

RESPAWN: REconfigurable Sensor Processing Across Wide-area Networks

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Overview

- More and more *Physical* data is becoming available...
 - Large-scale sensor processing tools should provide:
 - Interactive visualization
 - Rapid filtering / exploratory processing
 - Transducer data
 - Low-latency feature extraction
 - Tightly coupled to geographic locality
 - Useful data frequently lost through summarization
 - Edge storage is becoming cheaper (flash memory)
 - Edge processing is often resource-constrained
 - Network connectivity can be limited
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- Key idea: store raw data locally, push features to cloud
 - Approach: cloud-to-edge handoff based on query resolution, reconfigurable gateway hardware acceleration

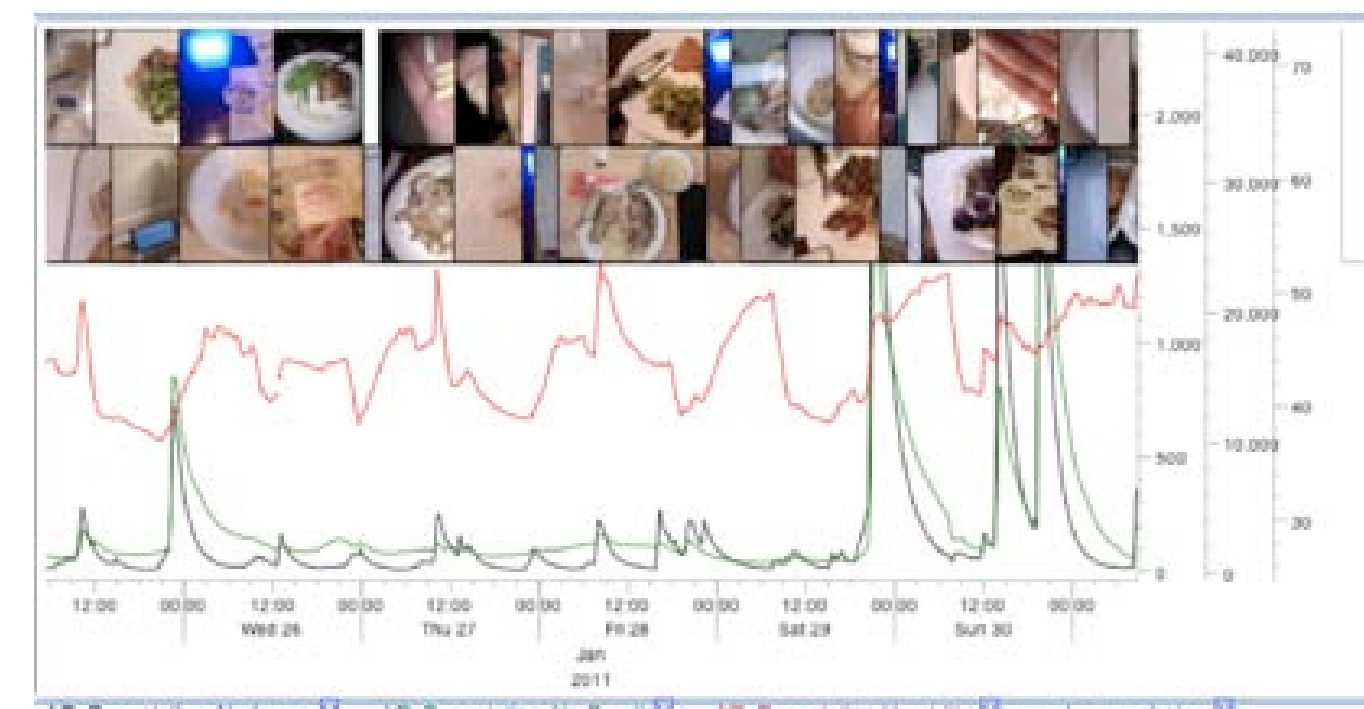
Target Applications



Waterbot



Building Energy

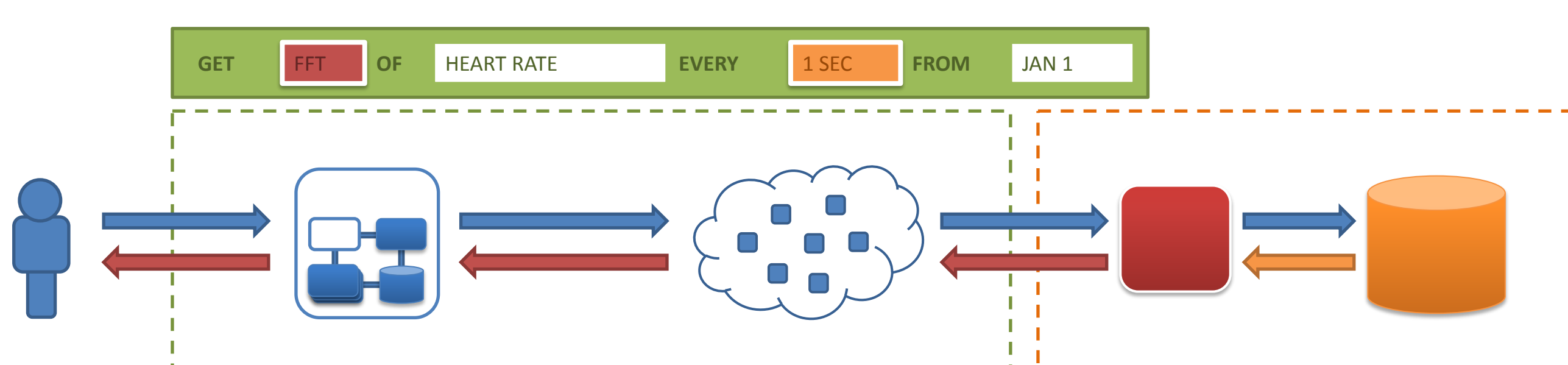
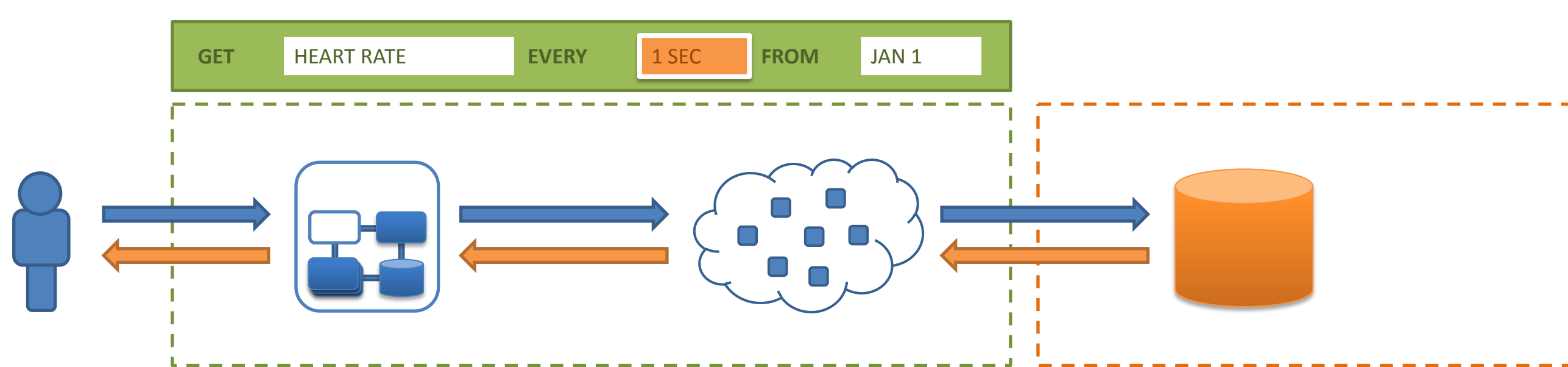
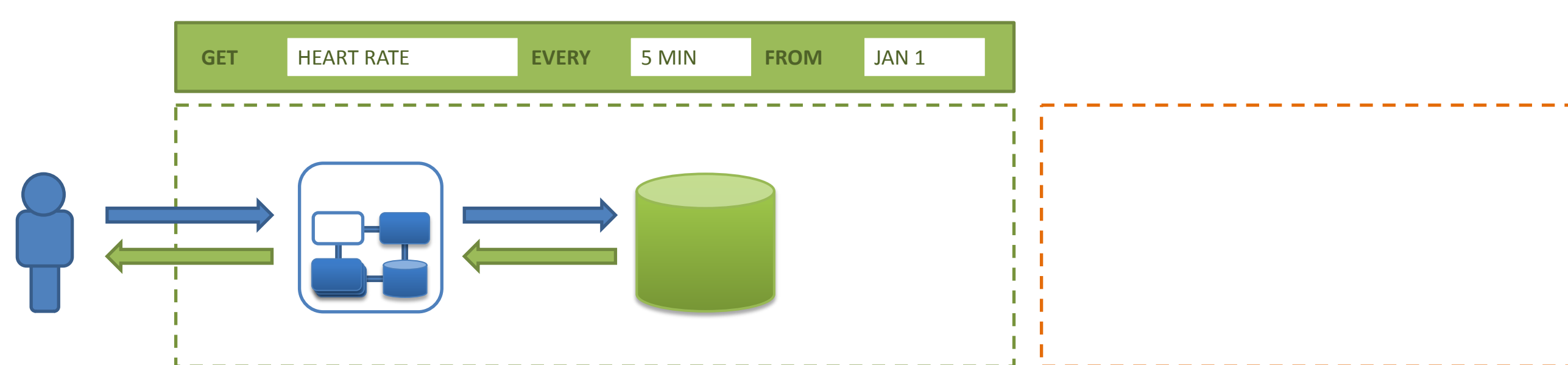
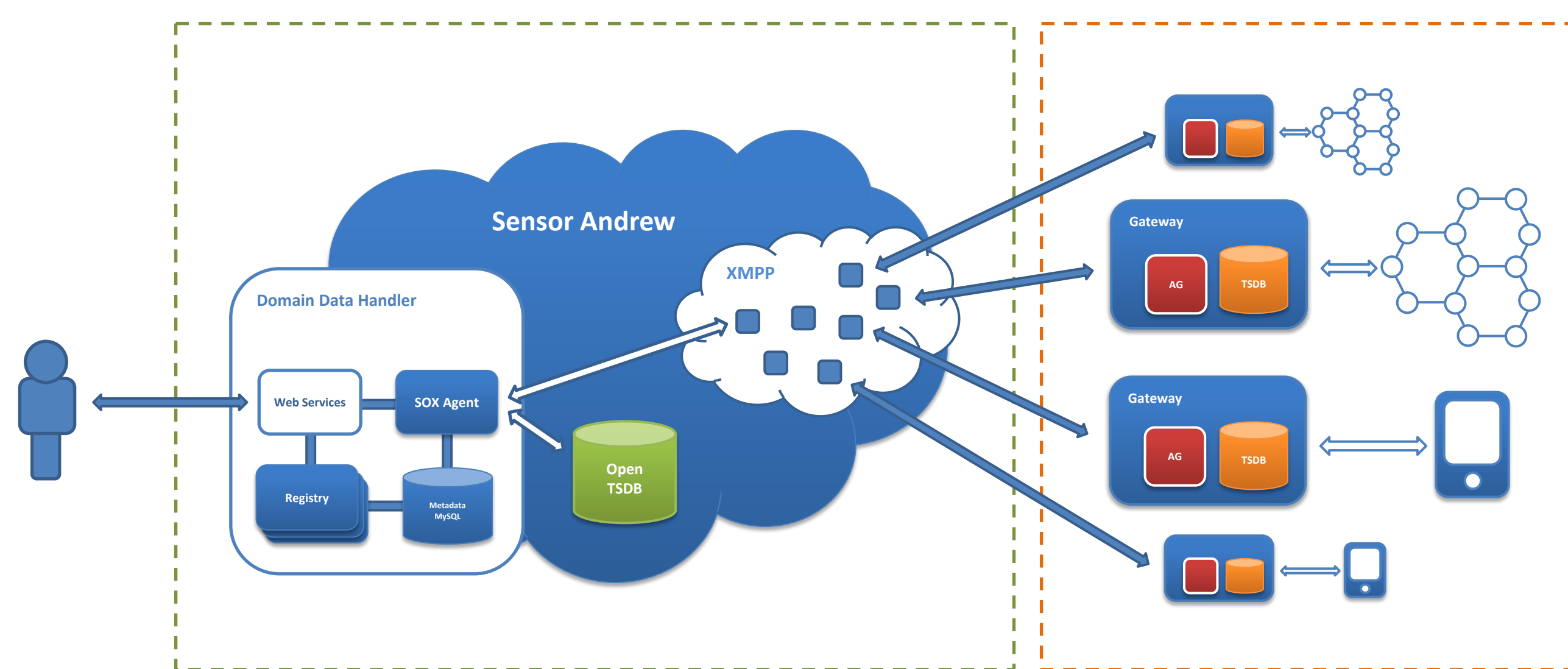


BodyTrack



A Living Laboratory for Infrastructure Sensing Technologies

Architecture



System Components

- Sensor Andrew: real-time communication
 - Extensible Messaging and Presence Protocol (XMPP)
 - Publish / subscribe architecture
 - Access control / presence
- Archival data
 - Cloud -> OpenTSDB (coarse-grained)
 - Gateway data -> local archive (fine-grained)
 - Resolution-based DB selection below query
- Synthesize hardware accelerators
 - Gateway aggregators (historical data)
 - Gateway feature extractors (streaming data)



Gateway Hardware



- Multi-Chip Single Package
- Atom E6x5C
 - Dual Core 1.3 GHz
 - 1 GB RAM
- Altera FPGA
 - 312 Multipliers
 - 60,000 Logic Elements
 - 350 user I/O pins

