**SmokeSignals**: Distributed Key-Value Store on a Mobile Network

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**BACKGROUND**

Internet-enabled smartphones depend critically on centralized infrastructure to access any network. This infrastructure has several shortcomings:

- large gatherings like sporting events or concerts often overwhelm network capabilities
- during a disaster such as a hurricane or terrorist attack, networks often fail completely when communication needs are critical
- users may prefer a surveillance-resistant decentralized network for sensitive communications

**GOALS**

Our proposed solution is a decentralized peer-to-peer key-value store replicated across mobile devices. It should:

- synchronize with nearby devices when they are in range, on a best-effort basis
- propagate changes across the network even as nodes move and sever existing links, or leave the network entirely
- provide a general API allowing developers to easily build a variety of peer-to-peer applications using our software

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**IMPLEMENTATION**

**Overview**

Our Android application consists of a background service running on each device, combined with a persistent copy of the underlying store. The background service continuously discovers nearby Bluetooth devices within the network, via the Service Discovery Protocol, and synchronizes with them without the user’s intervention.

**Architecture and data flow**

- **Application** Key-Value Store Driver
  - Application starts synchronization service and then uses driver to read and write data to persistent store
- **Other Devices**
- **Background Service**
  - Server Thread (Update Listener)
  - Broadcast Thread (Discovery)
  - Key-Value Store Driver

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**RESULTS**

**Data propagation**

Each device periodically broadcasts its view of the store to all devices in range. Eventually, each phone in a connected component is consistent with all other phones.

**Generic API for applications**

We provide a simple, generic API supporting standard operations on a key-value store. Values can be strings, which are generally kept in memory, or binary blobs, which are always persisted to disk.

**Two demo applications**

We have developed two applications making use of our API.

- One app broadcasts text messages to all devices in the network, useful in emergency situations.
- The other app is designed to share images, like a decentralized Dropbox.

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**FUTURE WORK**

- Support for additional operating systems
- Scalability and performance optimization
- Add encryption layer on top of key-value store