>THIS IS **THE WAY**

Connecting Rural and Developing Communities through Wireless Mesh Networks

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>THIS IS NORTEL

Why Connect Anyone Anywhere through High Speed Broadband Access?

ECONOMIC GROWTH	Access to a Global Knowledge Economy Eradicate disadvantages in distance & opportunity Reduce exodus and relocation
RESEARCH & EDUCATION	Access a wealth of Information Access Open Source Software Access Web Services on the Internet
ENERGY Efficiency **& ENVIRONMENT** Protection	Teleworking – Home-based workers Information & Services without driving or traveling Critical with rising fuel cost & increasing pollution

Nortel at a Glance…

OUR HISTORY

Over
100
years at the forefront of major technological innovation in telecom

OUR OPERATIONS

Serving more than
150
countries

OUR PEOPLE

Approximately
30,000
employees worldwide

WWW.NORTEL.COM

Nortel's Customers

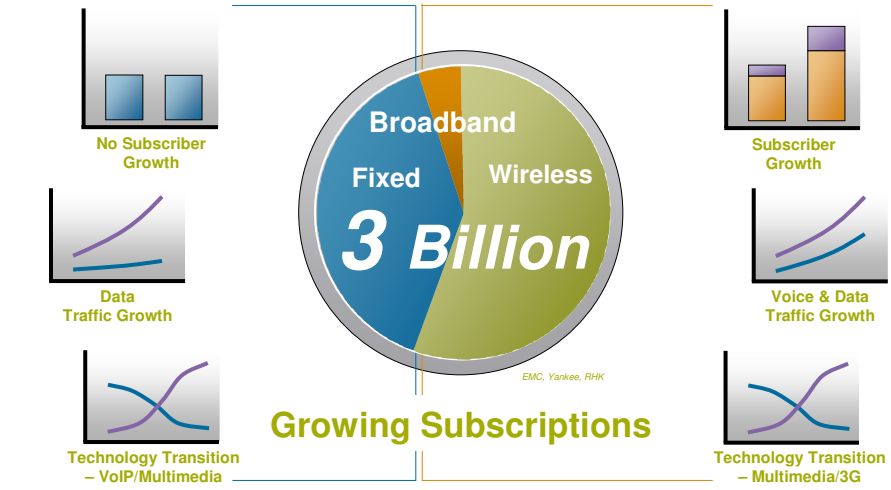
SERVICE PROVIDERS

> Public network carriers
> Wireless operators
> Cable operators

ENTERPRISES

> Small, medium and large businesses
> Governments and Public Institutions
> Educational institutions
> Financial institutions
> Hospitality industry
> Healthcare facilities
> Other industries

Telecom Market Trends



Options of High Speed (>512 kbps) Broadband Connections in Developing Nations

Wireline Broadband Access

Upgrade the Telephone Network
- ISDN – Low speed and Costly by the minute charges
- DSL – Digital Subscriber Line – Density required for economics

Television Cable Modem Networks rarely an option

Wireless Broadband Access

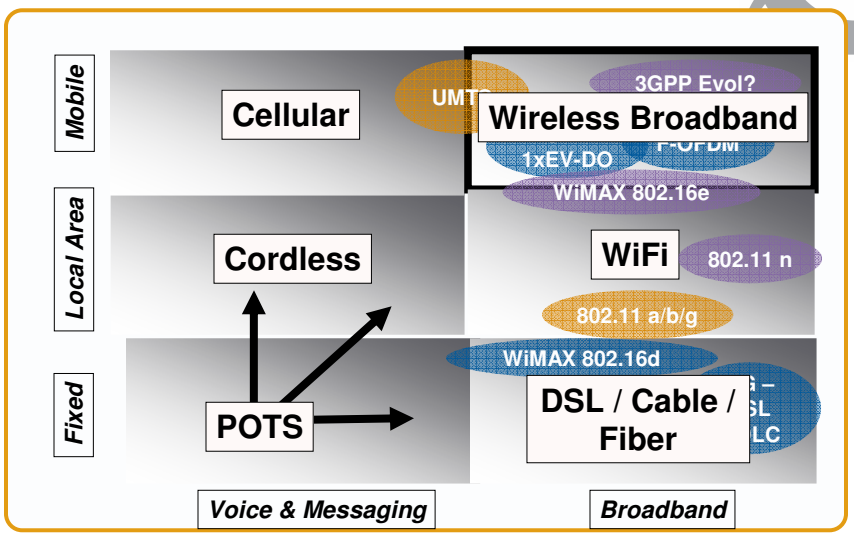
3G Networks
- New Installation – limited data bandwidth
- Upgrade to cellular network

Wireless Mesh Networks
- Cost Effective

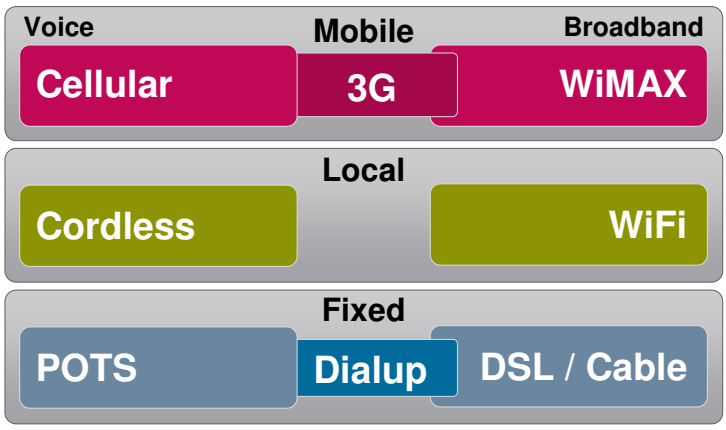
WiMAX - Emerging

Presentation Focus

Wireless Broadband – The New Category

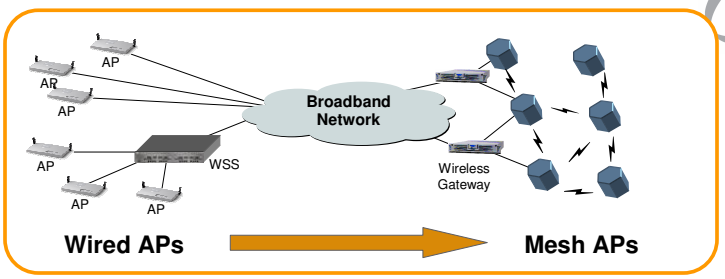


Segmenting the Telecom Market



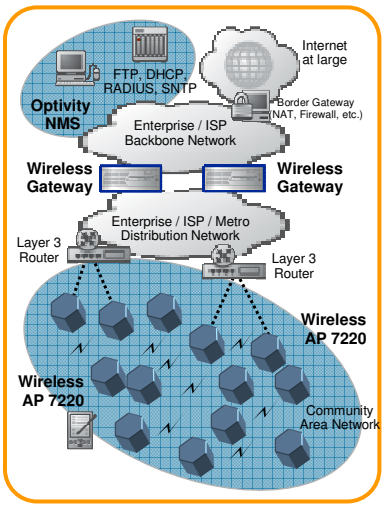
Voice and Data are different challenges

Mesh Networking Overview



- **Reduces backhaul facilities and opex significantly**
  - Small fraction of access points are directly connected to the network
  - Access points act as intermediate data transmission nodes, connecting wirelessly to each other
- **Reduces deployment and operations costs**
  - Just needs power – installed by an electrician
  - Self organizing – minimal setup required
  - Auto recovery – does not require technician intervention to re-establish transmission paths
- **Secure transmission links**
- **Seamless mobility in the mesh coverage area**

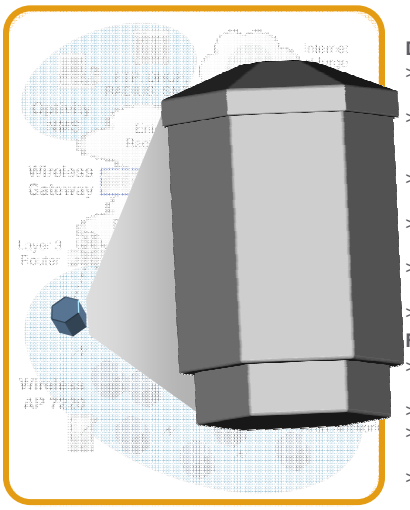
Wireless Mesh Network
Innovative WLAN Access Solution



- **Wireless AP7215 & AP 7220**
  - Access Points for indoor and outdoor deployment
  - 802.11b/g access link
  - 802.11a transit link with smart antennas
  - Self-configuring, self-healing mesh formation
  - Mobility client proxy for seamless subscriber mobility
- **Wireless Gateway 7250**
  - Enterprise class router
  - Advertises reachability (within Enterprise/ISP Network) for WLAN Community Area Network subscribers
  - Provides WLAN CAN-specific mobility anchor point
  - Provides data security for the mesh transit link
- **Wireless Bridge 7230**
  - Wireless point-to-point multiplexer transferring Ethernet traffic over wireless links
  - Full duplex, full rate for links as far as 2 km
- **Wireless Range Extension**
  - Provides indoor access to the outdoor Mesh network
  - Ethernet Adaptor with directional high gain antenna
- **Network Management**
  - APs and Gateway support SNMP network management interfaces
  - Integrated with Nortel's Optivity NMS:
    - Centralized facility for monitoring and managing network operations, leveraging a field proven network mgmt solution
    - Discovery & visualization of WG 7250 & APs
    - Fault management – traps, faults, system log
    - Real-time performance metrics – utilization, errors, interface metrics

Wireless Access Point 7220

Available Now



Description

- Small size (10" tall x 7.5" diameter) for flexible placement
- Optimized for outdoor deployment
  - Temperature range: -40 °C to +50 °C
  - Ingress protection: IP56 rated
- AC powered with low power consumption – 8W to 14W typical
- Advanced antenna designs for extended reach, simplified deployment, and reliability
- 802.11a with extensions (802.11s) for inter-AP transmissions (Transit Link)
- 802.11b/g for user access (Access Link)

Functionality

- Traffic collection & distribution functions for traffic within the Community Area Network (CAN)
- Routing and wireless transit
- Security functions for validating connections to other Wireless APs
- Security functions for controlling access by user devices

Wireless Mesh

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AP 7220 Radio Networking Technology

Transit Link @ 5 GHz

- Elevated dual-polar antennas with switched-beams
- Uses 802.11a technology

Access Link @ 2.4 GHz

- Elevated, dual-polar, diversity switched antennas
- Uses 802.11b/g technology

Mobile Client

Coverage of the Access Link (AL) from the Wireless AP

Access and Transit links separated in space and frequency

Wireless AP 7215

Available Now

Description

> Low profile: 240 mm x 155 mm x 50 mm
> Wall, ceiling or desk mount for flexible placement
> Optimized for indoor deployment
  - Temperature range: 5 ℃ to +50 ℃
> AC powered with low power consumption – 8W to 14W typical
> 802.11a with extensions (802.11s) for inter-AP transmissions (Transit Link)
> 802.11b/g for user access (Access Link)

Functionality

> Traffic collection & distribution functions for traffic within the Community Area Network (CAN)
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Wireless Mesh

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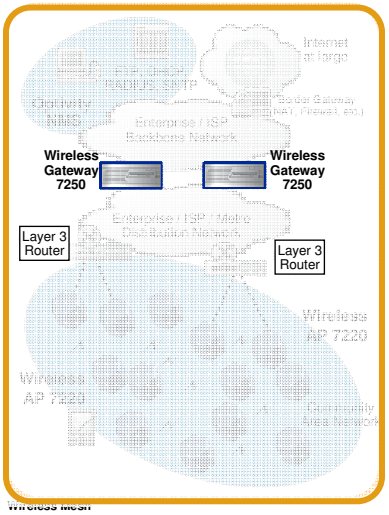
Wireless Gateway 7250

Available Now



Description

> Developed on Nortel's Contivity platform
> 19" rack mount Enterprise-class router
> 2U (3.5") tall
> Temperature range: 0 ℃ to +40 ℃
> Relative Humidity: 10% - 90% non-condensing
> AC powered; 200W typical power consumption
> I/O: 2x 100BT Ethernet ports

Functionality

> Advertises reachability (within Enterprise/ISP Distribution Network) for WLAN Community Area Network subscribers
> Mobility anchor point – manages mobility within the mesh and between peer Wireless Gateways
> Provides data security for the mesh transit link
> Typically supports up to 90 AP 7220s or 7215s

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Wireless Bridge 7230

Available Now

Wireless Mesh

Description

- Low profile: 304 mm x 304 mm x 58 mm)
- Wall or pole mount for flexible placement
- Outdoor unit with integrated antenna
  - Temperature range: -35 ℃ to +60 ℃
- Power over Ethernet – 20W maximum

Functionality

- Supports up to 17 Mbps full duplex for links as far as 2 km.
  - Up to 25 miles at lower data rates (with integrated antenna)
- Operates in unlicensed 5GHz bands (5.725-5.850GHz)
- Channel Bandwidth: 20MHz (5 configurable channels)
- Latency < 8 msec (3 msec typical)

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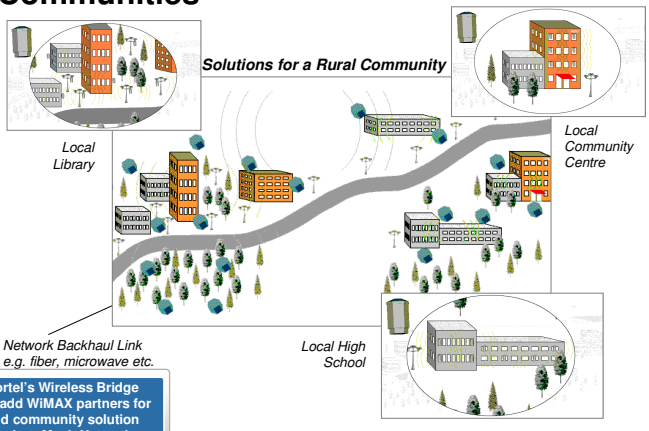
Nortel's Wireless Mesh Network for Rural Communities



Leverage Nortel's Wireless Bridge 7230 or value-add WiMAX partners for an end to end community solution with the Wireless Mesh Network

Nortel's Community First Approach:
Nortel offers a comprehensive community solution with the Wireless Mesh Network and flexible backhaul possibilities Delivering cost-effective broadband access to rural and remote communities

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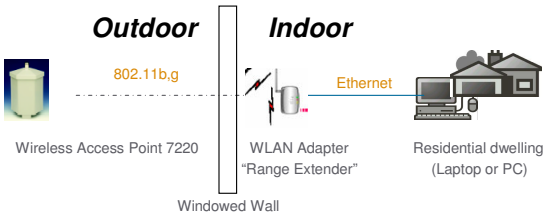
Nortel's Wireless Mesh Network for Rural Communities - Deployment Scenarios

General deployment scenario with Nortel's Wireless Mesh Network for range extension



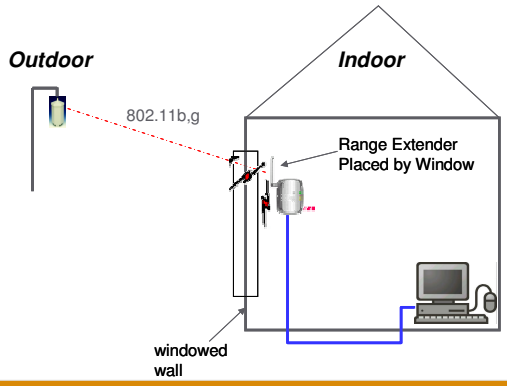
HOW IT WORKS

- **Step 1: Indoor WLAN Adapter, "range extender" associates with Nortel's outdoor Wireless Access Point 7220 (Wireless AP7220).**
- **Step 2: Ethernet traffic bridged from a client device (e.g. laptop, desktop PC) connected in the home or business to the "range extender" via Ethernet.**
- **Option: Support for multiple clients in the dwelling by connecting a low-cost standard home internet router or wireless router.**

Nortel's Wireless Mesh Network solution offers range extension for flexible deployment scenarios for residents and business owners in rural communities

Nortel's Wireless Mesh Network for Rural Communities - Deployment Scenarios

Scenario 1 – Support for a single user device



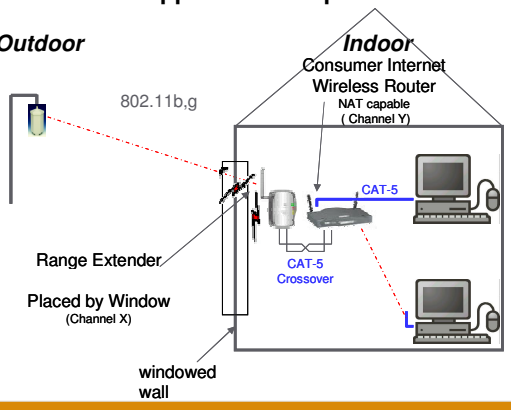
HOW IT WORKS

- **Step 1: Place the range extender with unobstructed line of sight to the Wireless AP7220.**
- **Step 2: CAT-5 Ethernet cabling runs directly from the range extender to the client's Network Interface Card (NIC).**
- **Note: For this scenario, the user's client device (laptop, PC) authenticates directly to the Wireless Mesh Network via the range extending device.**

Nortel's Wireless Mesh Network solution offers range extension for flexible deployment scenarios for residents and business owners in rural communities

Nortel's Wireless Mesh Network for Rural Communities - Deployment Scenarios

Scenario 2 – Support for multiple user devices



HOW IT WORKS

- **Step 1: If multiple devices in the dwelling (house or small business) must be connected, then a router will allow multiple computer devices to connect.**
- **Step 2: In this mode of operation, the router's WAN port is connected to the range extender, and will be assigned its WAN IP address via DHCP by the outdoor Wireless AP7220.**
- **Step 3: The router will then hand out private addresses (i.e. 192.168.X.Y) to all client devices attached to the router, wired or wireless.**

Nortel's Wireless Mesh Network solution offers range extension for flexible deployment scenarios for residents and business owners in rural communities

Nortel's Wireless Mesh Network for Creating Value for Rural Communities

Without a range extender
Up to 12 typical homes in a residential area in rural community cluster

With a range extender
Up to 18 typical homes in a residential area in rural community cluster

Notes:
(1) Diagram not to scale
(2) Assumes homes are approximately 10m by 10m, 5m from street. Actual # of homes covered will vary.
(3) Street is approximately 10m
(4) Coverage in each home will vary based on the physical interior & layout

Outdoor Wireless AP7220

Potential to INCREASE coverage to up to 50% more residential dwellings; ~33% fewer Wireless AP7220s required for indoor coverage

Nortel's Wireless Mesh Network
Potential Applications for Rural Communities

eHealth	Education	eDemocracy	Economic Development	Public Safety
>Digitized Patient records >Long-term health care >Telementoring	>Learning management/ Course registration >eLearning; webcasting, multicasting >Partnerships with 3rd parties	>Televoting >Online voting >Community Portal	>Online stores/virtual marketplace >Internet Access >Jobs >Call Centres	>Emergency Services >Video Surveillance >Security

Nortel's Wireless Mesh Network can enable a host of value-add services and applications for community-wide initiatives

Wireless Mesh Networks - 802.11s Summary

> WLAN Mesh Standard developing in IEEE 802.11s

> WMN Characteristics
- Cost Effective
- Simple to deploy and operate – Self Configuring and Healing
- Integrated Security, QoS, and Power Savings support
- Used for Uni-cast, Multi-Cast, and Broadcast Multimedia Traffic

> WMN Applications:
- Access in Rural and Developing Communities
- Metro Networks
- Campus Networks
- Military and Security Applications

Wireless Mesh Network & WiMAX (802.16.d)
Complementary Solutions Today

Wireless Mesh Network delivers:

- Consumer broadband access in rural and developing communities
- Hot zones – expanded public WiFi access coverage areas
- Extended enterprise WiFi network to both indoor and outdoor areas
- Nomadic, portable VoIP service
- Pedestrian speed mobility

+

WiMAX (802.16d Fixed) delivers:

- Backhaul of WiFi hot zone and hotspot traffic
- Boradband access for small to medium enterprises (SME)
- Consumer broadband services in rural and other underserved - microcellular
- Simultaneous delivery of these services over a single WiMAX system

WiMAX Market – 802.16d & 802.16e

> **802.16d – fixed – minor delays but rolling out late 2005**
  - Strong player with DSL extension & backhaul applications
  - Good applications but not a massive market

> **802.16e – portable / mobile – strong momentum → the main event**
  - **Momentum**
    - WiBro / WiMAX 802.16e reconciliation
    - Sprint / Nextel - 2.5 GHz spectrum consolidation in US
  - **Timeline**
    - 2006 – year of trials
    - 2007 – small scale deployments
    - 2008 – break out year

WiMAX FORUM

> THIS IS **THE WAY**

THANK YOU

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