
# Mobile Application Development Project

MTAT.03.266

Fall 2018

Satish Srirama

satish.srirama@ut.ee

Mobile & Cloud Lab

# Course Purpose

- Practice the mobile application development
- Apply well-known techniques to develop applications for the mobile devices
- Glance of research at Mobile & Cloud Lab

- https://courses.cs.ut.ee/2018/MADP/fall

# Questions

- Have you ever programmed for mobile devices?
  - This course assumes you have experience with at least one mobile technology
  - Or you have taken **MTAT.03.262** Mobile Application Development course
- Which mobile platforms have you used already?
- How comfortable you are with programming?
  - Java ?
    - External APIs?
  - Web programming?
- Have you heard of cloud computing?

# Related Courses

- **MTAT.03.262** Mobile Application Development (3 ECTS)
  - Fri. 14.15 - 18.00, J. Liivi 2-122
- **MTAT.03.280** Mobile and Cloud Computing Seminar (3 ECTS)
  - Wed. 16.15 - 18.00, Ülikooli 17 - 218
- **MTAT.08.036** Distributed Data Processing on the Cloud (6 ECTS)
  - Fri. 12.15 - 14.00 - J. Liivi 2-122
- **MTAT.08.027** Basics of Cloud Computing (3 ECTS)
  - Spring 2019

# Grading

- No written exam
- Just deliver a project
  - Max 3 persons per group
- Activities
  - Design the application
  - Develop using the platform of your choice; Android is preferred
  - Deliver the project with detailed reports

# To pass

- One must attend 80% of the sessions
- Submission of project report
- Final presentation and demonstration
- Max 5 min Video which will be uploaded to youtube
- Source code properly managed

# Grading - progress

- Prototype 1 (20%)
  - Presentation (5%)
  - Progress (10%)
  - Punctuality (5%)
- Prototype 2 (20%)
  - Split same as Prototype 1
- Final Presentation (60%)
  - Presentation (10%)
  - Demo (20%)
  - Report (10%)
  - Video/Poster (10%)
  - Managed Source (10%)
- Bonus – People's Choice (5%)
  - If more than 6 groups

# Outline

- Mobile Application Development
- Introduction to the projects
- General discussion and forming groups

Lecture 1

# MOBILE APPLICATION DEVELOPMENT

## The Seven Mass Media

First Mass Media Channel - ***Print*** from the 1500s

Second Mass Media Channel - ***Recordings*** from 1900s

Third Mass Media Channel - ***Cinema*** from 1910s

Fourth Mass Media Channel - ***Radio*** from 1920s

Fifth Mass Media Channel - ***TV*** from 1950s

Sixth Mass Media Channel - ***Internet*** from 1990s

Seventh Mass Media Channel - ***Mobile*** from 2000s

[Tomi T Ahonen]

| Rankings | Country or regions | Number of mobile phones | Population | Connections/100 citizens | Date of evaluation |
|---|---|---|---|---|---|
| | World | 7,000,000,000+ | 7,324,782,000 | 96 | 2015[1][2] |
| 1 | China | 1,321,930,000 | 1,371,220,000 | 96.40 | December 2016[3][4] |
| 2 | India | 1,183,408,611 | 1,131,005,994 | 86.89 | May 2018[4][5] |
| 3 | United States | 327,577,529 | 317,874,628 | 103.1 | April 2014[6][7] |
| 4 | Brazil | 284,200,000 | 201,032,714 | 141.3 | May 2015[8][9] |
| 5 | Russia | 256,116,000 | 142,905,200 | 155.5 | July 2013[8][10] |
| 6 | Indonesia | 236,800,000 | 237,556,363 | 99.68 | September 2013[8] |
| 7 | Nigeria | 167,371,945 | 177,155,754 | 94.5 | February 2014[11] |
| 8 | Bangladesh | 150,945,000 | 157,497,000 | 95.54 | June 2018[12][13][14][15] |
| 9 | Japan | 146,649,600 | 127,300,000 | 115.2 | 2013[16] |
| 10 | Pakistan | 150,169,643 | 207,774,520 | 74.21 | April 2018[17][18][19][20] |

NEWS

# Mobile IoT market set to expand 27% by 2026

By **Rene Millman** - July 9, 2018

**NEWSBYTE** The worldwide market for cellular Internet of Things (IoT) technologies will be worth $7.6 billion by 2026, according to a new forecast from analyst firm Persistence Market Research.

**Maribel Lopez**, Contributor

I track how mobile changes engagement and business strategies

+ Follow (87)

TECH | 4/18/2012 @ 7:43AM | 18,825 views

# Verizon's Stratton: The Future Of IT Is Mobile And Cloud

+ Comment Now + Follow Comments

# Popular consumer mobile applications

- Location-based services (LBSs)
  - Deliver services to users based on his location
- Mobile social networking
  - Most popular social networking platforms have apps for mobiles
- Mobile commerce
  - An extension of e-commerce
- Mobile payment
  - Near field communication (NFC) payment

# Popular consumer mobile applications - continued

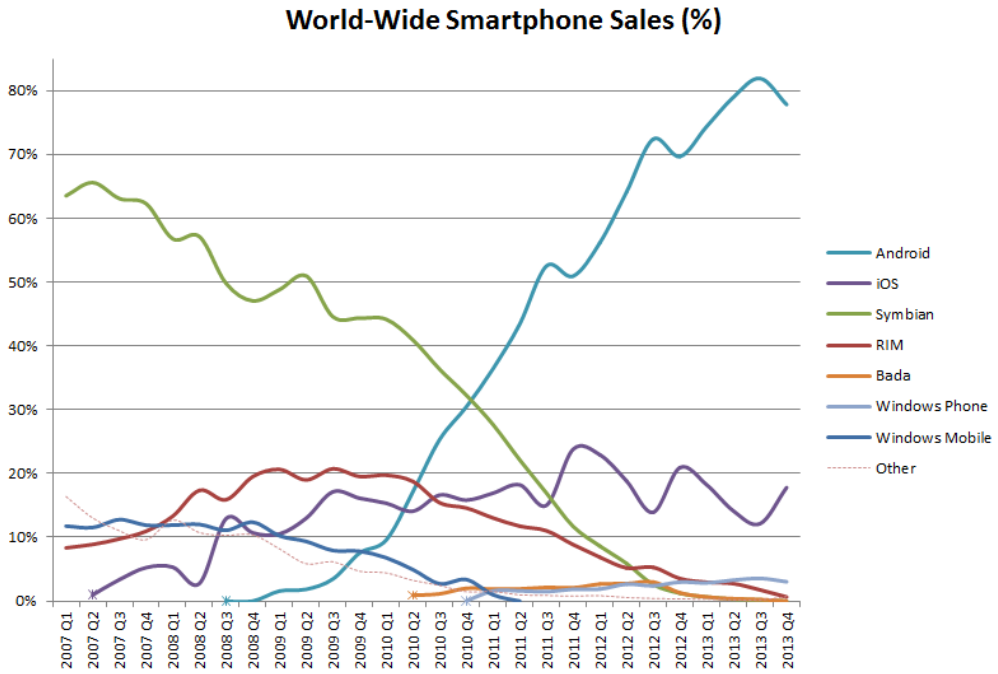
- Context-aware services
  - Context means person's interests, history, environment, connections, preferences etc.
  - Proactively serve up the most appropriate content, product or service
- Mobile instant messaging (MIM)
  - Skype for mobiles
- Mobile e-mail
- Mobile video

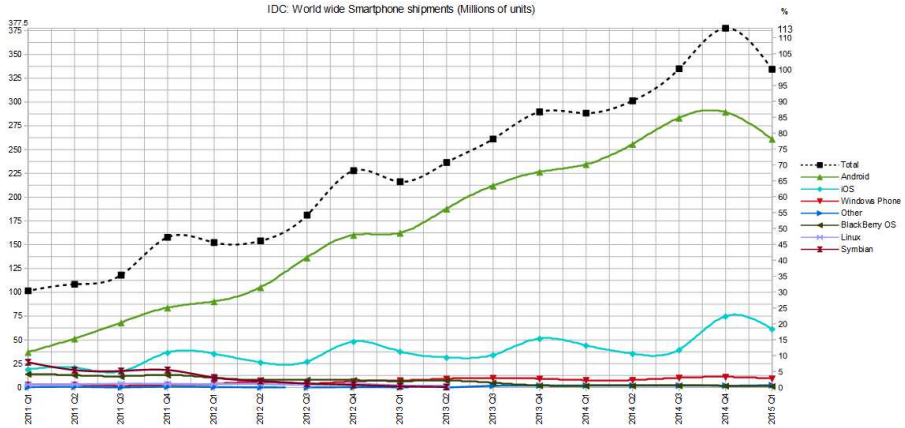
# Variety of languages and platforms to choose from

| | Programming language | Debuggers available | Emulator available | Integrated development environment available | Cross-platform deployment | Installer packaging options | Development tool cost |
|---|---|---|---|---|---|---|---|
| **Adobe AIR** | Action Script, HTML, CSS, JavaScript | Yes | Yes | Flash Builder, Flash Professional | iOS (iPhone, iPad, iPod touch), Android, BlackBerry | The native distribution format of each platform | Flash Builder, Flash Professional - Commercial licenses available Adobe AIR SDK (command line tool) - Free |
| **Airplay SDK (Now Marmalade)** | C, C++ | Yes | Yes | Visual Studio, XCode | All native: Android, BlackBerry, BREW, iOS (iPhone), Maemo, Palm/webOS, Samsung bada, Symbian, Windows Mobile 6.x and desktop, OSX | The native distribution format of each platform | Commercial licenses available |
| **alcheMo** | Java | Debugger integrated in Visual Studio, Eclipse or XCode | Emulator is available in corresponding IDE | Visual Studio, Eclipse, XCode | Android, BREW, iOS (iPhone), Windows Mobile | The native distribution format of each platform | Commercial licenses available |
| **Android** | Java but portions of code can be in C, C++ | Debugger integrated in Eclipse, standalone debugging monitor available | Yes | Eclipse, Project Kenai Android plugin for NetBeans | Android only, because of Dalvik VM, March 2009 | apk | Free |
| **Appcelerator** | JavaScript | Yes, in Titanium Studio, | Emulator is available using | Internal SDK | Android, iPhone, BlackBerry planned | The native distribution format of each platform | Apache 2.0 license, commercial licenses |

http://en.wikipedia.org/wiki/Mobile_application_development
http://en.wikipedia.org/wiki/Mobile_operating_system

# Popular platforms – Market share




http://en.wikipedia.org/wiki/Mobile_operating_system

# The devices we use

# GENERAL TOPICS OF INTEREST

# Mobile Web Services

- Provisioning of services from the smart phones
- Invocation of web services from smart phones
- Mobile web service discovery
- Addressing mobiles in 3G/4G networks
- Push notification mechanisms
- Mobile positioning
  - Indoor and Outdoor

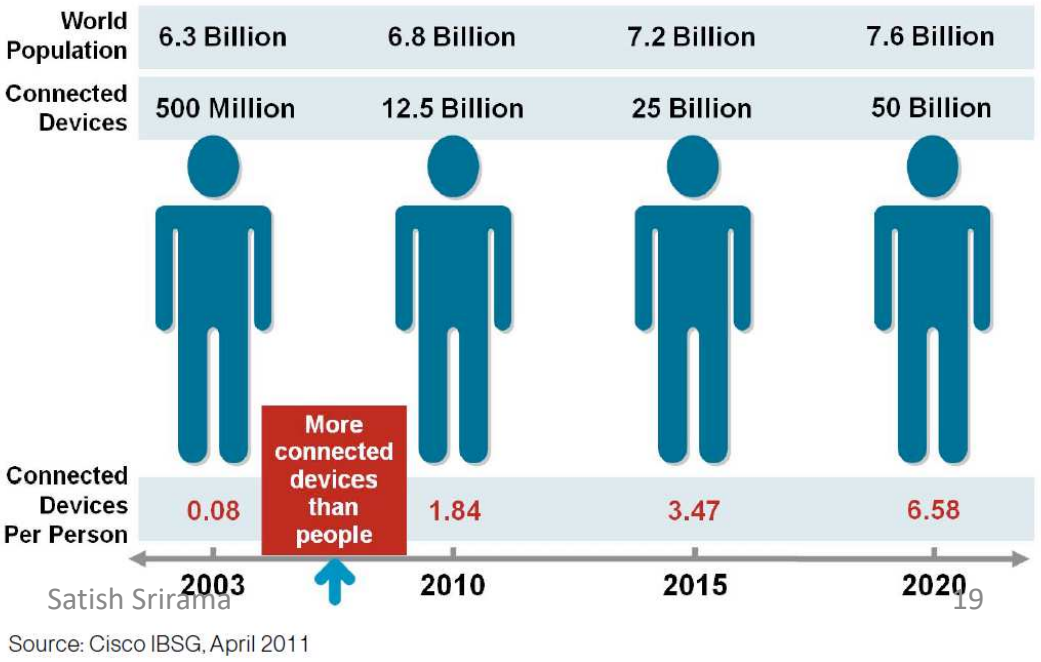
{srirama, chang}@ut.ee,

# Mobile Cloud Computing

- One can do interesting things on mobiles directly
  - Today's mobiles are far more capable
  - We can even provide services from smart phones
- However, some applications need to offload certain activities to servers
  - Processing sensor data
- Resource-intensive processing on the cloud [Flores & Srirama, JSS 2014; Flores et al, IEEE Communications 2015]
  - To enrich the functionality of mobile applications
  - Task delegation and code offloading

# Internet of Things (IoT)

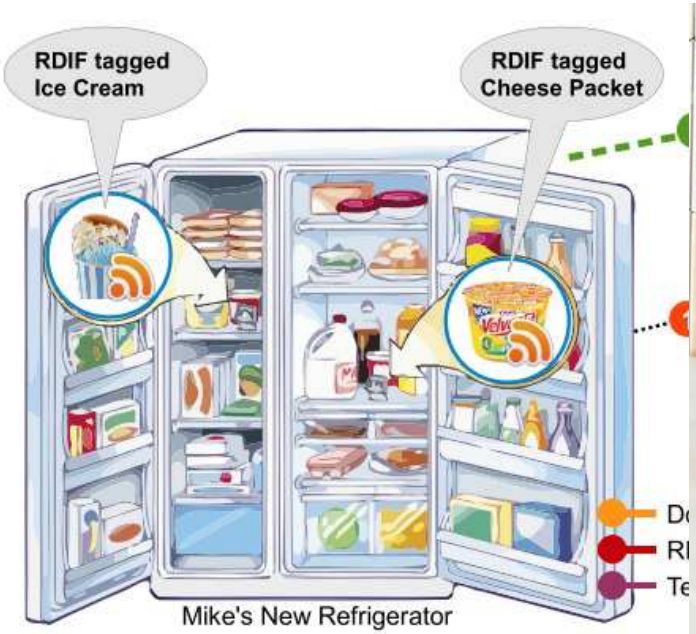
- *"The Internet of Things allows people and things to be connected* ***Anytime***, ***Anyplace***, *with* ***Anything*** *and* ***Anyone***, *ideally using* ***Any path/network*** *and* ***Any service***." [European Research Cluster on IoT
- More connected d
- Cisco believes the trillion by 2025

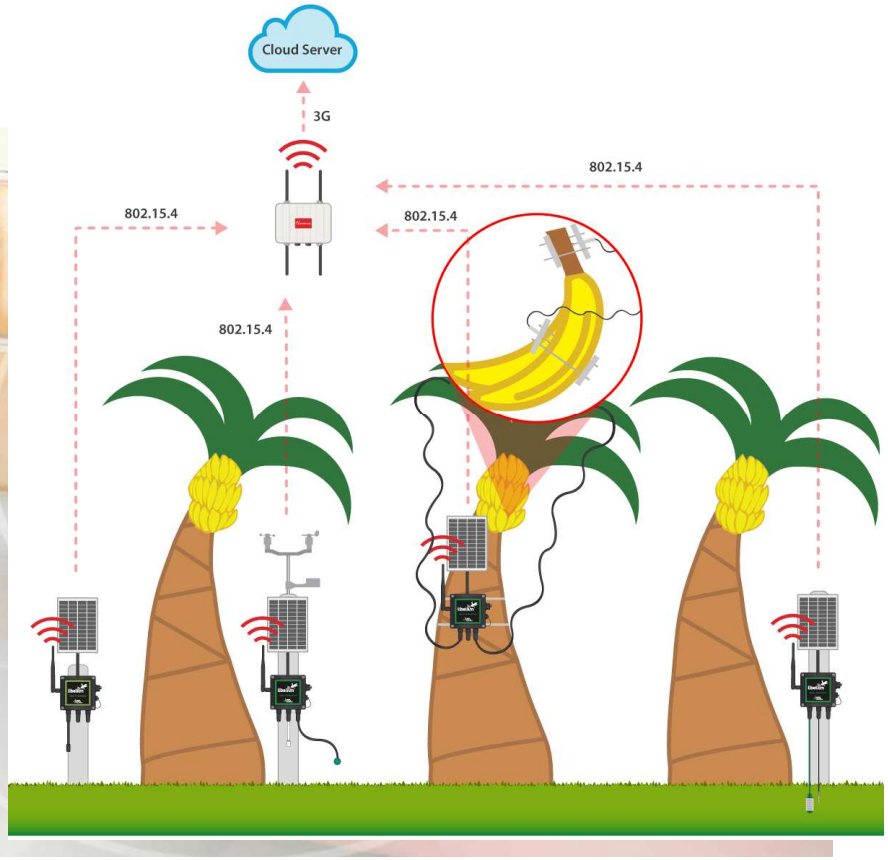



{srirama, chang, liyanage}@ut.ee

# IoT - Scenarios

- Environment Protection
- Smart Home
-
-




[Kip Compton]

[Perera et al, TETT 2014]

[http://www.libelium.com/improving-banana-crops-production-and-agricultural-sustainability-in-colombia-using-sensor-networks/ ]

# Internet of Things – Challenges

[Chang et al, ICWS 2015]

How to provide energy efficient services?

How do we communicate automatically?

Sensors

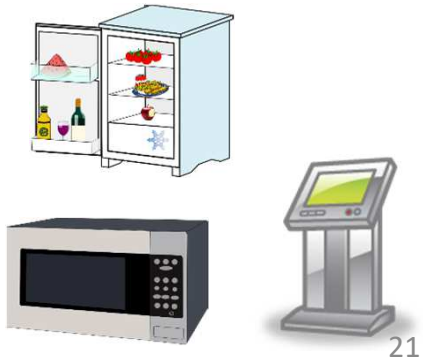
Tags

Mobile Things

[Chang et al, SCC 2015; Liyanage et al, MS 2015]

How to interact with 'things' directly?

Appliances & Facilities

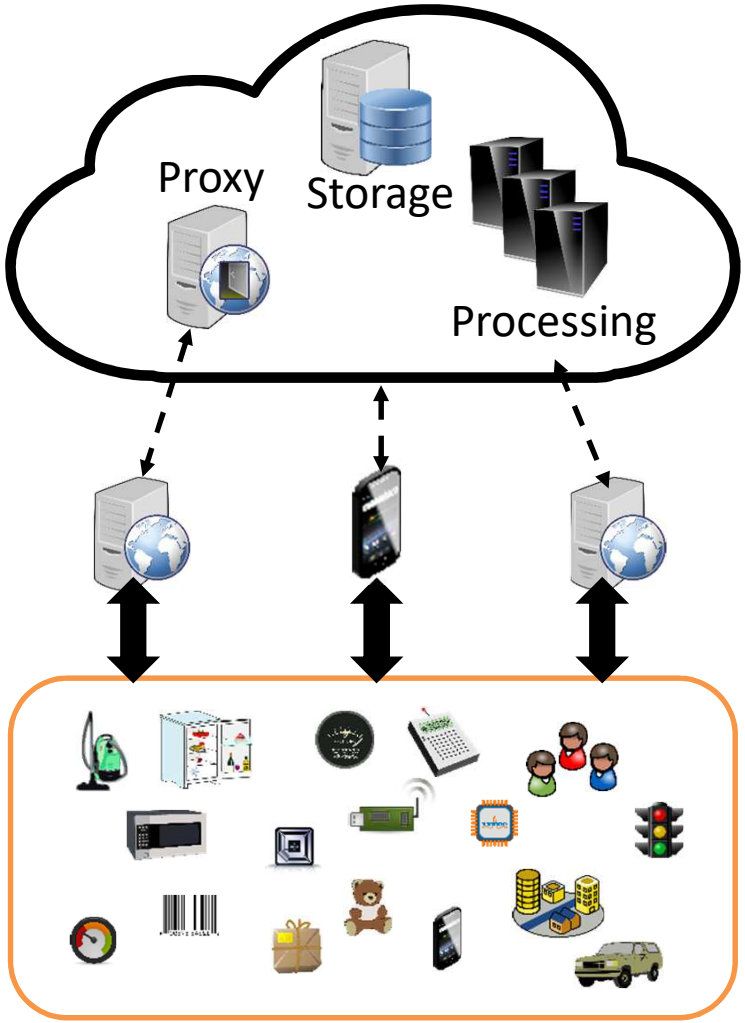


# Cloud-based IoT

Remote Cloud-based processing

Connectivity nodes & Embedded processing

Sensing and smart devices



# Research focus in IoT

- We have established IoT and Smart Solutions Lab with Telia company support
- Interesting topics
  - Discovery of IoT devices
  - Working with IoT based devices
  - Study of available IoT platforms
    - Amazon IoT
    - Open IoT
- IoT-based smart cities

{srirama, chang, jaks}@ut.ee

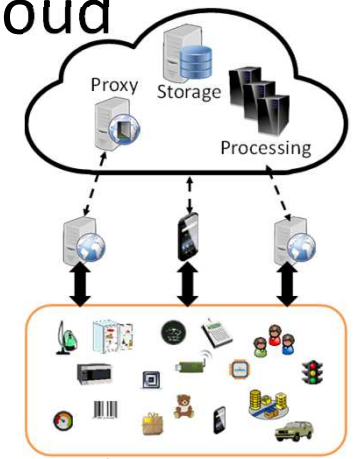
# IoT Data Processing on Cloud

- Enormous amounts of unstructured data
  - In Zetabytes ($10^{21}$ bytes) by 2020 [TelecomEngine]
  - Has to be properly stored, analysed and interpreted and presented
- Big data acquisition and analytics
  - Is MapReduce sufficient?
    - MapReduce is not good for iterative algorithms [Srirama et al, FGCS 2012]
  - IoT mostly deals with streaming data
    - Message queues such as Apache Kafka can be used to buffer and feed the data into stream processing systems such as Apache Storm
    - Apache Spark streaming
- Edge analytics

{srirama, jakovits, alo.peets}@ut.ee

# Issues with Cloud-centric IoT

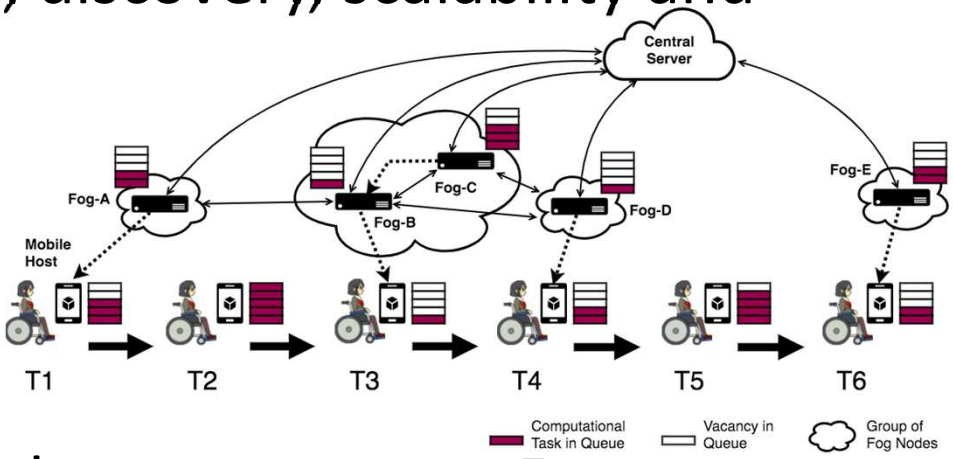
- Latency issues for applications with sub-second response requirements
- Certain scenarios do not let the data move to cloud
- Fog computing [Chang et al, AINA 2017; Mass et al, SCC 2016]
  - Processing across all the layers, including network switches/routers
- Mist computing
  - Processing at the edge devices
  - Dynamic provisioning of a platform for process execution [Liyanage et al, PDCAT 2016]
    - E.g. Android-ported Activiti BPM engine (http://activiti.org)
- Edge process management



# Ongoing Research in Fog Computing

- Mobility, task migration, discovery, scalability and containerisation

[Soo et al, IJMCMC 2017]




- QoE-aware application placement across Fog topology [Mahmud et al, JPDC 2018]
- Indie Fog [Chang et al, IEEE Computer 2017]
  - System architecture for enabling Fog computing with customer premise equipment

QoE – Quality of Experience

{srirama, chang, jaks}@ut.ee

# Research Roadmap – IoT & Fog Computing

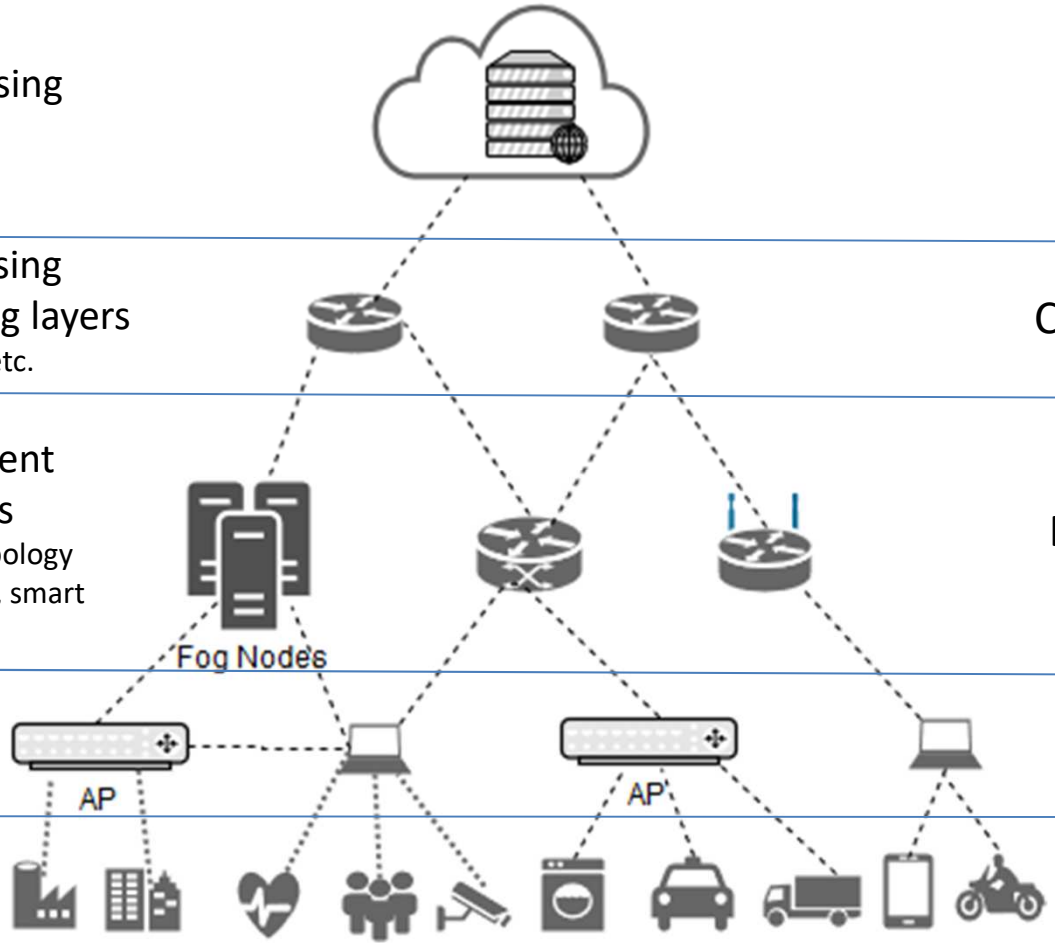
Distributed data processing on the Cloud
E.g. MapReduce, Spark

Distributed data processing across the Cloud and Fog layers
E.g. Personalized data, privacy etc.

Fog topology management and scheduling the tasks
E.g. tasks run across the fog topology such as stream data processing, smart streetlights etc.

Edge analytics
E.g. filter, error detection, consolidation etc.

Intelligent sensors
E.g. vehicular networks




Cloud

Core Network

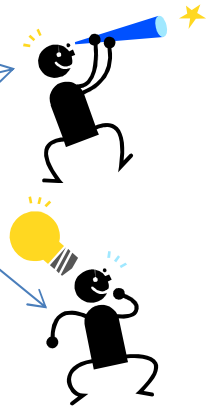
Edge Nodes

Fog

Gateways

End points

{srirama, chang, jaks, alo.peets}@ut.ee

email: srirama@ut.ee

# WE ALWAYS WELCOME NEW IDEAS!

# Course Schedule

- Today we introduce you the projects
  - Choose your project by 17th Sep 2018
- Lecture 2 (20.09)
  - Presentation by students about their topics
  - Deliver a preliminary report of the project
    - Meaningful report explaining (architecture, design, similar solutions etc.)
- Remaining schedule will be notified later

# Project selection

- Projects are available at

https://courses.cs.ut.ee/2018/MADP/fall/Main/Projects

- Responsible persons
  - Satish Srirama (srirama AT ut DOT ee)
  - Chii Chang (chang AT ut DOT ee)
  - Mohan Liyanage (liyanage AT ut DOT ee)

srirama@ut.ee

# THANK YOU