Solution Brief

Wireless Mesh Network

Outdoor Wi-Fi made simple

Pervasive Wi-Fi

Wi-Fi has forever changed the way business users and consumers access networks. With millions of Wi-Fi devices shipping annually, the technology is integrated with virtually all mainstream mobile devices including laptops, tablets, PDAs and even cameras and cell phones. Over the coming years, embedded Wi-Fi will put this capability in the hands, literally, of hundreds of millions of consumers and business users worldwide, creating an undeniable service opportunity for providers and an exciting wireless revolution for enterprises. As end-user Wi-Fi devices proliferate and drive demand for always-on mobile connectivity, pervasive wireless broadband in both private and public spaces is imminent. Wired access is giving way to Wi-Fi, indoor/outdoor boundaries are being blurred, and the familiar Wi-Fi hotspot is evolving to user-friendly hotzones and ultimately full-scale Wi-Fi metros.

Wireless Mesh Network feature highlights

- Dual-Radio access points
- Interference mitigating architecture
- Indoor/CPE mesh access point
- Smart Antenna technology
- Four-radio Duo-mode configuration
- Adaptive Mesh Management Protocol
- QoS enforcement
- WiMAX/4.9 GHz backhaul options
Outdoor Wi-Fi

Outdoor Wi-Fi deployments create unique challenges. WLANs are cost-prohibitive for massive-scale outdoor projects with coverage requirements that dwarf even the largest indoor implementations. Even administrators planning modest outdoor Wi-Fi projects need to contend with unique cabling and coverage challenges that reveal the inherent limitations of traditional WLAN architectures for outdoor deployments.

The Nortel Wireless Mesh Network

Nortel’s Wireless Mesh Network is a secure and highly scalable Wi-Fi solution that delivers low-cost wireless broadband for outdoor or expansive indoor areas. The Wireless Mesh Network makes outdoor Wi-Fi viable and is designed to enable a new revenue opportunity for service providers or to enable enterprises to extend their private WLANs to outdoor areas.


The Wireless Access Points perform client access and traffic distribution functions. The dual-radio access points feature a unique inter-AP wireless transit capability with adaptive wireless mesh routing. Client access is 802.11b/g in the 2.4 GHz spectrum and transit is carried over 802.11a in the 5GHz spectrum. Two models are available:

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The Wireless Access Point 7220 can be deployed indoors or outdoors and features a rugged, weather-proof housing with integrated smart antennas. A new Duo-mode option allows two 7220s to be co-located and cross-connected for a four-radio co-coordinated configuration that doubles radio resources for both transit and access links to improve throughput and allow for lower latency.

Wireless Access Point 7215 is a cost-effective indoor access point that can be deployed as a fixed CPE device for mesh-based broadband wireless service, or as a seamless indoor extension for enterprise deployments. The Wireless Access Point 7215 can connect to the network via a wired Ethernet connection or wireless transit link with other 7220/7215 WAPs.

Wireless Gateways logically connect the mesh network IP Subnet(s) to the enterprise’s wired network, or the service provider’s distribution network, and are responsible for routing, mesh transit link security, stateful firewalls and wireless user mobility.

Wireless Gateway 7250 features security acceleration hardware, dual 10/100 Ethernet interfaces with expansion slots, and support for up to 120 Wireless Access Points.

Wireless Gateway 7240 features dual 10/100 Ethernet interfaces and supports up to 10 Wireless Access Points.

Flexible mesh backhaul options

A benefit of the mesh network architecture is that each wired access point can share its Ethernet connection among the meshed WAPs. Additional wired APs can be added to provide resiliency, or to improve throughput by decreasing the number of transit link hops to the wired network. Locations where wiring is possible are typically limited, representing the most restrictive planning parameter in any installation. Nortel offers flexible mesh backhaul options that overcome this restriction and can greatly expand deployment opportunities, reach and the service potential of the mesh network.

The Wireless Mesh Management System is an enhanced version of Nortel’s ubiquitous Enterprise Network Management System — a common management platform shared among a wide breadth of Nortel wireless and wired networking products. The system provides a centralized utility for monitoring and managing wireless mesh network operations, including:

- Discovery and visualization of Wireless Access Points, Wireless Gateways and Wireless Bridges
- Visualization of mesh routes
- WAP status monitoring, event logging and alarms
- Fault management including capturing and logging of traps and faults
- Real-time performance metrics logging including utilization, error rates
- Provides an intuitive user interface for monitoring and reporting
The WiMAX BTS portfolio features modular base transceiver stations (BTS) and remote terminals to establish high-bandwidth, long-range WiMAX backhaul links in both licensed and unlicensed spectrums without line-of-site restrictions.

**Simplifying mesh deployments**

Nortel’s Adaptive Mesh Management Protocol is an integral component of the mesh access point operating system and has been developed solely to simplify the deployment and operation of mesh networks and optimize its performance and availability. Key functions include:

- Auto-discovery of neighboring access points and available routing paths upon initial boot cycle
- Auto-configuration and system synchronization without manual intervention
- Radio Resource Management featuring auto-channel negotiation and assignment with neighboring access points to minimize the effects of interference
- Smart Antenna management to control a sophisticated six-panel integrated directional antenna array for optimized transmission quality and data rates

- Dynamic mesh routing to establish available mesh routing paths, monitor their performance and self-optimize when better performing paths become available
- Fast fault recovery to ensure service resiliency by dynamically re-routing in the event of access point failure

**Nortel’s leadership in mesh networking**

**Interference mitigation** — The most destructive phenomenon for wireless networks is interference. Nortel’s dual-radio design uses different spectrums for transit and access to enable high-density deployments without the self-interfering limitations of single-radio designs. Nortel’s Adaptive Mesh Management Protocol allows access points to survey RF characteristics, share information with neighbors and negotiate the transit link channel configuration that delivers the best signal and data rates. Nortel’s exclusive Smart Antenna technology intelligently controls multiple integrated directional antennas and establishes transit link beams that don’t interfere with non-targeted neighbors.

*Figure 4. Wireless Mesh Network backhaul options*
Stronger security — Expansive mesh networks rely on transit and backhaul links that traverse public spaces, creating an opportunity for hackers to intercept transmissions. Nortel goes beyond the standards-based WEP/WPA/WPA2 access link security and addresses this transit link threat. Nortel delivers proven IPSec security for transit links — a method derived from Nortel's trusted VPN technology that already secures hundreds of millions of business users. When the secure tunnel terminates on the wireless gateway, a stateful firewall filters authorized traffic to the wired network and ensures that control systems are inaccessible to mobile users.

Greater scalability — Nortel's Adaptive Mesh Management Protocol allows operators to add capacity by simply adding another mesh access point into the targeted coverage zone. New Wireless Access Points auto-discover their neighbors, negotiate the cleanest channels, and establish and maintain optimized routes. If performance-impacting transit bottlenecks are identified, they can be relieved by Nortel’s Wireless Access Point 7220 Duo-mode configuration that effectively doubles available radio resources to support extended multi-hop paths, with reduced latency and greater throughput.

Simplicity — Nortel’s exclusive Smart Antenna technology lets operators take advantage of the range, throughput and spectral efficiency benefits of high gain directional antenna without the operational burden of manual installation, alignment or maintenance of typical external antenna designs. Auto-discovery, auto-configuration and self-healing capabilities simplify installation and ongoing management.

Service resiliency — Nortel’s Smart Antenna technology, combined with separation of access and transit spectrums, means that overlapping cells can be deployed to provide service resiliency at the client access level. Should an access point fail, Nortel’s Adaptive Mesh Management Protocol allows the system to recognize the failure and dynamically re-route to the best alternative path. For the most resilient installations, the 7220 Duo-mode configuration provides the access and transit radio resiliency of a chassis-based system but removes the risk of shared components to provide full redundancy for antennas and power supplies alike. The innovative design of the Wireless Access Point 7220 provides resistance to the elements — minimal external wiring removes an inviting vulnerability and the integrated Smart Antennas will auto-recover should the access point be knocked out of alignment under severe conditions.

Unique features

- Dual-radio AP design for dedicated access and transit
- Duo-mode configuration enables up to four radios at a single installation location
- 802.11 b/g access and 802.11a transit service
- WiMAX/4.9 GHz backhaul options
- Nortel Adaptive Mesh Management Protocol simplifies operations and optimizes performance
- Seamless roaming among all mesh access points
- QoS enforcement for voice and multimedia
- Access links secured with WEP/WPA/WPA2
- Transit links secured with IPSec
- Virtual service groups with discrete service profiles for up to eight SSIDs
- Smart Antenna technology, with an integrated switched-beam six-panel directional antenna array, optimizes backhaul data rates
- Wireless Access Point 7215 enables seamless indoor/outdoor roaming
- Integrated stateful firewall ensures traffic isolation
- Bandwidth reservation maintains QoS during peak loads
- Comprehensive centralized management
- Statistics logging and reporting
- Distributed routing intelligence
- Fault-recovery in event of AP failure
- Packet prioritization for differentiated services
- Dynamic mesh routing establishes optimal routes
- Radio Resource Management with auto-channel negotiation limits interference
- Power-only installation without Ethernet cabling
- Auto-configuration and verification
- Auxiliary Ethernet port for device integration
Quality of Service — Nortel’s Wireless Mesh Network supports differentiated services, including voice and multimedia by dynamically reserving transit link bandwidth and enforcing packet prioritization. QoS support removes the utility and service constraints of data-only solutions.

Flexible deployment options — Each outdoor deployment is unique. Nortel’s dual-radio WAP and 5 GHz transit link architecture opens up deployment possibilities by removing the proximity and density constraints of single-radio designs. The unique integrated six-panel directional antenna array delivers high-quality transit links that are tolerant of steep elevation changes between hops. And because wired network access points are hard to come by and costly to deploy, Nortel gives planners the freedom of deploying mesh networks many miles from the wired network access point using the Wireless Bridge 7230 or WiMAX backhaul options, using either licensed or unlicensed bands.

Lower cost — Nortel’s Wireless Mesh Network is optimized to deliver low-cost wireless broadband services over expansive areas. An innovative wireless transit architecture and flexible backhaul options keep wiring requirements and costs at a minimum. Where high throughput and low latency upgrades are required, the 7220 Duo-mode technology allows for easier installation than chassis-based upgrades, and Smart Antenna technology streamlines initial deployment, requiring fewer on-site technicians and fewer truck rolls.
Wireless Access Point 7220 — Technical specifications

Wireless AP 7220 Access Link
802.11b/g (2.4 GHz) Radio System

Center frequency
• 2417 MHz to 2457 MHz (i.e., North America)

Data rate: 54 Mbps max
• Supports 1, 2, 5.5, 11 Mbps (IEEE 802.11b)
• Supports 6, 9, 12, 18, 24, 36, 48 and 54 Mbps (IEEE 802.11g)
• IEEE 802.11b/g standard rates

Access antenna options
• Co-linear whip, 5 dBi nominal antenna, SMA connectors
• PIFA integrated antenna, 0 dBi nominal SMA connectors

Radiated EIRP
• +26 dBi typical

Receive sensitivity 802.11b (11 Mbps)
• -95 dBm typical @ 11 Mbps
• -96 dBm typical @ 5.5 Mbps
• -98 dBm typical @ 2 Mbps
• -101 dBm typical @ 1 Mbps

Receive sensitivity 802.11g (54 Mbps)
• -80 dBm typical @ 54 Mbps
• -82 dBm typical @ 48 Mbps
• -86 dBm typical @ 36 Mbps
• -90 dBm typical @ 24 Mbps
• -92 dBm typical @ 18 Mbps
• -95 dBm typical @ 12 Mbps
• -97 dBm typical @ 9 Mbps
• -96 dBm typical @ 6 Mbps

Wireless AP 7220 Transit Link 802.11a
(5 GHz) radio system

Center frequency
• 5740 MHz to 5840 MHz

Data rate: 54 Mbps max
• Supports 6, 9, 12, 18, 24, 36, 48 and 54 Mbps
• IEEE 802.11a standard rates

Antenna system gain from radio module card inside the unit
• 8.4 dBi nominal

Radiated EIRP
• +28 dBm typical @ 54 Mbps
• +30 dBm typical @ 48 Mbps
• +32 dBm typical @ 6-36 Mbps

Data rate: 54 Mbps max
• Supports 6, 9, 12, 18, 24, 36, 48 and 54 Mbps
• IEEE 802.11a standard rates

Environmental specifications
• Operating temperature range: -40°C min, 50°C max

Regulatory
• Weather rating: NEMA 4, IP56/Category 2 testing
• Safety: UL, CSA
• Emissions/radio: FCC Class B, Part 15, RSS 210

Hardware specifications
• Wired network interface: Auto sensing 10/100BaseT Ethernet, 1.5kV surge protection per IEC60950
• Power input nominal: 100V - 240V AC (45Hz – 65Hz)
• Power consumption
  – Operating: Indoor or outdoor > 0°C = 8W typical
  – Startup: Indoor or outdoor > 0°C = 8W typical
    Outdoor < 0°C = 8W – 14W (- 40°C)
  – Outdoor < 0°C = 24W (short duration)
    8W – 14W (- 40°C)
• Dimensions (without mounting brackets or antennas)
  – 265mm (10.5 inches) tall x 200mm (8 inches) diameter
• Weight: 2.4 kg (5.3 lbs)
• Color: Gray

Optional accessories
• Mounting brackets (right-angle or straight horizontal attachment)
• 5m, CAT5 Ethernet indoor/outdoor rated cable for network access point (NAP) operation
• Street light photo-electric control power tap ‘luminaire’ 120/208/240 V
• 13dBi, 18dBi and 23dBi TL external antennae

Wireless Bridge 7230 — Technical specifications

Radio frequency
• 2.4 GHz to 2.490 GHz
• 5.470 GHz to 5.725 GHz
• 5.725 GHz to 5.890 GHz

Data rate
• Up to 48 Mbps, user-configurable

Transmit power
• 4.9 GHz: 10 dBm (max)
• 5.4 GHz: 7 dBm (max)
• 5.8 GHz: 17 dBm (max)

Physical specifications
• Depth: 2.3 in. (5.8 cm)
• Width: 12 in. (30.5 cm)
• Height: 12 in. (30.5 cm)
• Weight: 3.3 lb. (1.5 kg)

Operating environment specifications
• Outdoor unit and external antenna
• Enclosure: all-weather case
• Temperature: -31°– 140°F (-35° – 60°C)
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