Universitas Esa Unggul

Smart, Creative and Entrepreneurial

www.esaunggul.ac.id

Jaringan Mobile
UMA and Related Technologies: The Road a Head

Taufik Rendi Anggara., MT
Teknik Informatika
Fakultas Ilmu Komputer

Seamless Convergence: Long-Term Vision

Seamless network architectures can roughly be classified as those ensuring either the mobility of the users accessing services with various terminals or the mobility of the terminals accessing services across heterogeneous access networks. Each type of convergence is coupled with services that can be supported with different levels of integration and have different impacts on the network. In this regard, four types of convergence are proposed: convergence in the home network, in the access network, in the core network, and at the application server level.

Home Network Convergence

Home network convergence can be defined as the capability to break the silo approach where a terminal is dedicated to the use of a given service. Home network convergence allows the following benefits:

- User can access different types of services from a same terminal. An example is the ability to handle a call with an handset and be able to display on this handset content retrieved from another device in the home network.
- Service is available on more than one handset. For instance, the video-on-demand (VoD) service is not only displayed onto the user's television screen but can also be viewed on a personal computer or mobile handset.
- Diverse communication technologies are expected within the home network sphere. Most prominent among these are Wi-Fi, PLT, and Giga-Ethernet. Hence, the home network is a convergence arena where the devices are able to interoperate together and also with the service platforms. It also is a strong opportunity for the operator to leverage from these local exchanges to enrich already existing services.

Home network convergence is mainly built around the introduction of a home gateway equipment, embedding features like IP routing and application controls. Äi s convergence mainly concerns fixed operators.

Access Network Convergence

Access network convergence can either be achieved with convergence at the transport layer or convergence at the service-oriented layer. First one is mainly driven by the reduction in Operational Expenditure (OPEX) costs. An example is to aggregate mobile access nodes into a backhaul network shared with a fixed access network, or more generally the use of a shared infrastructure for heterogeneous access solutions. Convergence at the service-oriented layer allows access to a same service irrespective of the access network infrastructure.

Core Network Convergence

Core network convergence addresses convergence in the core network and is typically associated with the definition of a common framework able to handle any service invocation irrespective of the access network. An intuitive example is the specification of the IP Multimedia Subsystem (IMS), specified in the 3GPP and endorsed by Telecoms & Internet converged Services & Protocols for Advanced Network (TISPAN) for the fixed broadband access network. IMS is a core network infrastructure to control user sessions for the following services:

- Conversational services with multimedia components like voice, video, etc.
- Real-time data-oriented services like instant messaging, presence, etc.
- Audiovisual services, in the scope of specifications for TISPAN in release 2.

Seamless Converged Communication across Networks

SCCAN∗ is an industry-led standard governed by Motorola, Avaya, and Proxim. SCCAN supports an emerging open specification for technologies that enables seamless converged communications. By incorporating the most popular SIP of the IETF as a control protocol, SCCAN's specifications aim at the convergence of Wi-Fi technology with cellular networks for voice, video, and data services. SCCAN provides an enterprise solution that offers seamless interoperability between the Wi-Fi enabled enterprise network and cellular wide area networks. SCCAN splits the functionality among dual-mode (Wi-Fi/cellular) handsets, mobility-enabled IP private branch exchanges (PBX), and WLAN gateways, as shown in Figure 2.1. When entering the office premises, the user's session switches from the cellular network to the Wi-Fi network. To assure this functionality in the core network, PBX has an SS7 (Signaling System 7) link to the wireless carrier so that the location registration and call control can be performed upon session switching. SCCAN may present some advantages to set up customized business offers. However, from a deployment perspective, such a type of solution presents significant constraints to interconnect with the mobile infrastructure.

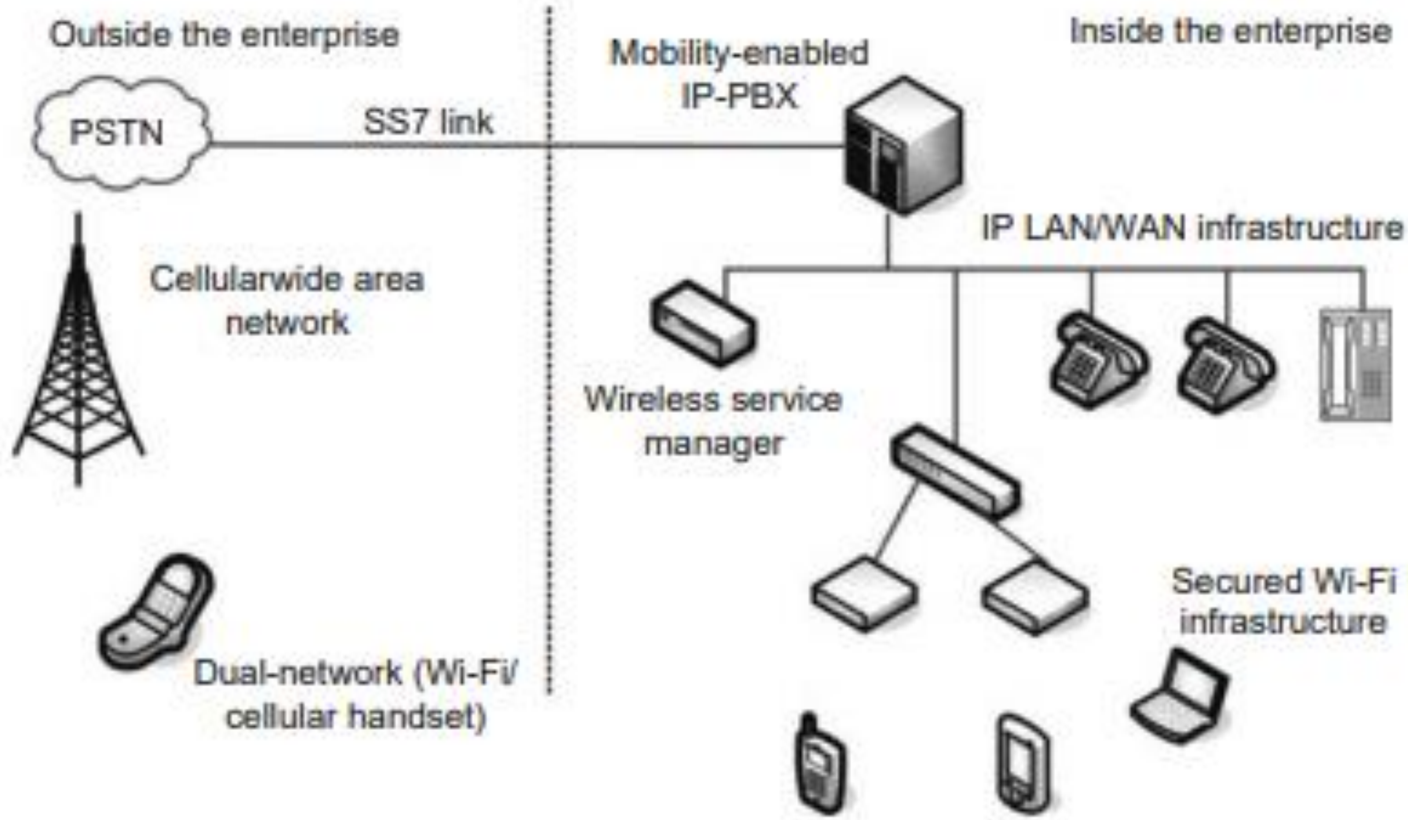
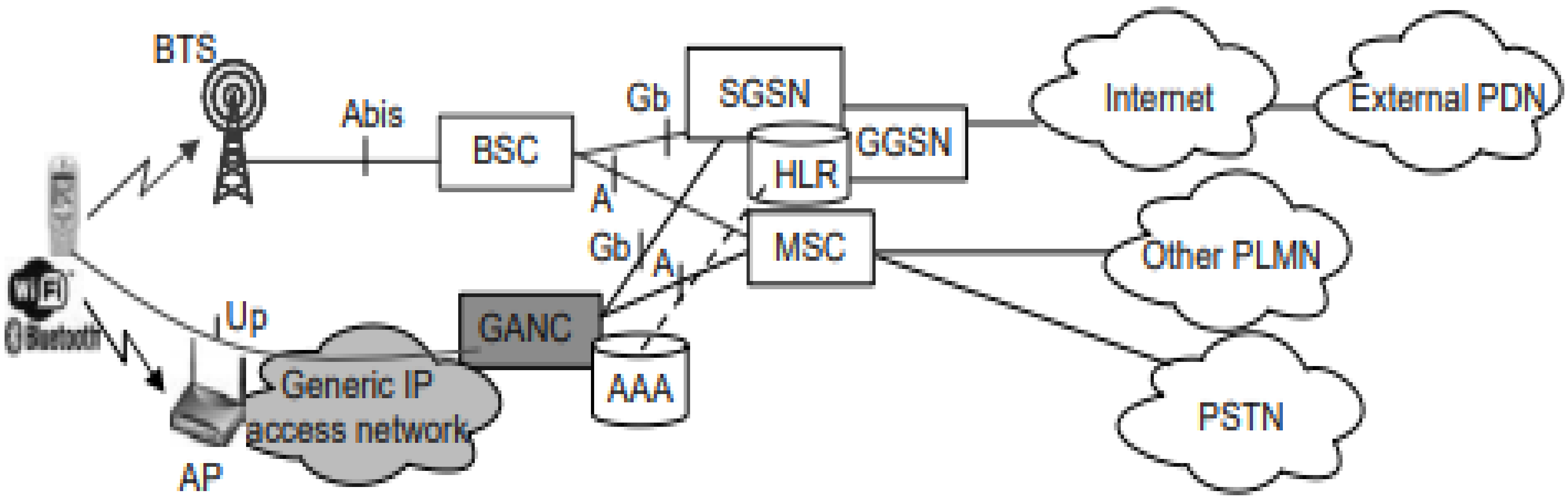


Figure 2.1 SCCAN enterprise solution architecture.

Unlicensed Mobile Access

UMA technology is designed to enable fixed–mobile convergence in an access network. It is currently endorsed by the 3GPP under the name of GAN (generic access network). GAN architecture and functional components are shown in Figure 2.2. A major feature of GAN is to offer call continuity from a GAN-capable terminal between a local area network (UWB or 802.11) terminating at a fixed access and GSM infrastructure. Data services are also supported but are limited in throughput because interconnection to the PSCN (packet-switched core network) is performed using the Gb interface. An outstanding evolution of GAN is to enrich user experience for data services as with the use of 3G Radio Resource Protocol and the support of interfaces. More precisely, UMA is today an available technology already deployed by certain operators like Orange with its Unik∗ offer.


BTS
Abis
BSC
Gb
SGSN
GGSN
HLR
A
Gb
A
MSC
Internet
External PDN
Other PLMN
PSTN
Up
GANC
AAA
Generic IP
access network
AP

Interworking-WLAN

3GPP is developing interworking solutions between 3G and WLAN networks under the auspices of Interworking-WLAN (I-WLAN), aiming to realize UMTS/WLAN integration [9,10]. (I-WLAN is a 3GPP standard that intends to define the Interworking architecture between a WLAN access network and a 3GPP core network).

I-WLAN Architecture

In the 3GPP Release 6 specifications that aim at providing access to mobile operator services from a WLAN Access Network, I-WLAN introduces three principal components for 3G/WLAN convergence: a WAG (wireless access gateway), a PDG (packet data gateway), and an AAA Server as shown in Figure 2.3. UE (user equipment) is typically dual-mode capable: inside WLAN coverage, it is capable of connecting to the WLAN AN (access network) using Wi-Fi or Bluetooth before attachment to the I-WLAN infrastructure and when outside WLAN coverage, it can connect to a UMTS operator network. Data from UEs through ANs is aggregated at WAG, which is further connected to PDG. During roaming, the visited WAG is also able to route packets toward the home domain of the operator to which the user has subscribed PDG in the I-WLAN architecture works as a gateway toward either the external packet data networks (PDNs) or the operator service infrastructure, as shown in Figure 2.3. PDG also interacts with the AAA server to perform service-level authorization, authentication, and accounting.

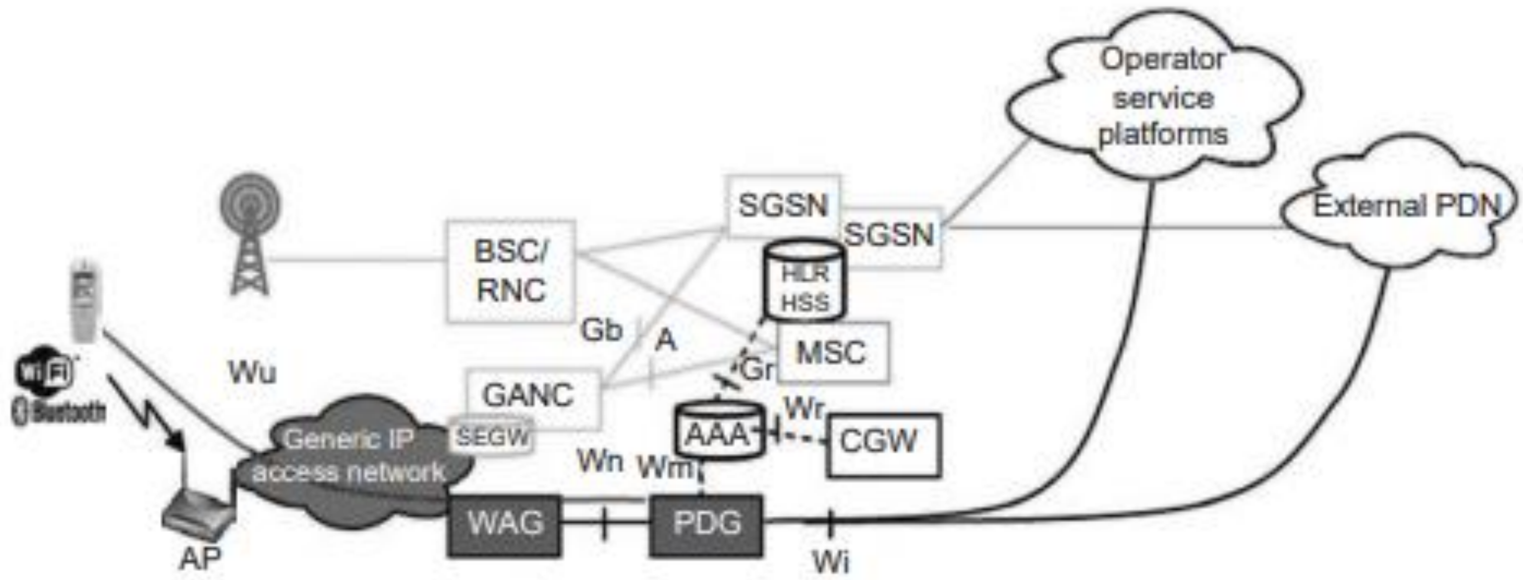


Figure 2.3 I-WLAN R6 architecture and functional components.

Media Independent Handover: IEEE 802.21

MIH defines a framework to support information exchange that aids mobility decisions, as well as a set of functional components to execute these decisions. MIH shields link-layer heterogeneity and provides a unified interface to upper-layer applications to support transparent service continuity. handover scenarios considered in 802.21 WG include wired as well as wireless technologies—the complete IEEE 802 group technologies and 3GPP and 3GPP2 access network standards

MIH Architecture

MIHF (media independent handover function) lies at the heart of the MIH architecture and performs an intermediary or a unified interface between the lower-layer heterogeneous access networks and higher-layer components, as shown in Figure 2.5. MIH provides generic access technology independent primitives called service access points (SAPs). SAPs are APIs (application programming interfaces) through which the MIHF can communicate with the upper- and lower-layer entities. Āe MIHF facilitates three services namely media independent event service (MIES), media independent command service (MICS), and media independent information service (MIIS), which are responsible for signaling state changes at lower layers, control by higher layers, and provision of information regarding neighboring networks and their capabilities, respectively, as highlighted in Figure 2.5.

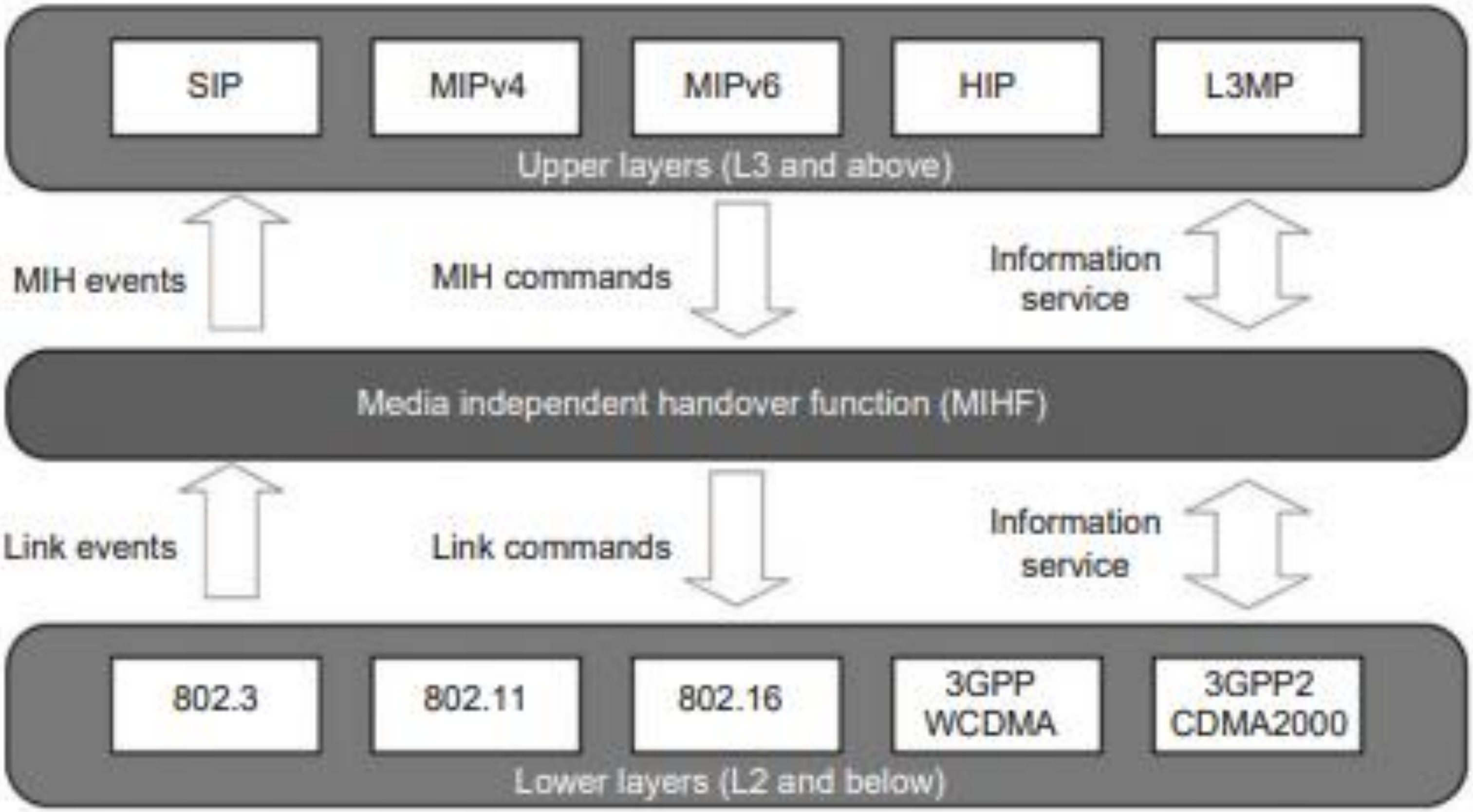


Figure 2.5 **MIH architecture and functional components.**

Limits and Potential of Seamless Convergence Solutions

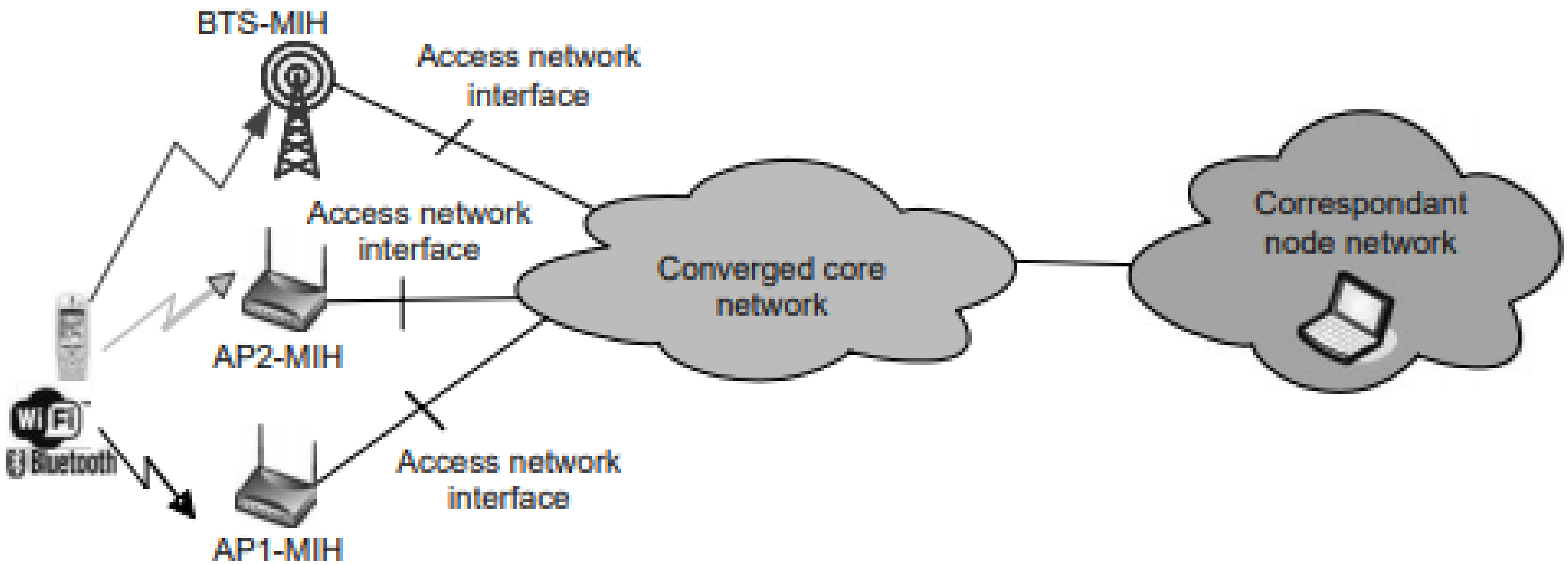


Figure 2.6 MIH potential integration with the current network architecture.

Summary

In this chapter, we presented an overall view of network convergence coupled with the services and their levels of integration and the different impacts on the network architecture. A comprehensive survey of different standardized seamless convergence solutions were presented with an in-depth discussion and comparison of their potential utilization and disadvantages. Main intention of the study was to assess different mid- and long-term architectural scenarios for convergence of heterogeneous access network mechanisms for seamless terminal mobility between different access networks ensuring continuity of service even for the most stringent types of applications.

Cont.

Seamless convergence of heterogeneous access networks is essential in today's telecommunication systems. It allows operators to provide services without worrying about the user's location, access technology, or device, apart from avoiding the problems of maintaining multiple networks that obviously creates interoperability issues and complicates maintenance, support, and upgrading. Fixed–mobile convergence provides the opportunity for fixed-only operators to defend their business against mobile substitution and also enables integrated operators to avoid developing separate facilities for each type of network. In contrast, the seamless convergence of heterogeneous access technologies enables operators to offer enhanced services and an ultimate user experience. To complete the convergence puzzle, if today's approaches are mainly focused on integrating WLANs with UMA and I-WLAN as short- and mid-term solutions, the distant focus might be to integrate cellular and noncellular technologies. MIH coupled with mobility protocols at the higher layers (MIPv6, e.g.) and in coordination with IMS and I-WLAN R7 could be the future of seamless convergence enabled network architectures.

Cont.

Table 2.2 Recommendations for Seamless Convergence Architectures at Different Periods

	Commercial Launch (BTFusion, Unik)	*Mid-Term Solution*	*Long-Term Solution*
Voice	UMA	GAN R6	I-WLAN R7 +
Data	UMA	I-WLAN R6 + MIP	IMS + MIP + MIH
Convergence type	Fixed–mobile	Fixed–mobile	Fixed–mobile + mobile–mobile

Note: ■ Seamless mobility ■ No mobility ■ Mobility partially handled.