

# 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 reliably report emergencies to the necessary responders

# SCALE Ecosystem

((((SCALE: Safe Community Alert Network))))

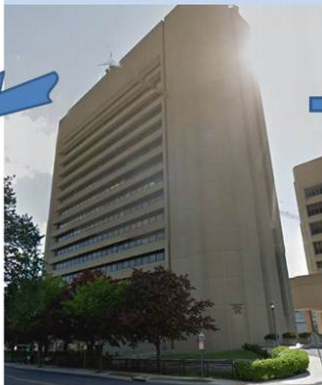
*Extending the Internet of Things to Everyone:* Residents of an affordable housing complex who cannot otherwise afford broadband are given smart community sensors. A resident, possibly elderly, is in distress and the sensor sends a signal to the nearest base station.



MONTGOMERY HOUSING PARTNERSHIP



County Facility Equipped with Antenna



Within minutes first responders arrive without any need for manual action by the person in distress



Cloud-based public safety awareness and alert system



Dispatch Center

Emergency validated via mobile device; alert is sent to the dispatch center and a first response unit is sent to the resident in distress.

- 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

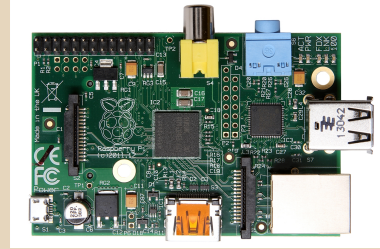


# SCALE Smart box



# 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

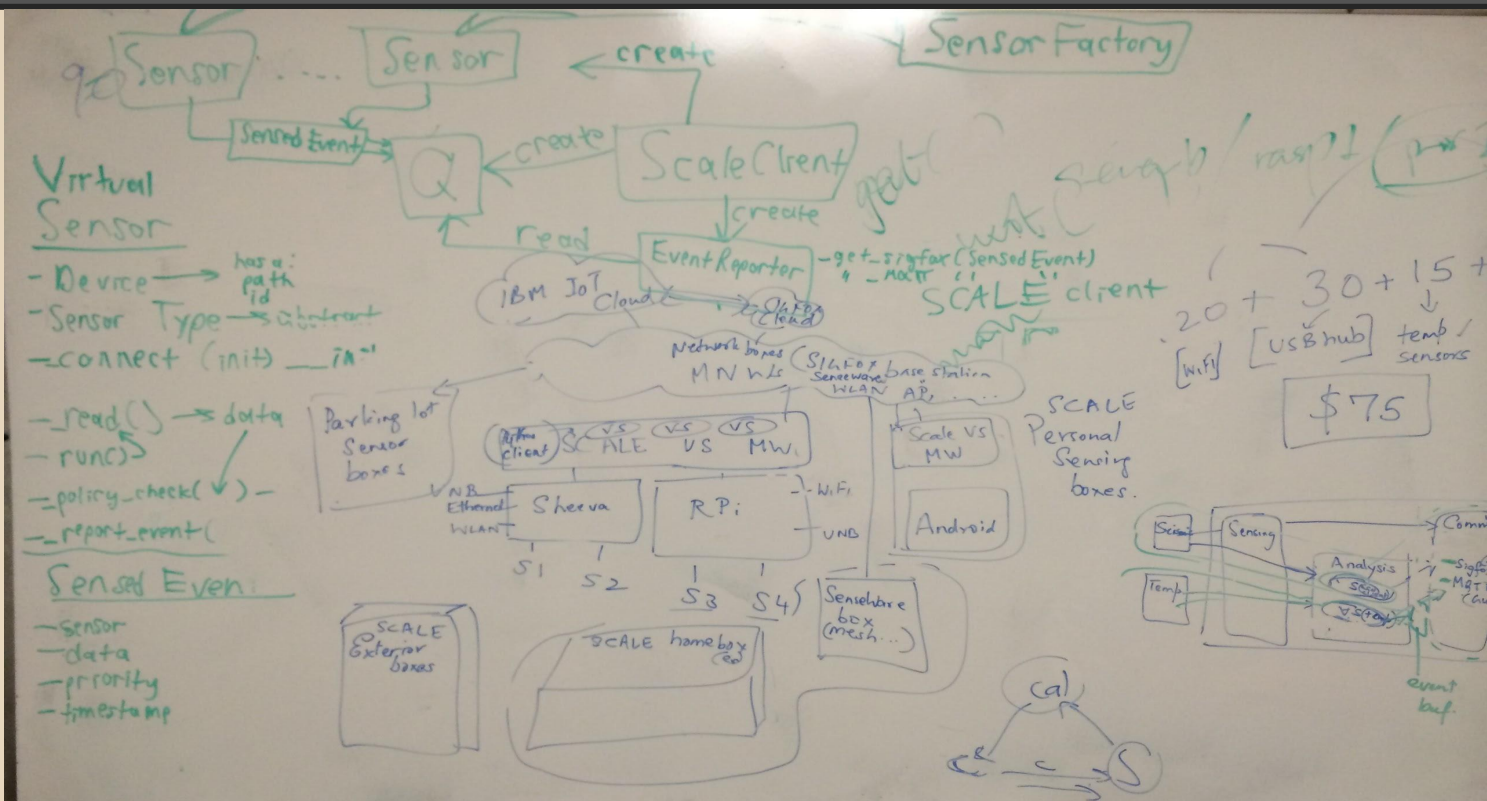
Salt: deployment and management system, which is used to manage SCALE smart boxes after they are deployed

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

Scale client: send sensors signals to MQTT server

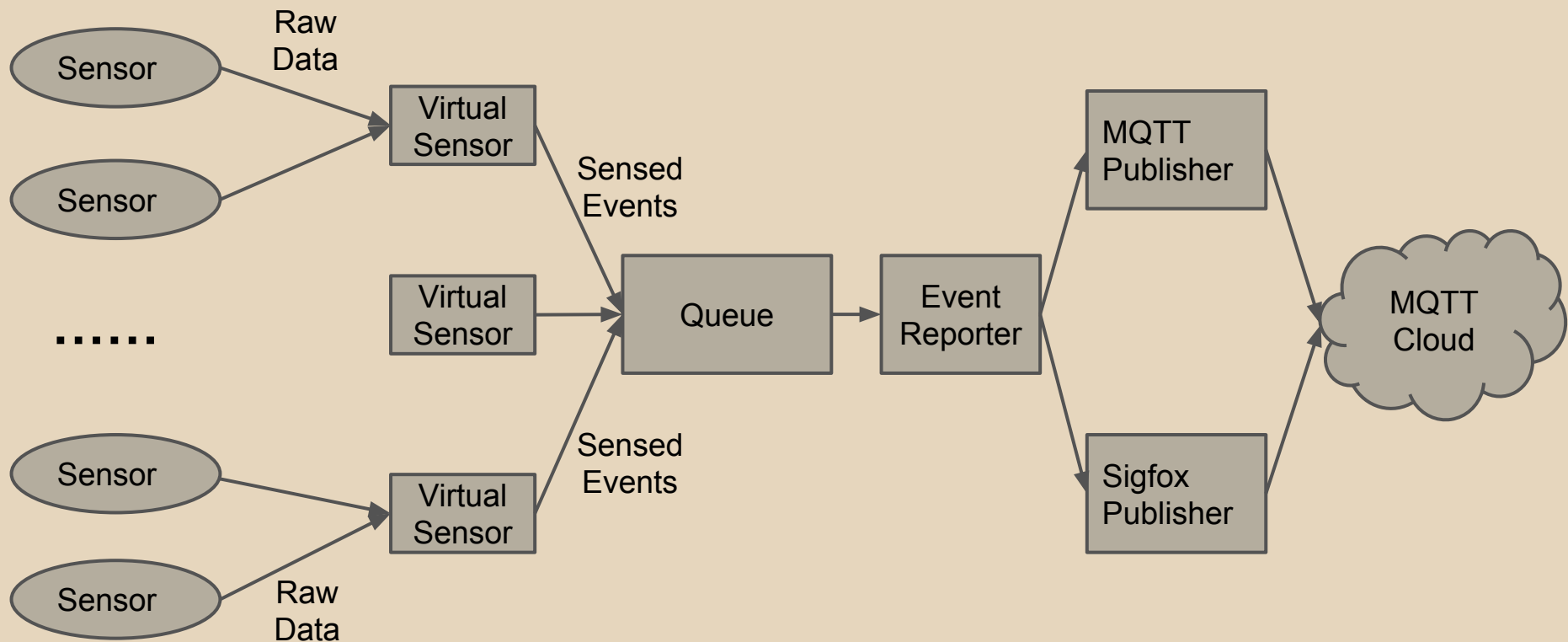


# SCALE Client System Design





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# SCALE Fall Detection

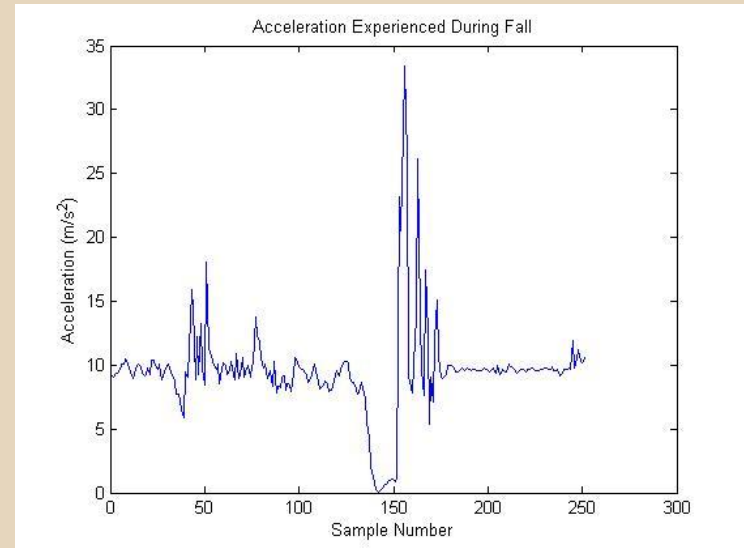
- Falls occur often in the elderly community and can cause serious injury

## Hardware

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

## Software & Algorithm

- Java & XML
- Compute total acceleration from components using  $\text{sqrt}(x^2+y^2+z^2)$
- 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