Android Smartphone as a Microphone in SmartRoom System

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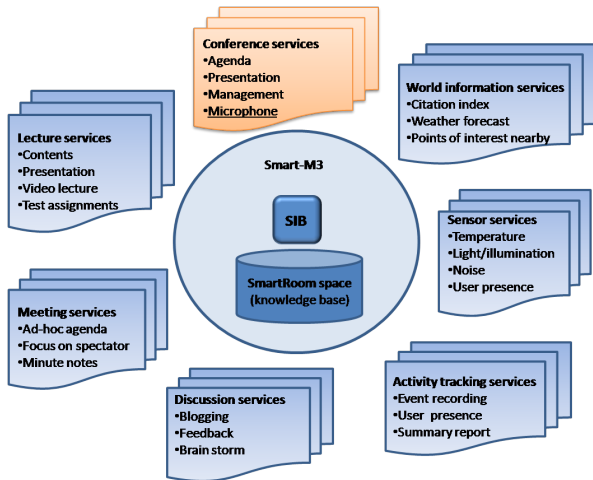
15$^{\text{th}}$ FRUCT Conference

April 24, 2014, St.-Petersburg, Russia

SmartRoom System Services

- Centralized data storage (SIB: Semantic Information Broker)
- Many mobile clients

Microphone-service: High Level Architecture

- **JNI** - enables Java to use native implementations
- **SmartSlog** - provides API for Smart Space interaction
- **JSpeex** - audio processing Java module
- **DatagramSocket** - Java implementation of UDP protocol
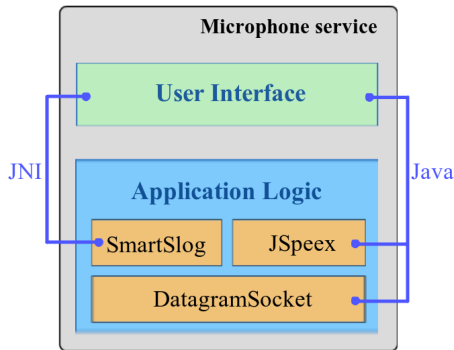
User Datagram Protocol (UDP) is more suitable for such streaming applications like Microphone-service.
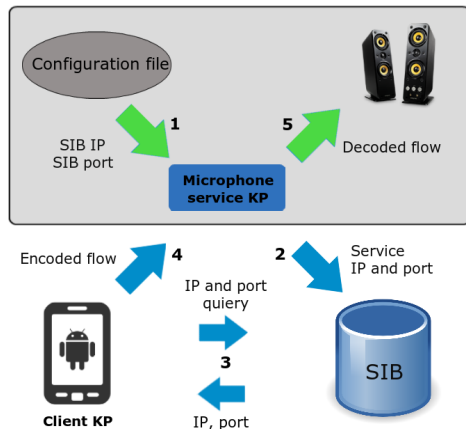
Microphone-service: Knowledge Processor
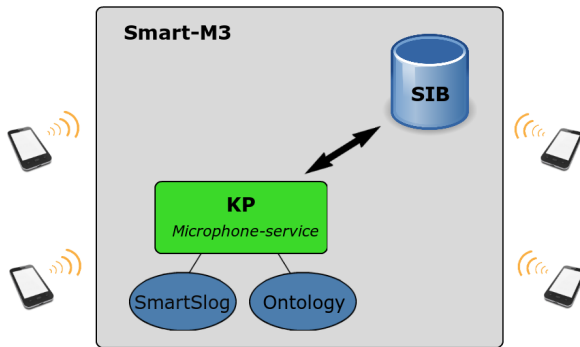
- Service is implemented as a single KP
- SmartSlog: SDK for KP development
- Ontology: service representation model (OWL, RDF)

Microphone-service: Workflow Scheme

1. Initialization
2. Publishing address
3. Listening for connections
4. Receiving and processing data
5. Playing audio flow

Development: Microphone-service KP (server) and Client KP

Android Client: Architecture

- **User interface** Java-based module uses Android SDK

- **JNI** enables Java to use native implementations

- **Application logic** is C written and supported by Android NDK

- **SmartSlog** supports ontology-driven implementation:
  - publication and extraction data
  - subscription mechanism
  - connection state tracking

(Android) **SmartRoom client KP**

User Interface

JNI

Application Logic

SmartSlog

CKPI

SIB
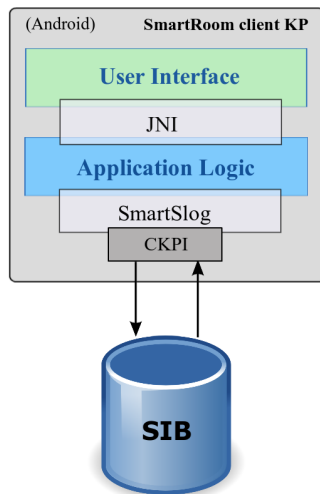
Android Client for SmartRoom: User Interface
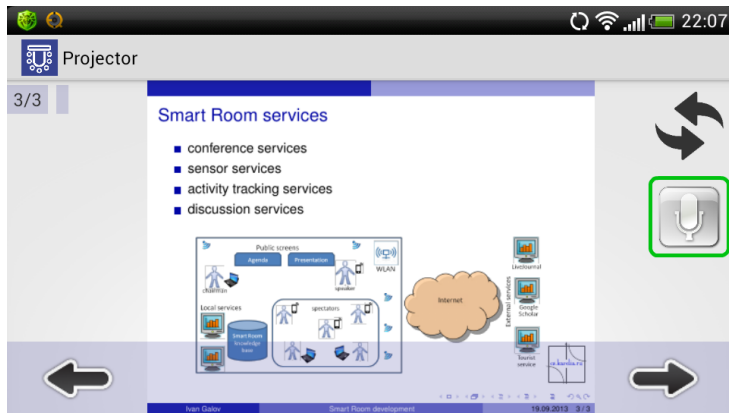
- Mobile device becomes a microphone
- Users: current speaker and chairman

Performance Experiments

Wireless network quality strongly influences on service performance.

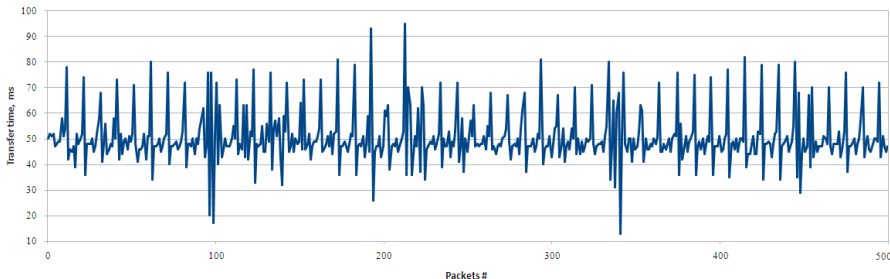| Network transmission		Audio processing
Average	Standard deviation	
$\bar{\tau} = 50$ ms	$\sigma = 6$ ms	≈ 15 ms

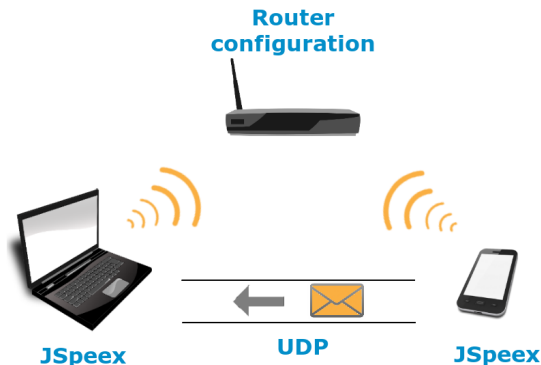Figure: Transmission time of 500 UDP packets of 62 bytes

Performance: Our Solutions

- Audio processing: JSpeex codec
    - based on CELP algorithm
    - well-suited to handle VoIP
    - suitable for unreliable transfer packets network
- UDP for real-time audio transfer
- Router configuration: selection of less used network channel

Metrics of Implementation

	Client side	**Server side**
Java code, loc.	138	293
C code, loc.	91	84
Devices	Samsung Galaxy S3	Notebook Asus x200ca D-Link DIR-320 router
Tools	SmartSlog SDK, JSpeex Android SDK/NDK, JNI	

Conclusion

- Released server (Linux) and client (Android) KPs
- Performance: solutions and experimental evaluation
- SourceForge:
  http://sourceforge.net/projects/smartroom/
  files/services/microphone-service/
- Project Wiki:
  http://oss.fruct.org/wiki/SmartRoom
- Android client:
  http://play.google.com/store/apps/details
  ?id=petrsu.smartroom.android.srclient

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