LTE-WLAN Interworking: 3GPP Release-12 Perspective

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Long Term Evolution (LTE)

- LTE Rel. 8/9
- LTE-A Rel. 10/11
- Beyond LTE-A Rel. 12/13
Technology Challenges

Scalability
- Billions of devices
- Very large number of concurrent, active connections

Capacity
- Rapid growth in number of data subscribers and data usage
- New communication paradigms and applications

Flexibility
- Wide range of deployment scenarios with diverse traffic patterns
Rel. 12 Focus Areas

System Capacity
- Enhanced MIMO, New Carrier Type, Advanced Receiver
- HetNets and Small Cells
- User Plane Congestion, Core Network Overload

WiFi Integration
- Network Selection
- Mobility
- Optimized Offloading

New Business Opportunities
- Public Safety and Critical Communications
- Proximity Services
- Machine Type Communications
Despite the increase in system capacity via technological enhancements, cellular networks are becoming more and more congested with increased data usage.

In parallel, there is explosive growth in WiFi-enabled devices such as smartphones and tablets.

Mobile operators see WiFi offload as the key towards relieving congestion in 3G/4G networks.

Study Item on 3GPP-WLAN interworking introduced to find potential enhancements for tighter integration.
Cellular Data and Voice Growth

Source: Ericsson Mobility Report, June 2013
WiFi Data Usage

Note: Figures cover Canada, Germany, Japan, South Korea, UK and US.
Source: Mobidia

Android devices only

Source: Informa Telecoms & Media, June 2013
Earlier releases of 3GPP support interworking with WiFi in the Core Network (CN)

The current study focuses on Radio Access Network (RAN) level integration between LTE and operator-deployed WiFi networks

The enhancements are expected to enable
- Coordinated radio resource management
- Improved user Quality of Experience (QoE)
- Reduced battery power consumption
Requirements

- Provide improved two-directional load balancing
- Improve WLAN utilization when it is available and not congested
- Reduce or maintain battery consumption in the user device
- Compatible with all existing CN WLAN-related functionality
- Backward compatible with existing 3GPP/WLAN specifications
- Rely on existing WLAN functionality and avoid changes to IEEE and WiFi Alliance specifications
Deployment Scenario

- WLAN deployed and controlled by operators and their partners

- Several WLAN access points may be deployed within the coverage of a single 3G/4G cell

- 3G/4G base station may know the location and/or other WLAN access point parameters
  - Scenarios where such information is unavailable are not excluded

- No RAN level information exchange between 3G/4G RAN nodes and WiFi networks via standardized interface
  - OAM-based information exchange possible
Use Cases

User moving towards WiFi coverage

User moving out of WiFi coverage
Use Cases

Some/all flows moved to/from WiFi to 3GPP

Some/all flows moved to/from 3GPP to WiFi
Technical Challenges

Discovery and Scanning

Access Selection

Traffic Steering
Access Selection and Traffic Steering

- The proposed solutions have to address the following issues
  - Operator deployed WLAN networks are often under-utilized
  - User experience is suboptimal when UE connects to an overloaded WLAN
  - Unnecessary WLAN scanning may drain UE battery resources

- Two approaches are proposed
  - Network provides UE with additional information to assist in deciding if/when to connect to available WLAN
  - UE provides network with information about WLAN and the network decides if/when UE should connect to available WLAN
Solution 1

- RAN provides assistance information to the UE via broadcast signaling (and optionally dedicated signaling)
- UE decides to steer traffic to WLAN or to 3GPP RAN based on
  - RAN assistance information
  - UE measurements
  - Information provided by WLAN
  - Policies obtained via the ANDSF or via existing OMA-DM mechanisms or pre-configured at the UE
Solution 2

- RAN provides assistance information to the UE through dedicated and/or broadcast signaling
- UE decides to steer traffic to WLAN or to RAN based on
  - RAN assistance information
  - Rules specified in the RAN specification
  - UE measurements
  - Information provided by WLAN
Solution 3

- Network controls traffic steering for UEs via dedicated traffic commands
  - May also take into account WLAN measurements reported by the UE
- The traffic steering commands can override ANDSF policy for specific flows indicated in the command
  - All other traffic continues to be subject to the ANDSF policy as applicable
RAN Assistance Information

WLAN and RAN Thresholds
- WLAN RSSI, WLAN BSS load and WLAN WAN metric
- UMTS/LTE load, RSRP/RSCP

Load Information
- Direct/indirect indication of RAN load

Resource Allocation
- Maximum resource allocation the UE may receive in RAN

Traffic Information
- Identifier(s) of the traffic flow(s) to be steered
Current Status of Study

- Qualitative comparison of the solutions is in progress in RAN WG2, based on:
  - Implementation complexity
  - Specification impact
  - Signaling overhead

- This will lead to further narrowing down of options, which will then be evaluated quantitatively.

- Upon the completion of study, a decision will be taken if changes to specifications are to be made.

Thanks!