SCALE System: Safe Community Alert Net

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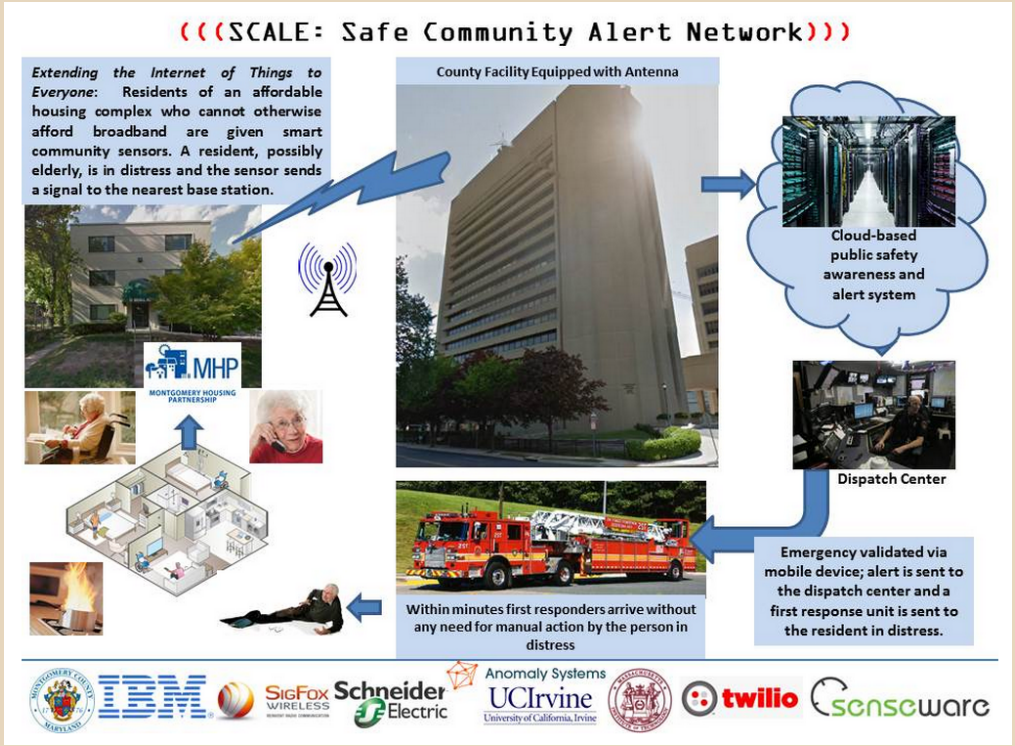
Overview

- Motivation
- Ecosystems
- Clients Design (SCALE Smart boxes and Android phones)
  - Hardware Components
  - Software
- Challenges
- Project Status

SCALE Motivation

- Several dangerous situations are not addressed efficiently in communities
- Often we must rely on manual reporting for emergencies or purchase expensive systems for automatic help responses
- SCALE aims to utilize sensors to create a connected safe home network which can affordably and reliable report emergencies to the necessary responders

SCALE Ecosystem

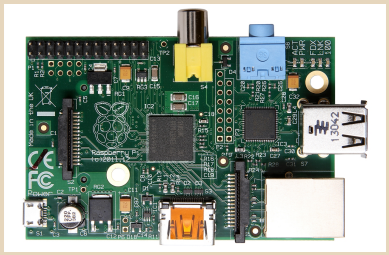


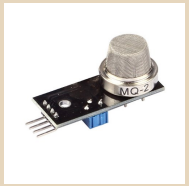
- A sensor box is placed in a resident's home
- This box collects information from a variety of sensors and communicates the data to an IBM server via MQTT
- A SCALE server then collects the sensor data from the IBM server and intelligently processes it to determine whether an event occurred
- Emergency responders react to these events accordingly

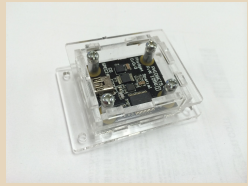
SCALE Smart box

SCALE Smart box hardware components

- Platforms
  - Raspberry Pi
  - SheevaPlug
- Sensors
  - Explosive Gas Sensor (MQ2)
  - Light Sensor
  - Passive Infrared Sensor
  - Temperature Sensor
  - Accelerometer
- Network Interfaces
  - Wi-Fi Dongle
  - Sigfox Adapter
  - Ethernet Interface







SCALE Smart box software components

OS: Debian

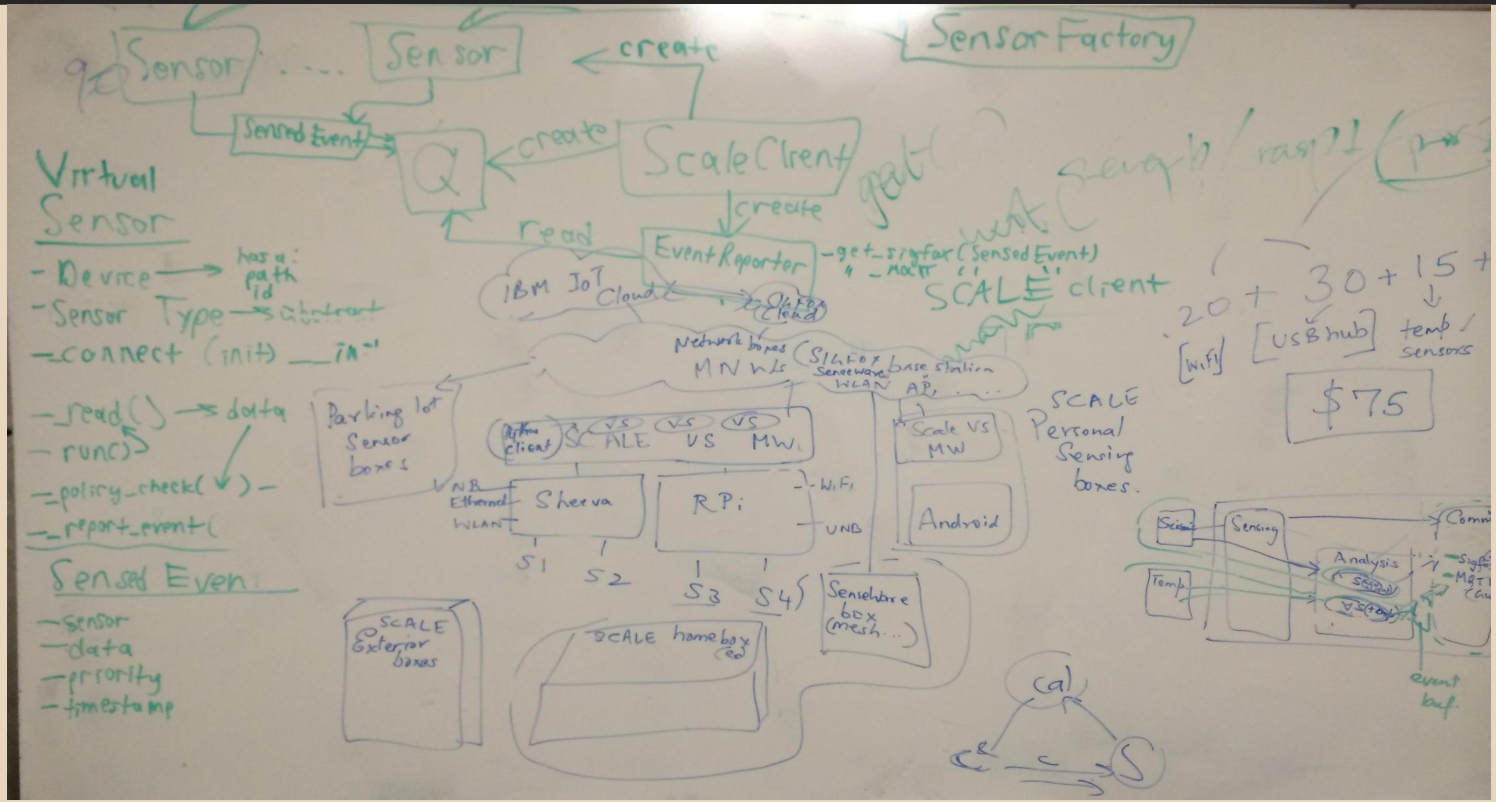
Network: Ethernet, Wi-Fi and SigFox

Salt: deployment and management system, which is used to manage SCALE smart boxes after they are deploy

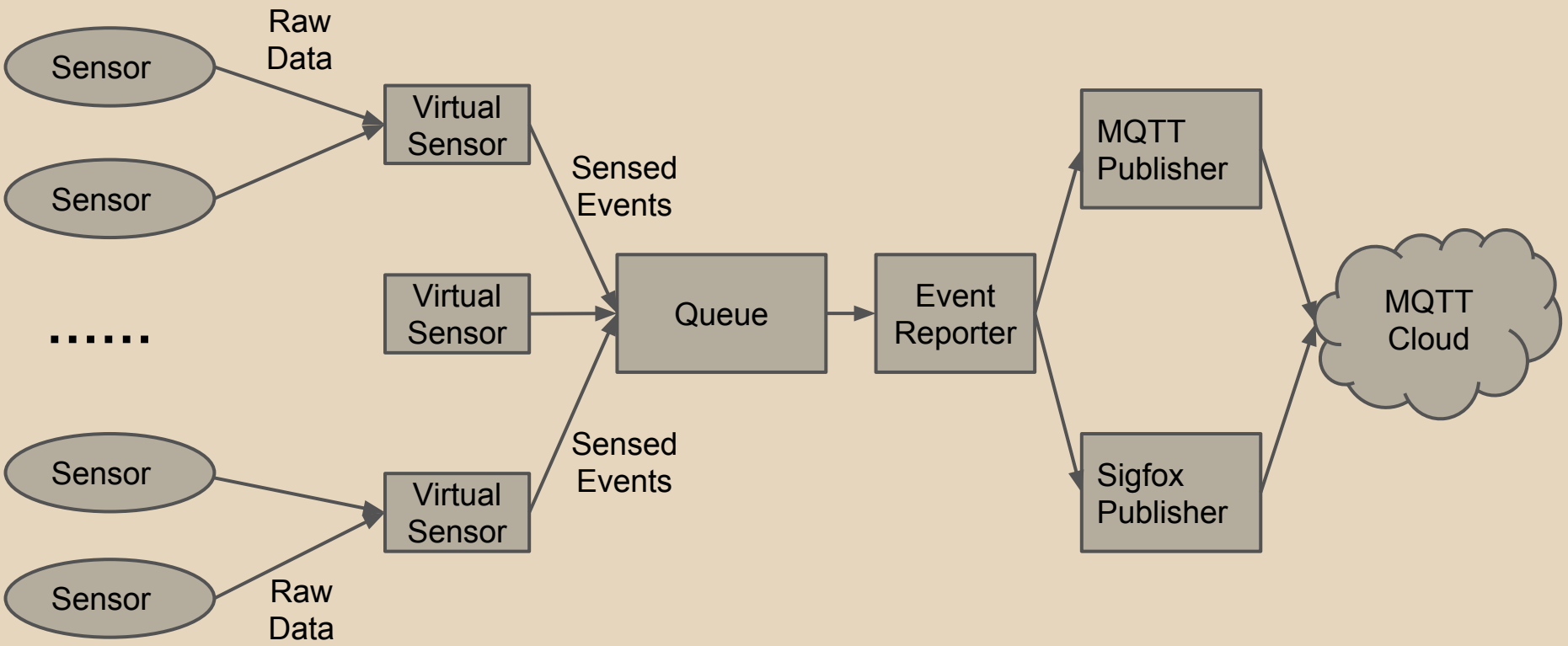
CSN Client: C++ application to collect ground shaking (written by Caltech)

Scale client: send sensors signals to MQTT server

SCALE Client System Design



SCALE Client System Design



SCALE Fall Detection

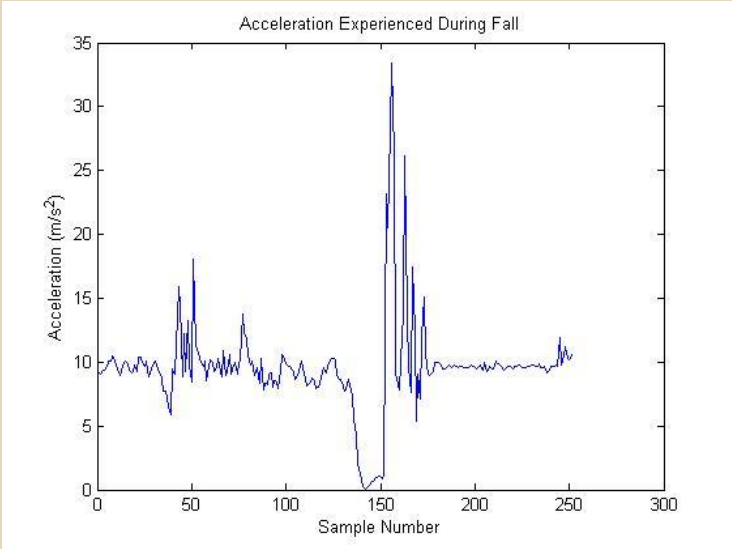
- Falls occur often in the elderly community and can cause serious injury

Hardware

- Android OS
- Triaxial Accelerometer
- Wi-Fi/Mobile Network

Software & Algorithm

- Java & XML
- Compute total acceleration from components using sqrt $(x^2+y^2+z^2)$
- Fall is detected when acceleration crosses two thresholds consecutively
- Send fall information via MQTT to IBM server



Challenges

1. Network configuration at residential houses (Wifi Dongle only works on unsecure network)
2. Software replication(sheevaplug)
3. How to extract events from raw data effectively?
4. Quality of Service(QoS)
5. Distinguishing between fall and everyday activity

Project status

1. Testing
2. Deploying SCALE Smart boxes (UCI campus and Montgomery County, Maryland, USA)
3. Demonstration scheduled on June 10th