Cisco Small Cell Wireless Backhaul Ecosystem: A Flexible and Proven Deployment Toolkit

Cisco has constructed a proven end-to-end mobile architecture that is deployed in networks around the world. With its internal innovation and strategic acquisitions and partnerships, Cisco is providing mobile network operators a system that offers the scalability, feature set, and value to exceed the high demands of mobile customers. Cisco's unified backhaul solution provides the fundamental transport service needed today, while setting the foundation for mobile operators to rapidly and efficiently simplify future network growth.

Challenges of Small Cell Growth

Continuing demand for wireless networking is promoted by a wide array of network-enabled mobile devices. This demand is increasing the need for more network capacity and ubiquitous connectivity. To support and monetize the enormous growth in data traffic, mobile networks are evolving to include a mix of denser, higher capacity small cells, including carrier Wi-Fi, deployed at street level on light poles and the sides of buildings. Industry analysts are forecasting huge increases in the deployment of outdoor small cells, with somewhere between 1.5 and 2 million outdoor small cells installed by 2017. With orders of magnitude more small cells deployed than macro cells, backhaul will be a critical challenge. Adding to the challenge, many of these base stations will be deployed under a variety of conditions, across diverse locations, without existing backhaul infrastructure.

As a result, leading carriers have been extensively testing backhaul solutions in varying use cases (urban, suburban, and rural). This location diversity is leading the industry to use multiple forms of wireless technology to provide complete coverage while meeting increasing capacity requirements and providing investment protection. Fiber-equivalent performance over wireless will be required to deliver applications and services with all the necessary performance characteristics, including packet-based timing and synchronization, service-level agreement (SLA) assurance, quality of service (QoS), security, and scalability. There is no single solution for small cell backhaul. Across carriers and regions, and even within a single operator's network, requirements will vary.

Solution Benefits

To satisfy demand for wireless small cell backhaul networks by global service providers, Cisco has created an ecosystem of wireless solutions that are centered around Cisco's best-in-class mobile backhaul solution, Cisco® Unified MPLS for Mobile Transport (UMMT). This flexible architecture supports any access technology from any vendor and dramatically reduces operating costs. The ecosystem pairs the Cisco ASR 901 Series Aggregation Services Routers portfolio of mobile backhaul routers with industry-leading wireless backhaul vendors (Table 1) that have proven interoperability and wide deployment by carriers around the world.

Cisco is introducing the only solution that offers complete coverage across today's wide variety of carrier deployment scenarios. The solution focuses on meeting the following crucial carrier requirements:

- **Broad spectrum:** The Cisco ecosystem offers complete frequency coverage, including licensed and unlicensed spectrum; Wi-Fi technologies; and line-of-sight (LoS), near line-of-sight (nLoS), and non-line-of sight (NLoS). Frequencies covered include sub-6 GHz, 6–42 GHz, 60 GHz (V-band), and 70/80 GHz (E-band).
- **Scalability:** The Cisco solution can deliver gigabits of data per small cell, exceeding all carrier requirements.
- **Zero-touch provisioning:** Unlike macro base stations, small cells will be located in public areas that require limited impact during installation. Self-automated installation tools can dramatically reduce backhaul turnup time and significantly decrease operating expenses (OpEx).
- **Flexibility:** Capacity can be added where and when it is needed using solutions that optimize bandwidth and coverage, regardless of obstacles. They can be deployed in point-to-point, point-to-multipoint, daisy chain, and ring topologies.
- **Manageability:** Complete management, paired with end-to-end operations, administration, management, and provisioning (OAM&P) and remote monitoring, minimizes carrier OpEx.
- **End-to-end QoS:** The Cisco solution delivers outstanding performance and reliability by managing QoS through all points in the network, helping to ensure that the bandwidth delivered matches the available bandwidth.
- **Real-time adaptive control:** In conjunction with its microwave partners, Cisco has defined and developed an adaptive code modulation (ACM) protocol that monitors wireless link quality and can reroute traffic, adjust shaping and policing policies, and reconfigure the network to maximize quality of experience (QoE).
- **Predictability and reliability:** Consistent capacity and high availability support dependable performance.
- **Simple planning and growth:** The needs of the network will change along with traffic patterns. The backhaul network must cost-effectively adapt to increasing demands.
- **Synchronization:** Synchronization support using GPS, IEEE1588, and Synchronous Ethernet (SyncE) provides outstanding accuracy.
- **Low total cost of ownership:** The solution is designed to help lower initial capital expenses (CapEx), as well as OpEx, including deployment and maintenance.
- **Network virtualization:** Using Cisco nV technology, operators can consolidate multiple physical networks, even those spread across multiple locations, into one virtual network. This ability to dynamically allocate and adjust what were previously disparate resources will improve how operators design, deploy, manage, and evolve their infrastructure. The end result is a dramatic increase in network efficiency with significantly reduced operational expenditures.
- **Reduced effect on environment:** Backhaul solutions for outdoor small cell networks must be environmentally hardened units. The products in the ecosystem are designed with the environment in mind. They are rugged, yet aesthetically pleasing, and can be deployed easily by field technicians.
- **Low delay and delay variation:** Cisco provides very low-delay backhaul solutions to deliver enhanced services over 4G networks.
- **Proven and deployed solution:** The best-in-class, MEF-certified Cisco mobile backhaul solution has more than 1 million radios backhauled today.

A shift is taking place in wireless networks, similar to the trend toward distributed architectures in computing and content delivery. Small cell networks will allow operators to provide better coverage, improve spectrum use, and scale their capacity to levels previously seen only on wired networks.

This proliferation of small cells will bring challenges to traditional network operating approaches. Delivering a flexible, scalable, and cost-effective solution to network providers, retail or wholesale, is essential to allow complete coverage and capacity, using a small cell architecture. The Cisco wireless backhaul ecosystem supports an end-to-end solution with an interface across multiple backhaul technologies to meet diverse carrier requirements. The Cisco solution is optimized for the backhaul of real-world heterogeneous small cell networks, across radio access networks with multivendor technologies.

Table 1.   Wireless Ecosystem Vendors

	Sub-6 GHz	6-42 GHz	60 GHz	70/80 GHz
Cisco Ecosystem Partners	BLiNQ, Cisco, DragonWave, Fastback, RADWIN, and Tarana	DragonWave and NEC	DragonWave, NEC, and Siklu	DragonWave, NEC, and Siklu

BLiNQ Networks

BLiNQ (the name is derived from backhaul link with IQ) has pioneered NLoS and backhaul-self organizing (B-SON) technologies, changing the way mobile operators deliver broadband services in urban and suburban areas. BLiNQ was founded after the acquisition of IP assets from Nortel Networks, specifically to solve the small cell backhaul problem. BLiNQ has developed an innovative small cell backhaul solution that allows operators to deploy small cells exactly where they are needed to eliminate overcapacity hotspots and poor coverage areas, while significantly reducing the time and expense associated with traditional backhaul deployment. BLiNQ's NLoS small cell backhaul solutions operate in time domain duplex (TDD) mode and combine the latest innovations in physical and medium access layer techniques to provide high-capacity backhaul for small cells. The BLiNQ X-100 product currently offers 80 Mbps of throughput over a 10 MHz channel. The devices achieve this performance through a relatively simple system configuration that includes a backhaul hub capable of supporting four associated remote units, along with intelligent software that increases spectral efficiency, in a non-line-of-sight, point-to-multipoint deployment configuration that can be installed by one technician in minutes. As a result, the BLiNQ X-100 is a very cost-effective solution, providing 30 percent cost savings over line-of-sight microwave and millimeter wave solutions, as well as 55 percent cost savings compared to fiber optical backhaul.

DragonWave

DragonWave is a leading provider of high-capacity packet microwave solutions that promote next-generation IP networks. DragonWave's carrier-grade point-to-point microwave product portfolio includes sub-6 GHz non-line-of sight, 6 to 60 GHz, and 70/80 GHz E-band systems. DragonWave solutions allow service providers, government agencies, enterprises, and other organizations to meet their increasing bandwidth requirements rapidly and affordably. The principal application of DragonWave's products is mobile network backhaul, offering multigigabit capacity for macrocell networks and aggregated backhaul applications, as well as highly efficient small form-factor (SFF) small cell backhaul solutions that deliver exceptional installation and provisioning simplicity for urban deployments. Recognizing the complexities and costs of small cell deployments, DragonWave takes advantage of its industry leadership in wireless backhaul to promote a total technology toolkit. DragonWave's award-winning products are known in the industry for their leading capacity, reliability, and spectral efficiency.

Fastback Networks

The Fastback Intelligent Wireless Transport solution delivers Carrier Ethernet 2.0 over wireless with 500Mbps performance, regardless of line-of-sight radio conditions. This capability, trademarked Any LOS, includes NLoS, nLoS, and LoS. The Fastback solution extends a fiber point of presence by 500m NLoS or up to 2Km LoS, with all the service-rich capabilities available, including UNI: MPLS/CE, packet-based timing, SLA assurance, security, QoS, and scalability. This new class of devices, trademarked the Anywhere Service Edge, fuses advanced radio and high-performance data networking technologies to provide reliable fiber-equivalent service at any location where mobile services are in demand. The Fastback breakthrough solution gives mobile network operators the freedom to deploy small cells at optimal locations and increase service revenues. Mobile service and fiber network operators can also extend existing fiber to reach those small cells or reach new customers and take advantage of commercial service opportunities.

NEC

Beginning in the early 1980s, NEC's research, development, production, and sale of its high-capacity mobile backhaul radio system, PASOLINK, made the system a first-class foundation for the essential backhaul lines required by mobile phone and fixed line data services. The system's unmatched performance is proven by the 2 million units that NEC has shipped to more than 1200 customers in 147 countries. NEC is also one of the first companies to set a vision for small cell networks and to take a pioneering role in small cell backhaul. NEC provides industry-leading quality and reliable operational excellence, a crucial advantage when promoting new technologies and new network architecture.

RADWIN

RADWIN is one of the leading global providers of sub-6 GHz solutions, currently offering the most advanced and comprehensive small cell NLoS backhaul portfolio. RADWIN's solutions are available at licensed and unlicensed bands (2.0 GHz, 3.0 GHz, and 5.0 GHz) and include both point-to-point and point-to-multipoint systems. Using RADWIN's state-of-the-art, patented air interface technologies together with advanced modem architecture, RADWIN's solutions provide carrier-grade, high-capacity backhaul systems designed to overcome the challenges of rapidly growing street-level urban deployments. These technologies are already implemented in more than 300,000 deployments globally, in more than140 countries, for varied backhaul and broadband access applications. RADWIN's solutions effectively address NLoS scenarios; mitigate radio interference; and maintain high capacity, robust connectivity, low latency, and QoS in the tough multipath conditions so common in dense urban areas. RADWIN's offering for small cell backhaul takes advantage of the company's enormous field experience and NLoS deployment knowledge, and it includes unique NLoS planning tools and engineering practices that help make NLoS backhaul planning and deployment a feasible, cost-effective, and highly reliable process. During the past 18 months, RADWIN has worked closely with Tier 1 carriers in North America and Europe, testing its NLoS backhaul capabilities and further integrating its NLoS backhaul solutions with the new small cell networks now taking shape.

Siklu

Siklu builds gigabit millimeter-wave wireless backhaul solutions over the 70/80 GHz E-band and 60 GHz V-band. Based on a unique all-silicon design that reduces price, minimizes the form factor, and increases reliability, Siklu's radios are ideal for macro and small cell backhaul. Using this state-of-the-art all-silicon radio technology, Siklu developed the EtherHaul-600T, a palm-sized all-outdoor small cell backhaul product that allows rapid deployment anywhere, including street lamps, rooftops, and the sides of buildings. Representing a crucial advance for mass deployment of small cells, the integrated, all-silicon Siklu approach brings down costs to a fraction of those of other millimeter-wave solutions. Siklu's field-proven technology is becoming the top choice of Tier 1 operators for gigabit backhaul worldwide, and thousands of units have been deployed and are operating reliably in all weather conditions.

Tarana Wireless

Tarana Wireless pioneered the development of AbsoluteAir™, a Carrier Ethernet–based universal wireless transport solution. AbsoluteAir is unmatched in delivering deterministic performance at full capacity across "true NLoS," nLoS, and LoS operation, enabling deployment of backhaul anywhere small cells are located. It is a breakthrough innovation that provides ubiquitous coverage, unprecedented capacity and scalability, simplified deployment, zero-touch provisioning and operation, and a low total cost of ownership. Tarana's "true NLoS" support is unparalleled, enabling wireless links completely obstructed by multiple solid structures to deliver the same dedicated high capacity as LoS links without compromising range (NLoS 2+ km, LoS 40+ km). Tarana has created a new wireless paradigm with its Concentrating Multipoint™ (CMP) topology. It supports multipoint links operating at full capacity simultaneously in a single channel, delivering metro scalability and unprecedented spectral efficiency of 28bps/Hz (600 Mbps across 8 links in 20 MHz spectrum). AbsoluteAir has been installed in multiple Tier 1 carriers, proving these outstanding results.

For More Information

For more information about the Cisco small cell wireless backhaul ecosystem, contact your local Cisco sales representative or visit http://www.cisco.com/go/smallcell.

Printed in USA

C02-728436-02   01/14