The Business Case for
Cable Operator Wi-Fi Deployments

LEVERAGING WI-FI TECHNOLOGY FOR GREATER REVENUE AND INCREASED COMPETITIVE ADVANTAGE
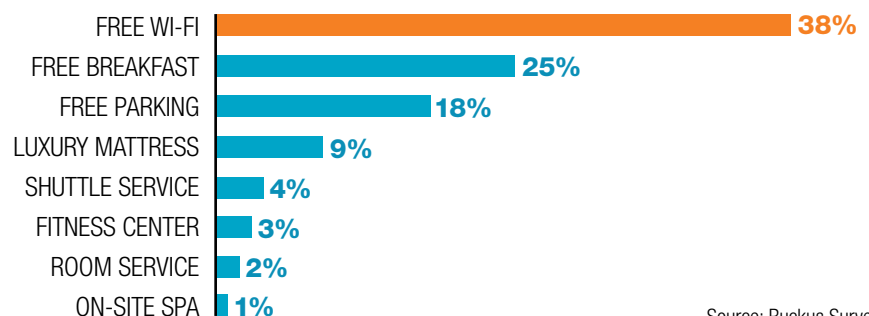
Introduction

The rapid acceleration in wireless data traffic has been well documented over the years and continues in all geographies. Smartphones have become the de facto method by which most of the world consumes the Internet. The challenge for MSOs is how to best profit from this major industry inflection point. Cable's hybrid-fiber coax (HFC) plant delivers a robust broadband experience to the edge of the network, and cable's aerial plant provides a compelling mounting location for Wi-Fi access points. This combination allows MSOs to rapidly deploy a broad footprint, especially when they work together in roaming alliances.

Cable operator Wi-Fi deployments will create value in multiple ways:

1. **Service Provider Wi-Fi.** Adding Wi-Fi to an existing service bundle increases customer stickiness and reduces churn, which increases operator cash flow. The ability of MSOs to band together into roaming relationships makes this story even stronger, allowing them to quickly advertise a very extensive Wi-Fi footprint.

2. **Managed Services for Businesses.** Business customers provide a rich vein for cable Wi-Fi deployments, as they are starting to look for managed Wi-Fi services. MSOs can deliver a compelling carrier-grade offering that includes not just the APs,

Figure 1: Hospitality is one of the most appealing vertical markets as Wi-Fi service quality is key to getting repeat business.

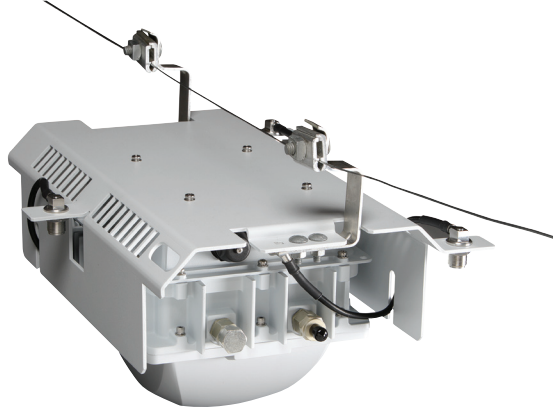### Which amenity is a must when choosing hotel accommodations?

Amenity	Percentage
FREE WI-FI	38%
FREE BREAKFAST	25%
FREE PARKING	18%
LUXURY MATTRESS	9%
SHUTTLE SERVICE	4%
FITNESS CENTER	3%
ROOM SERVICE	2%
ON-SITE SPA	1%

Source: Ruckus Survey

Figure 2: Strand Mounted AP

but also backhaul and network management. In addition to providing a private network for the business customer, the MSO can also offer a public network service for guest access. The latter can leverage Hotspot 2.0 technology to simplify the roaming and connection experience. Hospitality is one of the most appealing vertical markets, as Wi-Fi service quality is key to getting repeat business.

3. **Wi-Fi Wholesaling.** Cell site backhaul already delivers a substantial revenue stream for MSOs, and the next opportunity is to enter into lucrative Wi-Fi roaming arrangements with the mobile operators. Hotspot 2.0 makes the process of Wi-Fi roaming as seamless, secure, and easy to use as cellular roaming. It is also a tremendously scalable solution that can support an almost unlimited number of roaming partners.

4. **Small Cell Services.** MSOs can provide a hosted small cell service for MNOs as they can address all three legs of the deployment stool, which include site acquisition (starting with aerial plant), power, and backhaul. Cable Wi-Fi is the perfect springboard for providing MNOs with a hosted small cell service.

5. **Enabling Technologies.** Indoor location based services (LBS) are of great interest to businesses of all types, and Wi-Fi is an excellent enabling technology. It can locate a user to within about a meter and, unlike GPS, it works really well indoors. Wi-Fi networks in public venues also create new digital outlets for cable ad sales operations.

1) Service Provider Wi-Fi: Increasing customer "stickiness" with Wi-Fi

Pioneering MSOs have learned that adding a Wi-Fi service significantly reduces broadband churn. Analysis of cable Wi-Fi users has shown churn rate improvements of up to 35%. Operators often begin Wi-Fi builds in their most churn-prone, over-builder

areas and the fastest way to quickly get a network deployed is to leverage aerial plant. Once the aerial plant is built out the next step is to target other outdoor vertical assets (typically light poles) and indoor locations.

The following figure breaks out different locations by the amount of data that they can generate per square meter. It is no surprise to see stadiums, train stations, and airports at the top of the list.

Figure 3: Demand density by venue, average busy-hour Mbps per 10 m²
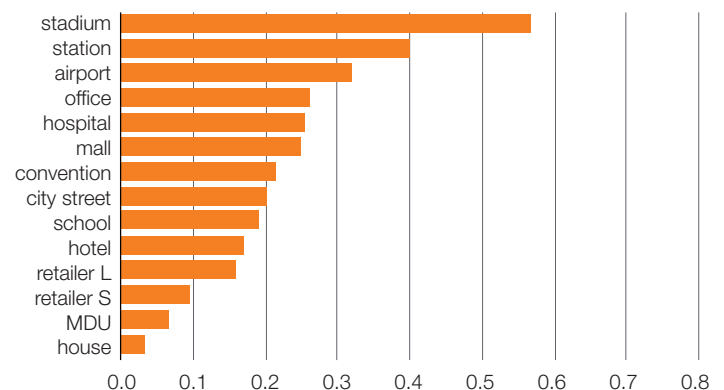
Source: Ruckus Experience

These large venues have IT departments and, barring a very deep relationship with the MSO, will insist on some level of public (not just MSO customer) Wi-Fi.

Because Wi-Fi is an excellent neutral host technology, there is a huge advantage in being first into a venue, as there usually isn't the need for a second operator. This creates an ongoing land grab by Wi-Fi service providers for the most desirable locations. Note: neutral host refers to a network that ANY user can access.

Competitors at these large venues include LECs, MNOs, WISPs and Tower companies. Cable's network capacity at the edge, in-market B2B teams, and strong focus on Wi-Fi leave them ideally suited to succeed. Winning solutions often require multiple Wi-Fi services within the venue, cable plant for backhaul, and a very strong Wi-Fi solution featuring reliable wireless connectivity.
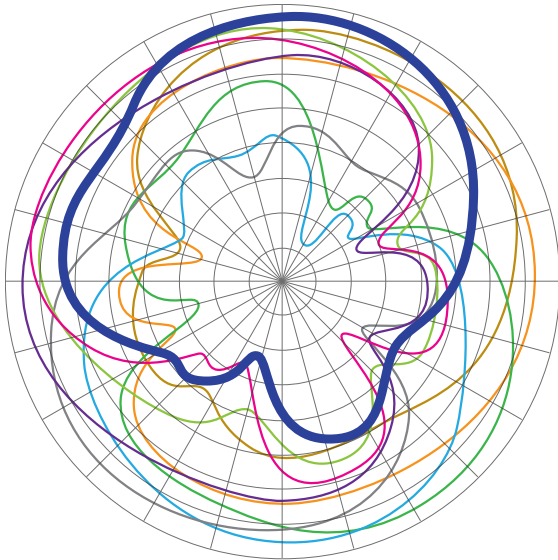
Reliable Wireless Connectivity
Reliable wireless connectivity is essential in any deployment because if you can't get connected and stay connected, nothing else really matters. A great deal of work has been done at Ruckus over the past few years to make Wi-Fi more reliable —it all starts with the airlink and adaptive antenna technology.

Adaptive antenna technology steers RF energy toward the user and away from neighboring APs that would see this as interference. The latter is very important in high-density designs, as

The Business Case for Cable
Operator Wi-Fi Deployments

LEVERAGING WI-FI TECHNOLOGY FOR GREATER REVENUE AND INCREASED COMPETITIVE ADVANTAGE

Figure 4: BeamFlex controls multipath to deliver as much as 6 dB of additional gain as seen by the user's device

Figure 5: Polarization diversity greatly improves performance regardless of the orientation of the mobile device


HORIZONTAL POLARIZATION

VERTICAL POLARIZATION

interference is often the limiting factor in a deployment since APs are in such close proximity to one another. Adaptive antenna technology has been proven in high-density venues worldwide and offers a significant advantage over legacy solutions. With BeamFlex, the RF energy is shaped and directed in different ways for different users by controlling the multi-path effects of Wi-Fi. This technology is especially effective on strand mounted APs and can increase the signal gain at the user's device by as much as 6 dB.

Adaptive polarization diversity is a key ingredient in a successful Wi-Fi deployment as it can increase the performance of the uplink. It is implemented in the Wi-Fi AP by having horizontally and vertically polarized antennas to receive the user's transmission. This enables the AP to receive a strong signal regardless of the physical orientation of the mobile device.

In high-density deployments there is no such thing as too much spectrum, and Wi-Fi has access to upwards of 600 MHz in many geographies. This far exceeds the licensed spectrum that a mobile operator would have in a major metro area. In many indoor deployments, the venue owner can exercise a great deal of control over what gets deployed in their building, which can help keep unlicensed bands from getting congested.

Self-optimizing network technologies like ChannelFly™ enable APs deployed in close proximity to automatically select the optimum channel for the situation based on realizable capacity and switch channels as circumstance dictate. One factor that changes the RF characteristics of a venue is the ebb and flow of
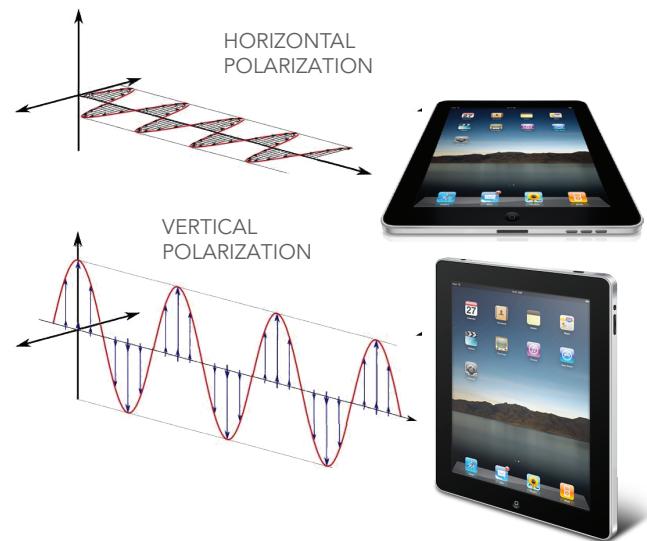
the crowd, as people do absorb RF energy. SON technologies like ChannelFly are absolutely essential to enabling massively scalable Wi-Fi networks to be rolled out quickly and with a minimum amount of network planning. When this is combined with technology that allows APs to be automatically configured, it makes large deployments fairly straightforward.

2) Business Class Services

Cable operators can extend their Wi-Fi networks into business accounts through a managed services offering that includes a private SSID for business use and a public SSID for guest access. This effectively increases the footprint of the MSO's public network service by piggybacking onto a private network deployment. In addition to basic private Wi-Fi service, there are opportunities to add a variety of value added services of which location based services (LBS) are almost always at the top of the list.

Clearly there is a role for MSOs in managed services, but what is driving businesses in this direction? For many it is a strong desire to shift the complexity of running a private Wi-Fi network onto a service provider that has expertise in this area. The business case gets stronger as networks get more complex with the addition of 802.11ac, VoIP, and BYOD to name a few. These are all areas where an MSO can help. Much of the actual installation can be turned over to VARs and SI's that specialize in specific vertical markets like hospitality, healthcare, and education to name a few. One of the most compelling Wi-Fi verticals is hospitality, as it is an area where guests will pay for a high quality service.

The Business Case for Cable
Operator Wi-Fi Deployments
LEVERAGING WI-FI TECHNOLOGY FOR GREATER REVENUE AND INCREASED COMPETITIVE ADVANTAGE

Figure 6: Business locations with cable Wi-Fi service
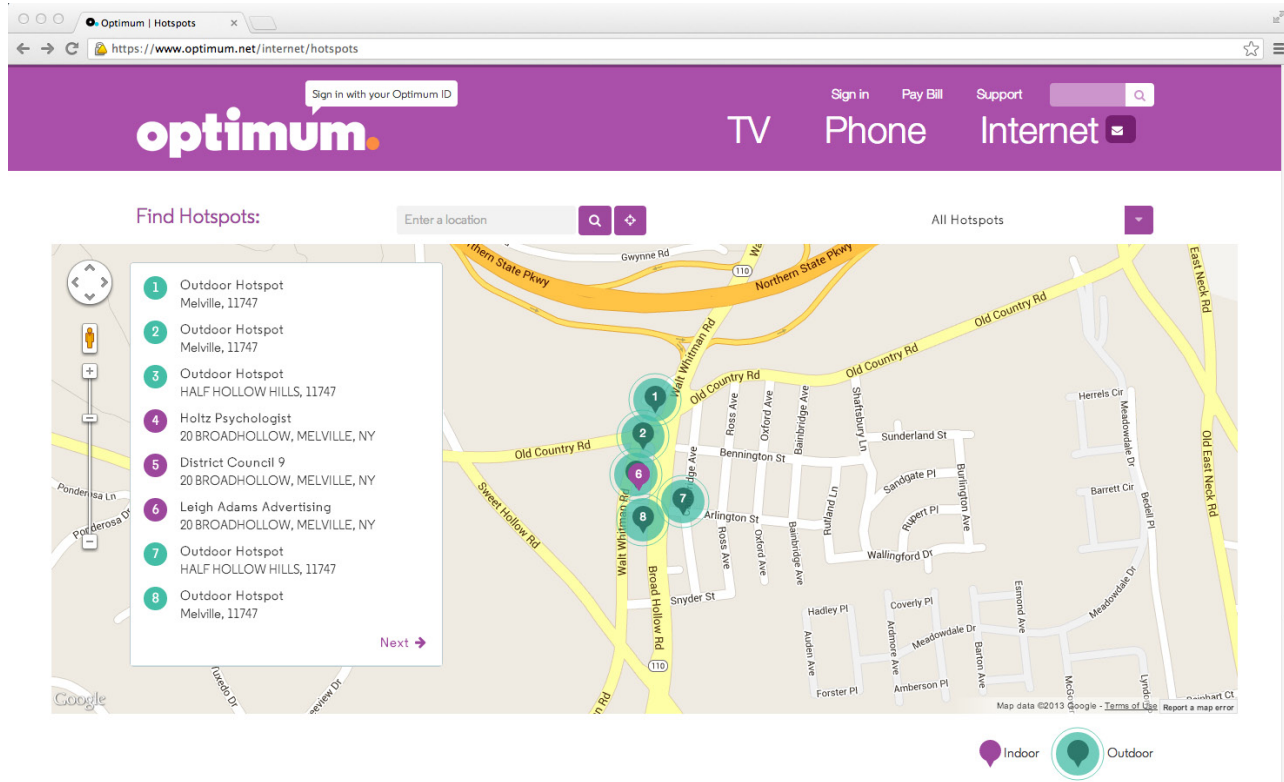
Hospitality

Many guests measure a hotel by the quality of the Wi-Fi, so for many hospitality brands this is something that gets a great deal of attention. The average guest now checks in with 2.5 wireless devices, with families having many more. The Wi-Fi network must cover the guest rooms and all public areas including conference rooms, the lobby, and restaurants. In addition to providing strong coverage throughout the building, IT organizations must get ready for new technologies like 802.11ac and greatly enhanced security and authentication approaches based on 802.1x and 802.11i (using the advanced encryption standard).

802.11ac is on the verge of entering the managed services market and in the right situations it can provide a real performance boost. 802.11ac uses new modulation techniques, greater channel bonding, and even more RF streams to push throughput up above 1 Gbps. Very few devices actually need this kind of performance, but it does enable the user to get on and off the airlink quickly, which enables even more users to be supported by the same AP. This technology will start to emerge in 2014 as it does require new APs and new devices. 802.11ac will not always be the right solution as it gets its great

Figure 7: Hospitality has long been one of the most profitable Wi-Fi vertical markets

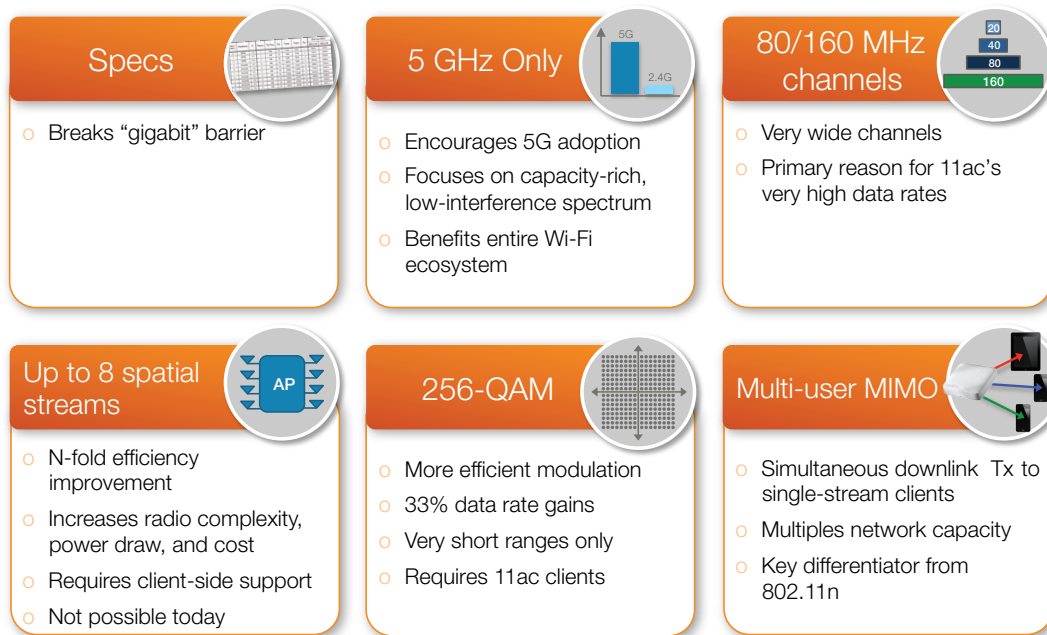**Managed services revenue**, $ per AP per month
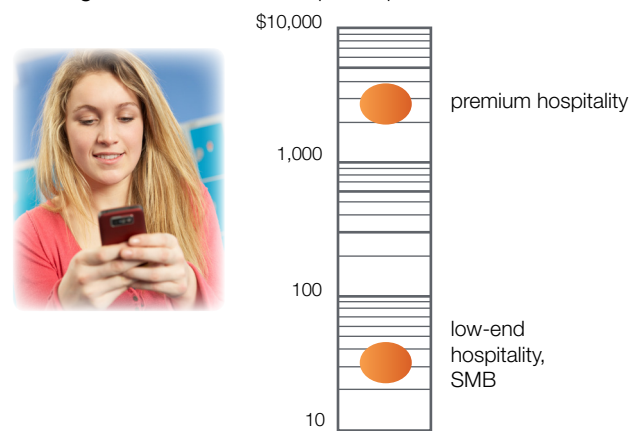
Source: Ruckus Experience

performance boost through channel bonding, and there will be those situations where more non-overlapping channels will trump the need for higher speed.

Figure 8: 802.11ac summary of capabilities

Specs
- Breaks "gigabit" barrier

5 GHz Only
- Encourages 5G adoption
- Focuses on capacity-rich, low-interference spectrum
- Benefits entire Wi-Fi ecosystem

80/160 MHz channels
- Very wide channels
- Primary reason for 11ac's very high data rates

Up to 8 spatial streams
- N-fold efficiency improvement
- Increases radio complexity, power draw, and cost
- Requires client-side support
- Not possible today

256-QAM
- More efficient modulation
- 33% data rate gains
- Very short ranges only
- Requires 11ac clients

Multi-user MIMO
- Simultaneous downlink Tx to single-stream clients
- Multiples network capacity
- Key differentiator from 802.11n

BYOD (Bring Your Own Device) is starting to become a big issue for managed business services. The adoption of smart devices such as smart phones and tablets creates two challenges for IT; network access and device security. Each category is unique and requires a different set of expertise and guidelines.
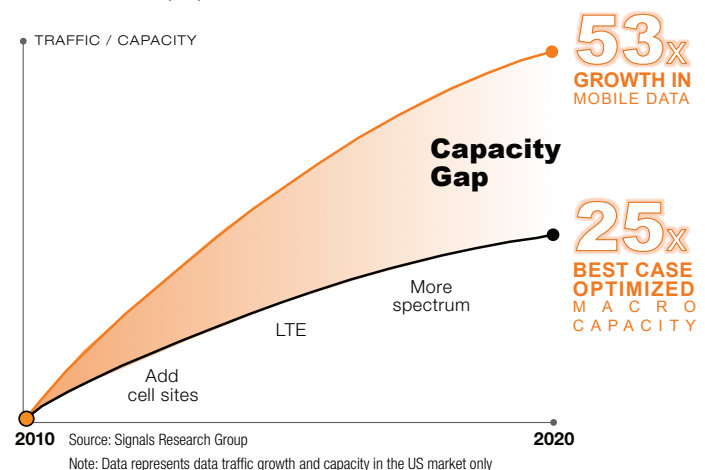
3) Wi-Fi Wholesaling
Mobile cell site backhaul delivers hundreds of millions of dollars in annual MSO revenue, and that number will only increase in the years to come.

Next up is entering into Wi-Fi roaming arrangements with these very same MNOs. This is a great way to monetize the existing MSO Wi-Fi build-outs.

Leading US MSOs already have a great deal of experience in Wi-Fi roaming relationships through the CableWiFi alliance. This alliance of leading US cable operators allow customers of each MSO to roam on the combined network. This is a great example of the power of roaming to greatly increase the utility of a network, and with Hotspot 2.0 this approach becomes massively scalable.

Hotspot 2.0 delivers a Wi-Fi roaming experience that is as seamless, secure, and automatic as the cellular experience we all enjoy when getting off an airplane just about anywhere in the

Figure 9: Even with MSO cell tower backhaul projects, MNO networks will not keep up

TRAFFIC / CAPACITY

53x GROWTH IN MOBILE DATA

Capacity Gap

25x BEST CASE OPTIMIZED MACRO CAPACITY

More spectrum

LTE

Add cell sites

2010 Source: Signals Research Group **2020**

Note: Data represents data traffic growth and capacity in the US market only

world. The Wi-Fi Alliance (WFA) is driving this through its Hotspot 2.0 initiative. Ruckus has long been a leader in the HS2.0 effort, and it's an integral part of the Ruckus SmartCell Architecture. All Ruckus APs and controllers are Hotspot 2.0 capable and any existing Ruckus 802.11n AP in the field can be upgraded to support HS2.0.

In May 2013, the smartphone industry began to ship HS2.0 capable devices beginning with the Samsung Galaxy S4. Apple

The Business Case for Cable
Operator Wi-Fi Deployments
LEVERAGING WI-FI TECHNOLOGY FOR GREATER REVENUE AND INCREASED COMPETITIVE ADVANTAGE

will follow in the fall of 2013. And with the industry expected to ship 800 million smartphones this year, it will not take long for this technology to sweep through the industry. The actual HS2.0 equipment certification program in the Wi-Fi Alliance is called Passpoint™.

In figure 10 we show a user in a visited network having their authentication request proxied back to the home network. The visited network could be an MNO, MSO, enterprise, wireline operator, public venue, or basically any entity with a broad Wi-Fi footprint. The impact of Hotspot 2.0 on Wi-Fi networks will be profound, and it will impact all device types.

Figure 10: Routing authentication requests back to the home network
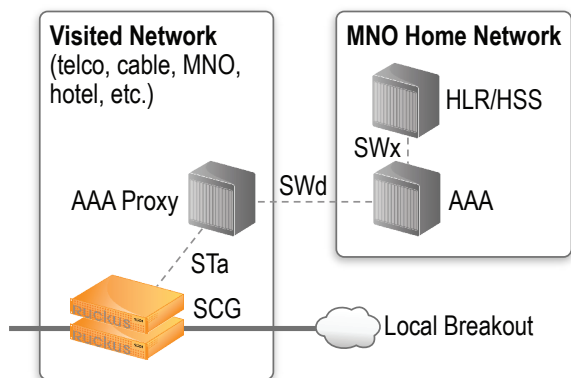
4) Backhauling small cells for MNOs

MSOs in many parts of the world are already generating a substantial amount of revenue by backhauling traffic from macro cell sites, and the potential exists to do the same for small cells. The MSOs are uniquely positioned to enable the broad-based rollout of small cells by leveraging their extensive broadband HFC footprint.

Where the MSO story is very compelling is where they have aerial plant as they can provide not just broadband backhaul, but also site acquisition and power. This scenario provides the cleanest path for an outdoor small cell deployment. Other outdoor deployment options include light poles, traffic lights, the sides of buildings, bus stops, and phone booths, all of which are more challenging.

Deploying a hosted small cell service for an MNO begins with a high-end DOCSIS (or fiber backhauled), strand-mounted Wi-Fi AP on the aerial plant. Many MSOs are already well down this path with extensive strand mounted Wi-Fi deployments. If the right Wi-Fi APs are deployed, layering in a small cell installation

Figure 11: Mounting a small cell next to a Wi-Fi AP on the strand
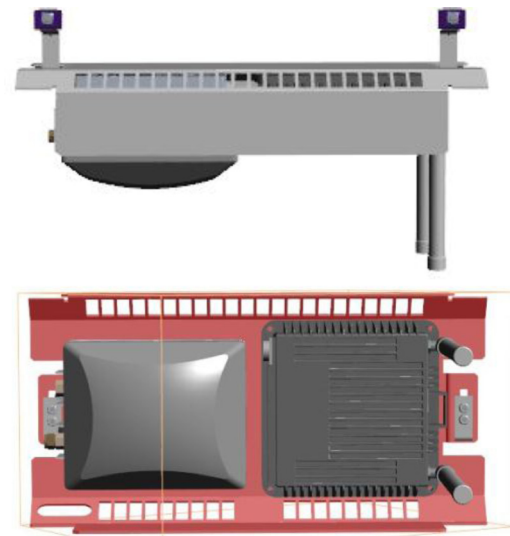
is straightforward. These devices can be directly attached to the Wi-Fi APs, which provide backhaul and power. A good choice for a solution is the Ruckus ZoneFlex 7781CM, which is a dual-band, 3-stream, DOCSIS 3.0 AP that has been environmentally hardened. It supplies power-over-Ethernet (PoE) to both backhaul and power the collocated small cell.

The 2-box solution makes for an easier deployment, as the MSOs and MNOs can each pick their preferred vendor and connect their equipment together via Ethernet. By focusing on a mechanical integration instead of circuit board integration, it becomes much easier for the MSO to deploy the small cell that is preferred by the MNO partner. Options here include small cells from the major RAN vendors as well as small cells from a variety of new entrants. The small cells will connect to the DOCSIS enabled AP via Ethernet, which will backhaul data traffic and provide power to the unit (PoE). This saves the cost and expense of having the small cell vendor integrate a DOCSIS modem into their unit. The same unit that might be deployed on a light pole or the side of a building can also be used on an MSO cable strand.

One of the advantages in deploying small cells off of a Wi-Fi platform is that it allows the MSO to sell a managed small cell service to all the MNOs in an area. This is possible because a licensed radio covers a greater distance than a Wi-Fi AP. Theoretically, a particular MNO may only need to attach to every fifth Wi-Fi AP in the MSO network, leaving the other four to support the other MNOs in the coverage areas.

Cable operators that secure attachment rights for their Wi-Fi builds should secure broad attachment rights at the same time.

page 6

Figure 12: Connecting small cells and Wi-Fi APs back into their respective cores

Connections Legend

Physical —— Logical [Control / Data]

Small Cell + Wi-Fi

LTE Small Cell

Ruckus Wi-Fi AP (7781CM)

UE

Client

Ethernet (10/100/1000)

Evolved Packet Core

Cable NOC

Internet

Power (AC on HFC)

5 GHz Mesh or Direct

HFC Network

Coax

Power Tap

Coax

Fiber Node

Fiber

CMTS

Serious site development work will open high value sites for small cell backhaul.

A great mounting asset in an urban street canyon without overhead plant are street lights. These are always found in downtown city centers, and they have AC power (in many cases they are always hot). Often streets lights have line-of-sight to cable pedestals or vaults – allowing cable operators to offer wireless mesh for the link from light pole to the HFC plant.

Figure 12 shows how different functions are handled back in the network. The Wi-Fi AP passes Wi-Fi traffic back to the SCG in the cable NOC. The small cell communicates with MME and Serving Gateways in the MNO's core network. The parallel networks only come together out on the cable plant.

5) Wi-Fi Enabling Technologies

Location-Based Services (LBS)
This represents a large new opportunity for cable operators, as it is now possible to locate users with great precision while they are indoors using general-purpose Wi-Fi infrastructure (Note: satellite-based GPS is not an indoor technology). With a properly engineered Wi-Fi network, accuracy is down to a few meters. This works through a process that triangulates on a user by getting input from a number of surrounding APs.

The figure on the left shows how a customer could be tracked as they move through a retail establishment. This is the kind of service that is invaluable to businesses of all types as it enables them to improve the design of their venue to better cater to the needs of their customers by observing how they move through the venue.

Ruckus LBS technology has opportunities across many verticals including:

Retail — Ruckus LBS provides the intelligence necessary to not only understand shopping behavior, but to influence shopping behavior. Retailers can identify customer shopping patterns, analyze marketing and merchandising effectiveness, deliver context and location relevant advertising, and improve customer

The Business Case for Cable
Operator Wi-Fi Deployments

**LEVERAGING WI-FI TECHNOLOGY FOR
GREATER REVENUE AND INCREASED
COMPETITIVE ADVANTAGE**

Figure 13: Using Wi-Fi location technology to track users as they move through a venue

Figure 14: Using Wi-Fi location technology to help a user navigate their way through a venue
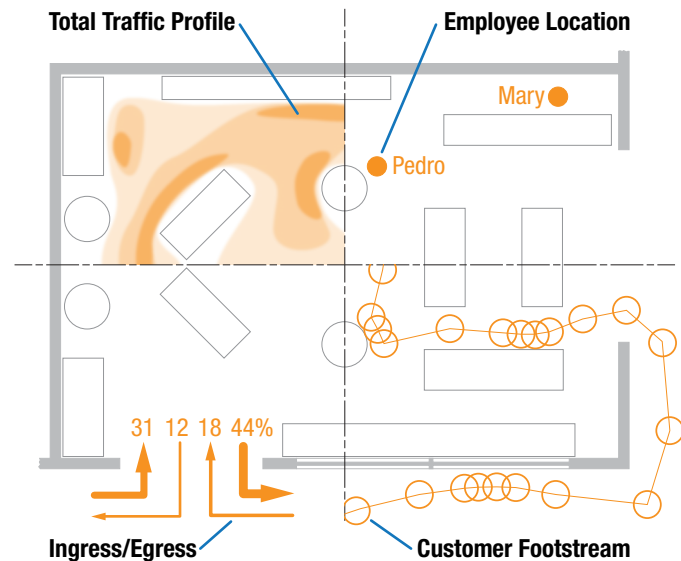
engagement. Additionally, the customer experience can be greatly improved through mobile services such as indoor way finding in complex environments, customer-specific promotions, social applications, and product and/or amenity locators — a digital concierge, if you will.

Hospitality — Ruckus LBS solution can help improve the customer satisfaction score of hotels by improving their staffs' service delivery times for guest needs. Loyalty member customers can benefit from on-device features such as automatic check-ins, way-finding, instant coupons for bar and restaurants.

Healthcare — Ruckus LBS provides a plethora of mission-critical benefits to critical care facilities. Staff wayfinding, asset tracking, and resource management via mobile applications enables better management in complex facilities.

Smart Cities — Ruckus LBS can provide airport management with location based services for real-time crowd control, provide locations-based information to hurried travelers, and provide an intelligent way for travelers to traverse these large facilities. Ruckus LBS can provide public transit operators with real-time passenger and traffic information, improving scheduling, dispatching, improved facilities and crowd management.

Smart schools — Ruckus LBS solution can provide an effective way for schools to locate their Wi-Fi assets such as tablets, help
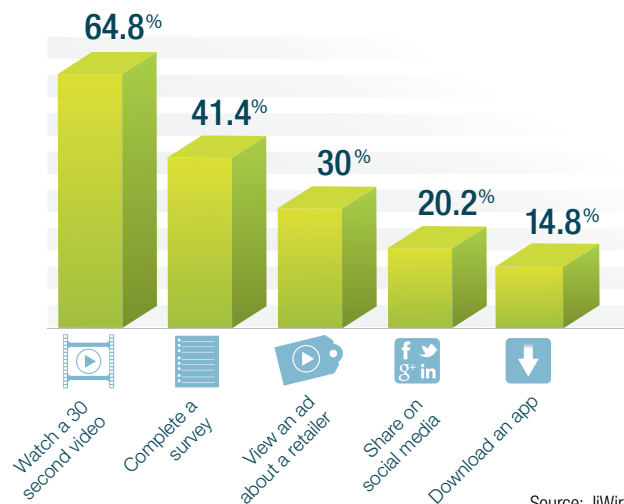
navigate guests and parents during competitions and fares, and assist during emergency situations.

Advertising, Hot Spots and Walled Gardens — When service providers provide public access in high traffic venues, they can monetize and market to their non-broadband customers.

Figure 15: What sort of sponsor engagement would you be willing to do for free Wi-Fi?

Source: JiWire, Q4 2012

The Business Case for Cable Operator Wi-Fi Deployments

LEVERAGING WI-FI TECHNOLOGY FOR GREATER REVENUE AND INCREASED COMPETITIVE ADVANTAGE

Conclusions

Wi-Fi deployments represent a great opportunity for MSOs to leverage their extensive broadband HFC networks, aerial plant where it exists, and strong customer relationships. The business opportunities that Wi-Fi enables are many and varied and usually start by increasing customer stickiness and build from there to include roaming relationships with MNOs, managed services for enterprises, opportunities in small cell backhaul, and indoor location services.

Figure 16: Cable Operator Wi-Fi Drivers

How Operators Weigh Wi-Fi Opportunities

Source: Ruckus Survey

Total = 100%

Ruckus Wireless, Inc.
350 West Java Drive
Sunnyvale, CA 94089 USA
(650) 265-4200 Ph \ (408) 738-2065 Fx

Ruckus®
Simply Better Wireless.

www.ruckuswireless.com