Nokia Bell Labs

Internship @ Nokia Paris Saclay – Sorbonne Université, master RES (M2)
• Natalya Rozhnova
• Nokia Bell Labs France
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“Through research and innovation, Nokia Bell Labs is changing the way people connect with the world”

https://www.bell-labs.com/
Nokia Bell Labs – General presentation
Bell Labs Scope & Scale: A global innovation engine

95% Focused on 5+ year future

1000+ Innovators

1 Game-changer per lab/year
Nokia Bell Labs – General presentation
Nokia Paris-Saclay

• **Paris-Saclay location**
  – 20 km south of Paris, Nozay, Essonne *(Paris-Saclay agglomeration)*

Research activities

– Network
– Algorithms
– Analytics
– **IoT Control**
– Security
– III-V Lab
– Optical networking & transmission
– Radio & end-to-end mobile networks
Internships in Internet of Things
General context of IoT

Internet of Things (IoT) growth ...
- Unprecedented growth of connected devices: 20~46 billions(*) devices expected in 2020
  (*) The Future X Network book, §11 – The future of the Internet of Things
- Promise of a new era of digital services

... but limited usage of IoT devices
- People buy connected devices for a limited experience
- Standard users do know:
  1) How to configure the network to use them properly;
  2) What services they can offer together;
  3) Which software to get the best service experience.

How to better leverage available connected devices in personalized services?
What the IoT world looks like?
Internships in Internet of Things
IoT control & service management

Need for digital assistance in IoT!

1. Communication control between IoT devices
   - Need for flexible network configuration layer
   - Software-Defined LANs = on-demand, dynamic & secure dedicated micro-networks for devices

2. IoT service recommendation
   - Universal description of IoT service classes to guide end-users in finding the right objects in the right spaces for their requested IoT services
     - Focus on physical functions and their interactions
   - Coupling with the network configuration layer:
     - Demo @ Nokia Campus Event, Paris-Saclay, Oct. 2017
Application-agnostic Remote Connection Manager (RCM)

- An abstract layer on top of BLE Protocol Stack
- Provides a transparent connectivity to remote BLE devices
- Has no impact on the Bluetooth applications nor the Bluetooth peripherals
- Easy to deploy: RCM is purely software and can be installed as an update of the Bluetooth Protocol Stack
- Offering real-time communication between clients and remote peripherals as if they were in proximity
- Doesn’t rely on complex infrastructures, dedicated hardware nor advanced network features
- Implemented under Bluez 5.43 (Official Bluetooth Protocol Stack for Linux) and tested on real devices
- Open source under GPLv2 license
- Research paper published at IEEE INFOCOM HotPOST’18 “Application-agnostic remote access for Bluetooth Low Energy”

Connectivity is said transparent when the native applications can access both local and remote short-range devices without any modification.
Internships in Internet of Things
Device sharing policies & multi-proxy communication for RCM

• Mandatory technical skills: C programming, Linux, low-layer programming, very good knowledge of network protocols (TCP/IP stack)

Will be an advantage: Android, short-range technologies (Bluetooth/BLE, ZigBee, etc.), knowledge in drivers and kernel programming, network programming, knowledge in DBus, GIO/GLib ...

Other skills:

Autonomous
Ability to work in a team and under deadlines
Self-starter and think outside the box
Analytic and Synthetic skills
Excellent organizational skills with attention to detail

Opportunity for PhD after the internship

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DO NOT FORGET THAT THIS IS AN INTERNSHIP, NOT A JOB PROPOSAL!
Conclusion
Internship in Nokia Bell Labs @ Paris Saclay

• How to know about Nokia internships ?
  – Nokia web site => “careers”:
    • http://company.nokia.com/en/careers/open-jobs
      (URL may change with Nokia integration...) (look at English ad French proposals)
    • Note: internship proposals, thesis proposals (CIFRE), etc...
  – The presenter
    • Natalya.Rozhnova@nokia-bell-labs.com
  – And your professors...
    • They have contacts with several Nokia Bell Labs researchers...