



Aalto University
School of Science

T-110.5130 Mobile Systems Programming (5 cr)

Practical issues and course arrangements

7th January 2015

D.Sc. (Tech.) Sakari Luukkainen, responsible teacher

M.Sc. (Tech.) Olli Mäkinen, course assistant

Agenda

- Course basics
- Mobile platforms
- Group assignments and topics
- Responsibilities of the group leader
- Lecture schedule and other important dates
- Topic introductions

Course basics (1/2)

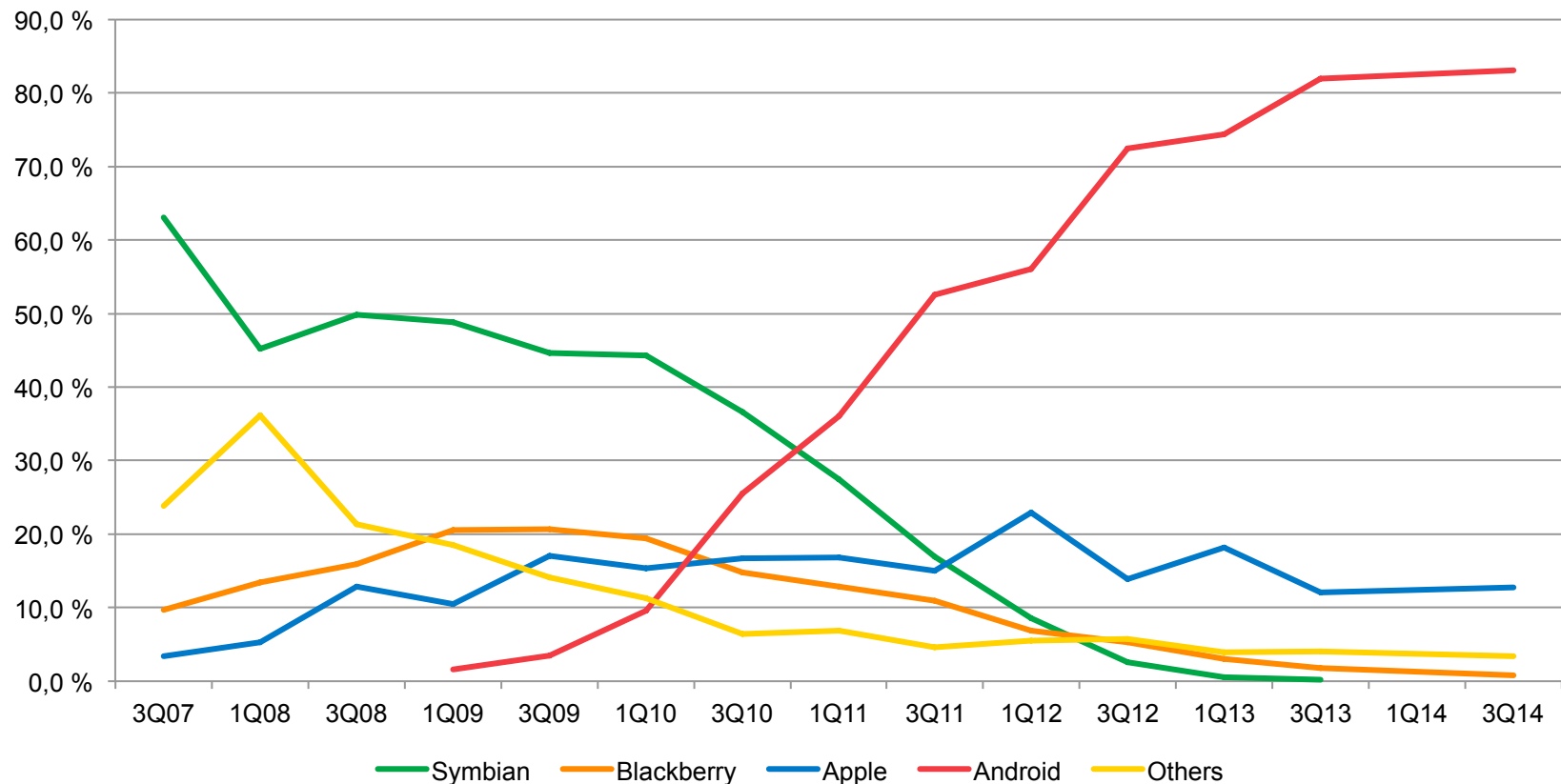
- Responsible teacher: Sakari Luukkainen
- Course assistant: Olli Mäkinen, olli.makinen@aalto.fi
- Additional contact persons for different topics
- Android technical support by Kimmo Ahokas (details will be provided later)
- 5 credits, periods III-IV + a demo session in period V
- Registration via e-mail to the course assistant (DL: 12th January at 23:59, details are available on the Noppa page)
- As a prerequisite, you should know the principles of programming

Course basics (2/2)

- Course news will be published in Noppa
- The goal is to introduce key aspects in mobile programming, ranging from platform selection to actual implementation and deployment
- Special focus is given to group working skills, innovative development of mobile applications and entrepreneurship possibilities in Aalto
 - App competitions are a great way for starting businesses
- Grading is based on a programming project done in groups, no exam (30% project plan, 30% final report, 40% project outcome / application demo)
- A demonstration video of the application can affect the grade upwards
- Giving course feedback is mandatory, the link to the feedback form will be published later in Noppa

Mobile platforms (1/3)

Source: Gartner



Mobile platforms (2/3)

Worldwide Smartphone Sales to End Users by Operating System in 3Q14 (Thousands of Units)

Operating System	3Q14 Units	3Q14 Market Share (%)	3Q13 Units	3Q13 Market Share (%)
Android	250,060.2	83.1	205,243	82.0
iOS	38,186.6	12.7	30,330	12.1
Windows	9,033.4	3.0	8,916	3.6
Blackberry	2,419.5	0.8	4,401	1.8
Other OS	1,310.2	0.4	1,407	0.6
Total	301,009.9	100.0	250,296.8	100.0

Source: Gartner (December 2014)

Mobile platforms (3/3)

- In this course, we are concentrating on Android, but if enough participants are interested, groups based on iOS and Windows Phone can be formed in the free topic
 - Google Developer Group Helsinki: <https://developers.google.com/groups/chapter/109967202177947139764/>
- Apple's App Store and Google Play compete for developers, and take a cut for themselves from sales
- Both have expanded to mobile payments (Google Wallet / Apple Pay)
- Both have expanded to car platforms as well (Google with Open Automotive Alliance, Apple with CarPlay)

App competitions

- Many different competitions are held with significant prizes
- Apps4Finland encourages developers to use open data
 - Organized every year in Autumn
 - <http://apps4finland.fi/en/>
- A similar Europe-wide competition is Apps for Europe
 - <http://www.appsforeurope.eu/>
- Best Mobile Service in Finland – a rather large competition
 - <http://www.bestmobileservice.fi/>
- AppCampus is designed for startups to utilize Windows Phone, funded jointly by Microsoft and Aalto
 - <http://www.appcampus.fi/>
- Another Microsoft organized competition is Imagine Cup
 - <http://www.imaginecup.com/>

Group assignments and topics (1/3)

- The group assignment consists of developing a mobile application as well as a plan for it and a final report
- One group will have 4-5 members unless there are very good reasons (doing solo is not possible)
- The available topics are:
 - Mobile-edge Computing, subtopics:
 - Video orchestration
 - Mobile P2P communication
 - Traffic safety
 - Local caching – content acceleration
 - Mobile control of LED lighting systems
 - Drones for data collection
 - Personal fitness
 - HSL
 - Signal strength mapping
 - Other

Group assignments and topics (2/3)

- Groups are assigned to participants on preferred topics and platforms – these will be published on next week's lecture
- Send an e-mail to the course assistant (olli.makinen@aalto.fi) with the following information (by 12th Jan at 23:59)
 - Your name and student ID number
 - Your preferred topics in order (mention all of them)
 - Your preferred development platforms in order (e.g.: 1. iOS, 2. Android, 3. Windows Phone 8). This will apply for the “Other” topic only.
 - Your programming experience and background (“mini-CV”) in general and with which languages and platforms
 - Possible aspiration to become a group leader

Group assignments and topics (3/3)

- We will assign a person in the group who will be responsible for gathering everyone for the first meeting
- The group will select a leader themselves
- Required reports:
 - Preliminary plan (template will be provided into Noppa)
 - Final report including a functional description, source code as well as an initial business and deployment plan to the appropriate Marketplace/App Store/etc. (using STOF, material will be provided)

Projects completed last year

- A variety of projects were done
 - Game built with Unity for Android
 - Translator app
 - Native app for HSL KutsuPlus
 - OBDII vehicle information fetcher
 - Autonomous drone flyer, following an object

Responsibilities of the group leader

- The primary responsibility of the group leader is to negotiate the group meetings and to be the primary contact person to the group's tutor
- The leader will also submit the group plan and final report

Lecture schedule and other important dates

- 7.1. at 12-14 in T2: Introduction
- **12.1. at 23:59: DL for the topic preference e-mail**
- 14.1. at 12-14 in T2: MEC / RACS
- 21.1. at 12-14 in T2: Android development
- 28.1. at 12-14 in T2: OpenStack
- **22.2. at 23:59: DL for group project plan for tutor by e-mail**
- 25.2. at 12-14 in T2: RACS programming clinic
- 4.3. at 12-14 in T2: Android and OpenStack clinic
- 18.3. at 14-16 in AS1: Mobile ecosystems (together with NSBM)
- 25.3. at 14-16 in AS1: Startup information (together with NSBM)
- 6.5. at 9-14 in T2: Project demonstrations 10-15min/group and **DL for the final report (tentative)**

Topic introductions

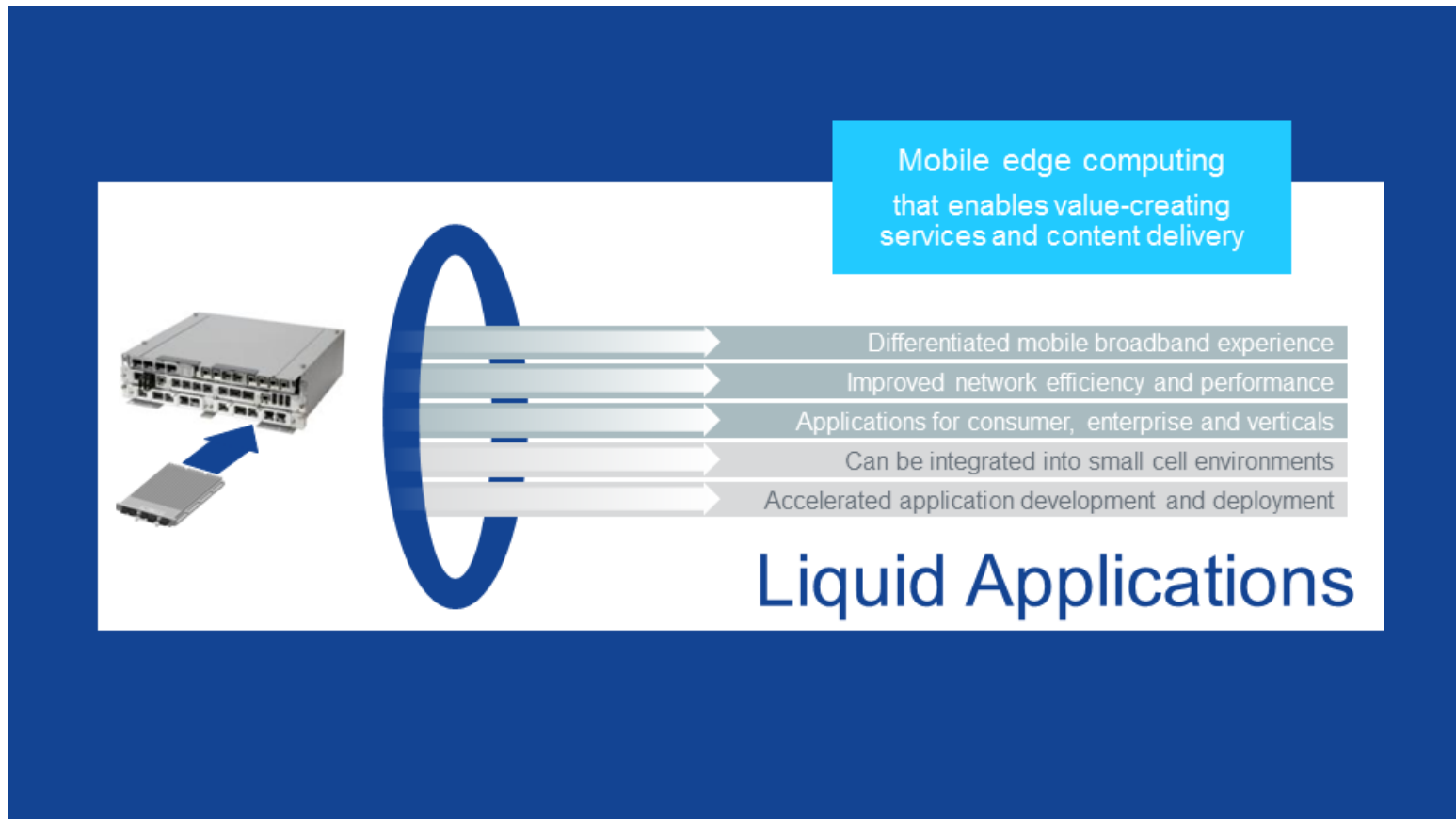
- MEC in general – Olli Mäkinen
 - Video orchestration – Olli Mäkinen
 - P2P communication – Olli Mäkinen
 - Local caching – content acceleration – Olli Mäkinen
 - Traffic safety – Mehrdad Bagheri
- Mobile control of LED lighting systems – Sakari Luukkainen
- Signal strength mapping – Sakari Luukkainen
- Personal fitness – Vesa Salento
- Drones for data collection - Ásgeir Bjarnason
- HSL

MEC in general

- Mobile-edge Computing is a new industry initiative targeted to implement new services next to the end user in a mobile network
- In practice, an ordinary server component is installed into the base station, providing computational and storage capacity
- Nokia is driving this together with other industry players (Huawei, IBM, Intel, NTT DoCoMo and Vodafone)
- Nokia's solution is called RACS, which has been installed at our test lab

MEC in general

From: Nokia



Video orchestration

- RACS video orchestration is a concept where multiple video streams are broadcast inside the LTE network directly from the base station to the end user's mobile phone
- For example, this can be utilized in a sports event to broadcast multiple video feeds from multiple camera angles in real-time, without delays caused by the Internet
- The task in this topic is to create an application that can receive these streams and allows the user to view their preferred one. Additionally, features such as interaction between other users can be designed to immerse the audience even further.

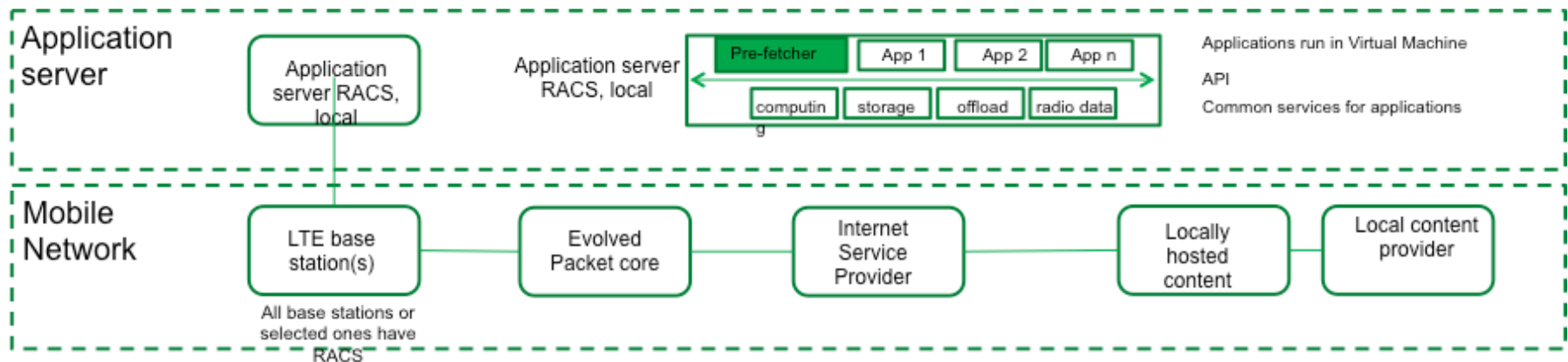
Mobile P2P communication

- This topic involves creating a Peer-to-Peer application for communication through RACS utilizing WebRTC
- The task is to enable communication in different ways, for example through text, voice messages or voice/video calls
- Intra-base station communication have a very low latency and high data speeds
- WebRTC is a framework of technologies released into open source by Google who bought a suite of patents, allowing developers to create a variety of communication services very easily, incorporating video, audio and messaging.
- <http://www.webrtc.org>

Local caching - content acceleration

- Task:
 - Develop a SW which downloads media content to Radio Access Cloud Server (RACS). Content is downloaded automatically and cached in the RACS storage. Download is periodical i.e. certain time of the day – once the content is ready to be delivered. SW is installed in the RACS server(s).
 - Each RACS will fetch the content independently via content provider's API
 - Some measurements will be done for estimating the improved performance. Measurements will verify the download improvement from the origin server and from RACS.
 - Mobile application which allows to browse this content
- Use case:
 - User downloads this prefetched media content (digital newspaper) to a mobile device. Pre-fetcher recognises the content based and if it is stored already in RACS. Content is delivered directly from RACS instead of downloading it from original server.

Local caching - content acceleration



Mobile control of LED lighting systems

- The goal is to develop a mobile application for controlling LED lighting systems
- 3rd party developers can now more easily design products that integrate mobile apps with LED lamps using open tools and APIs
- New kind of innovative services can be created by combining lighting control with other information like wake up time, calendar, movement sensors or weather forecasts...
- <http://www.developers.meethue.com/>
- <http://lifx.co/>

Signal strength mapping

- This topic involves creating an application where mobile signal strengths are recorded along with the GPS positional data into a database running in a cloud server
- This application would then e.g. be able to show the strength in a visually interesting way on a map
- This would provide new kind of use cases e.g. to make choosing the end user's mobile network operator easier in a competitive market
- <http://developer.android.com/reference/android/telephony/SignalStrength.html>
- There are already some solutions on market e.g.:
 - <http://www.internetsociety.org/netradar>
- Invent new kind of differentiated features and business model for your application!

HSL

- Region Transport HSL has continuously opened up new data sources and interfaces since 2009
- HSL governs the popular journey planner reittiopas.fi but is even prouder of their thriving developer community
- In early 2013, HSL kickstarted the public transport Navigator. The data, interfaces, standards, source code and collaboration are 100% open. This snowball has already rolled into several cities in Finland and abroad.
- The HSL topic involves developing the HSL Navigator even further – support from HSL
- <http://dev.hsl.fi/>