Motivation: Real-time Audio Apps.

Many real-time audio applications are emerging. Specifically, many of them use an audio device for measuring something based on acoustic sensing.

1. Localization
   - GuoGuo (MobiSys ’13)
   - SwordFight (MobiSys ’12)
2. Gesture recognition
   - SoundWave (SIGCHI ’12)
   - AirLink (UbiComp ’14)
   - Spartacus (MobiSys ’13)
3. Mobile acoustics
   - Mobile Maestro (UbiComp ’14)

Mobile Multi-speaker Audio (MMA) Apps

As one of them, MMA apps use loudspeakers of mobile devices collaboratively for immersive sound (e.g., 5.1ch surround sound)

Example: on a camping site, users easily can construct a spectacular surround sound for an action movie through MMA applications.

Timing Requirements of MMA Apps

Multiple mobile devices should be harmonized in terms of sound arrival time. “A high degree of accuracy in sound arrival time (up to 1 millisecond)”

Harmonized
(Within 1 millisecond)

Not harmonized
(More than 1 millisecond)

Real-time Audio Coordination (RAC)

We propose Real-time Audio Coordination (RAC) framework to support predictable audio playback of MMA apps.

Challenge: Unpredictability on Android

Commodity mobile devices do not offer tight timing guarantees for playing back audio streams.

In This Demo: Mobile Theater

You will experience Mobile Theater, a mobile 5.1ch surround sound system, based on 1) Android and 2) RAC

Scenarios

1. Other applications are already running while competing for CPU

2. Users construct a 5.1ch surround sound system using Mobile Theater, and watch a movie.

3. During the playback of Mobile Theater, one of players gets a message and a notification alarm is requested.

Due to the unpredictability of Android, the difference is randomly distributed [0, 35.7ms]