



MOBILE EXPERTS

Carrier Wi-Fi and the HetNet

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13: METHODOLOGY

To create estimates and forecasts for the Carrier Wi-Fi market, Mobile Experts relied on direct input from more than 70 industry sources, with 29 different mobile operators contributing to the overall analysis to give a detailed global view of the market. Mobile Experts built a “top down” forecast based on direct input from mobile operators and based on trends in end-user demand for mobile services. Then, Mobile Experts built a “bottom up” forecast through discussions with OEMs and semiconductor suppliers in the supply chain. Roughly 40 suppliers, integrators, and OEMs participated in this phase of the survey. Mobile Experts also used financial disclosures from publicly traded companies to assemble a quantitative view of the equipment market.

Mobile Experts has investigated the entire ecosystem for Carrier Wi-Fi, in order to effectively triangulate on market growth. Our forecast includes AP, controller, cloud controllers, core integration, user devices, and semiconductors so that we can use each element to double-check our forecast for the other elements.

SCOPE OF CARRIER WI-FI:

Carrier Wi-Fi includes deployment of Wi-Fi networks by mobile operators, cable operators and other multi-service operators (MSOs), as well as unique implementations on railways, aircraft, DAS neutral hosts, and over-the-top providers, to the extent that the Wi-Fi system is utilized by a telecom operator for end-user services. Backhaul via Wi-Fi, Enterprise Wi-Fi systems, and private Wi-Fi networks are not included in the scope of this market study.

The independent market for Small Cells is not included in this analysis, but integration of Wi-Fi with licensed-band small cells was considered, and the integration of the two modes is reflected in the forecast. See the March 2013 study on *Small Cells* by Mobile Experts for details on the outlook for licensed-band units such as femtocells, picocells, and metrocells.

NOTES ON BACKWARD COMPATIBILITY:

Forecasts for each generation of 802.11 standards assume backward compatibility with previous generations. For example, the Mobile Experts forecast for 802.ac Access Points assumes that all 802.11ac units are also compatible with 802.11n, 802.11g, 802.11b, and 802.11a. There is one significant exception to this rule: 802.11ad will not necessarily maintain physical compatibility with the other standards. The 802.11ad standard utilizes a 60 GHz carrier frequency, and therefore the option exists to deploy 802.11ad links without maintaining backward compatibility. In practice, Mobile Experts believes that all 802.11ad mobile devices will also include 802.11 ac,n, and previous generations. Similarly, for practical purposes in our forecast we have assumed that 802.11ad Access Points will also include Wi-Fi at 2.4 GHz and 5 GHz.

NOTES ON MARKET SHARE:

In the Mobile Experts forecast, “market share” designates the proportion of market revenue for each supplier. “Shipment share” denotes the proportion of total shipments from each supplier. In general, Mobile Experts uses market share for semiconductors and for software because revenue tracking is more straightforward than other measurements. However, in the case of network elements such as Access Points or Wi-Fi networks, the revenue from software and service creates confusion and “shipment share” provides a more trackable, straightforward metric.

NOTES ON CONTROLLER FEATURES:

Mobile Experts forecasts Access Controllers based on the features built in. In the case of Carrier Wi-Fi, the Mobile Experts forecast includes a category for Access Controllers which interface to an Access Gateway (in this case the Gateway interfaces to the service provider’s Authentication, Authorization, and Accounting or AAA server and the P-GW). The second category of Access Controllers includes the capability to interface directly to the AAA server and the P-GW.

Exhibits 11 through 14 give the detailed definitions for each category of equipment, for regions of the world, and for specific segments of Carrier Wi-Fi equipment.

Exhibit 11: Detailed definitions for regions

North America:	USA and Canada
Latin America:	Mexico through South America, including Caribbean
Europe:	Western and Eastern Europe, including Russia
China:	China, including Tibet and Hong Kong
Asia Pacific:	India through Australia/Micronesia, excluding China
Middle East/Africa:	Pakistan and Turkey through Africa

Source: Mobile Experts

Exhibit 12: Detailed definitions for categories of controller hardware

Local Controller:	A physical Access Controller, located in proximity to the Access points
Cloud Controller:	An Internet-based service that provides the control functions previously supported by a local physical Access Controller.
Integrated Controller:	An Access Controller that is physically integrated with the Access Gateway, at the Carrier’s core.

Source: Mobile Experts

Exhibit 13: Detailed technical definitions for specific Carrier Wi-Fi Architectures

Fat AP:	A network architecture in which the Access Point independently controls itself and manages its own traffic on the Internet
Thin AP:	A network architecture in which the Access Point passes control and data-plane traffic through an Access Controller
Fit AP:	A network architecture in which the Access Point passes control/signaling traffic through the Access Controller, data-plane traffic is optional, i.e., it can pass through the controller or through a different path

Source: Mobile Experts

Exhibit 14: Detailed technical definitions for specific authentication protocols

EAP-SIM:	Extensible Authentication Protocol-by Subscriber Identification Module. This approach uses the SIM card, generally in a handset, to authenticate the user. An increasing number of tablets include SIM cards to take advantage of this approach.
EAP-AKA:	An extension of EAP-SIM to authenticate a user via Authentication and Key Agreement. In short, this is a variation on EAP-SIM for UMTS 3G mobile devices.
EAP-TLS:	Authentication using Transport Layer Security relies on certificates. The TLS protocol uses certificates from both the end-user device and the network to validate a two-way connection.
EAP-TTLS:	Authentication using Tunneled Transport Layer Security also relies on certificates, but in this case only the network must provide a certificate and the client may be validated through a secured tunnel.

Source: Mobile Experts