Implementing proximity based device-to-device communication in commercial LTE networks in The Netherlands

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Agenda

- ▶ Introduction
    - ▶ What?
    - ▶ Why?
    - ▶ When?
- ▶ Research
- ▶ Use cases
- ▶ Results
    - ▶ Implementation options
    - ▶ Conclusion
- ▶ Questions

Introduction ("What?")

- Proximity based services (ProSe)
- Device-2-Device Communication (D2D)

Introduction ("Why?")

- ▶ More efficient spectrum use towards 5G
- ▶ Opens new possibilities for smartphone users
- ▶ Generating revenue for operators

Introduction ("Why?") (2)

- ▶ Social networking (who is nearby?)
- ▶ Advertising
- ▶ Intelligent traffic / parking systems
- ▶ Network offloading
- ▶ Public safety

Introduction ("When?")

- ▶ Currently being standardized by 3GPP
- ▶ 3GPP Release 12 includes public safety (December 2014)
- ▶ Release 13 scheduled for March 2016

Research

"What are the organizational and technical requirements for enabling proximity based services based on device to device communication on- and between the commercial LTE network operators in the Netherlands?"

- Limited to literature study
- Based on two use cases
- Focus on inter-operator scenario

Use case: advertising

- ▶ Local business communicating daily offers
- ▶ Local restaurant communicating todays menu
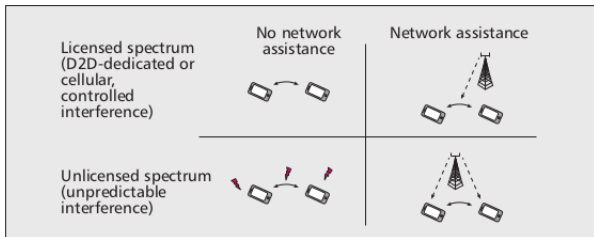- ▶ Cinema wanting to sell last empty seats
- ▶ ...

TNO innovation for life

Use case: social networking

- ▶ See who of your friends is nearby
- ▶ Find people to share a taxi ride
- ▶ ...

Radio communication

- Licensed spectrum
  - Network assisted
  - Autonomous
- Unlicensed spectrum
  - Network assisted
  - Autonomous

Challenges

- Inter-operator usage
- Battery consumption
- Interference
- Quality of service
- Up-front investment

Challenges (1): Inter-operator usage

Imagine KPN customer, using ProSe / D2D to discover a
Vodafone customer

▶ KPN customer transmits on spectrum resources belonging to
  Vodafone?

▶ Vodafone customer listens on KPN spectrum resources?

▶ Communication over dedicated spectrum?

▶ Communication out of band (e.g. bluetooth)?

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Challenges (2): Battery consumption

- ▶ Main issue when using OTT service
- ▶ Operators can add value on this point

Challenges (3): Interference

- ▶ Issue on inband communication
- ▶ Can be avoided by network assistance (coordination)
- ▶ Can be avoided by dedicated spectrum

Challenges (4): Quality of Service

- ▶ Issue on outband communication
- ▶ Main item to add value for operators

Challenges (5): Investment up-front

- ▶ Infrastructure
- ▶ Research and development
- ▶ Spectrum resources

# Summary: implementation options

- ▶ Licensed non-dedicated spectrum
- ▶ Unlicensed spectrum
- ▶ Licensed dedicated spectrum
- ▶ Network (EPC) based discovery

Summary: implementation options (2)

- Network (EPC) based discovery: step-up and two-step approach
  - Preliminary vendor support
  - Could improve efficiency
- Using LTE radio in non-dedicated licensed spectrum
  - Value adding
  - Opens up D2D communication

Requirements
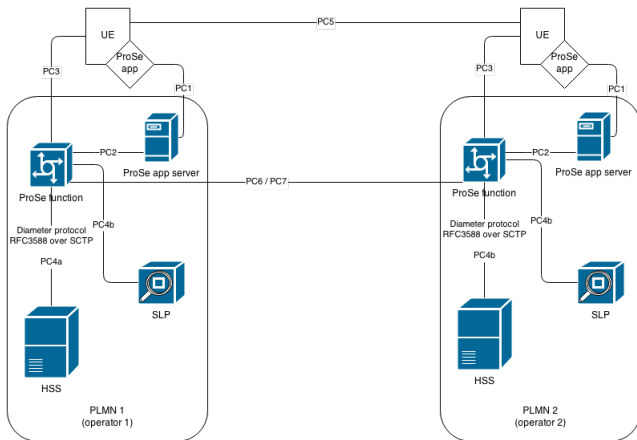
Requirements (2)

- ▶ Authorization for discovery
- ▶ Discovery of nearby UEs
- ▶ Authorization for identity
- ▶ Identity lookup
- ▶ Authorization for D2D communication
- ▶ Transport of user-plane data for D2D communication [1]
- ▶ Reservation of resources [2]

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[1] Depends on use case

[2] Depends on implementation model chosen

Conclusion

▶ Promising technique, first signs of industry take-up visible
▶ Operators: get organized!
  ▶ Exchange peering model?
  ▶ Working group to be established, as part of GSMA network 2020?
▶ More research needed on commercial models, privacy and (radio) protocols

Questions?