Wi-Fi PROFESSIONAL SERVICES

SPEED TIME TO MARKET FOR CARRIER Wi-Fi® NETWORKS

APPLICATION NOTE

TABLE OF CONTENTS

INTRODUCTION

Mobile data usage is exploding, and a significant amount of this is smartphone and tablet traffic accessed through Wi-Fi. This trend is expected to grow exponentially as more users access their data from wherever they are located: at home, in places of congregation such as coffee shops, airports or social gatherings, or while commuting or engaged in retail activities.

Due to Wi-Fi's unlicensed nature, some operators have been skeptical of it and even viewed Wi-Fi as a direct threat to their licensed spectrum offerings. Opinions have changed with the availability of Carrier Wi-Fi, and it is now regarded as a strategic solution for both wireline and mobile operators.

Carrier Wi-Fi should be considered as part of an operator's mobile broadband investment evolution. The transition to include Carrier Wi-Fi in an operator's portfolio must address RAN offloading, while still enabling operator control of the user experience (onloading), as well as subscriber and network security and investment monetization. Operators must identify the areas of their network which face the most severe demands, and plan their Wi-Fi and licensed networks to achieve the most significant impact on subscriber demand. Some deployments will consist of a large number of access points (APs) and sites, and the acquisition of these sites and timely site-staging will require expert tools and resources. Special events and high density areas as well as areas of high use with standard density all pose unique challenges and different approaches to Carrier Wi-Fi network design and implementation.

Given these considerations and the fact that many deployments will require multi-vendor support, there are benefits to leaving the complexity of this management and integration to one trusted partner. Alcatel-Lucent professional services provide wireline and mobile operators a cost-effective and fully-managed Carrier Wi-Fi deployment option that ensures seamless integration with their existing networks, and the highest levels of service quality and security.

This paper will discuss the benefits of deploying a Carrier Wi-Fi network using Alcatel-Lucent professional services. It will be of interest to several operator types:

- Mobile Network Operators (MNOs) looking for a way to relieve their 3G/4G capacity constraints.
- MNOs attempting to address high density areas that may impact their 3G/4G network.
- Multiple System Operators (MSOs)/cable companies looking for a way to add new services to their triple play packages and reduce churn, as well as a potential way to wholesale capacity to MNOs.
- Wireline/mobile operators looking to provide coverage to special events, underserved areas or a potential way to wholesale capacity to other wireline and mobile network operators.

NEW REVENUE OPPORTUNITIES WITH lightRadio Wi-Fi

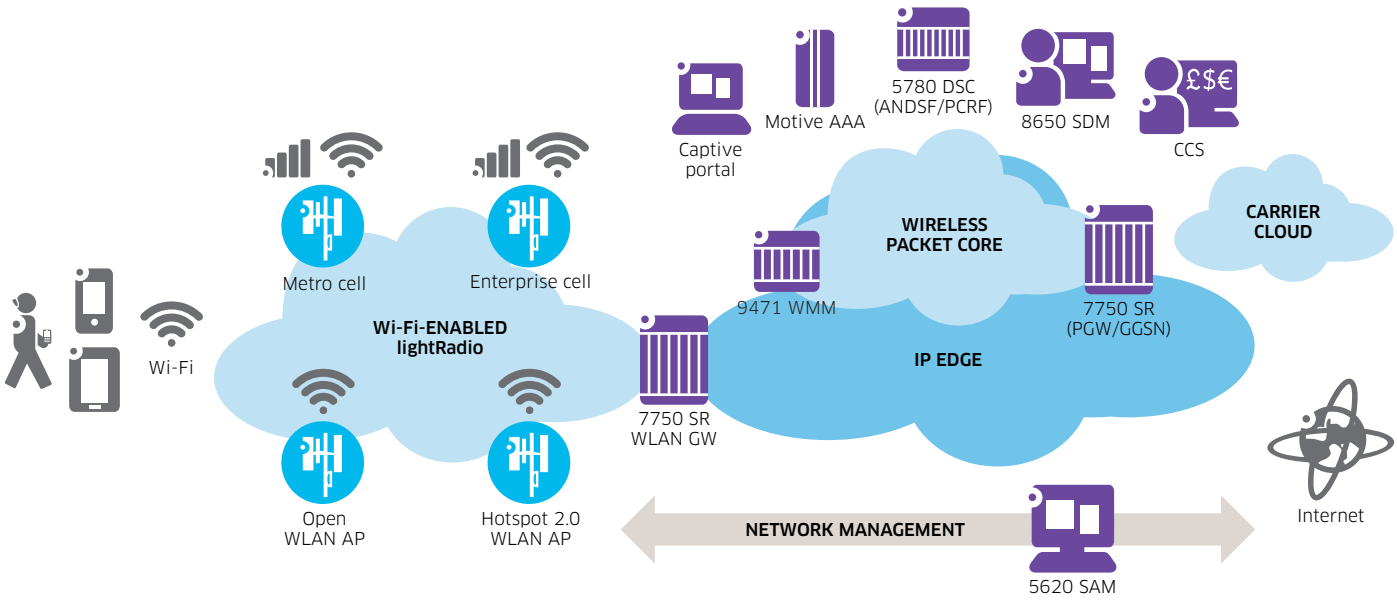
Operators need to cost effectively manage the exponential increase in mobile broadband traffic and at the same time capitalize on important new revenue and monetization opportunities. However, they need to do it with limited resources (spectrum) and by offering a safe and secure means (for the subscriber and the network) of addressing the usage growth.

The lightRadio™ Wi-Fi portfolio, supported by Alcatel-Lucent professional services, addresses these concerns. The most complete, carrier-grade, end-to-end Wi-Fi portfolio available today, it is composed of Alcatel-Lucent and valued third-party products. Carrier Wi-Fi enables operators to deliver a seamless and secure mobile broadband experience across Wi-Fi hotspots and cellular networks. By keeping customers on their network, operators have the opportunity to offer more personalized and bundled services, and pursue new business models. As a result, they can reduce customer churn while attracting new subscribers.

These opportunities for new revenue complement the potential efficiencies gained around staging incremental licensed spectrum in the RAN. Operators have multiple options to monetize the network:

- Wholesale access to other operators through partnerships
- Wholesale or leased access to enterprises or local businesses
- Co-branding/marketing with local governments or businesses via the captive portal splash page
- Allowance of guest registration on the network via the captive portal splash page. This opens up the potential for new users who might otherwise not have used the network
- High density/special event scenarios where applications tailored to the environment can be developed to enhance the user experience

Figure 1. End-to-end lightRadio Wi-Fi portfolio



lightRadio Wi-Fi provides multiple benefits over untrusted Wi-Fi. Subscribers are able to use all of their standard services regardless of whether they are on the 3G/4G or Wi-Fi network, without having to re-authenticate while on-the-go. In addition, the WLAN Gateway is based on the Alcatel-Lucent 7750 Service Router, which many operators already have embedded in their network. This familiarity will allow the operator to reduce OPEX costs.

Furthermore, due to the scalable nature of the lightRadio Wi-Fi portfolio an operator may choose to deploy a focused Wi-Fi network now and add Wi-Fi APs to the WLAN Gateway as demand warrants. This growth can also include interworking the WLAN Gateway to an operator's 3G/4G mobile packet core initially, or in the future.

Find out more about the **lightRadio Wi-Fi portfolio**.

SIMPLIFY EVOLUTION WITH A SINGLE, TRUSTED PARTNER FOR Wi-Fi DEPLOYMENT

The Alcatel-Lucent professional services team is a single, trusted partner who is able to handle all aspects of the deployment for the operator. This is even more important as operators begin to view Carrier Wi-Fi as part of their key mobile broadband investment evolution and deployment strategy. Working with Alcatel-Lucent professional services will ensure seamless integration with the operator's existing network, and that the requisite levels of service quality and security are achieved.

Leveraging Bell Labs innovation, the team provides a full suite of customized services that span business consulting, network design, integration and OSS/BSS implementation, as well as post-deployment support. The team works with operators on all sizes of projects — from large-scale, long-term roll-outs to on-site event day support.

Professional services for Carrier Wi-Fi span Alcatel-Lucent lightRadio Wi-Fi components, as well as partner components such as access points, captive portals and OSS/BSS platforms. These professional services are also available independent of an operator's network element choices.

Supporting the Carrier Wi-Fi deployment with Alcatel-Lucent professional services addresses the operator's need to reduce capacity strain, embrace a previously disruptive technology, and deploy in the fastest time-to-market possible. The operator maintains focus on day-to-day operations while the professional services team manages:

- The deployment of APs over a large geographic area
- A large number of suppliers and subcontractors
- The complex critical path that can mean the difference between on-time and late deployment
- The design and optimization of various Wi-Fi access infrastructure elements
- The design and configuration of the WLAN Gateway, customization of the captive portal, and the numerous interfaces between these and the Authentication, Authorization and Accounting (AAA) systems and, optionally, an operator's existing Home Location Register/Home Subscriber Server (HLR/HSS)

These tasks can be managed by a robust Program Management team backed by the Field Scheduling Tool (FST). The strong partner relationships that Alcatel-Lucent manages are leveraged to ensure a seamless and coherent delivery process. Additionally, the operator's objectives are captured by the Network Business Consulting team and translated into Radio Frequency (RF) and Network Design & Optimization requirements. This results in a network that meets or exceeds the operator's Quality of Service (QoS) and Quality of Experience (QoE) requirements.

As operators make the move to add Carrier Wi-Fi as a strategic element of their network, it is clear that working with the Alcatel-Lucent professional services team helps simplify the evolution, minimize disruption, and ensure implementation goals are met.

FASTER TIME-TO-MARKET WITH PROFESSIONAL SERVICES

This section provides a more detailed view of each of the most critical customized services available to simplify deployment and speed time to market with Carrier Wi-Fi. Services experts bring extensive expertise in turnkey Carrier Wi-Fi architectures supporting multiple frequency bands and technologies, as well as large-scale deployments. Proven methodologies and tools incorporating Bell Labs expertise help reduce cost, mitigate risk and accelerate time to market for new Carrier Wi-Fi networks.

Alcatel-Lucent professional services

Network Business Consulting

- Comprehensive business planning methodology to provide customized market analysis, preliminary network design/architecture, supporting business case, and preliminary view of prime hot spots and markets.
- Wi-Fi site selection: Identifying the optimal placement of Wi-Fi access points is critical to reducing capacity constraints and monetizing the network. The most effective way to do this is via demand planning (when there is no history of traffic patterns in the operator's network or via traffic geo-location when network data is available). These systematic approaches to identifying where traffic can be most effectively removed from the licensed network ensure that the operator's investment is utilized in achieving their long-term goals.

Site Acquisition/Installation

- Obtain site agreements, negotiate equipment placement, and determine site requirements to support the assembly, installation and power-up of equipment at these sites.

RF Engineering & Design

- Wi-Fi RF site surveys to determine the optimal quantity and placement of access points, RF design, and configuration.
- Alcatel-Lucent RF design engineers use the same tools utilized for licensed networks with modifications to tools and procedures to account for the differences associated with Wi-Fi. These tools are used to validate the Wi-Fi RF propagation model/AP placement developed by the RF engineers. The propagation models generated by the RF engineers are based on many years of experience designing and deploying large macro networks as well as experience gathered through several years of deploying Wi-Fi networks.

Network Integration & Validation

- Configure and provision an end-to-end network including Wi-Fi access, core, security, on-site/remote integration and security implementation, and testing of Wi-Fi access network elements.

Wi-Fi Network Planning & Design

- The design of the Carrier Wi-Fi network is based on ensuring the seamless communication of several core network elements that have been validated end-to-end in Alcatel-Lucent labs as well as in multiple deployments spanning several different configurations. The Alcatel-Lucent approach to designing the network ensures the operator is able to offer subscribers (and optionally non-subscribers) an experience with no perceptible difference between the licensed and Wi-Fi RAN. Authentications, handoffs and QoE will meet or exceed the service end users have come to expect.

OSS/BSS Implementation

- Multi-vendor methodology and approach to authentication, charging and subscriber management including captive portal, AAA flexibility and network management integration.

Program Management

- When deploying complex networks involving third parties and many subcontractors, an effective and clear Program Management plan will keep the project on track. This is important to helping the operator achieve end-user satisfaction levels, impact capacity constraints, and reach revenue objectives in the fastest time possible.

Maintenance

- End-to-end support for third-party partners, SLA support for Alcatel-Lucent products. One Alcatel-Lucent number to call for support.
- Operational stability of the network is covered by comprehensive plans for Remote Technical Support (RTS) and Repair & Exchange Services (RES). Additionally, the operator can opt for event day on-site support for high density/special event venues that require additional support.

ARCHITECTURE VALIDATION SIMPLIFIES INTEGRATION

In addition to a wide range of professional services, Alcatel-Lucent has conducted extensive testing and validation of elements of the lightRadio Wi-Fi portfolio in order to ensure seamless deployment for operators. Recent testing has included the validation of captive portal authentication and the resulting end-user experience. Alcatel-Lucent has conducted a number of tests to understand the end-user experience when authenticating through the captive portal, and is also researching how to utilize the operator's HLR to enhance that experience.

Testing continues in the area of interface validation of all components in the lightRadio Wi-Fi portfolio. Given that these are industry standard interfaces, validation will assure operators that applicable subsets of the portfolio will work with their existing infrastructure.

This will simplify introduction of these elements into the operator's Carrier Wi-Fi network, as well as reducing cost, risk and time to market.

The complete end-to-end implementation of the lightRadio Wi-Fi portfolio includes the following elements.

- The WLAN Gateway (7750 SR) supporting:
  - ¬ Wi-Fi traffic aggregation and shaping – Aggregate traffic from the Wi-Fi APs and apply QoS to shape traffic to and from the APs.
  - ¬ Enhanced subscriber management – Mechanisms to link authentication, quota management and legal intercept to the operator's back-end systems.
  - ¬ Soft GRE – Automatically creates GRE tunnels when a device attaches to an AP and removes the tunnels when they are no longer needed, increasing the scalability and flexibility of the WLAN Gateway.
  - ¬ Thin and fat pipe tunneling – Fat pipe tunneling provides a secure tunnel between the AP (or AC for thin APs using an AC for control) and WLAN Gateway and requires the AP to place the User Equipment (UE) into the tunnel. Fat pipe tunneling places no new demands on the UE and uses less UE and fewer network resources than thin pipe tunneling.

- The Motive Authentication, Authorization and Accounting (8950 AAA) Server:
  - ¬ Verify the device credentials.
  - ¬ Verify the users can access the services they are requesting.
  - ¬ Record when sessions start, update, and end. Pass this information to billing, policy management systems, etc. for accounting.

- Captive portals:
  - ¬ Interface between the AAA and the WLAN Gateway.
  - ¬ Provides captive portal functionality for guest access and co-marketing.
  - ¬ Provides payment portal for guests.

- Access points:
  - ¬ Provide users with secure data access in interference rich environments.
  - ¬ Ecosystem of partners provides the operator with deployment flexibility.
  - ¬ Provides operators with a cost effective way to relieve cellular capacity constraints.

- Wireless Packet Core interworking:
  - ¬ S2a Mobility over GTP (SaMOG) for seamless mobility between Carrier Wi-Fi and cellular.
  - ¬ Rich operator-defined policy control mechanisms via 3GPP ANDSF.
  - ¬ Introduction of Metrocell components to the Carrier Wi-Fi architecture.

This portfolio has been deployed in operator environments and also implemented in the IP Transformation Centers to replicate various operator scenarios and develop KPIs to enhance the end user experience and further augment the delivery capability. This experience and lab platform supports the ability to further tailor the services to provide a customized deployment experience.

EXPERTISE WITH LARGE-SCALE PROJECTS

Alcatel-Lucent has worked with multiple operators to roll out large-scale Carrier Wi-Fi deployments. Case studies demonstrate how the Alcatel-Lucent professional services teams work closely with operators to determine objectives and deliver a secure and trusted Carrier Wi-Fi implementation on schedule.

North American cable operator: adding Wi-Fi to metropolitan area

Alcatel-Lucent worked with a North American cable operator who wants to offer Wi-Fi access to its existing high-speed data subscribers as part of its strategy to reduce churn and attract new subscribers. Faced with threats from mobile and wireline operators who are offering triple- and quadruple-play services, the operator fully understood that it must offer new and competitive services to retain and grow its customer base.

Seeing Carrier Wi-Fi as a tool to help counter this competitive threat, it decided to move ahead with a Carrier Wi-Fi deployment in a large metropolitan area as its initial trial site. However, the operator needed help to understand where to place Wi-Fi within this urban center. Wi-Fi access points may have a small coverage area with a cellular site, so the location of a Wi-Fi AP becomes very important for multiple reasons, including:

- Site access and construction requirements (power, backhaul, access)
- Ensuring the site chosen has enough end-user demand to justify the investment

The operator realized it lacked the in-house expertise to address this, especially daunting given the large market it wanted to cover. Alcatel-Lucent was engaged to advise regarding how the operator could best meet its objectives, and then to implement the resulting plan in a quick and efficient manner.

Alcatel-Lucent was tasked with designing and optimizing more than 10,000 indoor and outdoor Carrier Wi-Fi APs, and managing the deployment, installation and optimization of those APs. Alcatel-Lucent was chosen for its technical expertise, ability to scale quickly, commitment to share with the operator best practices and lessons learned, and a strong network of third-party partners.

North American mobile operator: enhancing the fan experience

Alcatel-lucent worked with a North American mobile operator to offer guests and employees of an outdoor entertainment facility an alternative way to access facility-specific content without overburdening the cellular network. The operator wanted to provide fans with an option to experience and interact with mobile content – which had previously been impossible at high-density venues – and also offer additional ways for back-office and convenience staff to access data. At the same time, the operator wanted to ensure that its LTE network was not overloaded during events. Time was a critical factor; the operator had only seven months in which to implement the complete Wi-Fi network.

The operator deployed a 7750 WLAN Gateway-based Wi-Fi Gateway, which included a partner captive portal, and teamed with Alcatel-Lucent to integrate this into its existing AAA. Alcatel-Lucent also designed and deployed several hundred partner APs around the facility.

Alcatel-Lucent provided a comprehensive suite of services that brought together its own and third-party products. The implementation allows the operator to meet its near-term requirements for the entertainment facility as well as allow for future expansion of the Wi-Fi networks into the operator's LTE packet core.

CONCLUSION: THE CARRIER WI-FI OPPORTUNITY

Demand for mobile data is expected to increase by a factor of 25 by 2016. Network operators will need technologies that address capacity constraints while enabling delivery of enriched services that their end users want. The Alcatel-Lucent lightRadio Wi-Fi portfolio, supported by professional services, addresses both operator needs and end-user demands.

The lightRadio Wi-Fi portfolio equips wireline and mobile network operators with the most complete, carrier-grade, end-to-end Wi-Fi portfolio available today, enabling a simple, secure and seamless mobile broadband experience for end users.

With Carrier Wi-Fi a critical element of the operator's strategy for mobile evolution, implementation of the network is even more critical. The Alcatel-Lucent professional services team is a single, trusted partner who will manage all aspects of the deployment to ensure success. A comprehensive suite of professional services spans business consulting, network design, integration and OSS/BSS implementation, as well as post-deployment support. Consulting experts use Bell Labs innovation in methodologies and tools to help build an optimal strategy for each individual operator – regardless of the size of the project, from large-scale, long-term roll-outs to on-site event day support.

Extensive lab and field validation to address various components of the end-to-end portfolio accelerates implementation and ensures service delivery meets end user expectations for Quality of Service and Quality of Experience. Furthermore, Alcatel-Lucent's expertise in wireless and IP helps to more effectively integrate Carrier Wi-Fi into the operator's network.

Alcatel-Lucent specialized services add significant value to operators. By supporting the Carrier Wi-Fi deployment with Alcatel-Lucent professional services, the operator is able to reduce cost and risk, and at the same time accelerate time-to-market for new Wi-Fi services.

ABBREVIATIONS

AAA	Authentication, Authorization and Accounting
ANDSF	Access network discovery and selection function
AP	Access point
BSS	Business support systems
CCS	Convergent Charging System
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GTP	GPRS Tunneling Protocol
HLR	Home Location Register
HSS	Home Subscriber Server
IP	Internet Protocol
LTE	Long Term Evolution
MNO	Mobile network operator
MSO	Multiple system operator
MPLS	Multiprotocol Label Switching
MVNO	Mobile virtual network operator
OSS	Operational support systems
PGW	PDN Gateway
QoE	Quality of experience
QoS	Quality of service
RAN	Radio access network
RF	Radio frequency
SGW	Serving Gateway
SLA	Service Level Agreement
SR	Service Router
UE	User equipment
WLAN	Wireless local area network