Abstract

Smartphone and IoT sensors allow us to build dense distributed sensor networks to supplement traditional networks. Due to the increased volume, velocity, and variety of data being produced, data acquisition, storage, analysis, and reporting techniques are evolving from single server to more complex distributed computation architectures. In the interest of protecting privacy and sensitive data, it is critical to provide end-to-end security and data provenance. In collaboration with Lawrence Livermore National Laboratory, we build upon our distributed data pipeline to provide enhanced end-to-end security by utilizing standard web based encryption protocols. Authentication provides data ownership and provenance from device to server and is implemented via JSON Web Tokens and elliptic curve encryption technology. On-demand reporting has been enhanced with improvements to Apache Kafka. Internal system messages and data formats have been standardized to facilitate importing and exporting of data and metadata. Distributed real-time notifications allow us to target app users by geography, alerting them of upcoming infrasonic events. We describe how these software components work together to provide acquisition and analysis for recent infrasound signatures as well as how these technologies can be used to capture future infrasonic events of interest.

Emphasizing Security / Privacy
- Encrypted Time Synchronization
- Encrypted User Interaction
- Private Servers for Sensitive Data
- JSON Web Tokens for Data Provenance
- Elliptic Curve Signed/Verified Keys
- Sanitization of Sensitive Reports

Lokahi Framework
- Distributed Acquisition
- Distributed Real-Time Analysis
- Distributed Persistence
- Distributed Metrics / Data Access

Standardization of APIs
- Protocol Buffers Internal Comms
- Protocol Buffers for Sensors
- Standard Schema Specifications
- Programming Language Flexibility
- Makes Collaboration Easier

Real Time Processing Improvements
- Query Apache Kafka Directly
- Tune Parameters Sensor Type
- Tune Parameters for Sample Rate
- Less Memory Pressure for Analysis

Google Firebase Notifications
- Notifications by OS
- Notifications by Configuration
- Notifications by Region

Metadata QA
- Extract / Export Metadata
- Query by time range
- Filter Fields

This work was funded in-part by the Consortium for Verification Technology under Department of Energy National Nuclear Security Administration award number DE-NA0002534