INNOVATION REPORT

Seamless service continuity between wireless networks

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Wireless network access is becoming ubiquitous and a nomadic usage of networks has become a reality through private wireless local area networks (WLANs) and public WLAN and 2.5G/3G data networks. The true mobile user will move around from private networks to public networks or even to special-purpose networks such as wireless networks on trains or the wireless ad-hoc network set up for emergency relief at a disaster scene.

The seamless integration of all these heterogeneous wireless networks, needed to establish true mobility, is not a reality today – hence the need for 'Easy Wireless' technology.

Seamless service continutiy

The current telecommunications market comprises many large networks built in a range of differing technologies. When a customer uses a service for which network access is needed, only a single network and one end-to-end path are used, even when many other appropriate network connections are available to this user. If the access network has to be changed due, for example, to insufficient signal strength, in many cases the connection is first broken and then re-established via a new network. This wastes time and is inconvenient for the user. For a better service and more efficient use of the network, a switch from one network to another should be made seamlessly, while the connection is maintained at the same quality-of-service (QoS) level.

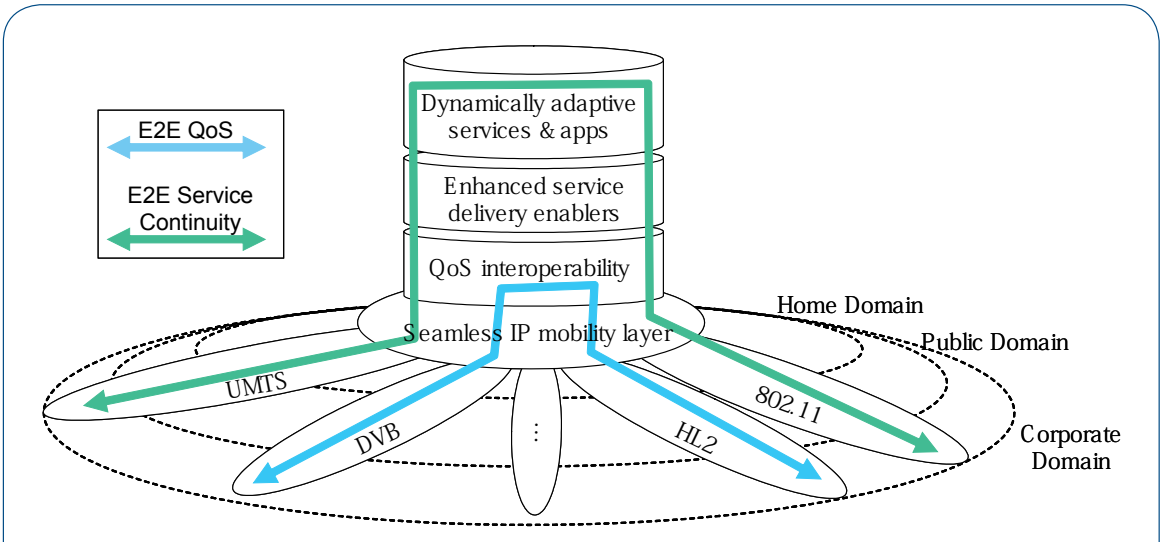

Figure 1. Easy Wireless view of end-to-end seamless connectivity

Without special provisions, a service – virtual private network (VPN), live video streaming, etc – is disrupted when moving from one wireless network to another. A manual intervention by the user is often needed to continue the service. An evaluation of the requirements led to the conclusion that a

single network layer solution cannot accommodate all use cases. An architecture with solutions at different network layers was developed, as shown in Fig. 2. The transport layer approach has been applied to provide a solution that can be uniformly deployed on any network. A specific layer for the deployment of an emergency wireless network has been introduced and a new handover mechanism with only 50 ms handover time was developed at the data link layer. From the global Easy Wireless network architecture as presented in Fig. 2, solutions will be applied in the network, depending on the specific service to be supported.

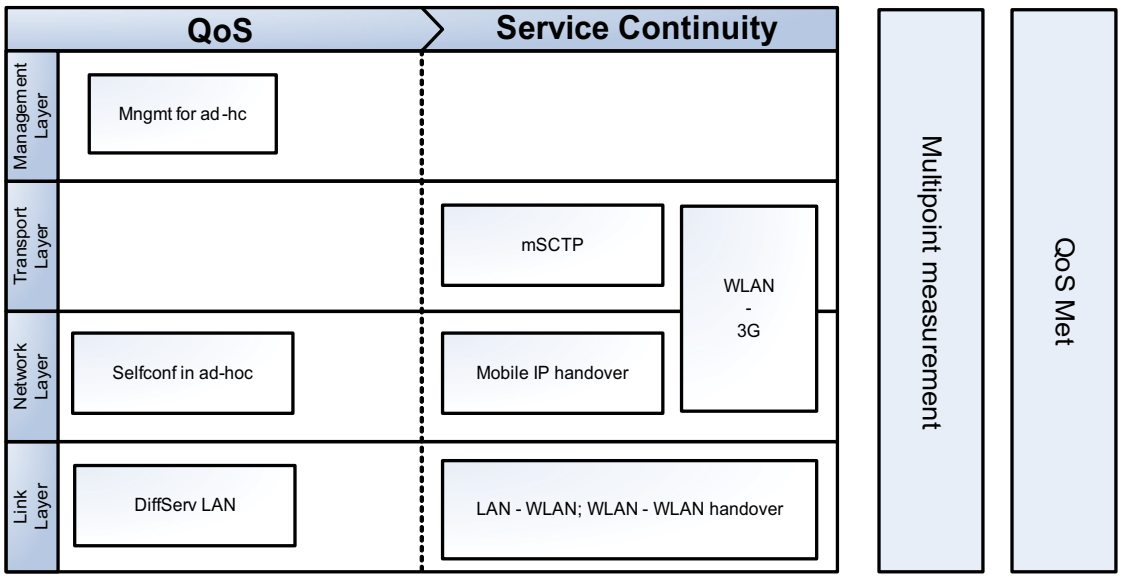

Figure 2. Easy Wireless solution matrix

Focus on the service

The wireless technologies deployed focus on providing network connectivity. The Easy Wireless architecture targets mobile services that will use several of these wireless technologies – for example, video streaming starting at the home WLAN and continued outside. Each service has its own requirements with respect to bandwidth, latency, etc, jointly called the quality-of-service parameters. The Easy Wireless architecture makes it possible to set these parameters for every segment of the end-to-end network, in order to realize the service.

As QoS provisioning is still an active field of research, the Easy Wireless QoS framework built on top will need to be extended in the future to provide a comprehensive QoS solution. For ad-hoc networks, existing QoS provisions were found to be insufficient and have been improved in Easy Wireless.

A need for accurate end-to-end QoS measurements exists to evaluate the methods deployed. A new passive end-to-end measurement tool was developed. As an alternative approach, an agent-based solution was investigated with agents gathering the distributed measurement data.

In some cases, QoS parameters cannot be maintained across networks – for example, when moving from home WLAN to GPRS, bandwidth will decrease. As the focus is on the service and the user experience, service adaptation was integrated in the architecture.

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Promising application domains

While the issue of seamless wireless connectivity is encountered in any mobile wireless application context, three scenarios were identified as promising from a business perspective:

1. A 'home-and-office' scenario integrating private wireless networks at home and in the office with public cell-phone networks. This is a mass-market application, enabling many services. The generally applicable solutions developed at the higher network layer are suitable for this application. For multimedia services, the QoS integration developed would also be used.
2. Establishing an 'emergency' ad-hoc wireless network at a disaster scene, which also requires integration of heterogeneous wireless networks but with different constraints on network measurement, discovery, routing policies, quality of service, etc. This means additional components from the Easy Wireless architecture are used.
3. In the context of on-board connectivity on trains, two levels of mobility are to be supported: the passenger moving inside a train, connected to the WLAN infrastructure of the different carriages that make up the train, and the train moving along the track. This requires seamless integration of wireless networks, based on the exchange of connection parameters.

The Easy Wireless service offering

The application domains above illustrate the value of the technology developed. This technology can be offered as an extra service on top of existing wireless networks. The end customer would pay to have a seamless service, roaming between different networks. This **integration service** can be offered by an existing service provider such as a public mobile operator, a railway operator or a government institution maintaining an emergency communication infrastructure. A business case study has shown the feasibility for a separate service company delivering the Easy Wireless service.

An alternative valorisation path is to offer the developed technology as a **product enhancement**. Examples are railway on-board infrastructure for wireless crew terminals with integrated voice, CCTV and seat reservation. Another example is a fire-fighter terminal offering services enabled by Easy Wireless. These examples are integrating Easy Wireless core technology in a product. In addition, the measurement techniques and routing algorithms developed will be integrated as product improvements.