

Company Assessment

Ruckus Wireless

Service Provider Infrastructure

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Company Assessment

Ruckus Wireless

KEY COMPANY STATISTICS

Company Name	Ruckus Wireless
Locations	HQ: Sunnyvale, CA; Development Centers in Taipei, Taiwan and Shenzhen, China
Primary Markets	Service Provider Infrastructure, Enterprise
Revenue Growth	2006 – 2010: 1,046% Growth (88% CAGR)
Employees	~350
Founded	2004
Founders	Bill Kish and Victor Shtrom
Financing	\$51 million
Key Technology Innovations	Adaptive antenna arrays, dynamic pre-shared keys, smart Wi-Fi meshing, unicast-to-multicast conversion
Patents	27 granted, 30 pending
Largest deployment	45,000 outdoor mesh nodes
Notable Customers	AT&T, BT, Deutsche Telekom, Swisscom, Telefonica, China Telecom, KDDI, Tikona Digital Networks, Telstra, Telia, Belgacom, The Cloud, Towerstream, BP, Rock Bottom Breweries, SM Malls, Delhi University, Fairmont Hotel Group, Mandarin Oriental, Intercontinental Hotel Group, Marriott Hotels, St. Vrain Valley School District, Baruch College, Satilla Medical Center, Sundance Film Festival, Georgia World Congress Center, Kuala Lumpur International Airport, Mumbai International Airport
Product Lines	Wi-Fi Networking Infrastructure – ZoneFlex indoor/outdoor access points, Wi-Fi bridges, WLAN controllers, PoE switches, WLAN gateways

MARKET OVERVIEW

Wi-Fi has had a very interesting journey. Originally conceived as a technology of convenience for consumers and small business users, Wi-Fi has slowly found its way into large-scale enterprises. Now carriers are in the process of rethinking their use of Wi-Fi as a strategic tool, beyond simple hotspots.

The problem is that 802.11 was never really developed to deal with latency-sensitive applications such as voice and video, or the scalability and capacity requirements of power carriers. Add to this an explosion of new wireless-only handheld smart devices and tablets finding their way onto corporate and carrier networks and the picture becomes clear. Wi-Fi must grow up.

Initially developed for small businesses and residential deployments, Wi-Fi has never really been adopted by carriers as a strategic tool. Mobile operators were initially skeptical of the technology, considering Wi-Fi

inferior to their licensed-spectrum offerings and/or a direct threat to their mobile broadband services. But over time, their opinions of Wi-Fi have changed as they look to leverage Wi-Fi to offer:

- Faster and more reliable public wireless broadband access,
- 3G/4G mobile data offloading to relieve spectrum constraints,
- Non-line of sight backhaul for their cellular network, and
- On-ramp to the mobile packet core.

With the exponential growth of data traffic on cellular infrastructure being driven by the increased use of Wi-Fi-enabled smartphones and tablets, mobile operators now see Wi-Fi as an essential technology to augment their 3G/4G macro networks with smaller cells that can provide affordable coverage and capacity. Consequently, mobile operators are now starting to see Wi-Fi as an important part of their overall radio access network (RAN) strategy.

Operators around the world are all aggressively scoping an integrated Wi-Fi/cellular approach that allows Wi-Fi traffic to appear on the evolving packet core as any other traffic type would.

Meanwhile enterprises are feeling the pain as they look to move to higher speed 802.11n technology. These same mobile devices hitting carrier networks are also finding their way into the enterprise. Unlike laptops, these devices can't be connected with an Ethernet cable and are truly mobile in their application. As users move around while accessing the network they are constantly changing the orientation of these devices. This creates a major challenge for Wi-Fi technology, as it is not adequately equipped to deal with the nuances of different types of signal polarization for instance.

Over the last decade several different Wi-Fi standards have been developed, such as 802.11n. Each new generation of the standard looked to improve upon the previous. One issue regularly addressed with these new 802.11 standards was the need for more bandwidth or network capacity. 802.11b promised a maximum raw data throughput of 11 Mbps. 802.11g raised this to 54 Mbps. With 802.11n, thanks to new spatial multiplexing techniques, the use of multiple antennas (MIMO) and larger channel sizes, users are being promised up to 600 Mbps or more of throughput. However, even as Wi-Fi vendors roll out higher-bandwidth solutions, end-user demands for more bandwidth remain unabated. And more capacity doesn't necessarily mean a stable and reliable wireless connection.

The growth of Wi-Fi-connected devices and high-bandwidth applications like video streaming are forcing infrastructure vendors to find new ways to wring greater capacity performance out of their network solutions. One solution is the development of smarter radio and antenna technologies that can direct capacity to where it is most needed, reduce interference and create a more consistent end-user experience. However, network capacity is just one of the many issues facing Wi-Fi infrastructure vendors.

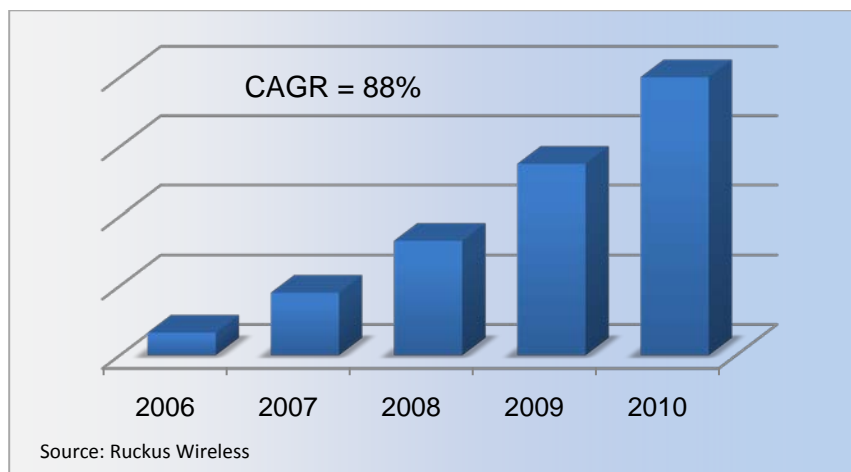
Mobile operators are also tasking their vendors with helping them to streamline the network connection process for end-users along with providing tighter integration between Wi-Fi and cellular networks. As 802.11 technologies have moved up the value-chain, evolving from home networks to enterprise infrastructure and now a part of service provider networks, those technologies are being forced to provide reliability and performance levels far beyond what they were originally designed to support. To be successful, Wi-Fi infrastructure vendors must innovate new approaches to meet these demands.

COMPANY OVERVIEW

Formed in June 2004, Ruckus Wireless is a privately owned Wi-Fi infrastructure vendor located in Sunnyvale, California, competing in the service provider infrastructure and enterprise wireless markets.

Ruckus has raised \$51 million to date. While it doesn't disclose revenues, the company says it has seen sales growth of over 1,040% since 2006. The company also reports its revenues are evenly distributed among Asia Pacific, North America and Europe/Middle East. It operates development centers in Sunnyvale, Taipei and Shenzhen. Figure 1 shows revenue growth for 2006 through 2010:

Figure 1. Ruckus' Annual Revenues (\$ in Millions), 2006 through 2010



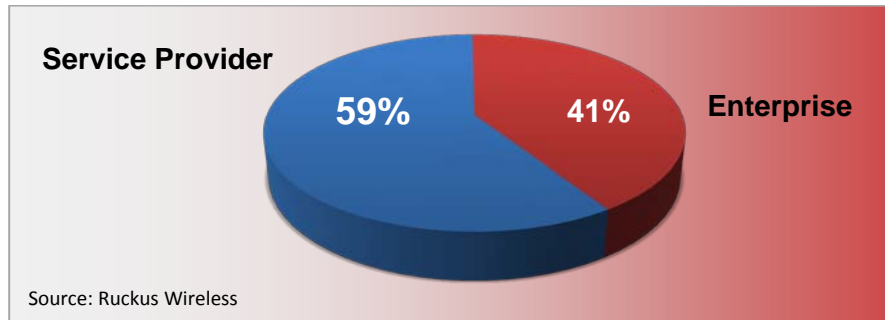
Named a Technology Pioneer by the World Economic Forum, Ruckus has been granted 27 patents as of May 2011 in the areas of Wi-Fi transmission optimization, video transport and advanced wireless security. But the company is best known for the invention of miniaturized, adaptive antenna arrays that it integrates into its access points, as well as QoS software (e.g., multicast-to-unicast conversion) uniquely designed to stream IP-based HD video over 802.11.

Since its earliest days, Ruckus has actively worked with service providers. It got its start selling service providers Wi-Fi customer premise equipment to stream of IP-based video signals around subscriber homes – landing AT&T, Deutsche Telekom, SwissCom, Telefonica, Belgacom and others among its first customers.

The company has since diversified its business, entering the crowded enterprise WLAN market in 2007. In a relatively short period of time, Ruckus has successfully penetrated that market by focusing on underserved enterprise segments served by the channel, such as education, hospitality, healthcare and retail. Within three years, the company had built a sizable network of 2,600 partners and distributors in 45 countries around the world. As a result, Ruckus has experienced significant sales growth. Since 2007, the company claims to have sold into approximately 6,700 enterprise and service provider accounts – with the enterprise business dominating its revenue distribution to date. This is rapidly changing as the

company actively wins major infrastructure deals within the global service provider segment. Figure 2 shows 2010 revenue distribution by market – enterprise and service provider.

Figure 2. 2010 Revenue Distribution by Market



As the revenue contribution would suggest, many of those enterprise accounts are significant in size such as large colleges, school districts, major hospitals and national hotel chains. However, Ruckus does expect that contribution percent to decline as its service provider infrastructure business ramps up. From a product perspective, there are significant synergies and overlap between the two markets as many of the vendor’s products are sold into both segments.

As part of the vendor’s long-term strategic focus, Ruckus recently entered what it calls the “mobile Internet infrastructure” business, selling purpose-built carrier mesh access points, long-range 5 GHz 802.11n bridges and wireless gateway/control systems to service providers and mobile operators. Its application focus within the service provider market includes public Wi-Fi access, wireless broadband access, 3G/4G mobile data offload, Wi-Fi backhaul for small cell deployments and carrier-managed enterprise wireless LAN services.

In the carrier market, Ruckus claims to have deployed one of world’s largest outdoor Wi-Fi mesh networks with Tikona Digital Networks. The vast Wi-Fi network is comprised of more than 45,000 outdoor mesh devices, hundreds of controllers and hundreds of thousands of customer premise equipment (CPE) throughout India. It has also landed major service provider deals with KDDI, The Cloud, Towerstream, Brighthouse Networks and other major broadband providers.

Ruckus’ product portfolio, under its flagship ZoneFlex brand, includes a wide range of indoor and outdoor Wi-Fi access points, WLAN switches and controllers, CPE, and network management and planning tools.

A key support underlying the vendor’s radio products is its patented BeamFlex technology. BeamFlex is a combination of antenna array hardware and best path selection algorithms that use multiple antenna elements to form thousands of unique antenna patterns for each client device. These patterns help Ruckus’ access points focus and control Wi-Fi energy, directing signals only where they are needed. This stands in stark contrast to standard omnidirectional antennas that transmit and receive Wi-Fi signals equally in all directions. The promise of BeamFlex is more targeted and stronger signals “steered” over the best performing signal paths to help minimize packet loss and avoid radio interference – with the purpose

of delivering a more consistent end-user experience at longer distances. This same technology is used also used on provide better reception of client Wi-Fi transmissions.

At the February 2011 Mobile World Congress (MWC), Ruckus announced its newest service provider system, the Ruckus Wireless Service Gateway (WSG), a new class of Mobile Wi-Fi Gateway, which won the GSMA 2011 “Best Mobile Broadband Technology” award at the show. The gateway is designed to allow mobile operators to better integrate Wi-Fi with their cellular networks and allows them to use existing core network systems to manage their Wi-Fi assets. This helps service providers by allowing them to use a single system for user-management and other network backend systems. Ultimately integration should help save operators money and make the user transition between cellular and Wi-Fi networks seamless. Ruckus plans to make the gateway commercially available by the end of 2011.

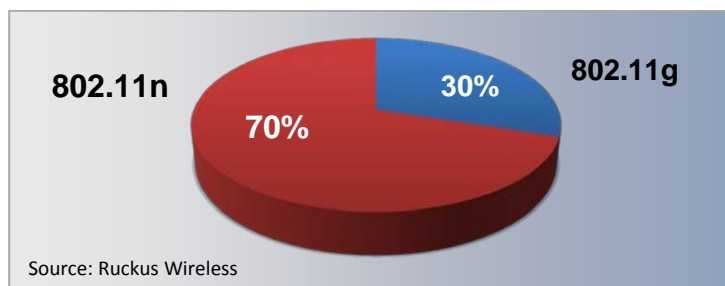
COMPANY STRATEGY

Unlike other Wi-Fi vendors, Ruckus has not locked itself into any one single market or geography. However, these different markets are not totally unrelated. The company looks to take lessons learned in older markets and leverage them as it moves into newer markets. For example, Ruckus’ original market, carrier-based subscriber deployments for streaming video, gave the company exposure to working with service providers, network install requirements and experience in supporting network applications. Here the company was able to take its deployment and applications experience and apply it to larger-scale deployments. From the enterprise, the company then went back to service providers to pursue its next big opportunity with network infrastructure.

Service provider infrastructure, in many ways, made for a natural next move, as it allowed the company to leverage its previous experience in working with service providers, along with the network scale requirements coming out of the enterprise space.

For Ruckus, each new market promises a larger revenue opportunity than the previous. This has been important for the company when it comes to growing revenues. The vendor claims a top line sales growth of over 1,145% (88% CAGR) for fiscal years 2006 through 2010. Ruckus has also been successful in moving its Wi-Fi product line from the older 802.11g standard to the newer 802.11n standard. The capabilities of the “n” standard will be needed to meet the networking demands of the service provider market. Figure 3 shows 2010 shipment breakouts between 802.11g and 802.11n.

Figure 3. 2010 Unit Shipments by Technology – 802.11g and 802.11n

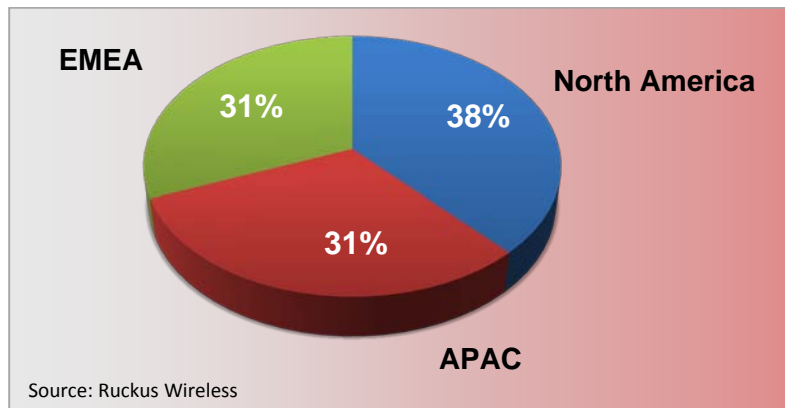


The company believes the larger revenue potential found in the service provider infrastructure space will help keep this rapid rate of revenue expansion going. Supporting the company's growth strategy has been its focus on technologies and channel development.

Like any infrastructure vendor, Ruckus' technology is an important part of its go-to-market messaging. While Ruckus highlights several important technologies such as SmartCast for application streaming, SmartSec for security, and SmartMesh for mesh networking, it is BeamFlex that truly differentiates the vendor. With this technology Ruckus promises improved capacity utilization with the goal of a better end-user experience. While plenty of vendors, including Ruckus, have provided service providers with solutions to better manage their end-users and streamline network access, Ruckus differentiates its Wi-Fi solution based on the users' experience in connecting reliably to wireless networks. Getting its technology story out, however, calls upon the development of new, direct sales and support channels that the company is currently ramping up.

In the enterprise space Ruckus sells through a two-tier distribution model. This channel has helped give Ruckus global reach in the enterprise space with total company revenues evenly distributed across the world: Americas (38%), Asia Pacific (31%), and Europe/Middle East/Africa (31%). Figure 4 shows 2010 revenue distribution by region.

Figure 4. 2010 Revenue Distribution by Region



As the service provider market is more targeted than the enterprise space, Ruckus has taken a direct sales approach in this area. However, the company did enter into a March 2011 agreement with ARRIS, for ARRIS to resell its strand-mounted Wi-Fi/cable modem system to cable operators. For Ruckus, service providers include both Tier 1 mobile operators and Tier 2 broadband wireless access providers.

While Ruckus takes a direct sales approach in the mobile operator space, this market does require Ruckus to develop working relationships with larger wireless infrastructure vendors such as Alcatel-Lucent, Nokia Siemens Networks, Ericsson and others. Tier 1 mobile operators generally prefer to have their larger cellular RAN vendors manage the relationship rather than working with smaller companies directly.

CURRENT ANALYSIS' PERSPECTIVE

We take a positive perspective on Ruckus in the wireless infrastructure space. The company overall cannot be compared directly to the likes of Alcatel-Lucent, Ericsson, Huawei, Nokia Siemens Networks or ZTE, as Ruckus' scale, breadth of products and services, and operator relationships cannot compare with them. But within the Wi-Fi infrastructure space, Ruckus is a major player and extremely competitive. Part of this comes from its focus on advanced radio technologies as a point of market differentiation. As an example, the company recently revealed (February 2011) that Wi-Fi network operator The Cloud had selected Ruckus over its incumbent Wi-Fi supplier to replace its existing City of London network, along with a landmark deal with KDDI to outfit Japan with Wi-Fi products and technology for a nationwide public access and mobile data offload networks in over 100,000 locations.

The company has shown an ability to identify new market opportunities and successfully move into them. Its focus on Wi-Fi for 3G/4G data traffic offload is in sync with demands coming out of the service provider market, as service providers continue to struggle with their growth in mobile broadband data traffic. Where we have reviewed the company's Wi-Fi infrastructure solutions for service providers, they are competitive and hold up well against the likes of Cisco, BelAir Networks and Motorola Solutions. Although Ruckus' current market position is positive, there are certainly areas of concern.

Wi-Fi is not the only answer for dealing with the growth of data traffic. Mobile operators see Wi-Fi as just one of the tools they have for dealing with this issue. Another option is the use of small cells (picocell/femtocell) using licensed spectrum. While Ruckus has suggested that it will integrate LTE picocell technology into its wireless portfolio as part of its long-term product roadmap, currently it doesn't market any small cell solutions that support more traditional cellular technologies like CDMA 2000, WCDMA, HSPA and LTE.

This vulnerability also plays out with the vendor's new gateway, as it lacks any kind of gateway or radio controller functionality needed to support a small cell solution. Ruckus cannot avoid these issues, and will need to either develop solutions in-house, acquire IP or partner with other vendors to address them. Third-party relationships also could be an area of concern as Ruckus ramps up its service provider infrastructure efforts. Successfully selling into mobile operators requires the company to develop and manage relationships with larger infrastructure vendors. The size of Ruckus, at approximately 350 employees, could make it challenging for the company to scale its efforts in this area. Fortunately for the vendor, these issues are not insurmountable, and should not prevent the vendor from achieving its growth strategy with service providers.

MARKET DRIVERS FOR RUCKUS

- **Data Growth.** The increase of data traffic will force mobile operators to look for new ways to manage that traffic and architect their networks. This bodes well for Wi-Fi in general, and Ruckus specifically. LTE and new spectrum allocations will only take them so far. As end-users have shown, when a network provides more capacity, they will find ways to fill up that capacity. This market

reality motivates mobile operators to find new networking strategies, including Wi-Fi, that will let them meet their users' rising demands for broadband.

- **802.11 Improvements.** Technology developments like 802.11u and market initiatives like the Wi-Fi Alliance's "Wi-Fi Certified Hotspot Program" promise to ease Wi-Fi network user connectivity. One of the continued knocks against Wi-Fi has been the need for the creation of user names and passwords along with manual login to access hotspots. Efforts underway to automate device discovery of preferred Wi-Fi networks, tie hotspot authentication to cellular network subscription credentials, and streamline account provisioning will help to eliminate some users' issues with Wi-Fi.
- **Mobile Operators' Attitudes.** Service provider attitudes towards Wi-Fi still remain a challenge for Ruckus. While more and more operators are seeing Wi-Fi as an important asset, there are still those mobile operators that remain hesitant to deploy the technology out of concerns over interference coming from the use of unlicensed spectrum or from the belief that LTE and small cells can handle the growth of broadband traffic.
- **New Competitors.** The entrance of larger and better-known wireless infrastructure vendors into the Wi-Fi infrastructure space could negatively impact Ruckus. Large infrastructure vendors like to have end-to-end solutions, and with Wi-Fi becoming one of those ends, the likelihood of them entering the market with their own Wi-Fi solution increases. Nokia Siemens Networks has already taken an initial step in this area with the February 2011 launch of its "Smart WLAN Connectivity Solution" that supports 3G traffic offload to Wi-Fi.

RECOMMENDED VENDOR ACTIONS

- Ruckus should develop an access point that incorporates both Wi-Fi and a picocell/femtocell. This will give the company a broader product portfolio and one that provides mobile operators with greater variety in developing their network strategies. Several of Ruckus' Wi-Fi competitors have taken steps in this direction, and it is important for Ruckus to follow suit to protect its market position.
- In conjunction with the development of a picocell/femtocell solution, Ruckus should enhance its Wi-Fi gateway solution to include some support for small cell solutions. A more complete end-to-end data offload solution using both Wi-Fi and small cells will make Ruckus more competitive.
- Moving into bigger market opportunities, like mobile operators, also equates to a bigger resource challenge for Ruckus. Adequately managing third-party relationships with larger infrastructure vendors can put a significant strain on the company. To ease some of this possible strain, Ruckus should develop close working ties with select larger infrastructure vendors. The company should even look to replicate its ARRIS relationship with another infrastructure vendor in the mobile operator space.
- Ruckus needs to prove out its newly announced Mobile Wi-Fi gateway with demonstrations and operator trials. The gateway represents a major step for the company, tying its traditional Wi-Fi gear in closer to the cellular network. Demonstrations and trials will help build the vendor's credibility in this area.