



Enabling Multi-Informatics for Nuclear Operation Scenarios via a Scalable and Data Agnostic Framework

A. Christe¹, M. Garces¹, K. Asmar¹, S. Magana-Zook², J. Gaylord², D. Chichester³
¹University of Hawaii at Manoa, ²Lawrence Livermore National Laboratory, ³Idaho National Laboratory
Milton Garces, milton@isla.hawaii.edu
Consortium for Verification Technology (CVT)



Abstract

With the advent of distributed computing, managing data flow from sensor networks has become increasingly complex. We examine numerous cutting-edge technologies to enable secure acquisition, analysis, reporting, and collaboration of IoT sensor data. Our platform provides end-to-end security and data provenance to address sensitivity and privacy concerns. Our framework utilizes a flexible data model that accepts data from any of the available sensors on a smartphone. These data are provided to our collaborators in real-time over secure distributed data queues. We describe how these components work together to enable efficient collaboration and how they aid in the collection, detection, and analysis of signals of interest.

Introduction and Motivation

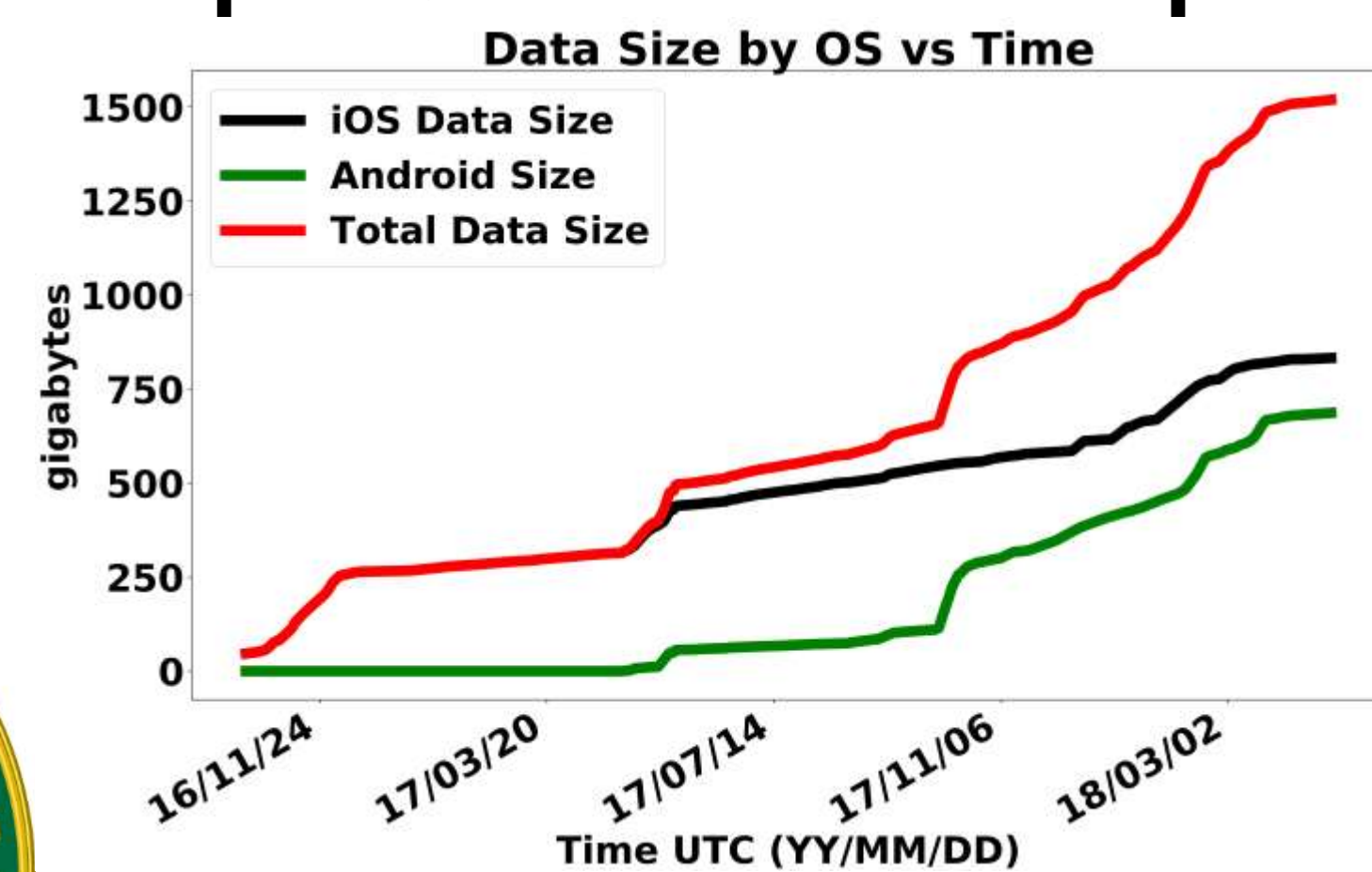
Benefits of Distributed Smartphone Networks

- Ubiquitous / mobile
- Rapidly deployable
- Small size, low weight, power, and cost
- Structured access to all onboard sensors

Challenges of Distributed Mobile Sensors

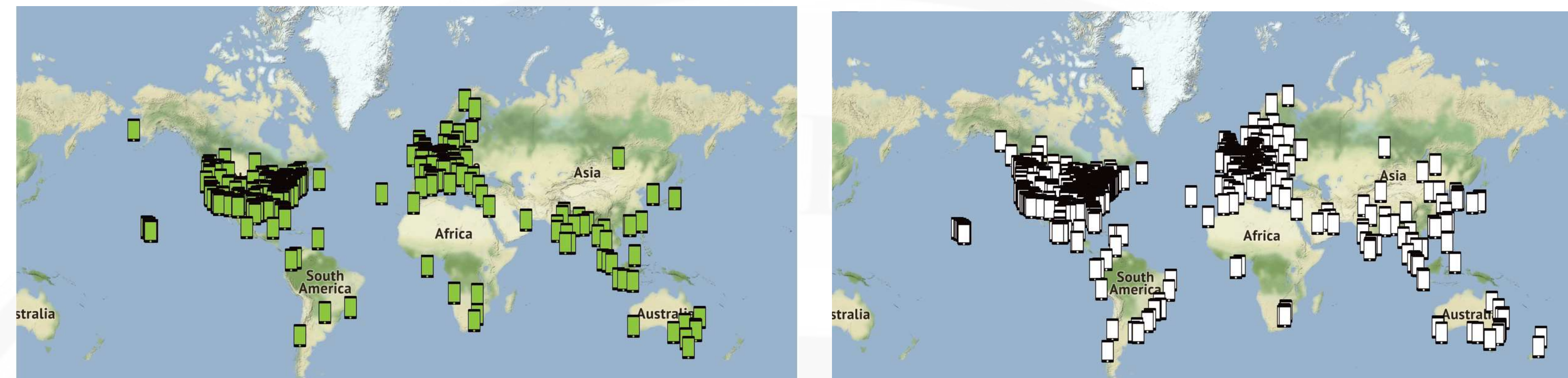
- Volume, velocity, variety, and value of data
- Secure sharing large data sets
- Intermittent data collection
- Deployment in restricted areas

Rapid Growth and Adoption

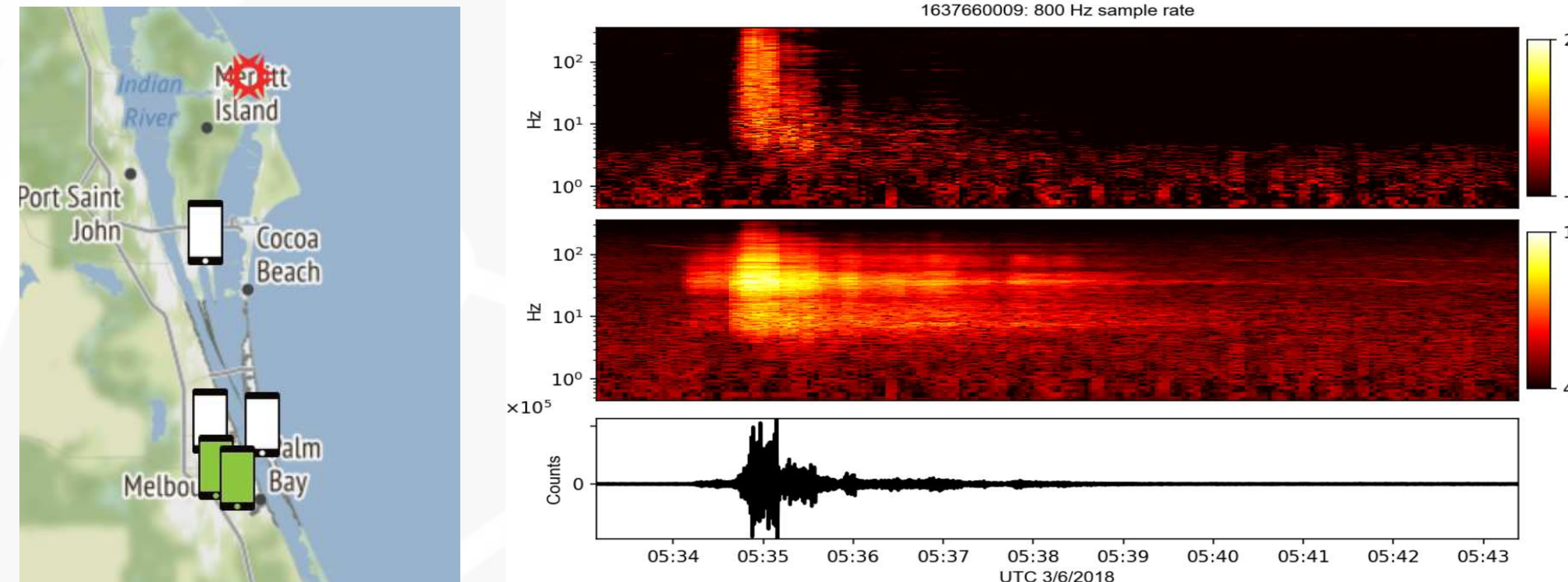


Mission Relevance

Supplement Global Monitoring Networks with Smartphone Networks



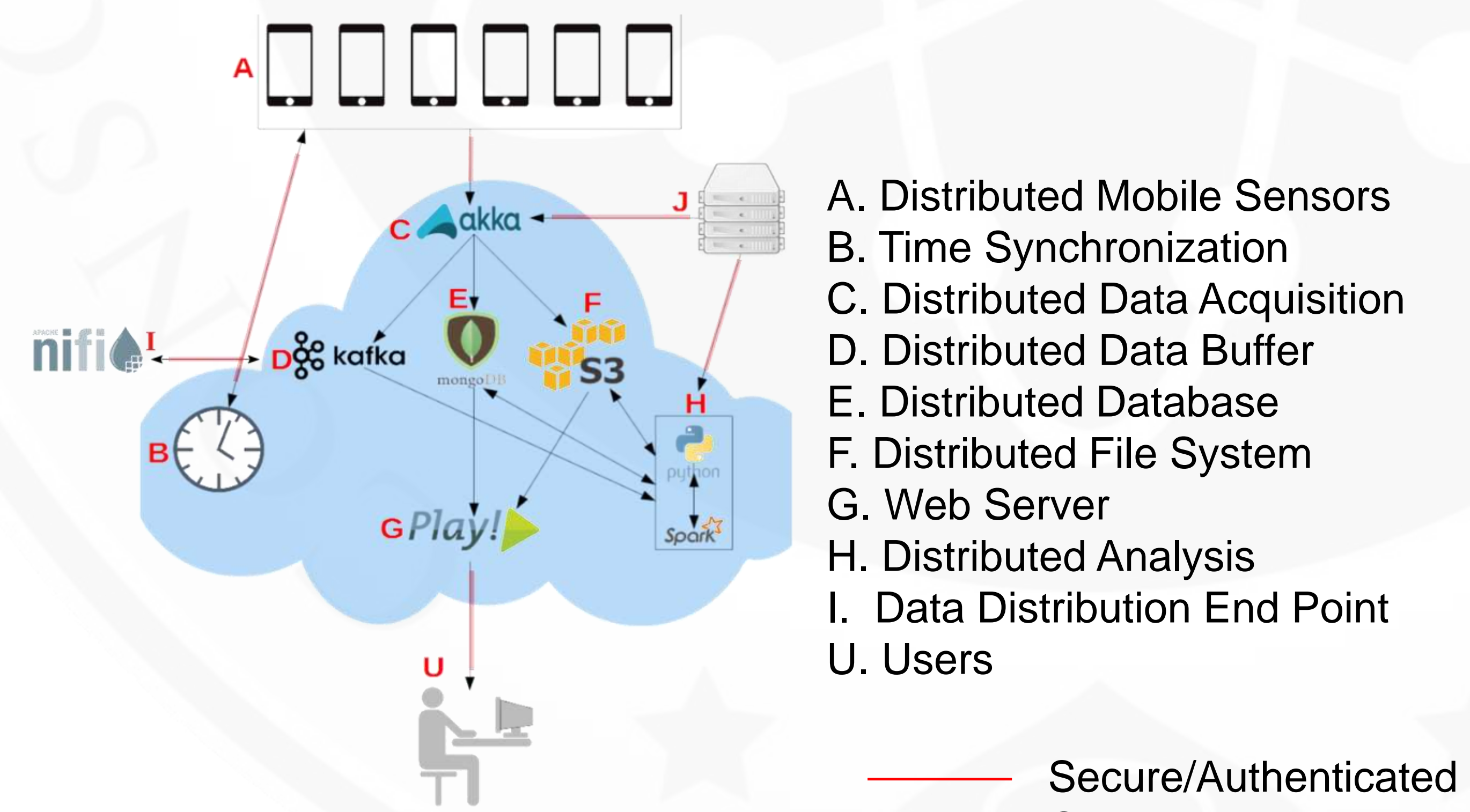
Provide Infrasonic Detections of Declared and Undeclared Activities



Selected Report: Falcon 9 Hispasat

See full report at <https://redvox.io/@/89c5>

Technical Work and Results

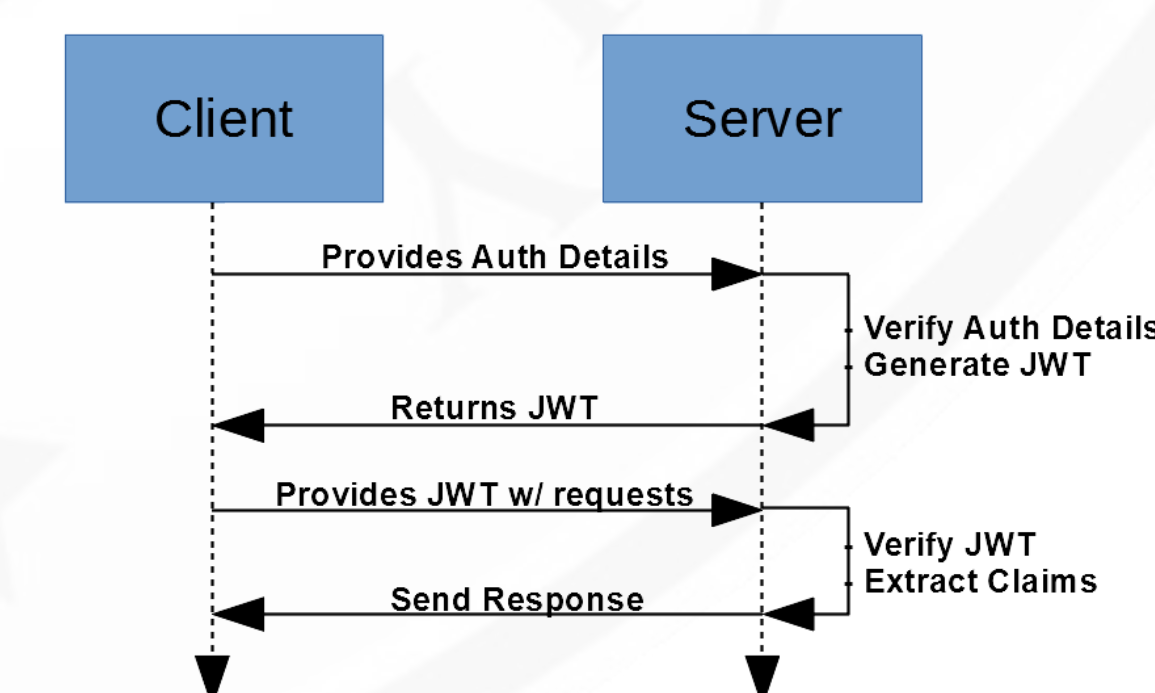


Lokahi Framework

Distributed - Acquisition / Analysis / Persistence / Reporting / Collaboration

Security & Privacy

- Fully encrypted
- Fully authenticated
- Control of sensor data
- Secure data sharing



Jason Web Token Authentication

CVT Impact

Unprecedented global collection capability

- From explosions
- From the nuclear fuel cycle
- From rocket launches
- On high-altitude balloons

Personal impacts

- LLNL Academic Cooperation Program
- CVT, UITI, & UPR Workshops
- *A Framework for Real-Time Collection, Analysis, and Classification of Ubiquitous Infrasonic Data*, AGU, 2016

- *A Big Data Pipeline for Temporospatial Infrasonic Analysis*, ASA, 2016

- Collaborations with INL, ORNL, SNL

Technical collaborations

- Evaluate Big Data tech stacks – LLNL
- Field collections - LLNL
- Identify possible fuel cycle signatures – INL & ORNL
- Smart phones at high altitudes - SNL

Conclusions

- Framework enhances our ability to detect and characterize declared and undeclared infrasonic signals of interest
- Mobile sensors allow us to quickly deploy and supplement the International Monitoring System (IMS) network
- Distributed system handles multi-modal mobile sensor data securely at scale
- Real-time sharing of data with collaborators



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