What to do With the Wi-Fi Wild West

Project Information
&
Invitation for the Operator Board

Project to develop mature Wi-Fi networking solutions

The European Commission has a program (Horizon 2020) to stimulate network innovations for the benefit of the European citizens and industries.

In the context of this program, Liverpool John Moores University (project coordinator), Telefonica, Airties, the University of Zaragoza and TNO have received funding for the project Wi-5, a project aimed at the development of mature Wi-Fi networking solutions. These solutions include Wi-Fi resource management, QoS and hand-over and network roaming based on over-the-top-technological solutions.

<u>The project has started Q1 2015</u> and will run until Q4 2017.

All interested network operators and service providers are invited to become a member of Wi-5's Operator Board. The objective of this Operator Board is to share relevant information with operators and to gather their viewpoints and opinions. Thus the Operator Board will be a project guide in informal manner.

Project context

Present situation:

- Ever increasing popularity of wireless connectivity,
- Wi-Fi attractive and widely available in homes and offices,
- Customer home network gradually develops from single stand-alone AP to multiple uncoordinated APs,
- Nomadic use of Wi-Fi develops in the market as a prosumer service,
- Operators use customer Wi-Fi to build an alternative wireless network (FON, BT, etc.):
  - Mobile operators to offload their 3/4G networks,
  - Fixed operators to enrich their fixed broadband services with high-quality wireless access in the homes and with nomadic services.

Wi-Fi Challenges:

- Wi-Fi hasn't been developed for such a dense deployment and as such it reaches its performance limitations:
  - Interference from nearby AP and terminals
  - Inefficient use of the available radio resources
- Wi-Fi lacks protocols for cell handover and roaming. Currently such protocols are developed that will work in converged mobile-fixed network (single operator or consortium). However, new Wi-Fi protocols are needed that work in:
  - a situation of managerially separate mobile and fixed networks
  - In the customer home network with multiple APs.
- Wi-Fi has not been developed for premium services like video and gaming

Wi-5 Objectives

Development of Smart Access Points solutions:

In particular we will develop the technology for the coordination between APs needed to optimize the use of the available Wi-Fi radio resources

- Packet grouping of small packets,
- Dynamic channel selection,
- Transmit power control

Development of cross-layer networking solutions:

- Seamless hand-over and roaming between Wi-Fi APs, Wi-Fi and 3/4G networks based on an over-the-top solution,
- Solutions to warrant and manage the end-to-end service quality of the applications

Development of new and appropriate business roles and business models as an enabler for the above Wi-Fi radio resource management and roaming services in a single operator network and in a multi-operator situation.

Wi-5 System Solution
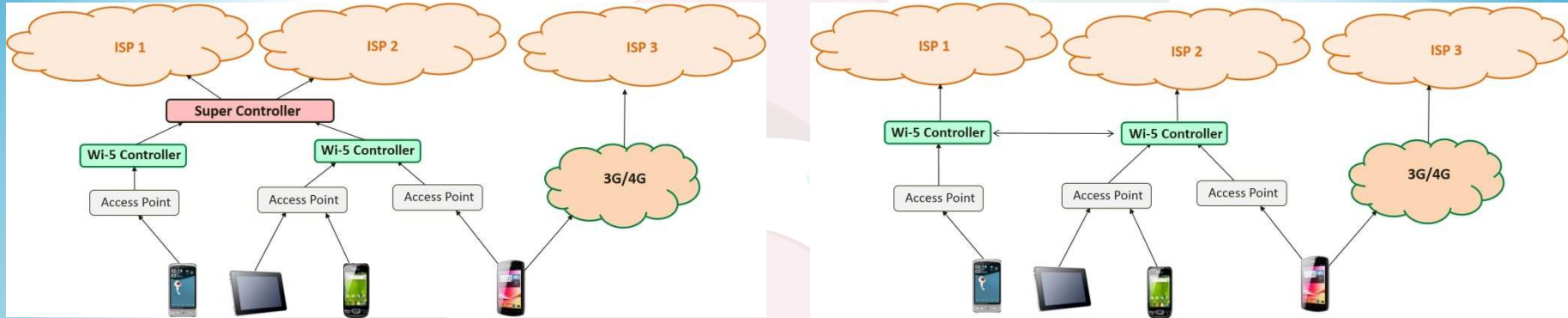
Hierarchical inter-operator cooperation   **Distributed inter-operator cooperation**

Use of existing hardware and IEEE 802.11 protocols
- Solution doesn't require new hardware or an update/amendment of any IEEE 802.11 protocol
- Solution fully software-based: APs and STAs only need new firmware, a new driver or an App respectively

Use of a controller:
- A controller system is introduced to control all APs and STAs in a single operator domain
- IP-based control messaging (over-the-top)
- Optionally, a super controller or a distributed controller is introduced for inter-operator cooperation:
  - Handover between APs in different managerial domains or between Wi-Fi and 3/4G networks
  - Optimization of Wi-Fi channel allocation in a multi-operator environment

Fully based on the concept of Software Defined Networking:
- OpenFlow
- ODIN

Wi-5 Use Cases and Services

In the first year, the project has selected the specific use cases that will be considered to develop and validate the Wi-5 solution. This selection has been discussed with the Wi-5 Operator Board. All use cases represent mainstream Wi-Fi network scenarios with foreseen technical and operational challenges:

- Airport/train station
- Dense apartment building
- Pico-cell street deployment
- Large home/SOHO
- Community Wi-Fi

Services taken into consideration:

- VoIP
- Video (conference)
- Television
- Online games
- Video downloads
- ……..

Wi-5

Wi-5 Business Models and Business Roles

Wi-Fi spectrum is limited and unmanaged, causing interference or spectral congestion in high-density areas. Interestingly, often this spectral congestion is solved by installing an extra AP, which relaxes the customer's problem but aggravates spectral congestion for neighbours. Next, the neighbours could consider the installation of an extra AP, but in the end the overall situation is further deteriorated instead of being improved. This dilemma is an example of the so-called *"tragedy of the commons"*. As a rule, there is no technical solution; cooperation is the only way out. Therefore, an appropriate business models is a crucial element of the Wi-5 solution.

However, cooperation between the operators in a highly competitive market is as a major paradigm shift:
- National market regulators will be very suspicious for anti-trust reasons,
- The Wi-Fi frequency spectrum is unlicensed, so there is nobody with a mandate to manage the spectrum,
- Broadband providers are most competitive, and cooperation with the competitor is against their nature
- However, there are examples of technical cooperation of competitors too, for example:
  - to minimize DSL cross talk in telephony cables, operators have developed deployment rules,
  - mobile operators have developed installation rules for site sharing in mobile networks.

Therefore, with the help of the Wi-5 Operator Board, some basic requirements have been formulated:
- Cooperation among operators is feasible only on a purely voluntary basis,
- The Wi-5 solution must support different levels of cooperation like rungs of a ladder.

For a full fledged cooperation (the highest rung of the ladder), Wi-5 foresees a new business role: the Spectrum Usage Broker. Currently, we are studying the need of this new role. Questions addressed are, amongst others:
- What is the regulatory basis and the regulatory space for bilateral cooperation between two operators,
- What will be the regulatory framework for cooperation between operators, or how should it look,
- What would be the role of the Spectrum Usage Broker in this framework.

Wi-5 Operator Board

The Wi-5 Operator Board has been founded to involve the market in the project.

The Wi-5 Operator Board convenes twice a year. These meetings are intended to:

- Provide information on the project, including the progress and results
- To discuss the work and results with operators and providers
- To obtain the suggestions and the opinion of the operators and providers
- To align the project with the needs of market.

Membership will require typically 2 days per year to participate the meeting and the preparation time. Unfortunately, the project team cannot reimburse travelling costs. The project team will organize the meetings just before or after a large European networking event (e.g. Broadband World Forum).

Current Members Wi-5 Operator Board

Wi-5 Operator Board Meetings

18 June 2015 The Hague

A summary of the Wi-5 project was presented.
There were two discussion items:
- The "small office" use case should be extended to a "large home" use case,
- Cooperation between operators should be implemented on a voluntary bases.

Both were adopted by the project

22 January 2016 Madrid

An update of the project was given, including a demonstration of a seamless SDN-based handover. There were two discussion items:
- The operators agree with the role of a spectrum usage broker, but the different implementation levels should be supported, offering operators the opportunity to start cooperation at the lowest rung and on a voluntary basis,
- Currently there is no good and standardized consumer solution for cooperation between APs in the consumer home domain. As a minimum, such a solution should support inter AP handover and Wi-Fi dynamic channel allocation for home networks. The operators would welcome such a solution on the short term and in the advent of the final Wi-5 solution.

Wi-5

Operator's Benefits of the Wi-5 Operator Board

The home network is a major (or arguable the major) challenge in the development of Gb broadband services. Wi-Fi will play a crucial role to deliver in home broadband services however, simultaneously, Wi-Fi is a major source for many service impairments and customer complaints. Therefore, optimization of Wi-Fi spectrum usage and cooperation between APs are most crucial to equip Wi-Fi for its future role.

Membership of the Wi-5 Operator Board offers operators the following benefits:

- Wi-5 targets at solving the Wi-Fi Wild West. Solving this Wild West is at the heart of the premium operator broadband offer,
- By defining an integrated solution, it provides a target for vendors and standardization bodies to work toward. Wi-5 guides and accelerates developments,
- Wi-5 identifies the key issues that have to be solved, amongst others the need of cooperation between operators to avoid the *"tragedy of commons",* and explores and develops solutions to address these,
- The Operator Board offers operators the possibility to guide our work and to help shaping of the solutions. Operators can express their interests and their objections,
- Wi-5 operator support will increase vendor commitment to implement the Wi-5 solutions

Invitation

Interested companies that want to support the project are most welcome to join the Operator Board and to strengthen the project. To apply for the Operator Board, one can send an email to Jan de Nijs of TNO

For further information and to apply for the
Operator Board:

Jan de Nijs

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