The past decade has witnessed the fast evolution and successful deployment of a number of wireless access networks. The two most promising ones are cellular networks and wireless local area networks (WLANs). Originally aimed at high-quality circuit-switched voice service with wide area coverage, cellular networks have been well deployed around the world. The second-generation (2G) cellular networks (e.g., Global System for Mobile Communications [GSM] and IS-95) were a revolution from analog to digital technology. 2.5G cellular networks such as General Packet Radio Service (GPRS) provide packet-switched lowrate (approximately up to 100 kb/s) data services. With the ever-increasing demand for high-rate multimedia services, after many indoor and outdoor tests, commercial third-generation (3G) cellular networks have been deployed in many countries, and are expected to provide multimedia services with a maximum bit rate of 2 Mb/s. On the other hand, WLANs have shown their potential to provide higher-rate data services at lower cost over local area coverage. Working in the license-exempt 2.4 GHz industrial, scientific, and medical (ISM) frequency band, the IEEE 802.11b WLAN offers a data rate up to 11 Mb/s, while the IEEE 802.11a WLAN and European Telecommunications Standard Institute (ETSI) HIPERLAN/2 can support a data rate up to 54 Mb/s in the 5GHz frequency band. Compared to cellular networks, WLANs typically cover a smaller geographic area as a wireless extension to wired Ethernet. As a result, WLANs are feasible candidates for high-rate data service provisioning at hotspot areas with low user mobility. Driven by the service anywhere and anytime concept, it is well accepted that fourth generation (4G) wireless networks will be heterogeneous, integrating different networks to provide seamless Internet access for mobile users with multimode access capability. The well-deployed cellular networks and WLANs will both be included along with other wireless access networks such as ad hoc networks, sensor networks, and wireless metropolitan area networks (WMANs). One major challenge in cellular/WLAN interworking is how to take advantage of the wide coverage and almost universal roaming support of cellular networks and the high data rates of WLANs. Many issues should be carefully addressed to achieve seamless interworking, such as mobility management, resource allocation, call admission control (CAC), security, and billing. This article focuses on resource allocation and CAC in the integration of cellular networks and WLANs. First, a differentiated services (DiffServ) interworking architecture with loose coupling is presented. Second, we discuss the resource allocation issue in cellular/WLAN interworking. Third, we propose an effective call admission scheme for voice and data services in integrated cellular and WLAN networks. Finally, the performance of the proposed scheme is evaluated to show its strengths and impact on the system. Many interworking architectures have been proposed to integrate cellular networks and WLANs for 4G wireless communications, mainly aimed at augmenting cellular networks with high-rate data services by WLANs in hotspots. Based on the interdependence between the two access networks, the interworking architectures can be classified into two categories. Tight coupling architecture: The WLAN is connected to the cellular core network, and appears to the cellular core network as one cellular radio access network. For example, the integration point of WLANs to a GPRS/Universal Mobile Telecommunications System (UMTS) core network can be the serving GPRS support node (SGSN) [1] or gateway GPRS support node (GGSN) [2]. A user roaming across the two

domains is based on the mobility management protocols of the cellular networks, thus enhancing the interdomain mobility management capability. The main disadvantages of the tight coupling approach are that:

• An interface in the cellular core network exposed to WLANs is required, which is a challenge as the two domains are likely to be developed and deployed independently by different operators.

• A large volume of WLAN traffic will go through the cellular core network, possibly making the latter a network bottleneck.

• WLANs need to have a protocol stack compatible with that of cellular networks. The induced complexity and cost may hamper the deployment of a tight coupling architecture [2]. Loose coupling architecture: The gateway directly connects the WLANs to the Internet backbone, and there is no direct link between the WLANs and the cellular core network [2]. The main advantage of the loose coupling approach is the independent deployment of the two domains. However, as the two domains are separated, the mobility signaling may traverse a relatively long path, thus inducing relatively high handoff latency.