

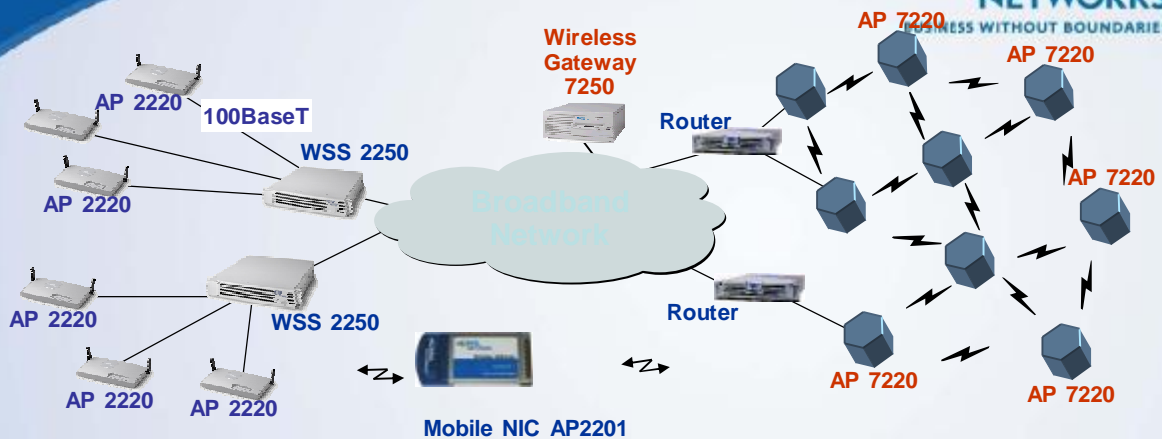
NORTEL NETWORKS

BUSINESS WITHOUT BOUNDARIES

Wireless Mesh Network

Extending the reach of Wireless LAN

Nortel WLAN Solutions



WLAN 2200 Series

- Designed for standard in-building deployments
- Access Point 2220 connected to Wireless Security Switch 2250 via Cat5 cabling

Advantages

- Exploits existing wiring infrastructure
- Inexpensive and simple to deploy
- Ideal for indoor and concentrated deployments

Wireless Mesh Network 7200

- Designed for cost effective coverage of large open spaces, industrial installations, concentrated hotspots
- Connection between AP7220 uses self-configuring wireless broadband links
- Access Point 7220 connected to other APs in peer-to-peer topology layer 3

Advantages

- Minimal network cabling
- Fault recovery through alternate routing
- Rapid deployment for outdoor and dispersed deployments

Wireless Mesh Network 7200 is...

auto- configuring

Minimises maintenance, avoids service outages, provides efficient routing using auto-discovery and self-healing

unlicensed

Uses 802.11 interfaces in unlicensed spectrum, exploiting the immense – and growing – consumer base of WLAN compatible devices

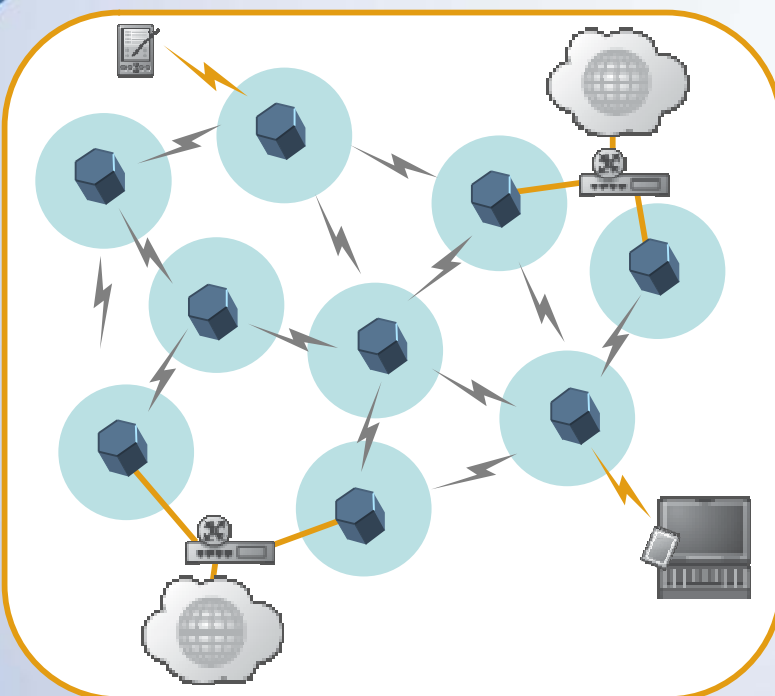
mobility- enabled

Allows mobility within the network to provide a larger coverage area than traditional WLAN hotspots

network

Provides a complete access network solution, incorporating strong authentication and encryption procedures along with centralised OAM&P operations

Wireless Mesh Networks



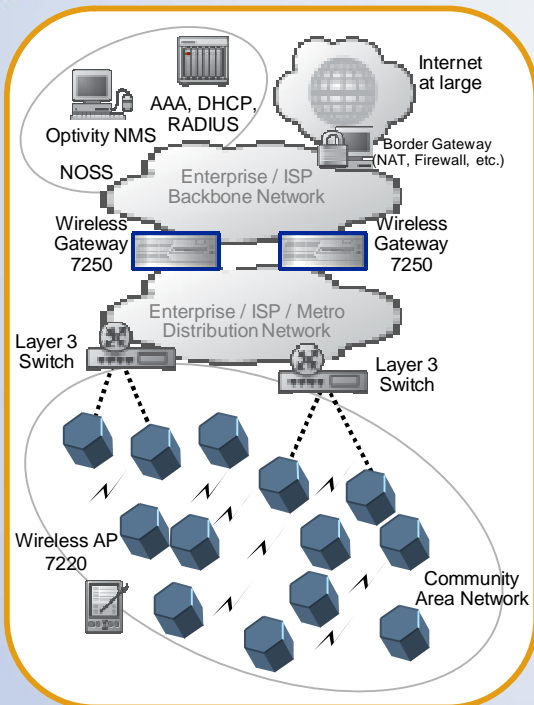
• Key characteristics

- Auto-discovery of nodes and routes
- Auto-configuration of network components
- Mesh topology
- Wireless interconnection

• Advantages

- Rapid network deployment
- Reduced infrastructure costs
- Reduced engineering and operational costs
- Increased network reliability

An innovative public WLAN access solution



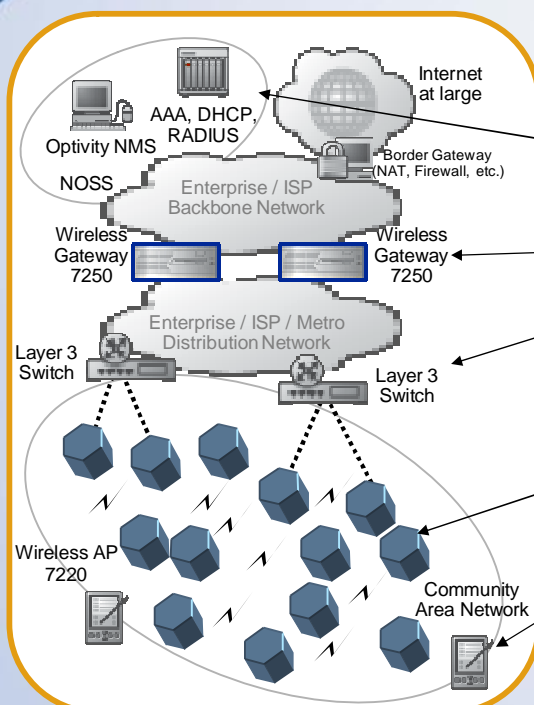
Wireless Mesh Network

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- **Reduces installation and commissioning costs by more than 75%**
 - Self-configuring, self-healing
 - No RF engineering required
 - Outdoor packaging and low power consumption permits installation almost anywhere
- **Reduces operating expenses by more than 70%**
 - Eliminates requirements for wired backhaul connection to every AP
 - Basic router connection to backbone network, Packet Gateway manages mobility, roaming, and security
- **Provides differentiated WLAN access in large areas**
 - Mobility within the CAN
 - Broadband access and transit remove network bottlenecks

Wireless Mesh Networks (WMN)



Wireless Mesh Network

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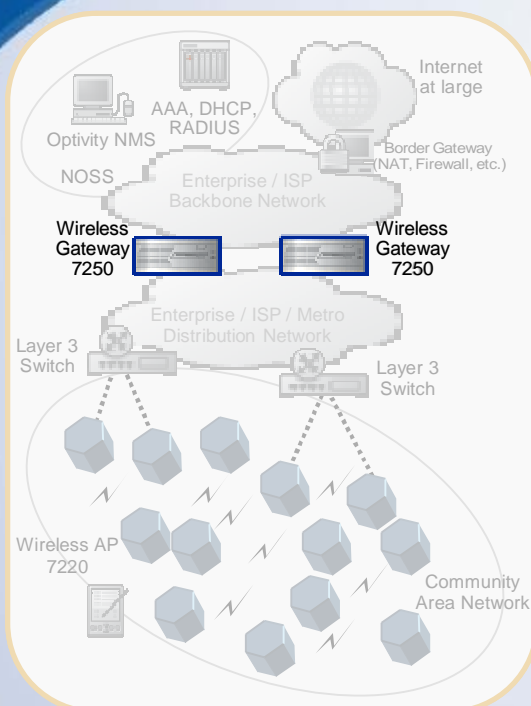
Network elements:

- **Optivity Network Management System**
- **Wireless Gateway 7250**
- **Layer 3 routers for connection of mesh to wired distribution network (details depending on network architecture and size)**
- **Wireless Access Routing Point 7220**
- **Wireless mobile node (client card using standard WLAN NIC)**

WMN system Functional Features Overview

- **Auto-configuration**
 - Automatic neighbor discovery
 - Automatic frequency coordination and selection with neighbor Wireless Access Points (WAPs)
- **Dynamic Configuration**
 - Automatic download and configuration of WAP configuration data from NOSS elements (Plug n Play)
- **Dynamic Routing (OSPF) Support**
 - Automatic shortest path discovery to/from WAP mesh and wire line network
- **Mobility Support**
 - Seamless handover between WAPs
 - No special mobility software required on mobile devices
- **Security**
 - **WiFi Protected Access (WPA) based Authentication** for WPA enabled devices
 - WPA uses Extensible Authentication Protocol and EAP-TLS, EAP-TTLS & EAP-PEAP will be supported
 - Access Link user traffic encryption using TKIP encryption algorithms for WPA enabled devices
 - **Legacy devices (i.e. non-WPA enabled)** may be authenticated based on MAC addresses
 - No user traffic encryption over the air for non-WPA enabled devices
 - User traffic and management traffic encrypted via IPsec tunnels between WAPs and the Wireless Gateway (WG)
- **Network Management**
 - Operational Measurements and Status monitoring from a centralized location
 - Remote S/W upgrade capabilities

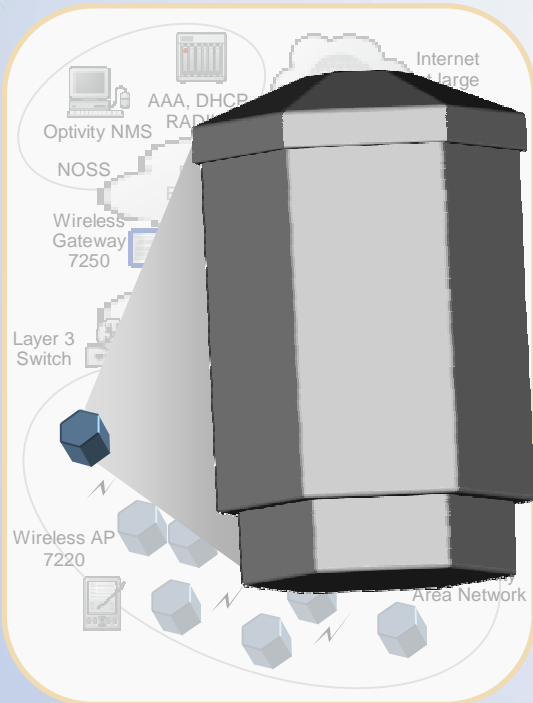
Wireless Gateway 7250



- **Advertises reachability (within Enterprise/ISP Distribution Network) for WLAN CAN subscribers**
- **Hides WLAN CAN-specific mobility and security functions from the rest of the Enterprise/ISP Distribution and Backbone Networks**
- **Provides data security for the mesh transit link**

Implemented as software built on the Nortel "Contivity" 1700 platform

Wireless Access Routing Point 7220



- Performs traffic collection & distribution functions for traffic within the Community Area Network (CAN)
- Incorporates *routing* and *wireless transit* functions
- Incorporates security functions for validating connections to other Wireless APs
- Incorporates security functions for controlling access by user devices
- Incorporates low-cost advanced antenna designs for extended reach, simplified deployment, and reliability
- Small size (10" tall x 7.5" diameter) for flexible placement

Radio Networking and access systems

Initial product uses 802.11a technology because it is available, reliable and inexpensive. System can be adapted to 802.16 standard as it (or if it) matures

Transit Link (TL) @ 5 GHz

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

Access Link (AL) @ 2.4 GHz

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

Contains TWO radios, one used for backhaul and one for access

Wireless AP 7220

To other AP7220 units

Existing utility pole or wall offering elevated mounting position

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



MN



Mobile Node (MN)



MN

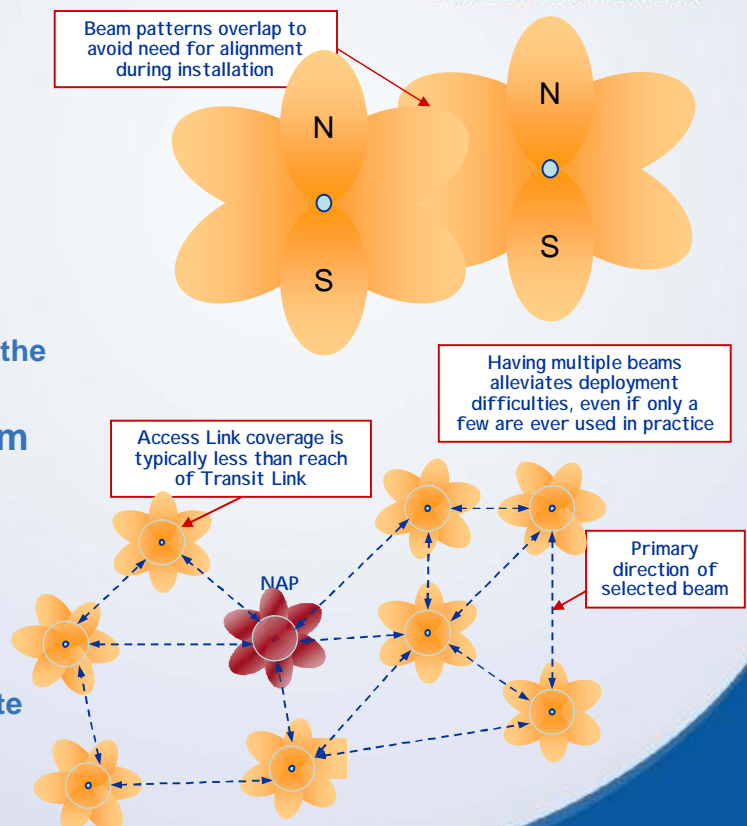
Access and Transit Backhaul Radio links separated in frequency with adaptive interference control.

- Advanced transit link antenna Beam switching
- Radio interference monitoring and automatic frequency selection/re-selection
- Co-channel interference control
- Diversity receive antennas
- Dual-polarised antennas
- Adaptive dynamic power control
- Coordinated burst switching
 - Proprietary MAC protocol for transit links based on 802.11a technology

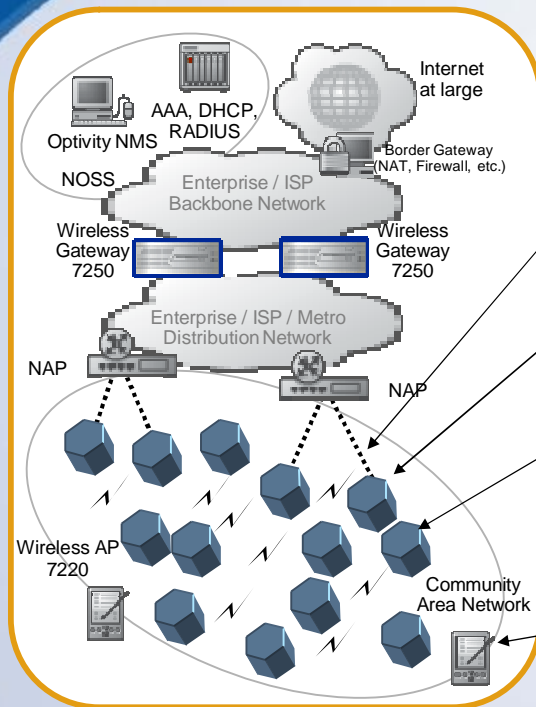
These technical features distinguish AP7200 Nortel product from competitors

Wireless Access Point 7220 **NORTEL NETWORKS** Switched Beam Antenna for Transit Links

- **Low-cost structure incorporated into AP**
 - Inherent directivity improves reach and minimises interference.
 - One beam is selected for communicating with each of the neighbouring APs.
- **Multiple degrees of freedom for each transit link**
 - Beam
 - Frequency
 - Polarisation
 - Burst time
 - Taken together, these mitigate interference and maximise system capacity



Radio deployment guidelines



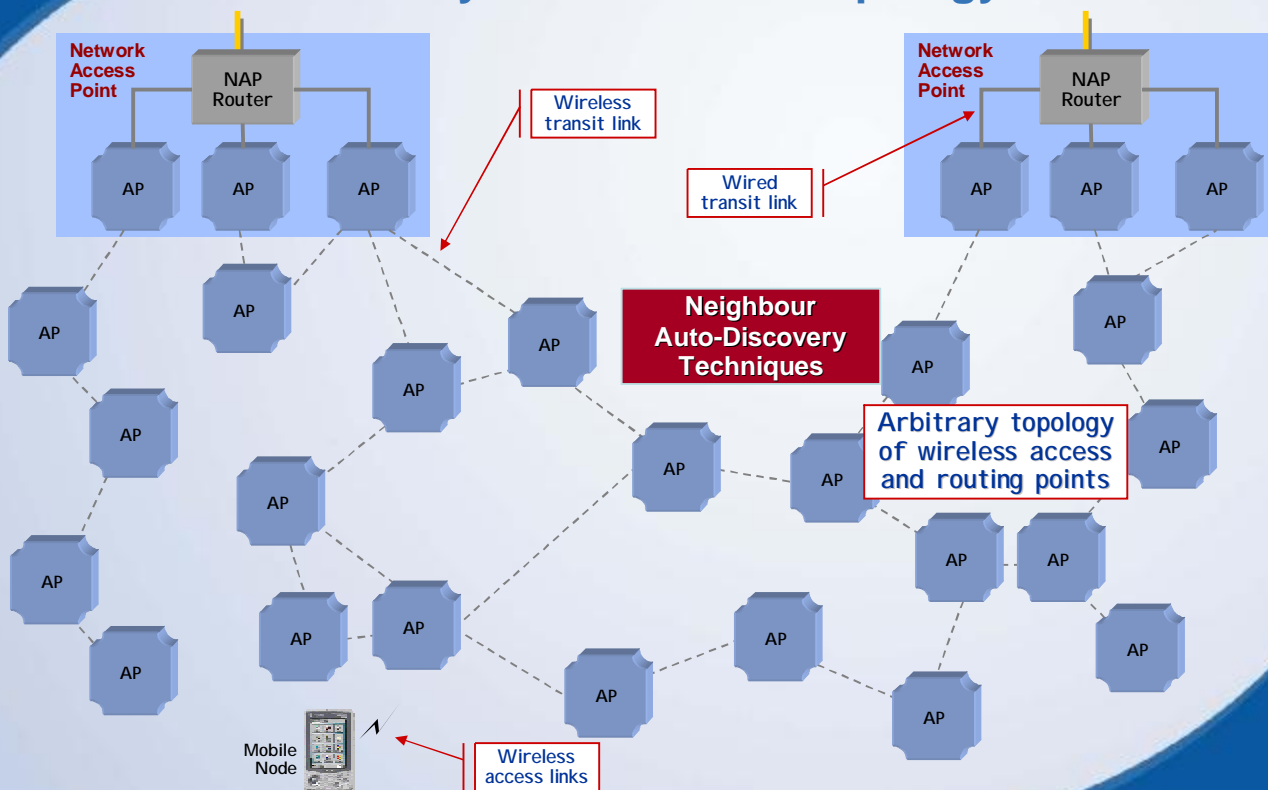
Rules of thumb:

- AP7220 and NAP router may be separated from router by up to 100 m Ethernet cable
- The AP7220 at NAP should have routes to at least two subtending AP7220
- Approx 200 m range of transit links between AP7220 using integral antennas (may be up to 1km (or more) with external antennas)
- Approx 100 m range from user to AP7220

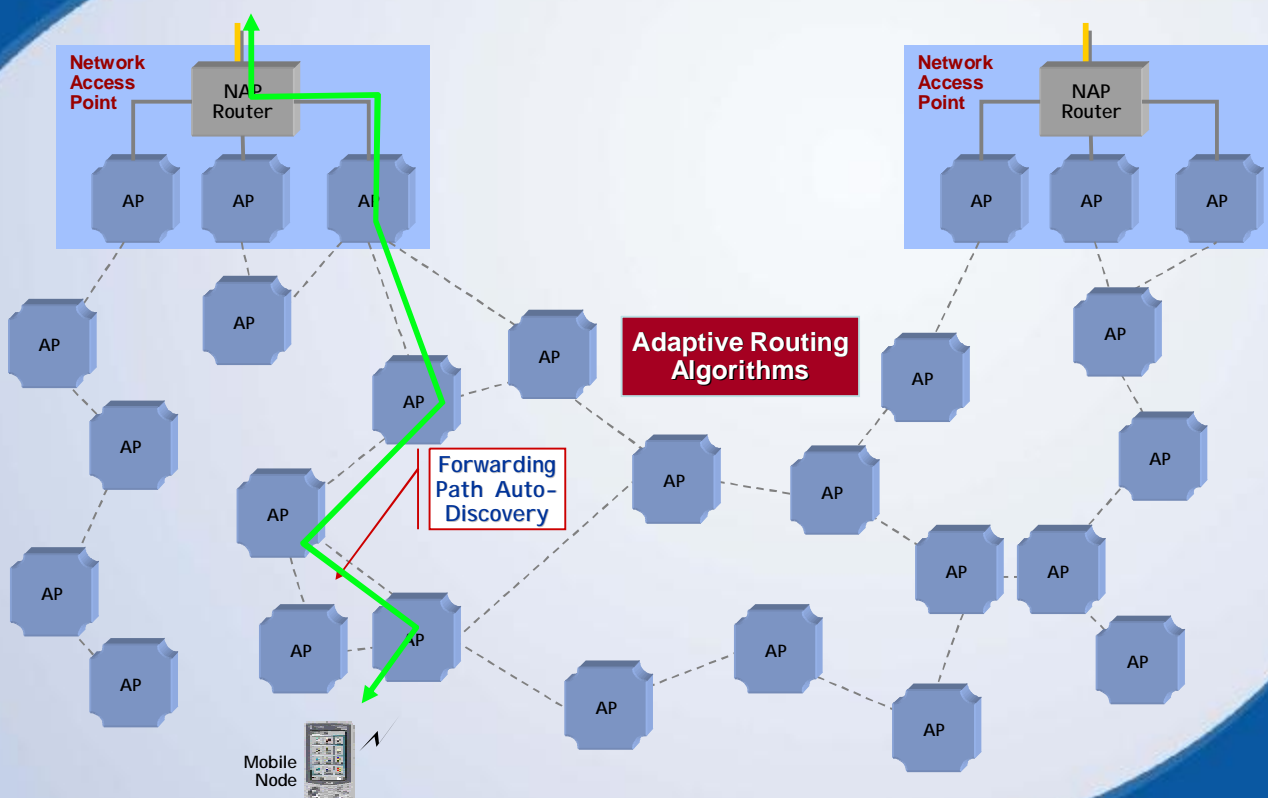
Wireless Mesh Network 7200

Community Area Networking Principles of Operation

Wireless Mesh Network 7200 Community Area Network Topology



Wireless Mesh Network 7200 Packet Data Forwarding



200 Nortel Networks Faults



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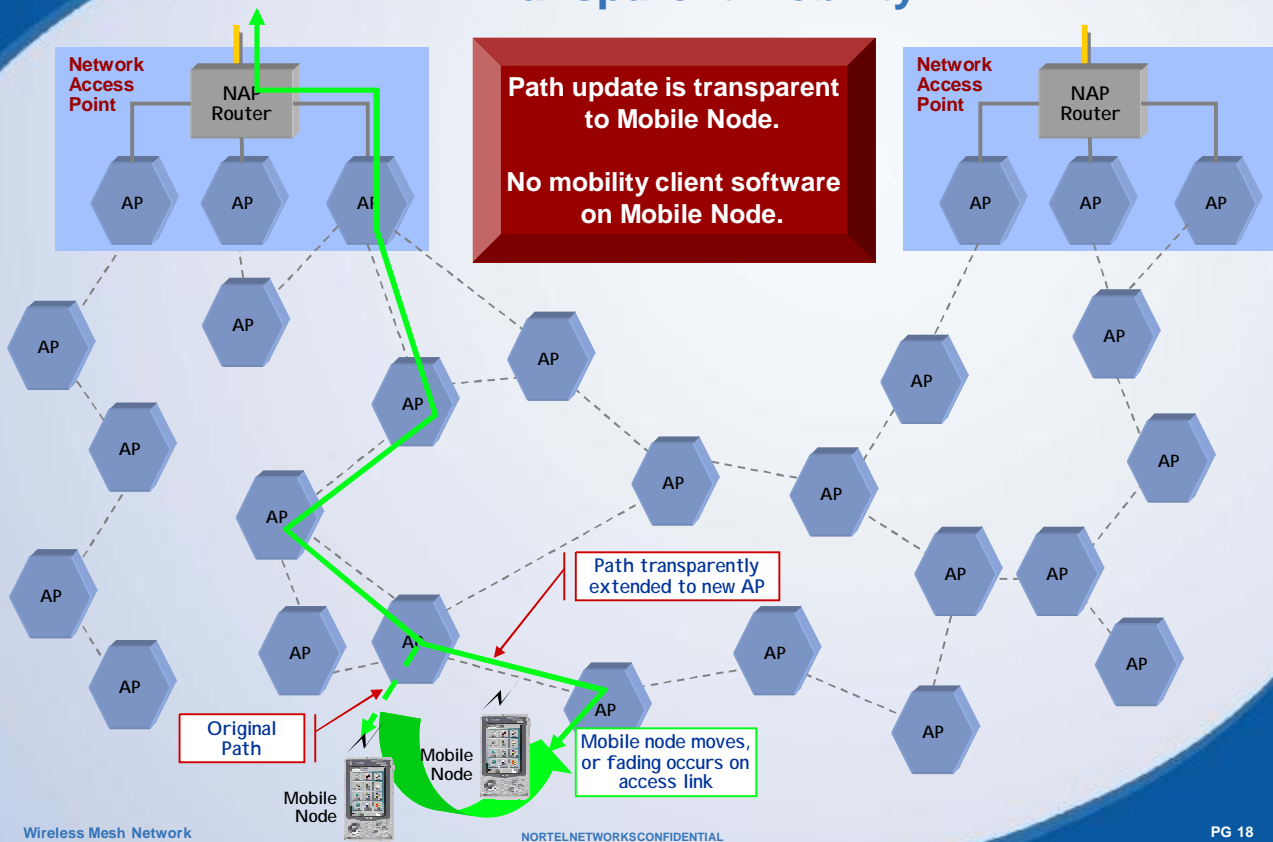


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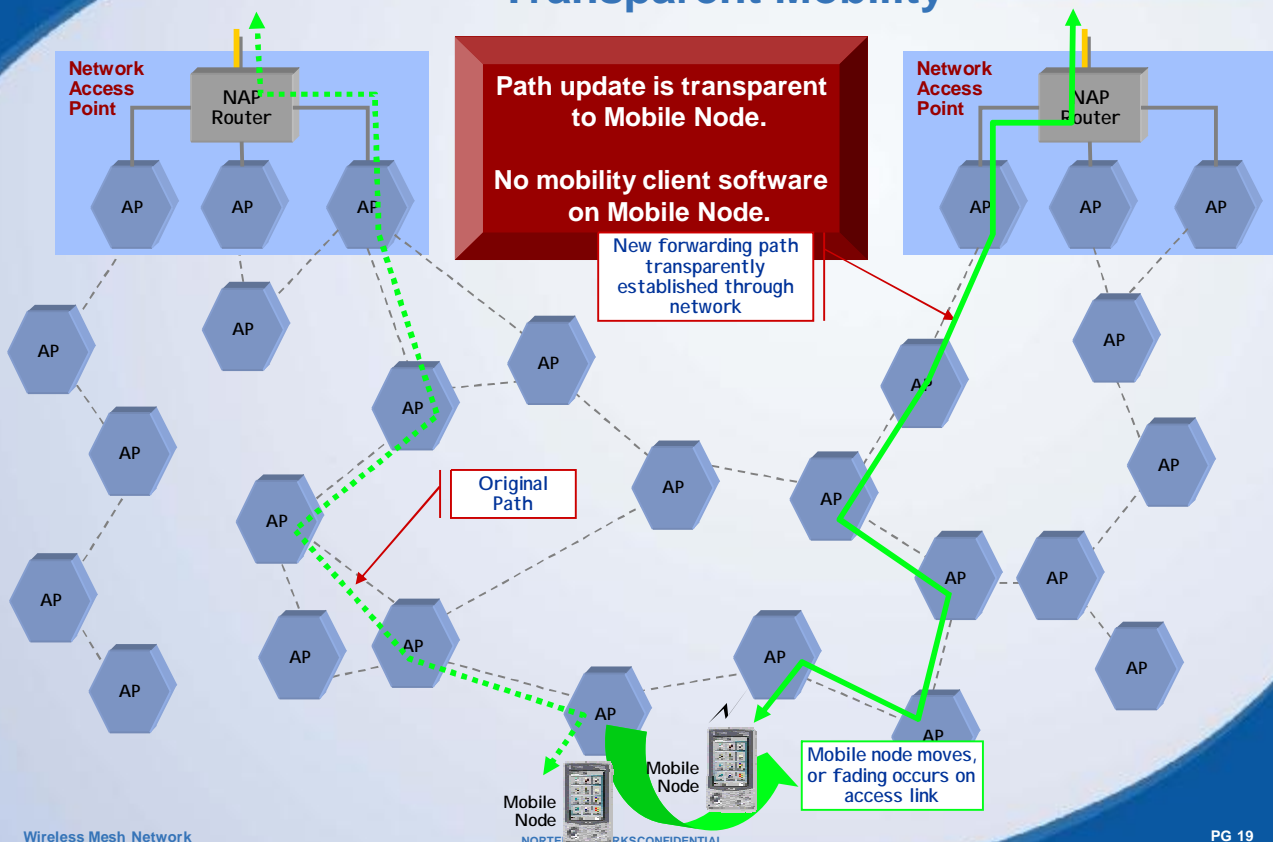
Wireless Mesh Network 7200

Transparent Mobility



Wireless Mesh Network 7200

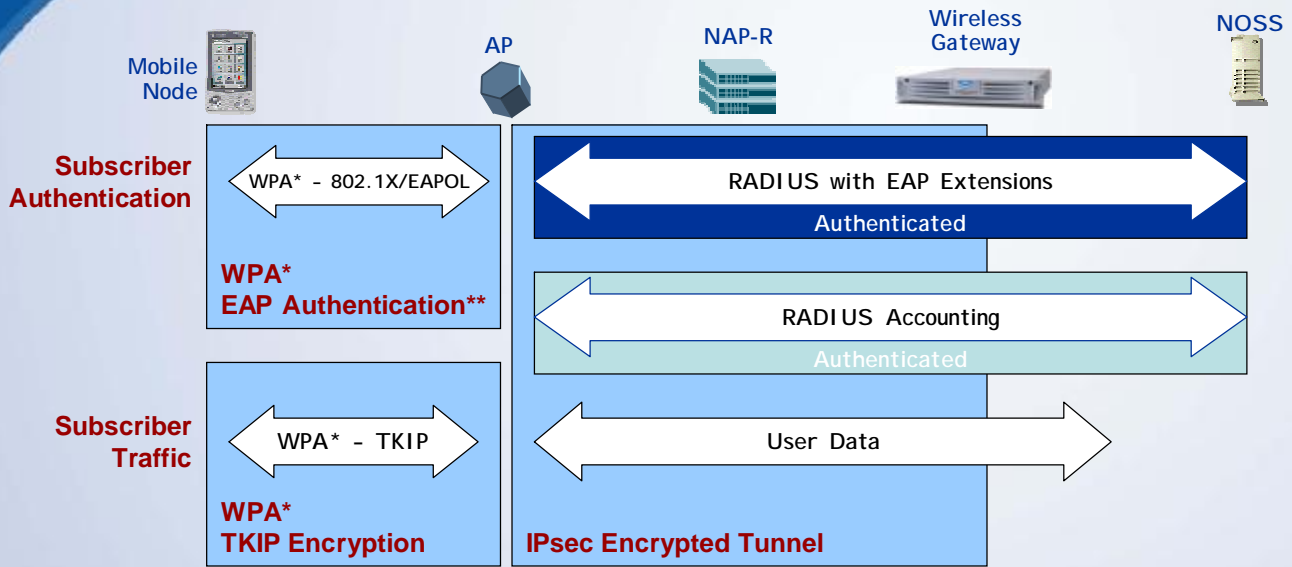
Transparent Mobility



Wireless Mesh Network 7200

Subscriber Security

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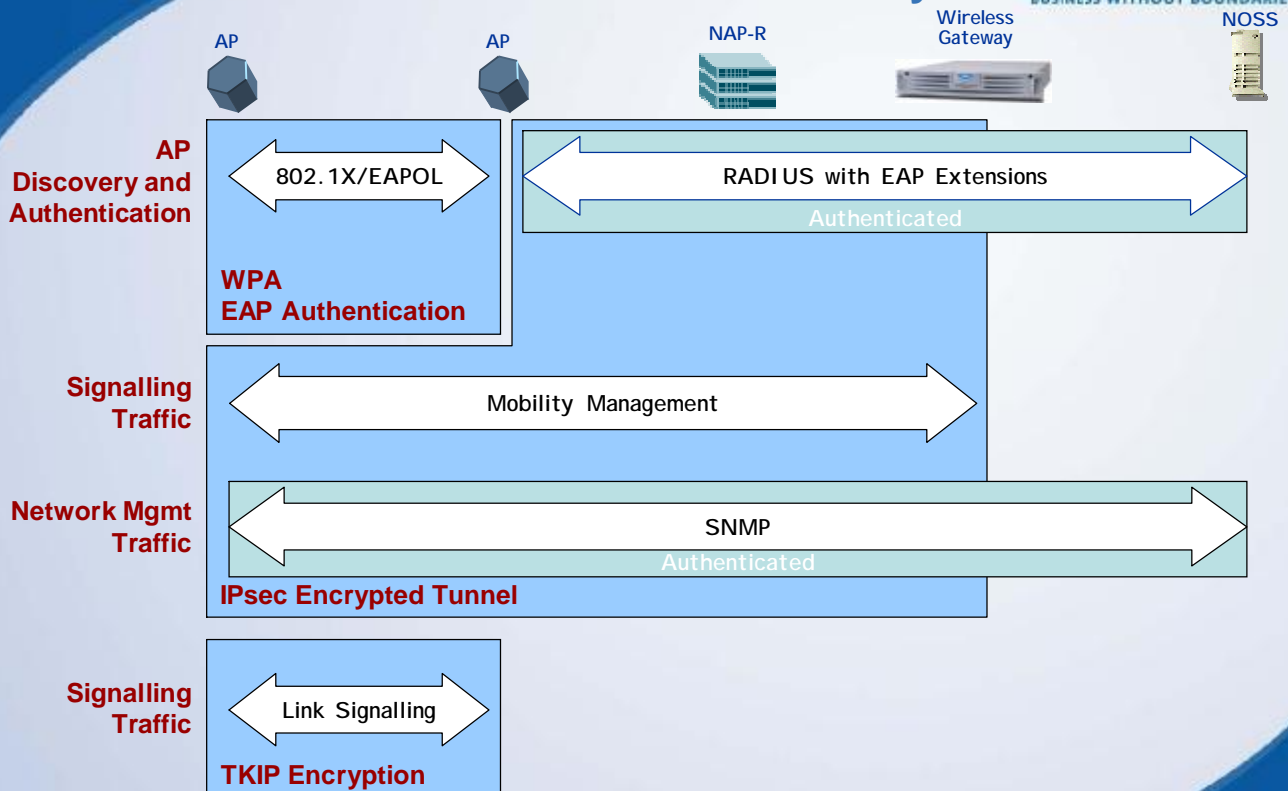


* Industry standard WiFi Protected Access, evolving to 802.11i
** TLS, TTLS, PEAP

Wireless Mesh Network 7200

Network Security

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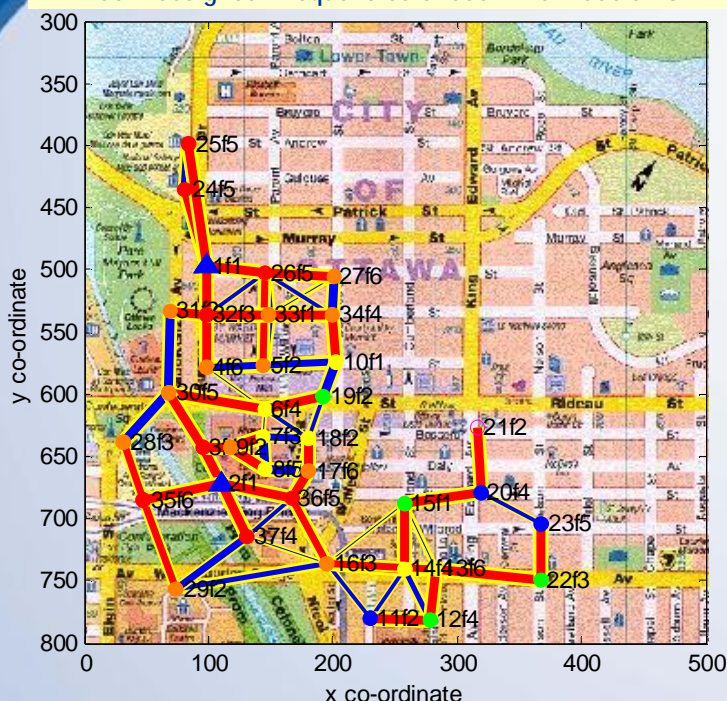


Wireless Mesh Network 7200

Deployment Case Study

Frequency Self-Selection

Illustrative WARP locations showing preferred routes and self-assigned frequencies chosen from set of 6



- Simple algorithm at each WARP selects transit link frequency
- Each WARP automatically selects its own frequency for its traffic to its neighbours
 - To maximise network throughput
 - To make use of maximum amount of spectrum available
 - To avoid interference and adapt to changes
- Automatic discovery of new nodes and routes
- Frequency assignment algorithms make use of local WARP information available from 802.11a radio units and do not require global information



Wireless Mesh Networks



- **Utilises 802.11 technology** – the interface for high-speed wireless packet data
- **Offers high-speed wireless packet data access across wider coverage areas**
 - Today's cellular systems don't provide the bandwidth available in Wireless LANs
- **Minimises cost of capital, installation and commissioning**
 - Utilises low cost 802.11 technology
 - Uses wireless links for backhaul to eliminate costs associated with installation of wired interconnect
 - Auto-configuration algorithms in Wireless AP eliminate costs associated with engineering and organisation of the wireless backhaul network
- **Minimises cost of operations**
 - Uses wireless links for backhaul to eliminate costs with ongoing leasing of facilities
 - Auto-configuration, self-organising and self healing are intrinsic to the Wireless Mesh Network
 - Centralized OAM&P minimizes staffing requirements
- **Highly flexible in terms of capacity, coverage, and availability**
 - Increasing capacity, coverage simply means deploying more Wireless Access Points
 - Wireless Access Points may be deployed indoors or outdoors

Enabling a new WLAN business model

