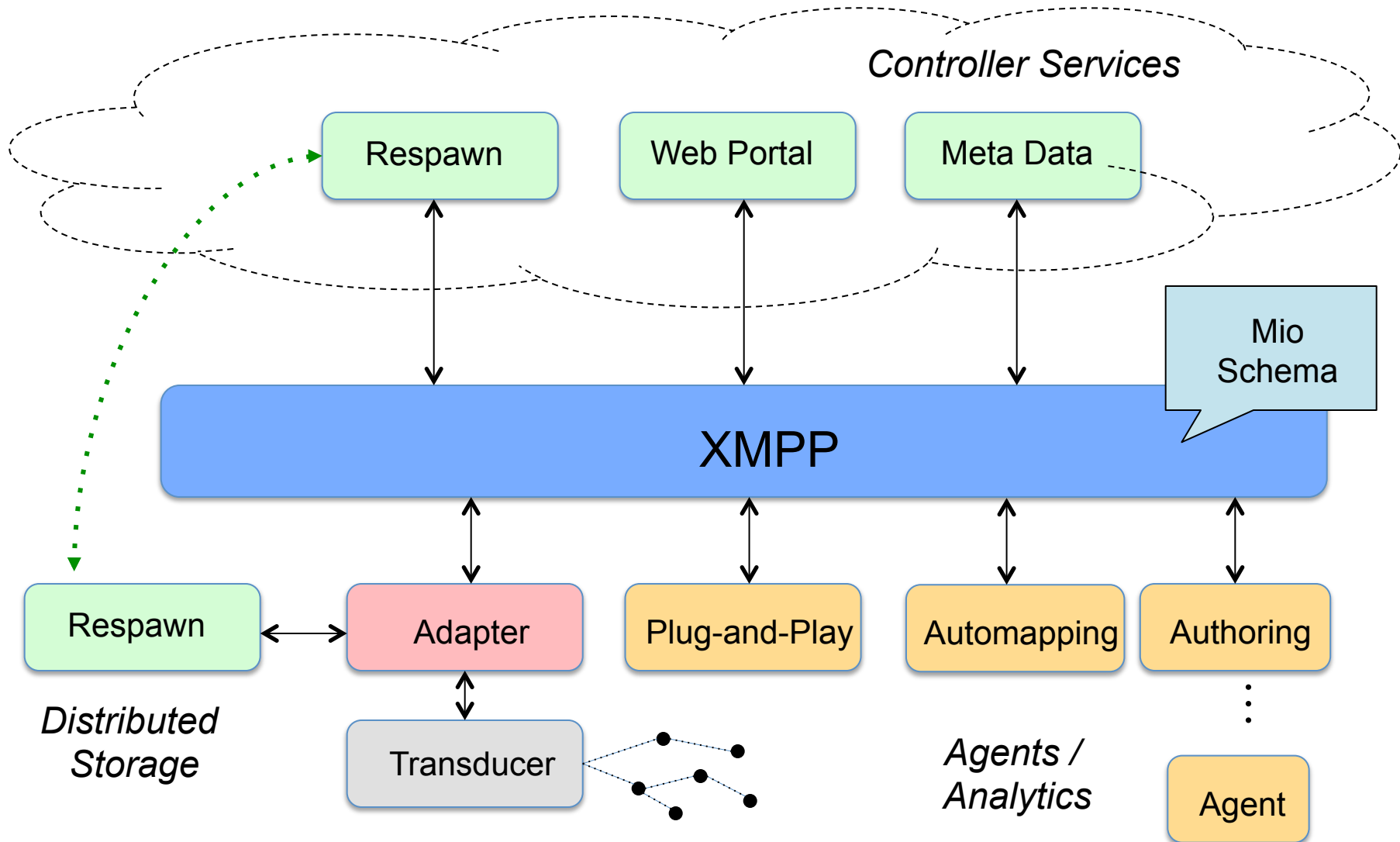
Andrew Mellon

Why not Sensor Andrew v1.0 for BAS?

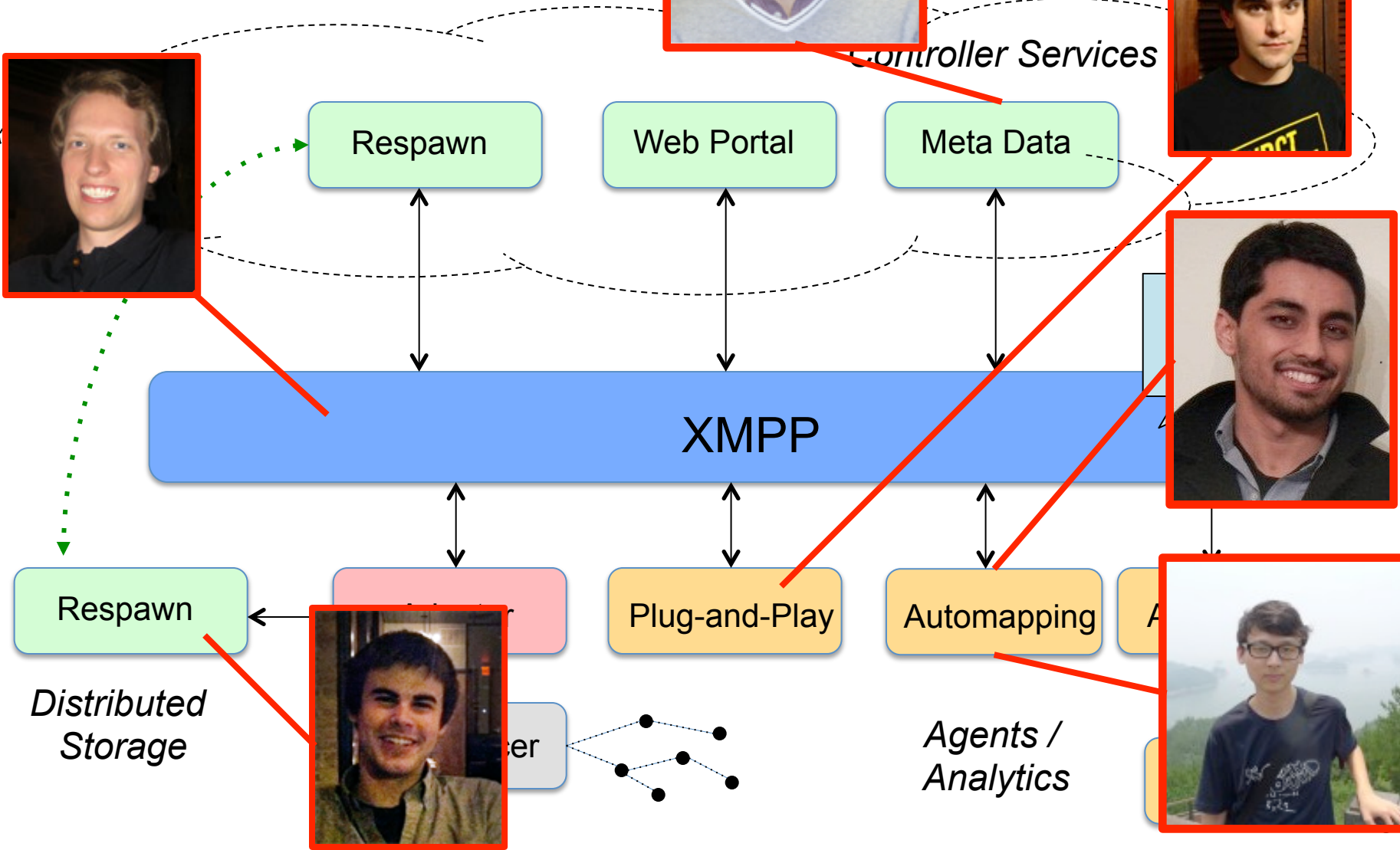
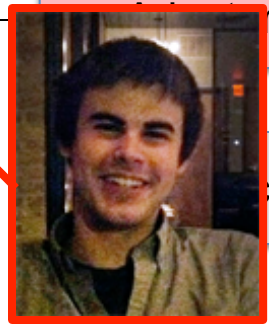
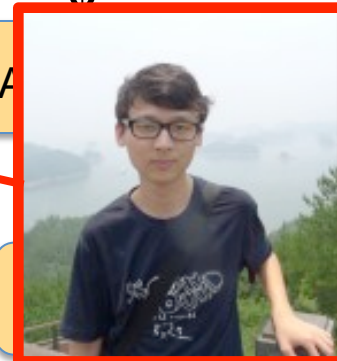
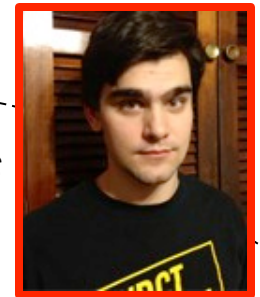
- Registration was extremely general
- Too resource intensive and cloud-centric
- Difficult to run and manage

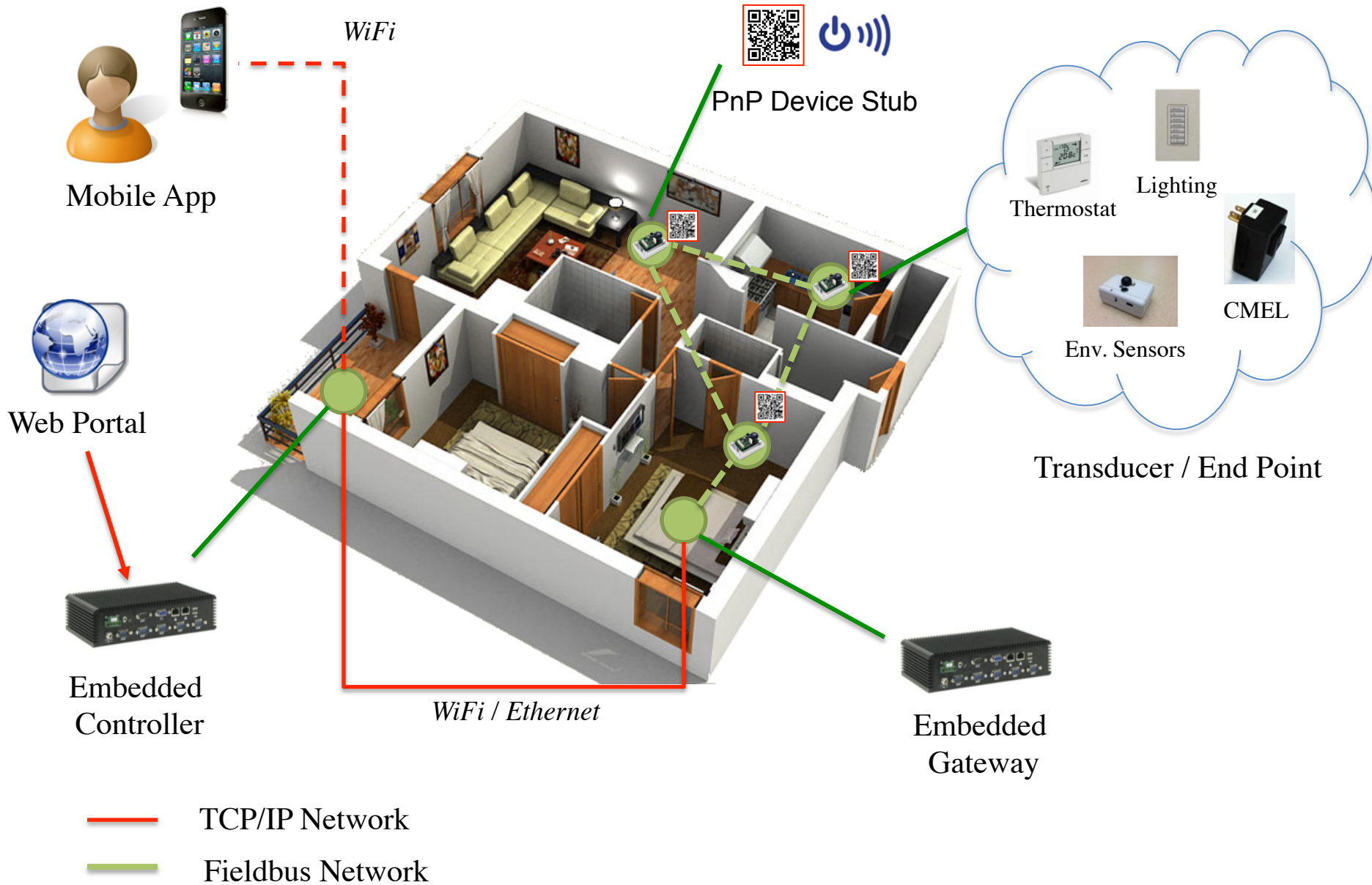


Mortar.io Architecture



Mortar.io Architecture

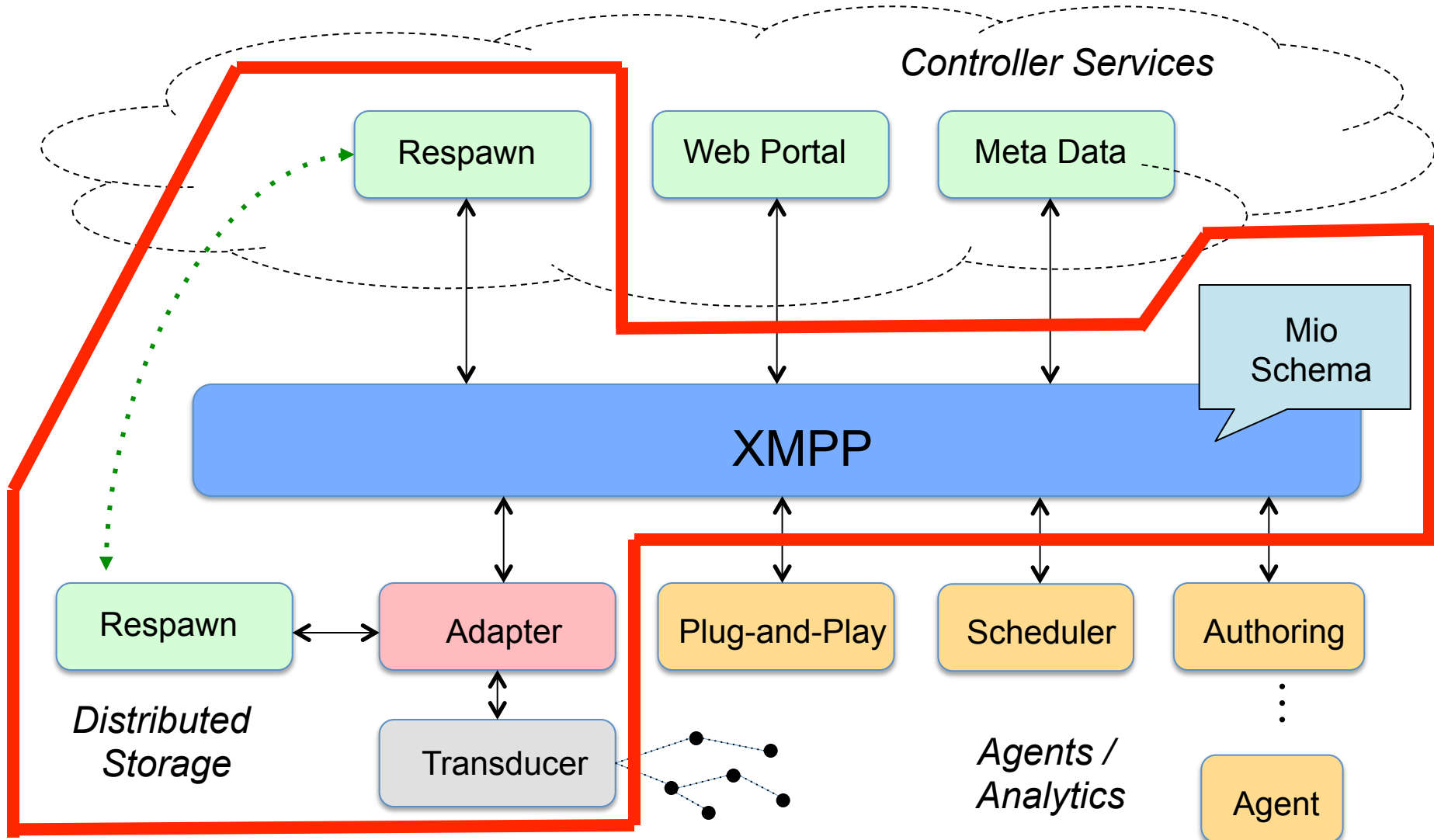




Mortar.io Highlights

- **Networking**
 - Publish-Subscribe Architecture
 - Device-Level Access Control
 - Automatic Discovery / Plug-and-Play
- **Storage**
 - Multi-Resolution Time Series Database
 - Cloud-to-Edge Data Storage
 - High-resolution data stored at routers
 - Aggregates intelligently pushed to server side
- **Extensible Device Interfaces**
 - FireFly Wireless Sensing Platform, BACnet, Android@Home, NEST thermostat, Web Services, ModBus, PUP, Zigbee, Zwave

Mortar.io Architecture

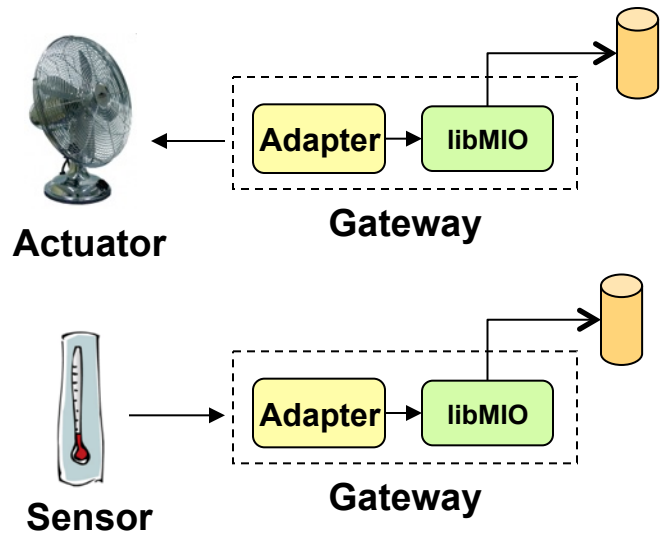




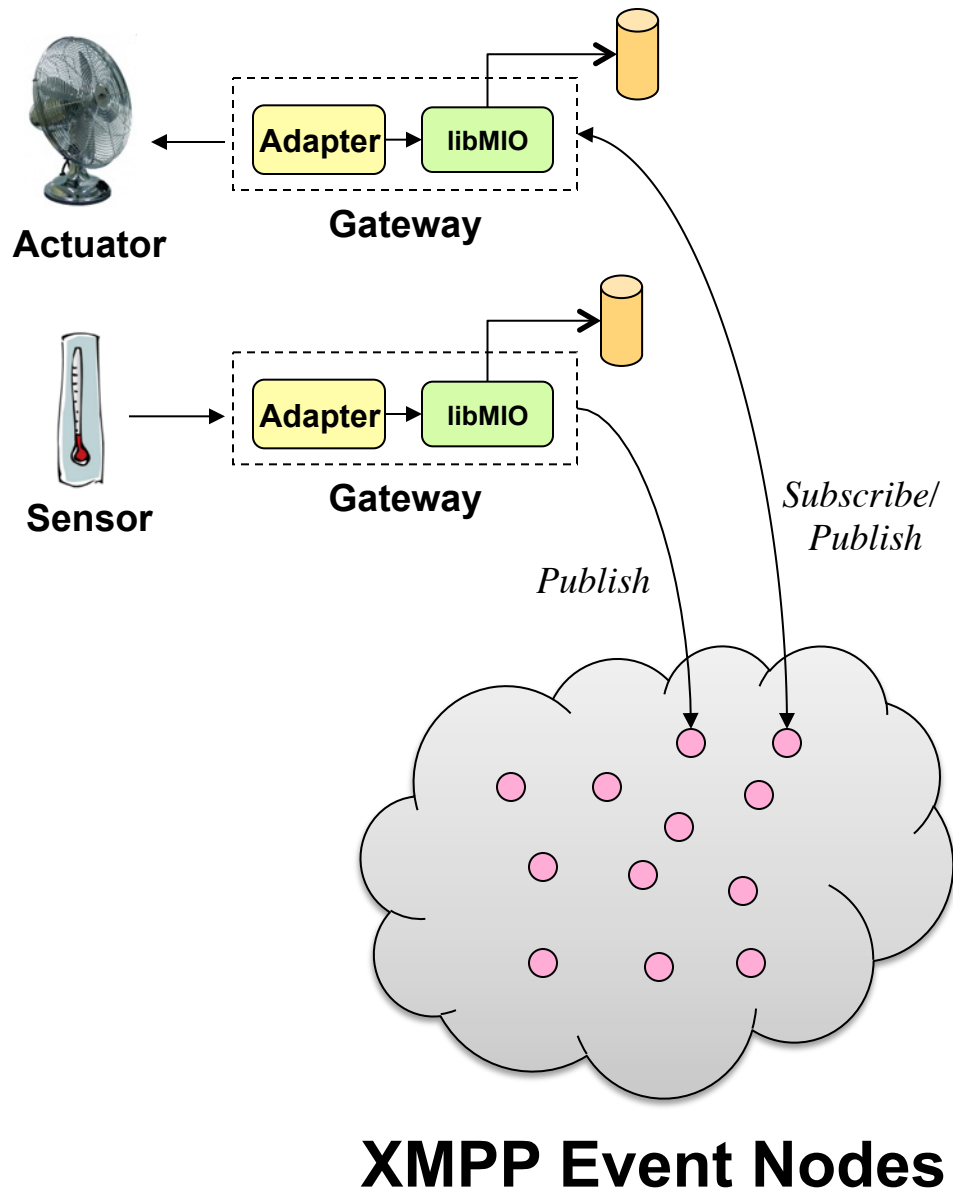
Why XMPP?

- **Decentralized**
- **Open standards**
 - Not just messages, but data formats XEPs
- **History**
 - Open protocol since 1999
 - Many open servers in a variety of languages
- **Security**
- **Rich Features**
 - IM, groupchat, network management, content syndication, file sharing, geolocation, VoIP

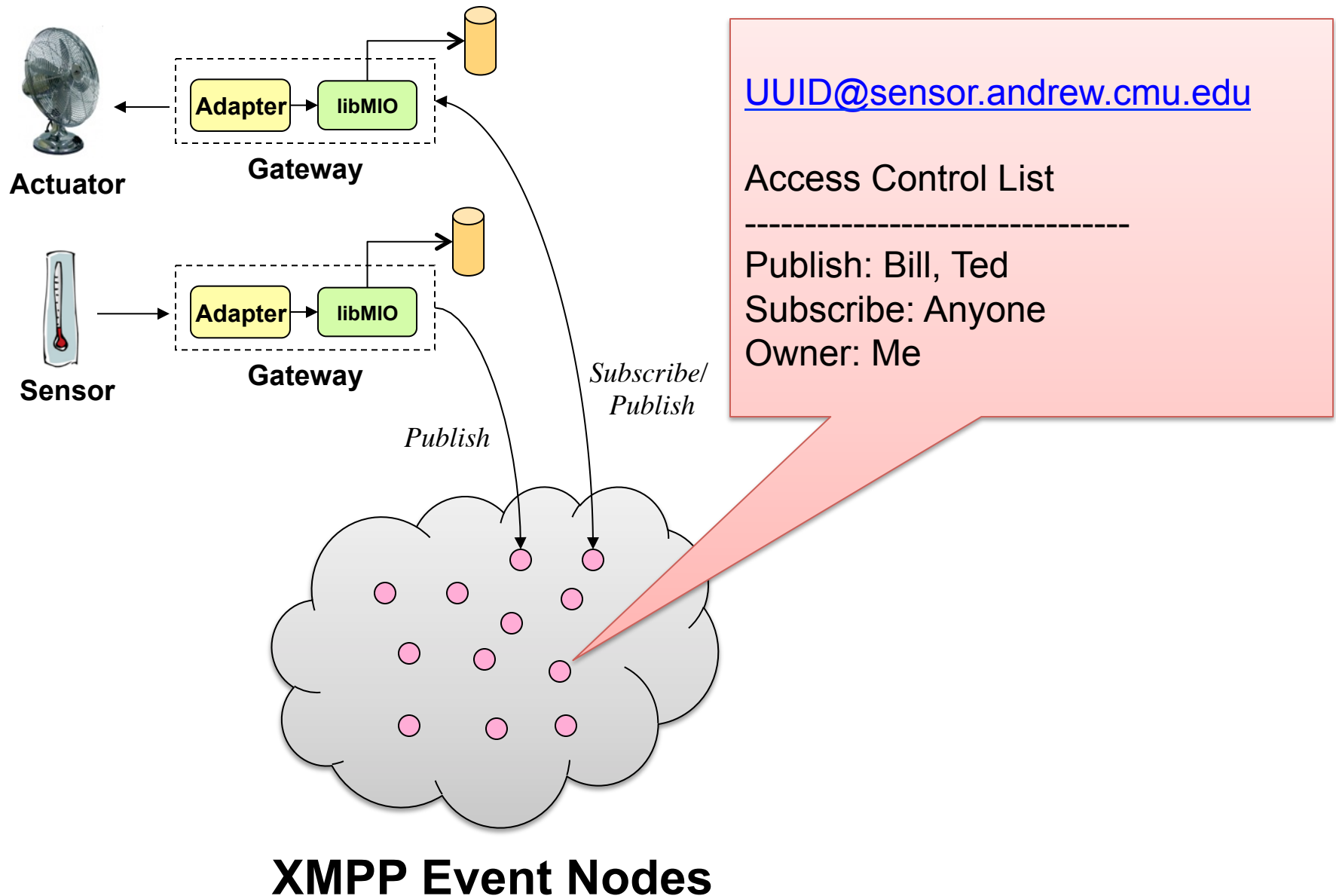
Mortar.io Architecture



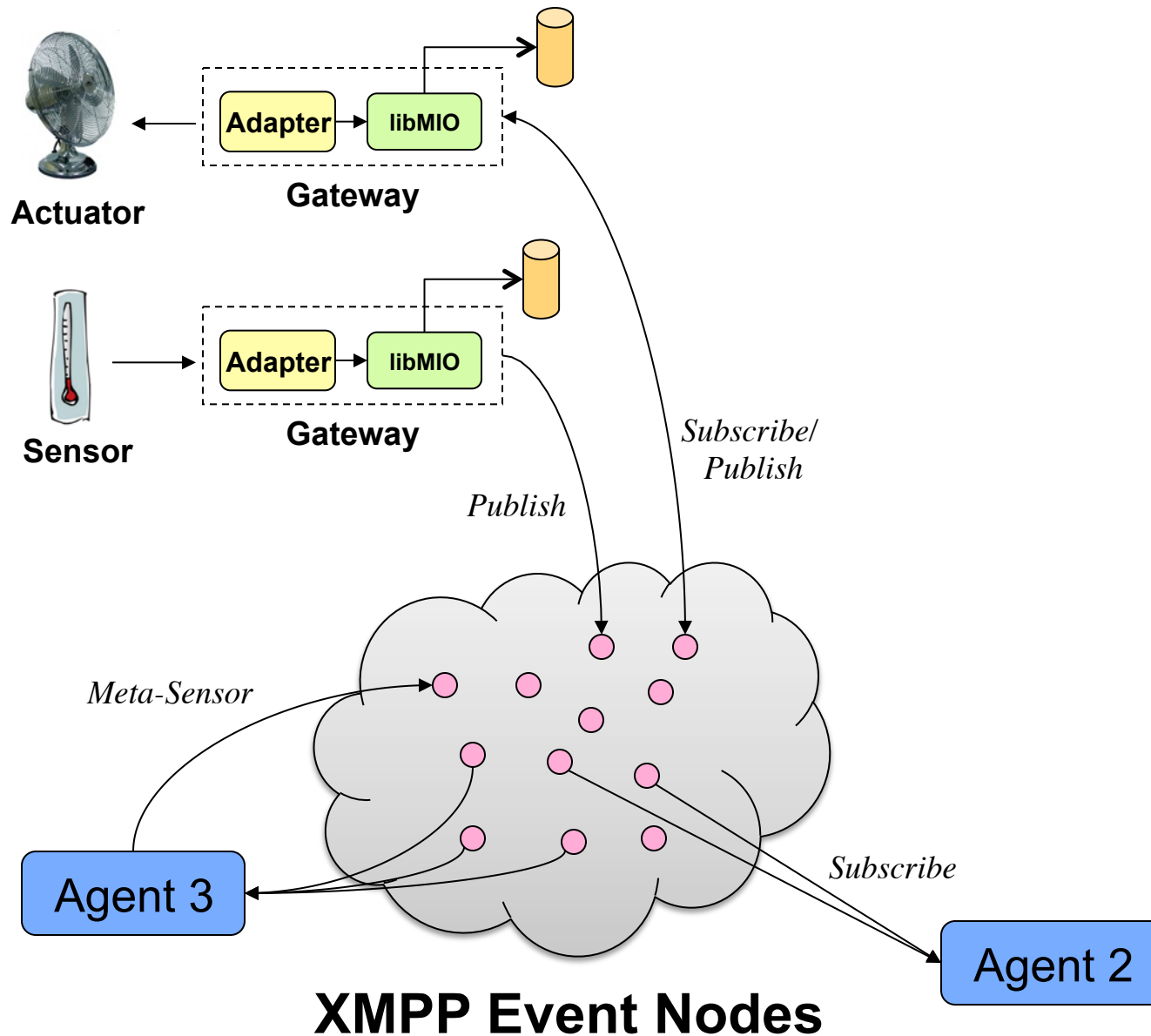
Mortar.io Architecture



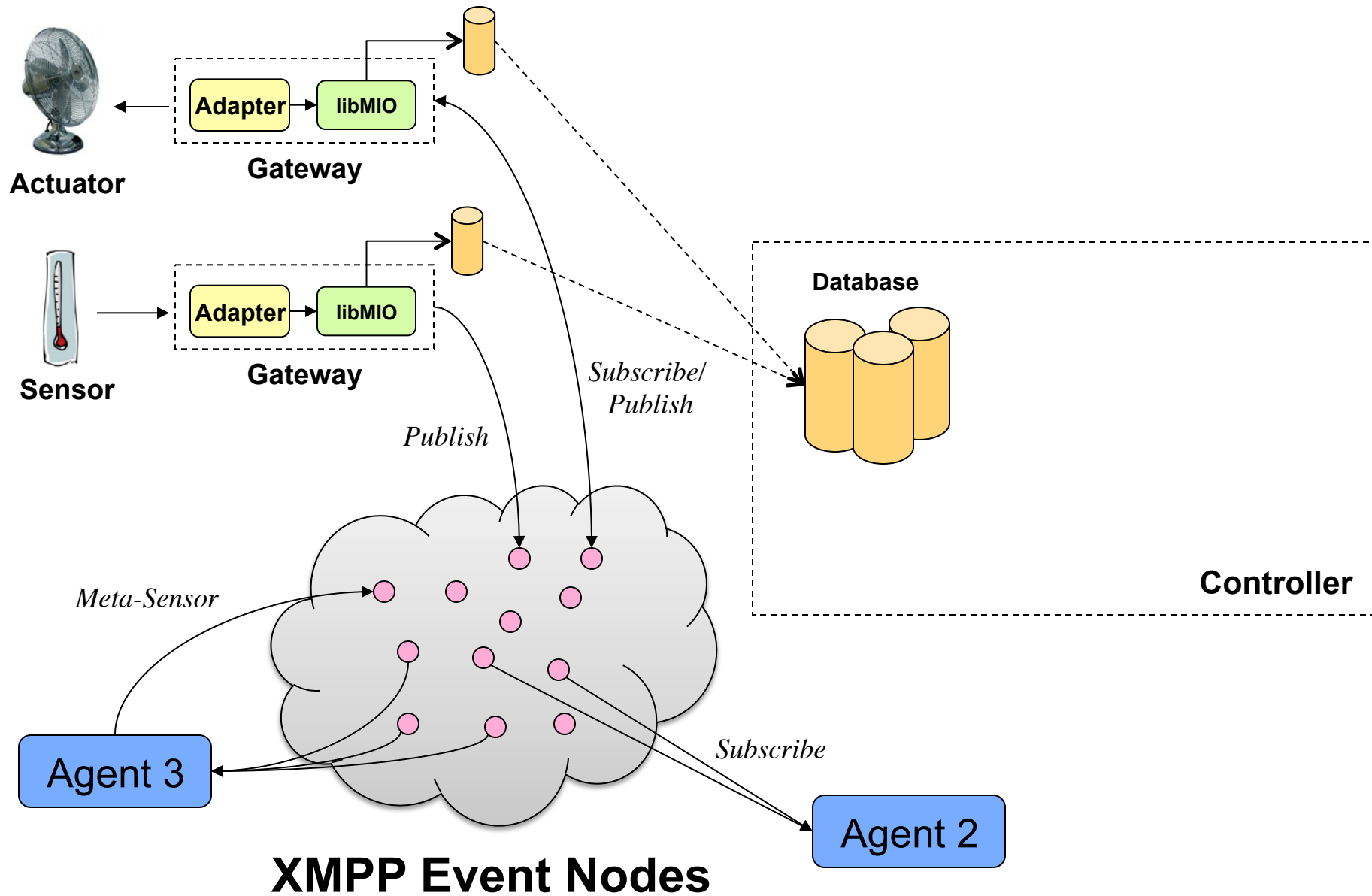
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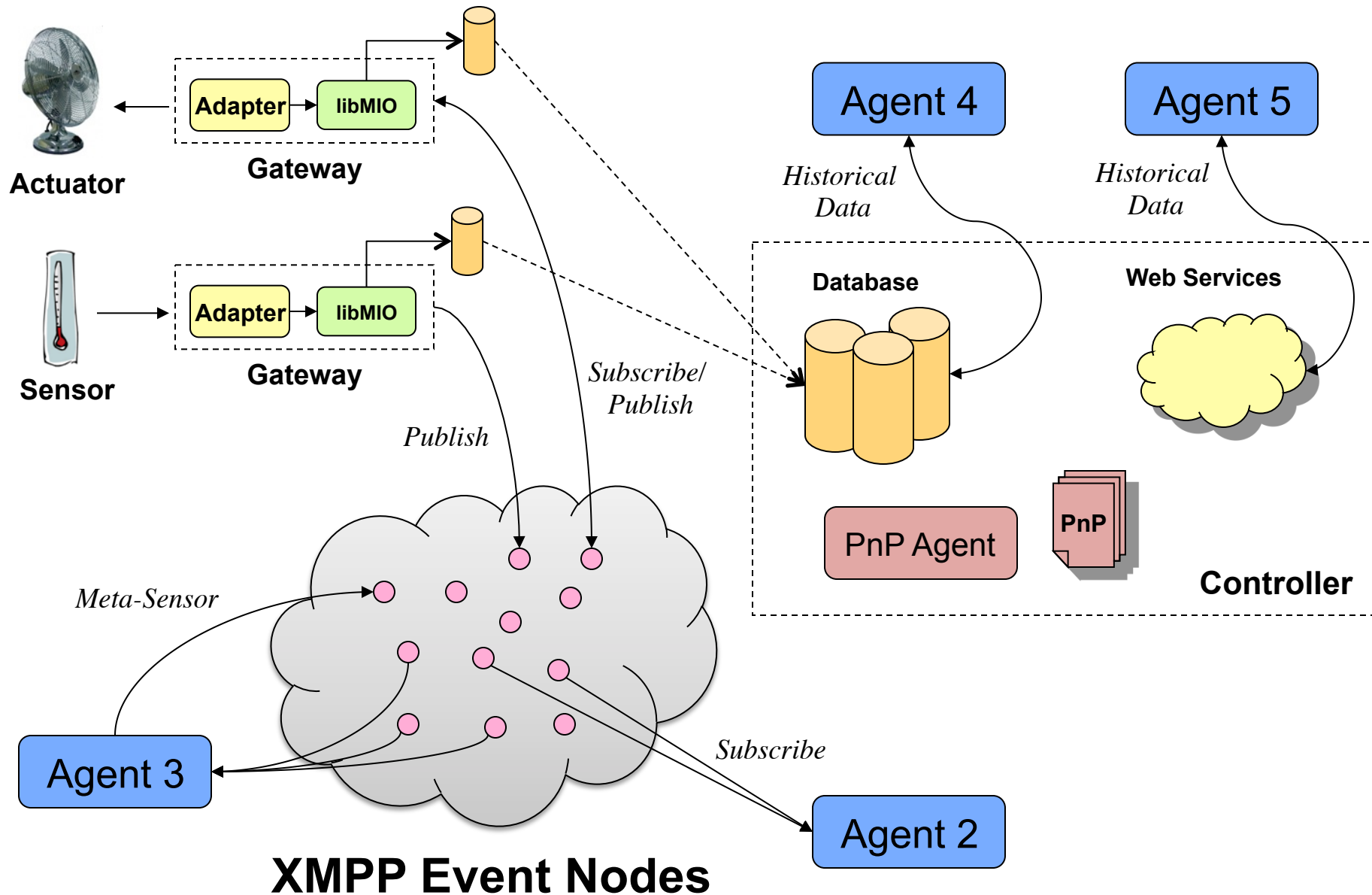
Mortar.io Architecture



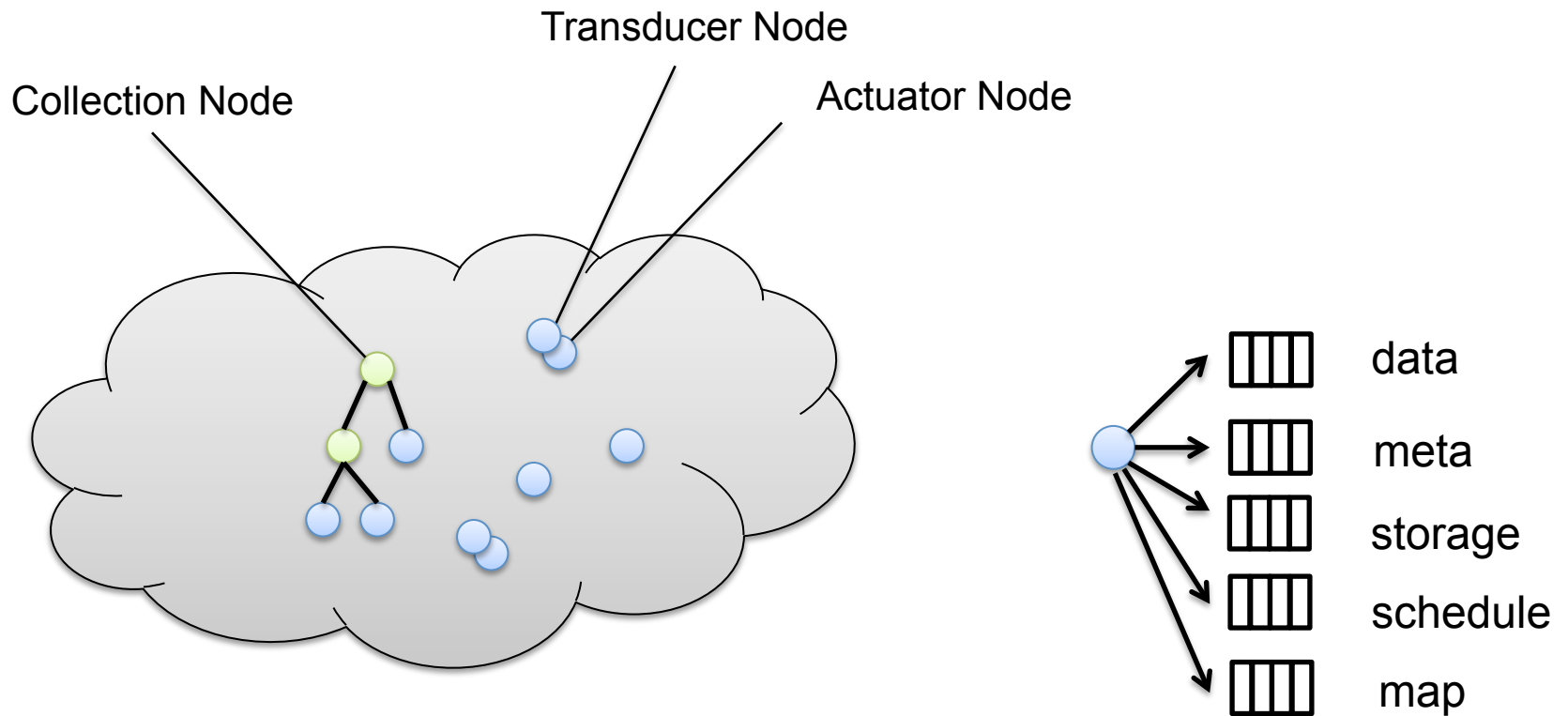
Mortar.io Architecture



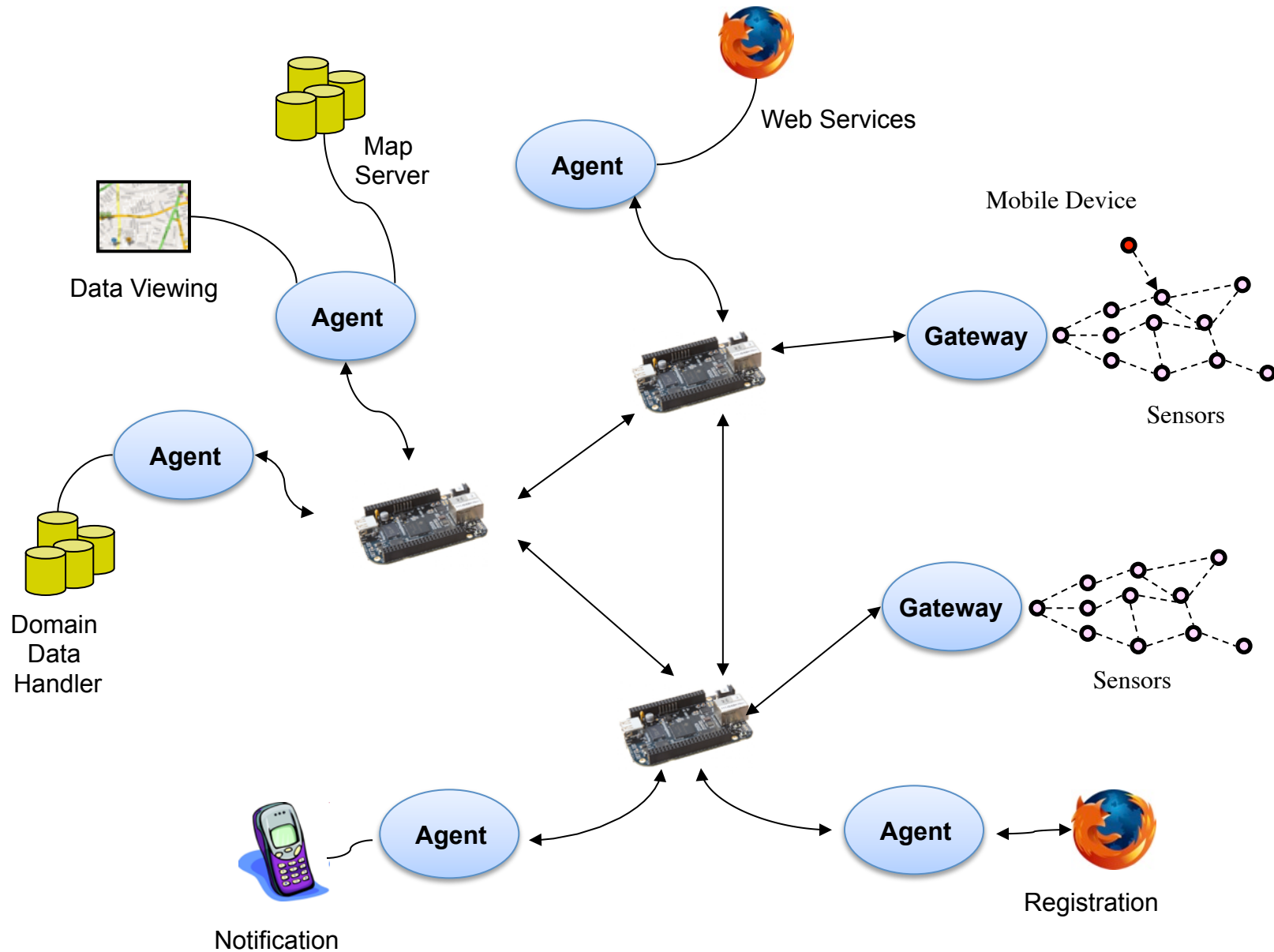
Mortar.io Architecture



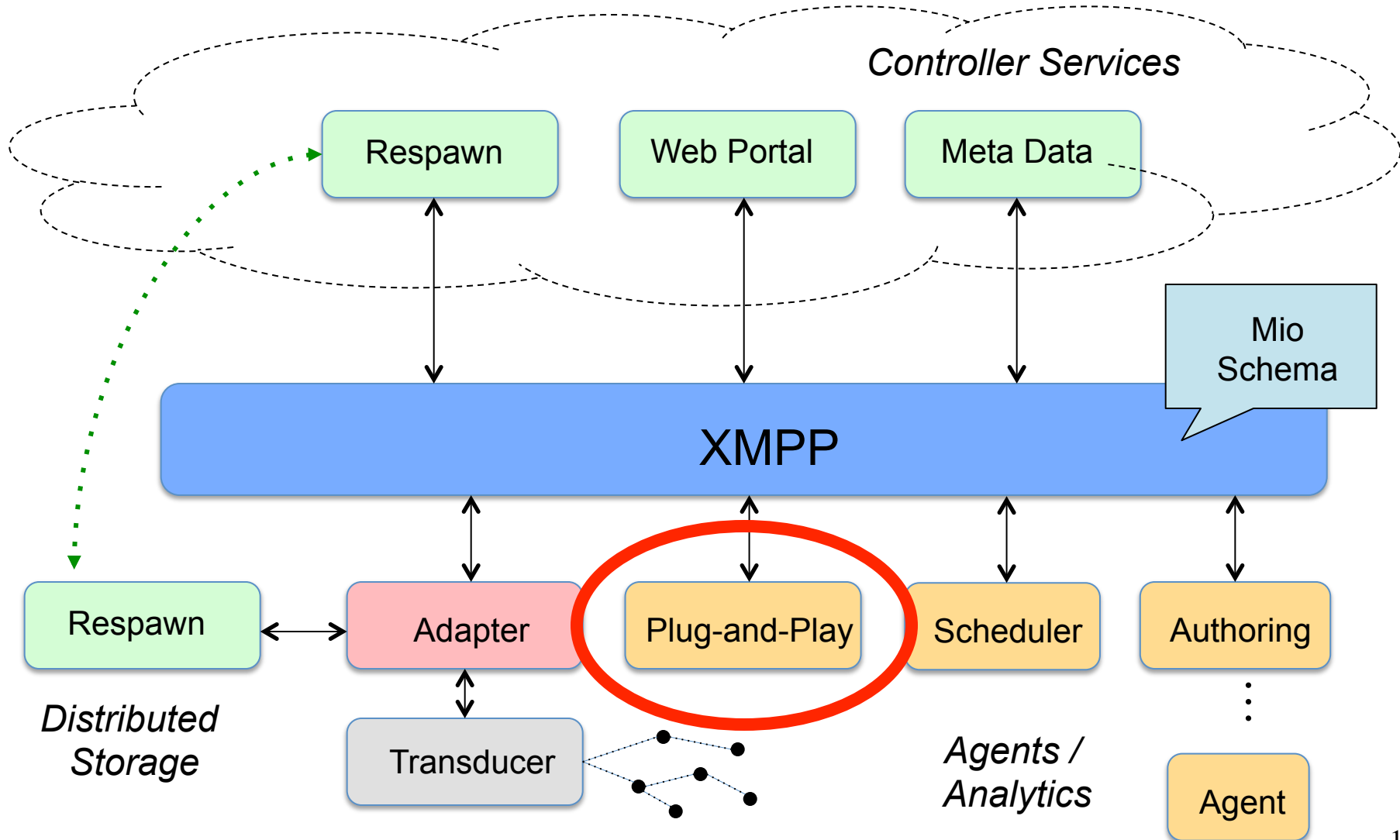
Publish Subscribe Architecture



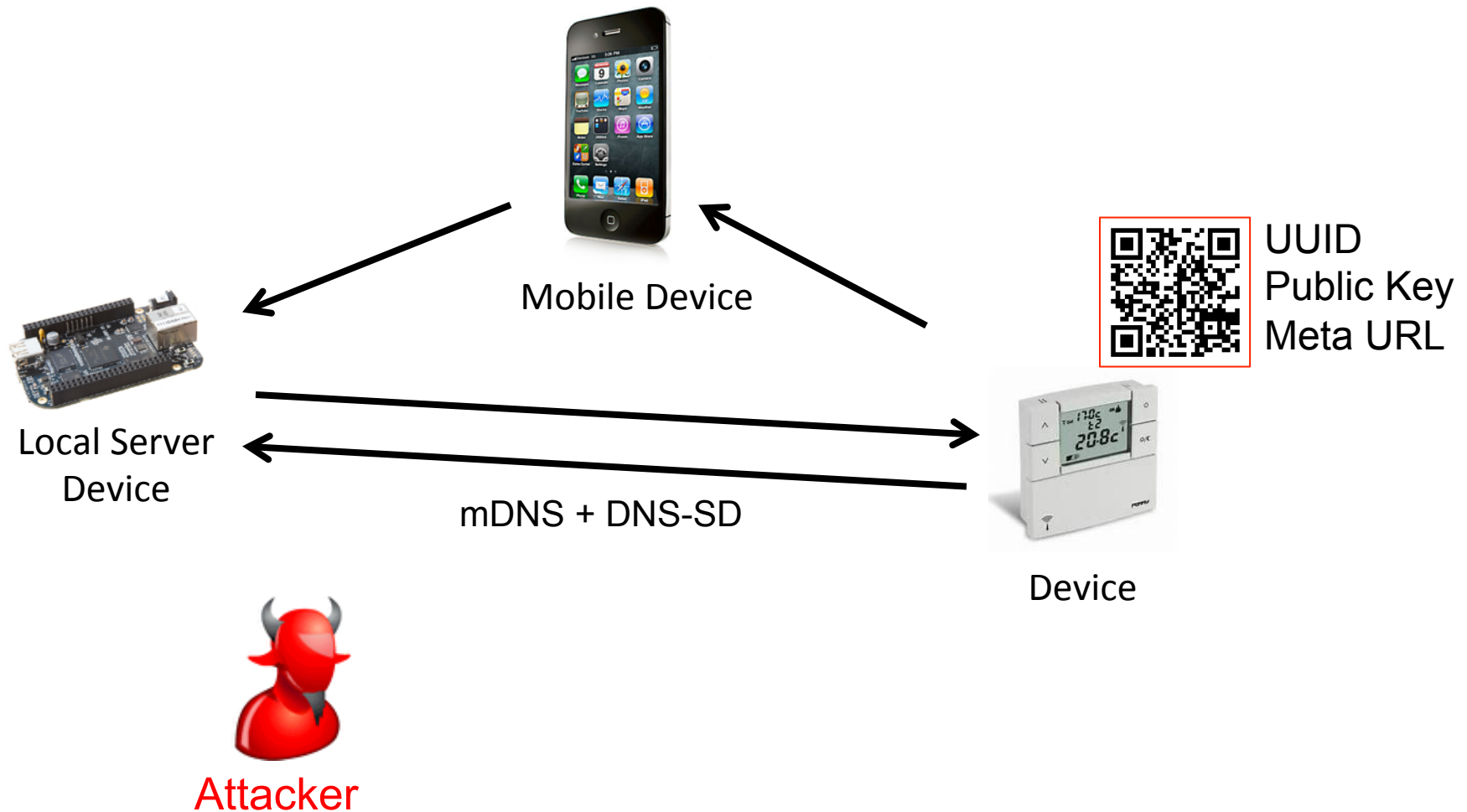
XMPP Federation



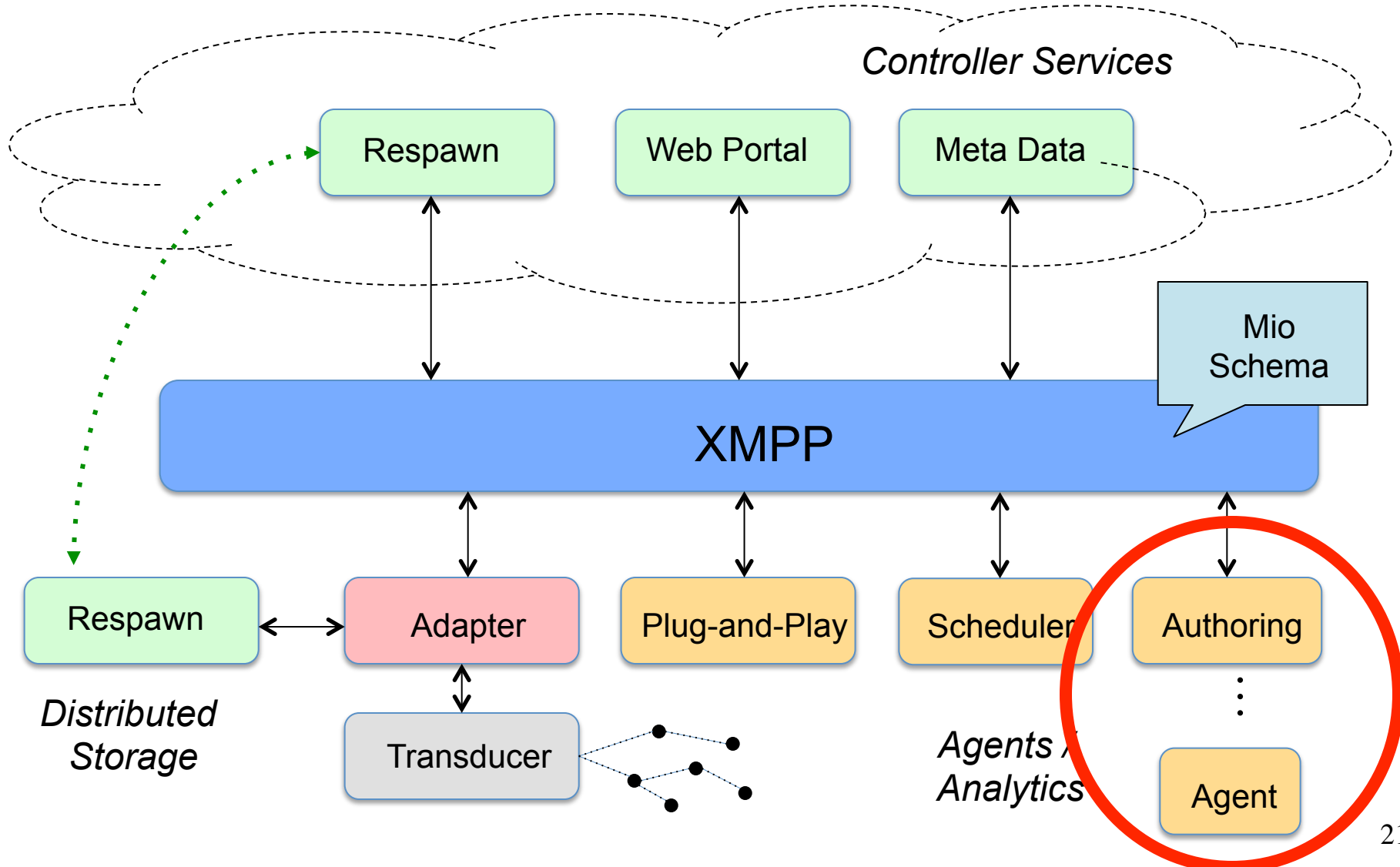
Mortar.io Architecture



Plug-and-Play



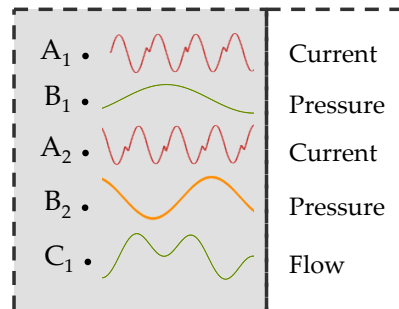
Mortar.io Architecture



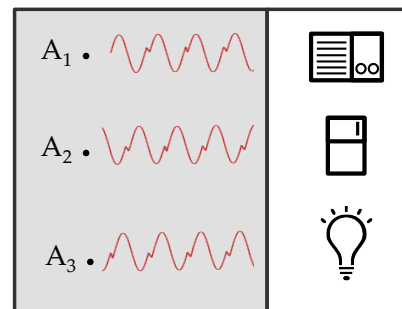
Auto-Mapping

- How can we locate and validate correct placement of sensors?
 - Classify sensor type
 - Classify sensor stimulus
 - Use context to discover relationships
 - Map relationships into the physical space

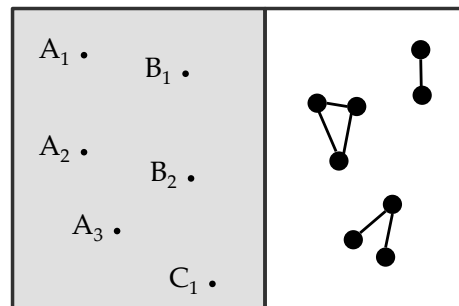
Identifying Sensor Types



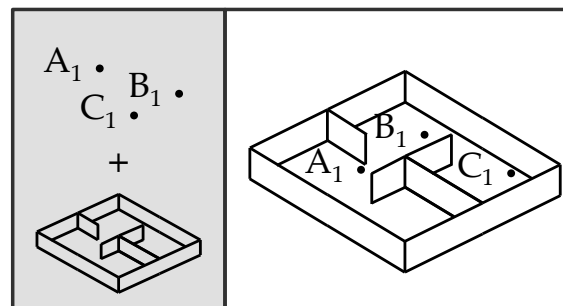
Characterizing Stimulus



Discovering Relationships



Automatically Mapping Sensor Locations



Thank You!

Questions?