Cost-effective, Secure, Reliable Wireless Connectivity

MOTOROLA WIRELESS BROADBAND

Connectivity Challenges

Expand

- Coverage to all areas including expansive and remote areas

Enable

- Improvement initiatives such as
  - Data Connectivity
  - Video Surveillance

Improve

- Cost Efficiency instead of High Cost Leased Lines

Secure

- Connectivity, Facilities And Assets

Comprehensive Portfolio

Wireless LAN

Largest Installed Base of Wireless Switches – 135,000
Wi-NG architecture with adaptive technology supports up to 12,000 APs per cluster, FIPS 140-2 & CC EAL4

Most Comprehensive Access Point Portfolio
Thick, Thin, Adaptive, Outdoors, C1D2, Mesh, Sensor

Unique Client Products
Bridge and OEM Cards provide unique understanding down to the client

Wireless Broadband

Market Leading Point-to-Point Solutions
300 Mbps at up to 155 miles
T1/E1 Replacement

Market Leading Point to Multipoint Solution
21 Mbps at up to 10 miles
T1 Replacement

MOTOMESH
Coverage across large outdoor spaces such as cities, campuses, utilities and oil and gas fields

Voice & Messaging Solutions

TEAM - Voice Server
PBX Integration / Telephony Extn.
Push To Talk / Dispatch (Wi-Fi)
SIP Proxy/Registrar
Cellular – Wi-Fi Seamless Roaming

Enterprise Wi-Fi/Dual Mode Handsets

Good Mobility Suite
Device independent messaging

One Point Wireless Suite

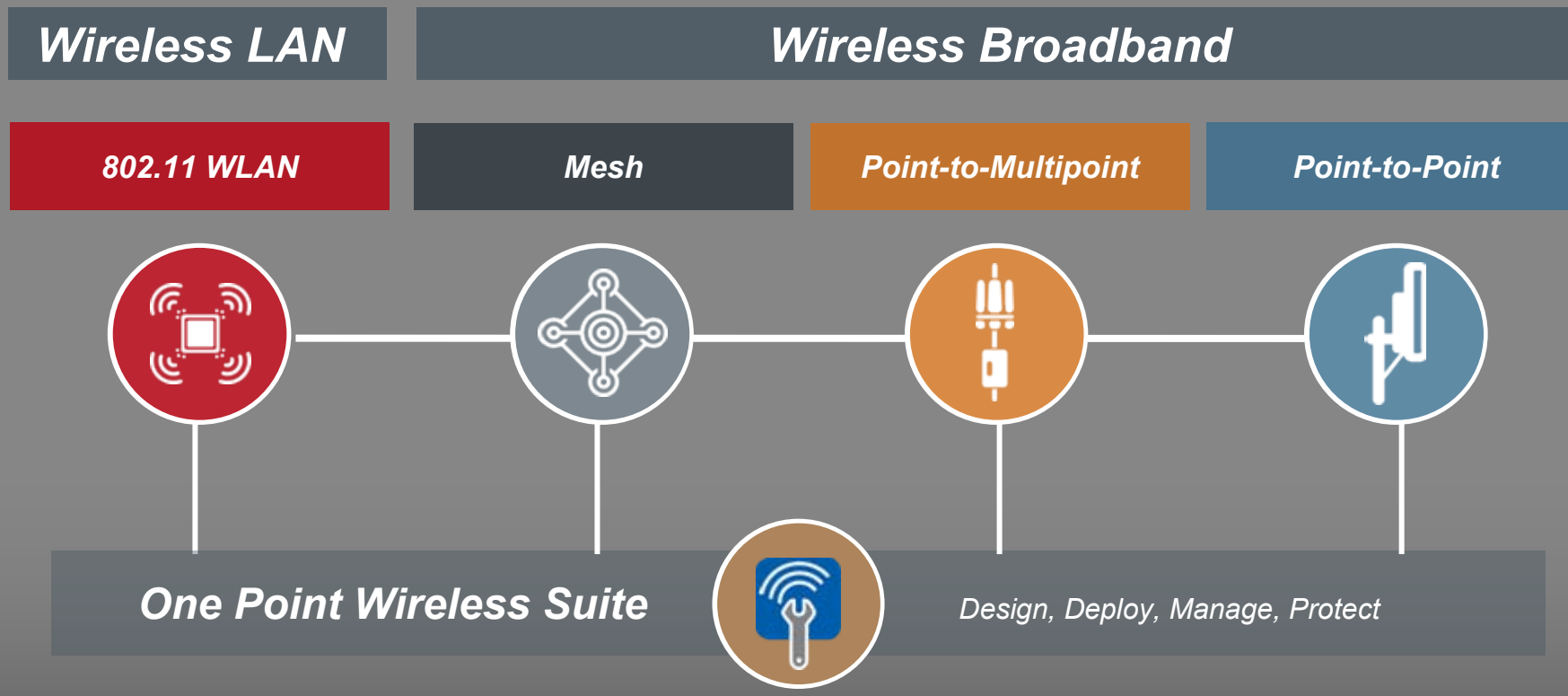
Indoor RF Management
Industry leading Planning Tool
Configuration and Compliance
Monitoring and Troubleshooting,
Locatioin ing
Security

Wireless IPS with 35 of Fortune 100 customers
Industry leading overlay security offering intrusion protection, policy enforcement, and advanced forensics

Outdoor Wireless Management
One Tool for Monitoring and Troubleshooting All Outdoor Nodes

- Google Earth Network Map

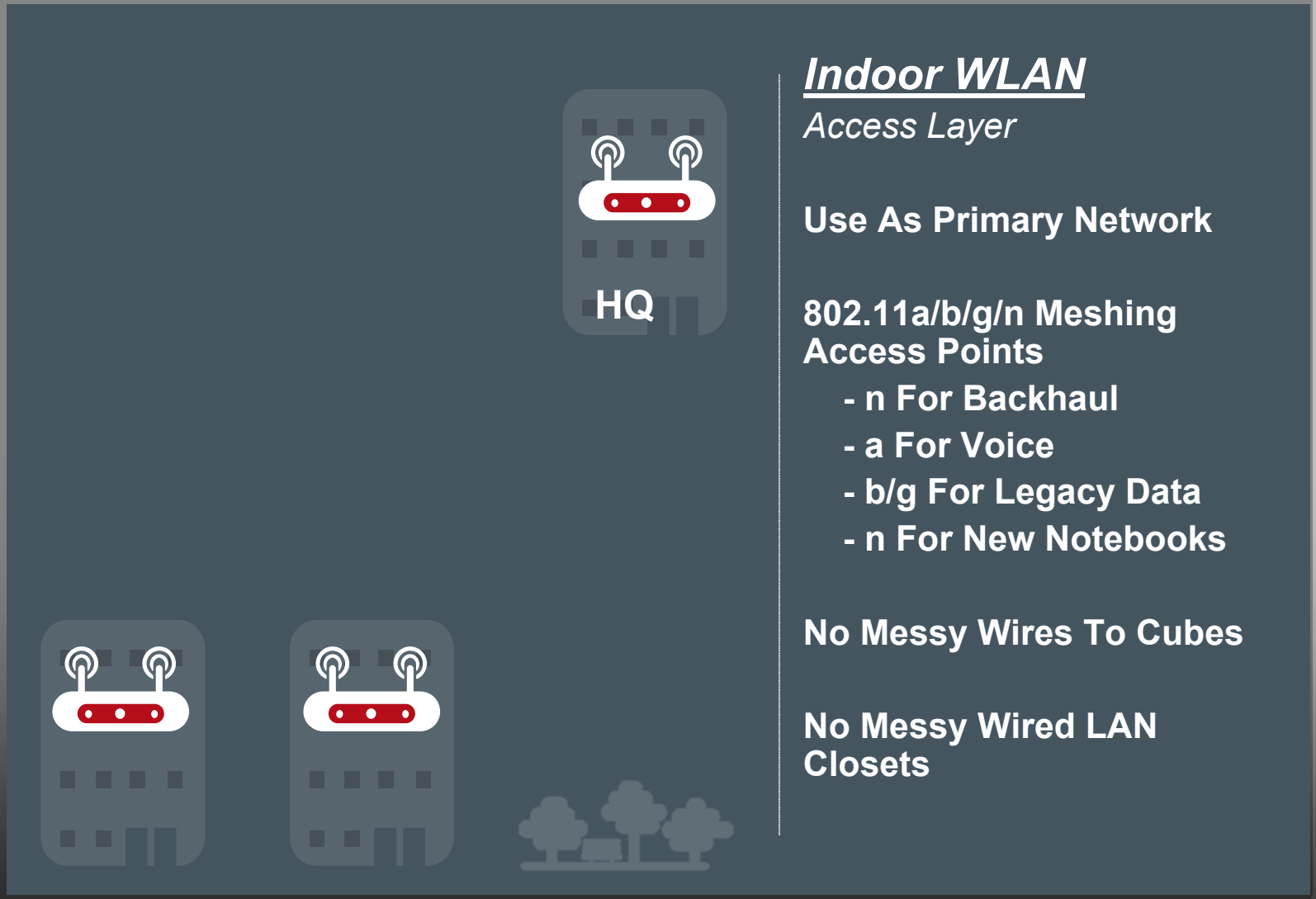
Motorola Wireless Broadband Portfolio



From the access layer to the core, build end-to-end wireless networks with Motorola Wireless Broadband and Motorola Wireless LAN solutions

Motorola End-To-End Wireless Networks

Indoor/Outdoor Wireless Networks for Enterprise and Gov't



802.11 WLAN

Indoor WLAN

Access Layer

Use As Primary Network

802.11a/b/g/n Meshing Access Points

- n For Backhaul
- a For Voice
- b/g For Legacy Data
- n For New Notebooks

No Messy Wires To Cubes

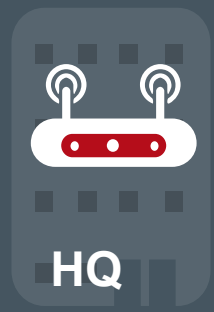
No Messy Wired LAN Closets

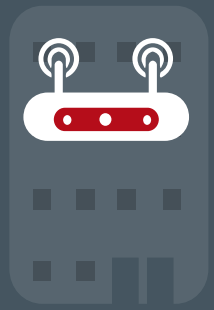
Motorola End-To-End Wireless Networks

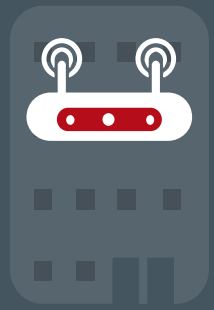
Indoor/Outdoor Wireless Networks for Enterprise and Gov't

Outdoor Mesh

802.11 WLAN







Outdoor Mesh Network

Access Layer

Fixed Or Mobile Access

Ad-hoc Self-forming and Self-healing

Highly Reliable and Scalable

Easy, Cost-effective Deployment

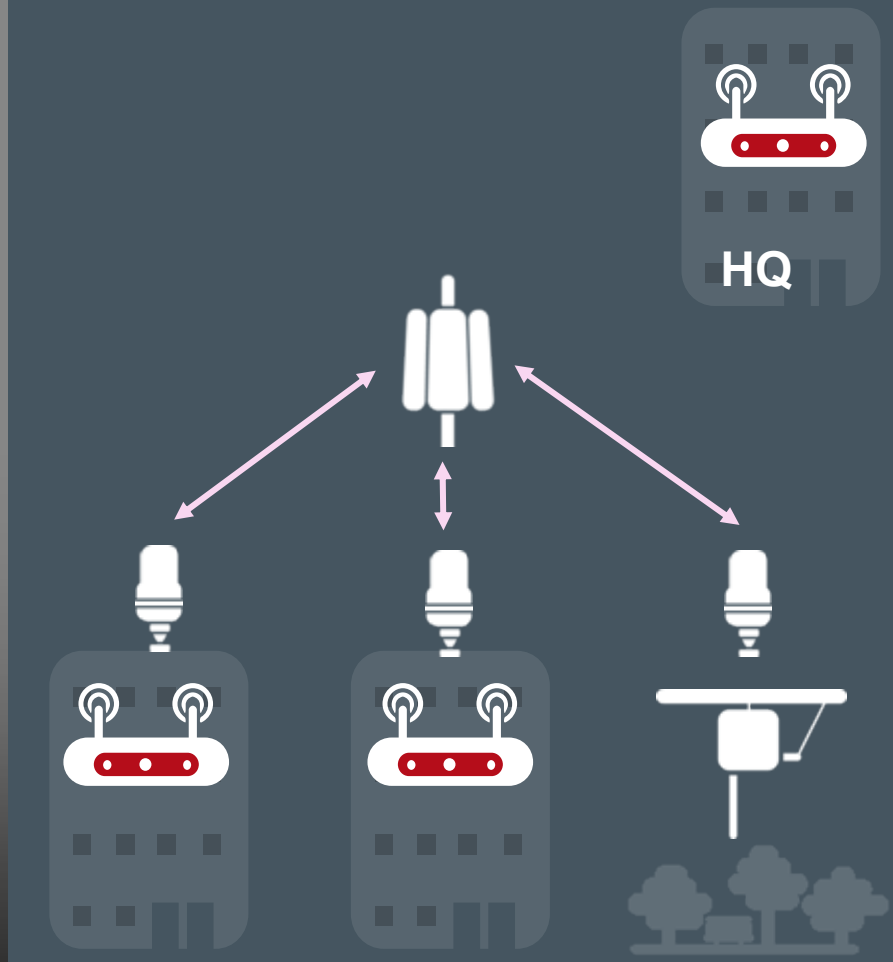
Motorola End-To-End Wireless Networks

Indoor/Outdoor Wireless Networks for Enterprise and Gov't

Point-to-Multipoint

Outdoor Mesh

802.11 WLAN



Point-To-Multipoint

Distribution Layer

Secure and Reliable

Cost-effective

Scalable

21 Mbps, 16 km (10 miles), LOS And NLOS

Deployed In Over 120 Countries Globally

Motorola End-To-End Wireless Networks

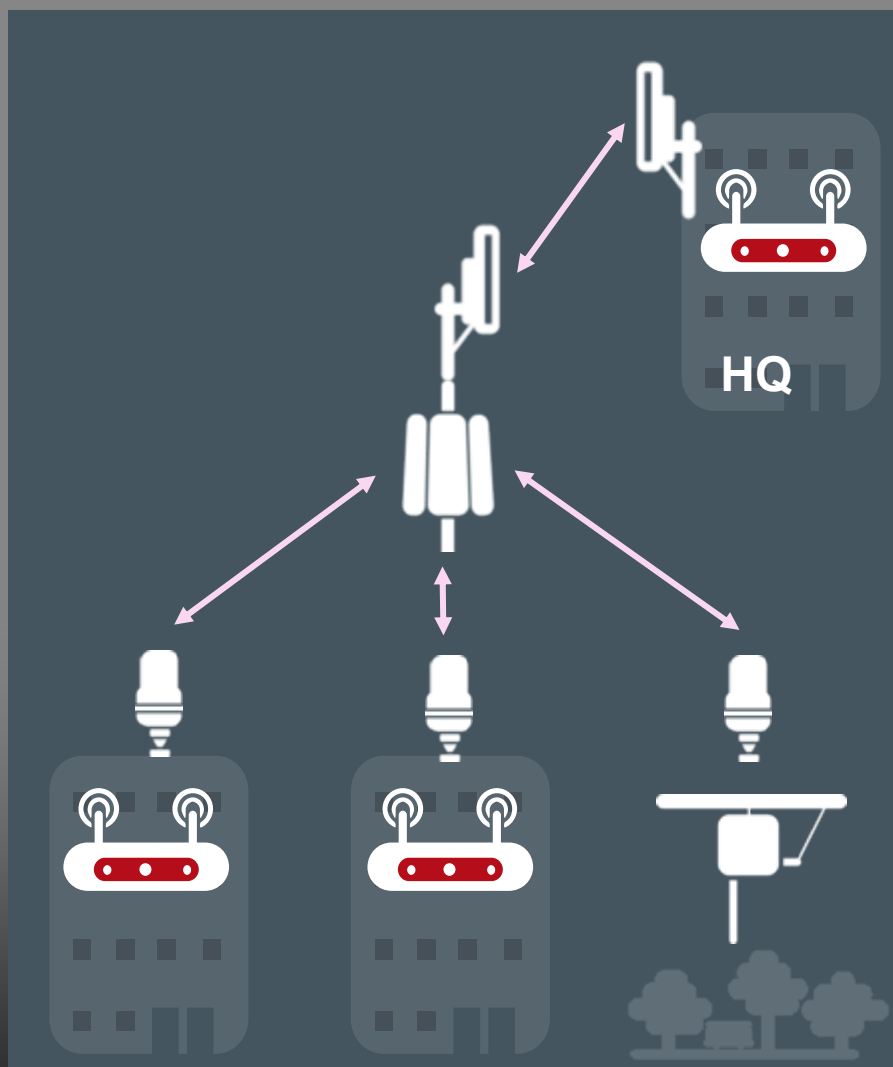
Indoor/Outdoor Wireless Networks for Enterprise and Gov't

Point-to-Point

Point-to-Multipoint

Outdoor Mesh

802.11 WLAN



Point-To-Point

Backhaul Layer

High Capacity – 300 Mbps

Long Distance – 249 km (155 miles)

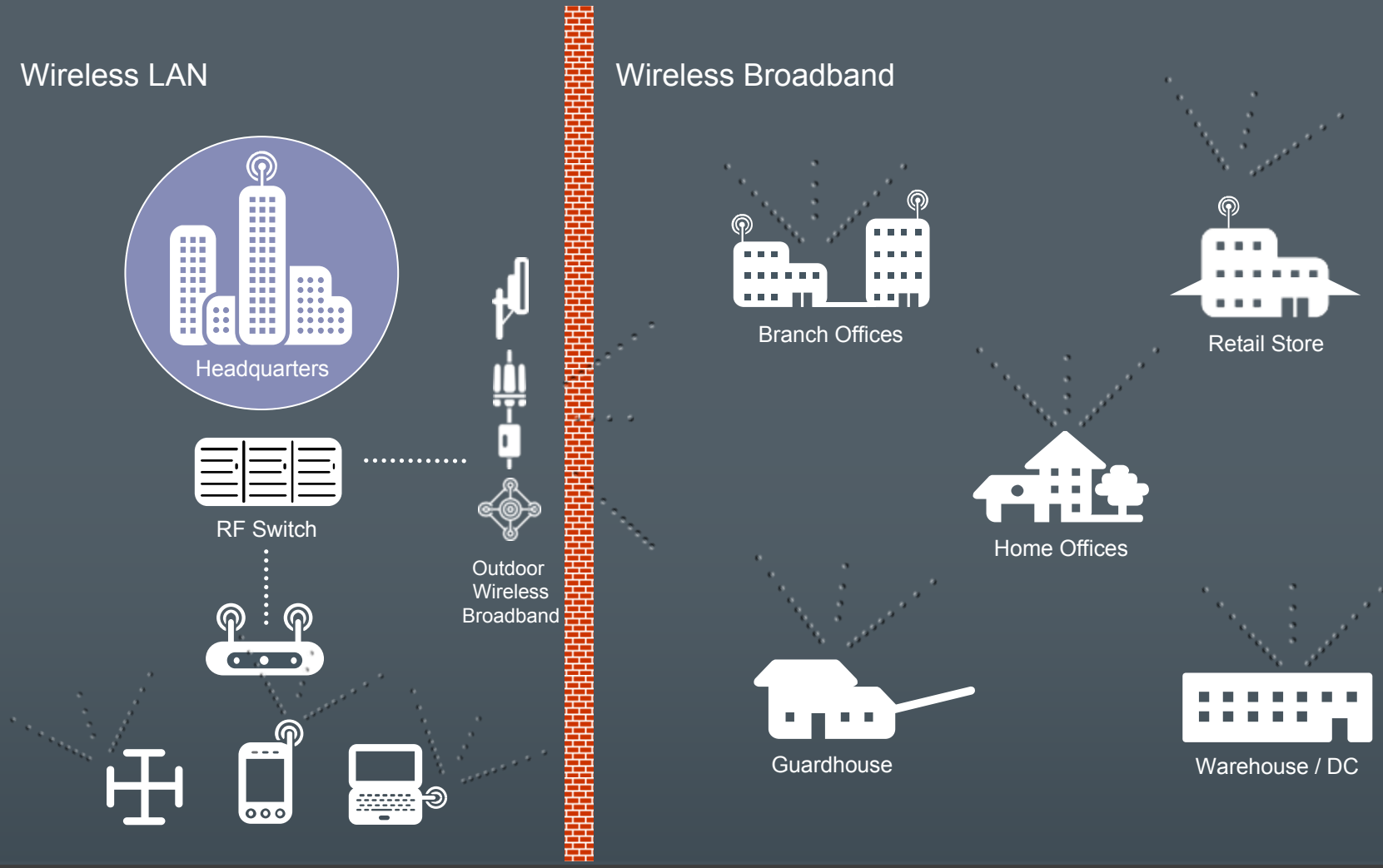
LOS or NLOS

Connect Over Water

Thousands Of Deployments Globally

Expanding Wireless Reach

Extending The Network With Motorola Wireless Broadband



Wireless By Default, Wired By Exception

Motorola Wireless Broadband Advantages

Fast Installation	Wireless networks are easy to install *- Hours instead of weeks or months* Wireless networks often have "zero footprint" *- Install on existing towers / structures*
Coverage where you want it	Extend existing networks *- Where you need, when you need* Reach New Hard-To-Reach Locations *- Where wired is not feasible (distance, obstructions, water/desert/features)*
Positive Control	Design for high availability Built-in high security Take control of your network instead of leasing connectivity

When It's About Lowering Cost

Connectivity At A Lower Cost

~4-8 Months ROI

T1 Replacement ROI Calculator

T1 Leased Line Costs		
Monthly Fee	$ 500	Rate collected from subscriber
Installation Fee	$ 800	Rate collected from subscriber
PTP Costs		
Equipment Cost	$ 2,000	7 Mbps PTP100
Installation	$ 800	estimate
Total Fixed Costs	$ 2,800	
Months to Break Even	4	

Wireless Networks Can Eliminate Recurring T1/E1 Costs

Wireless Networks Cost Less To Purchase And Install

When It's About Staying Connected

Motorola Wireless Broadband equipment is engineered for superior reliability even in challenging environments.

Robust Point-To-Point Backhaul

Near / Non Line-of-Sight links using Multi-In-Multi-Out links to maximize signal

Synchronized Point-To-Multipoint

GPS-sync'd transmit / receive timing and best- in-class SNR maximize signal

Self-healing Mesh Network

Leveraging military-grade technology for maximum network survivability

Point-to-Point Products

PTP 600
PTP 500
PTP 300

PTP Integrated with dual built-in antennas

PTP Connectorized – high-gain advantage of external antennas

Power Indoor Unit (PIDU Plus) – Power-over-Ethernet to outdoor units

PTP 200

PTP 200 Link Pair

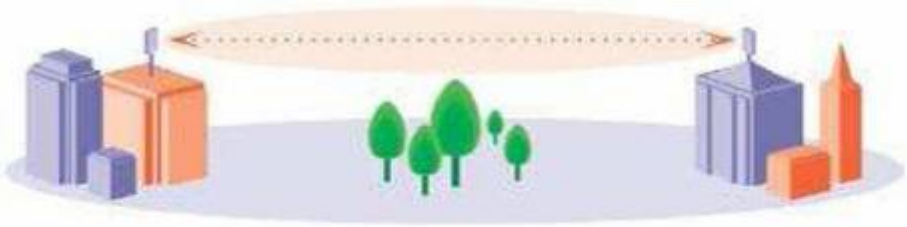
PTP 200 CMM module
for power and Ethernet

PTP 100

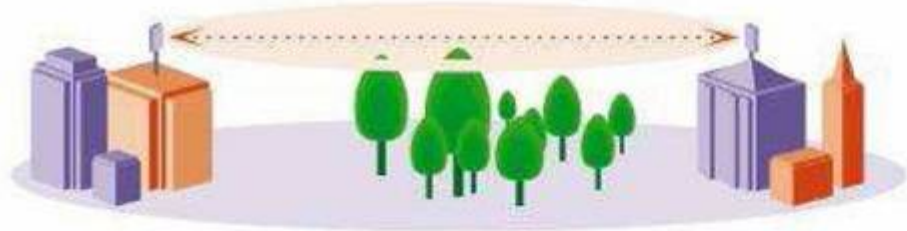
PTP 100 Link

PTP 100 Link with Reflector

NLoS and LoS Performance



Line-of-Sight (LoS)
Up to **249 km / 155 miles**

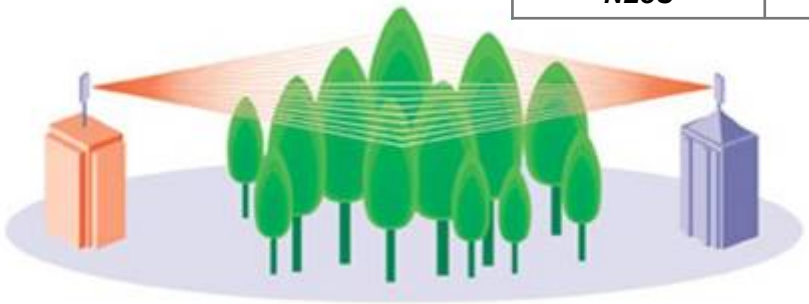


near-Line-of-Sight (nLoS)
Up to **40 km / 25 miles**

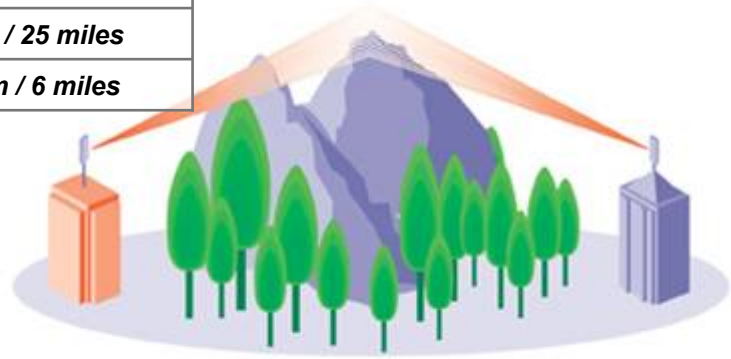
Non-Line-of-Sight (NLoS)
Up to **9.5 km / 6 miles**

Non and near Line of Sight - Examples

LoS	*249 km / 155 miles*
nLoS	*40 km / 25 miles*
NLoS	*9.5 km / 6 miles*

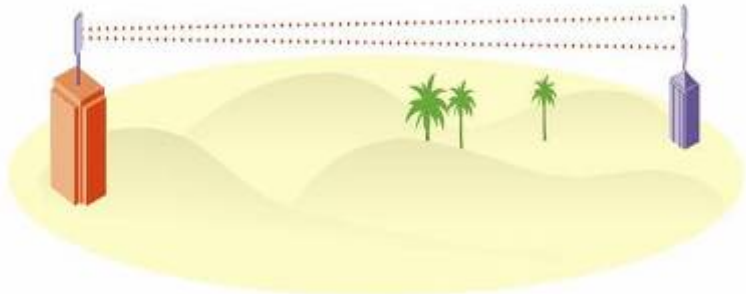


Through Trees



Over Hills

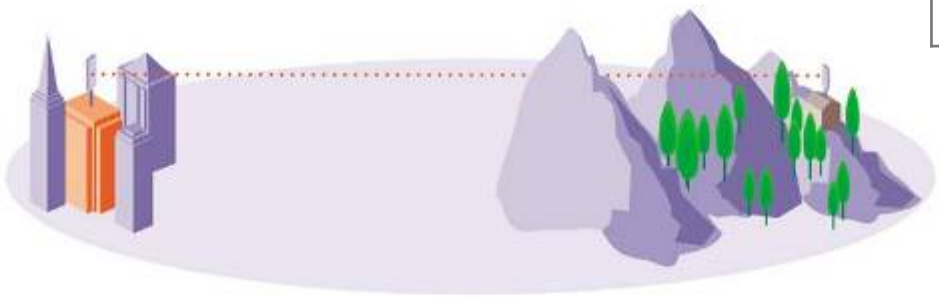
Around Buildings



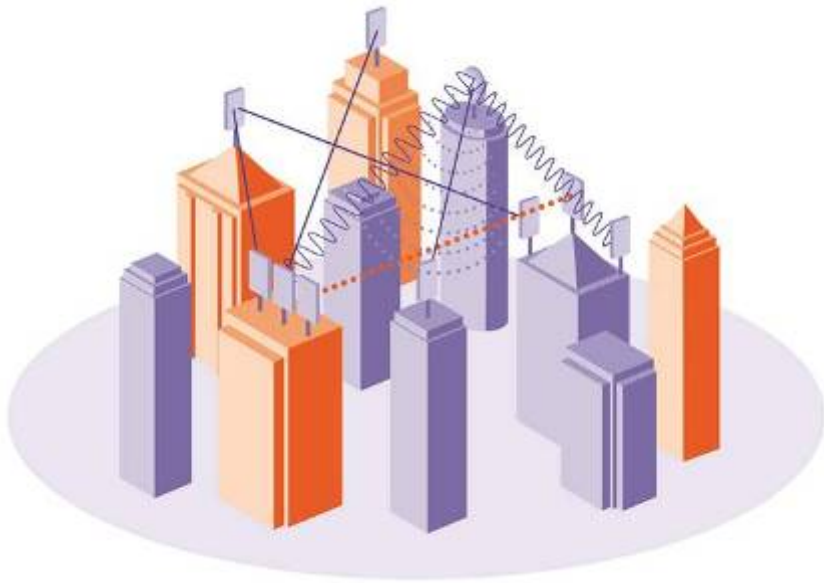
Over Desert or Water

Robust Line of Sight Capabilities

LoS	*249 km / 155 miles*
nLoS	*40 km / 25 miles*
NLoS	*9.5 km / 6 miles*



Across Long Distances



In High-Interference Area

PTP Wireless Link

Motorola PTP Superior Design

Multiple-Input Multiple-Output (MIMO) – increased tolerance to signal fading

Intelligent Orthogonal Frequency Division Multiplexing – greater resistance to multi-path interference and selective signal fading, plus higher spectral efficiency

Adaptive Modulation – sustains the maximum throughput while maintaining highest link quality

Advanced Spectrum Management with *i*-DFS – samples the band up to 1,200 times a second and automatically switches to the clearest channel

Best-in-Class Radios – highest system gain in the industry

Typical Applications

Building-To-Building Connectivity – Connecting WLAN “Islands”

T1 Leased Line Replacement or Backup

Video Surveillance

Data, Voice And Video Communications

High-Speed Wireless Backhaul: WiMAX, LTE

Disaster Recovery And Temporary Services And Public Safety

Distance Learning And Telemedicine

PTP Options

Point-to-Point				
	Unlicensed	Licensed	Speed Mbps	NLOS
600 Series	Y	Y	150 / 300	Y
500 Series	Y		52 / 105	Y
300 Series	Y		25	Y
200 Series	Y		21	Y
100 Series	Y		7 / 14	

PTP 600 Series Overview

- 2.5, 4.9, 5.4, 5.8, 5.9 GHz frequencies
- Up to 300 Mbps Ethernet data rate
- Up to 124 miles (250 km) range Withstands temperatures from -40° F to +140° F (-40° C to +60° C)
- Survives wind speeds up to 200 mph (320 kph)
- Robust security – unique scrambling plus optional 128/256-bit AES Encryption
- 10 / 100 / 1000 Base T (RJ-45), optional 1000 Base SX
- Small footprint

PTP 600 Integrated with dual built-in antennas

PTP 600 Connectorized – high-gain advantage of external antennas

Power Indoor Unit (PIDU Plus) – Power-over-Ethernet to outdoor units

PTP 500 Series Overview

- 5.4 and 5.8 GHz unlicensed bands
- Up to 105 Mbps Ethernet data rate
- Up to 155 miles (250 km) range
- Built-in lightning protection
- Robust security – unique scrambling plus optional 128/256-bit AES Encryption
- 10 / 100 Base T (RJ-45)
- Small footprint
- Easy to deploy and use

PTP 500 Integrated with dual built-in antennas

PTP 500 Connectorized – high-gain advantage of external antennas

Power Indoor Unit (PIDU Plus) – Power-over-Ethernet to outdoor units

PTP 300 Series Overview

- 5.4 and 5.8 GHz unlicensed bands
- Up to 25 Mbps Ethernet data rate
- Up to 155 miles (250 km) range
- 15 MHz channel size
- Integrated – multiple built-in antennas
- Connectorized – high-gain advantage of external antennas
- Built-in lightning protection
- Robust security – unique scrambling plus optional 128/256-bit AES Encryption
- 10 / 100 Base T (RJ-45)
- Small footprint
- Easy to deploy and use

PTP 300 Integrated with dual built-in antennas

PTP 300 Connectorized – high-gain advantage of external antennas

Power Indoor Unit (PIDU Plus) – Power-over-Ethernet to outdoor units

PTP 200 Overview

- 5.4 GHz
- Up to 21 Mbps Ethernet data rate
- Up to 10 miles (16 km) range
- 10 MHz channel size
- near Line of Sight capable
- Connectorized – operates with a selection of separately purchased antennas (50 ohm N-type)
- Robust security – 56-bit DES or optional 128-bit AES encryption
- 10 / 100 Base T
- Easy to install
- Compatible with existing power supplies, surge suppressors, brackets, software, Prizm and CNUT

PTP 100 Series Overview

- 2.4, 5.2, 5.4 and 5.8 GHz unlicensed bands
- Up to 14 Mbps Ethernet data rate
- Up to 15 mile (24 km) LOS range with passive reflector
- Robust security – unique scrambling plus optional 128/256-bit AES Encryption
- 10 / 100 Base T (RJ-45)
- Small footprint
- Easy to deploy and use

PMP Network Elements

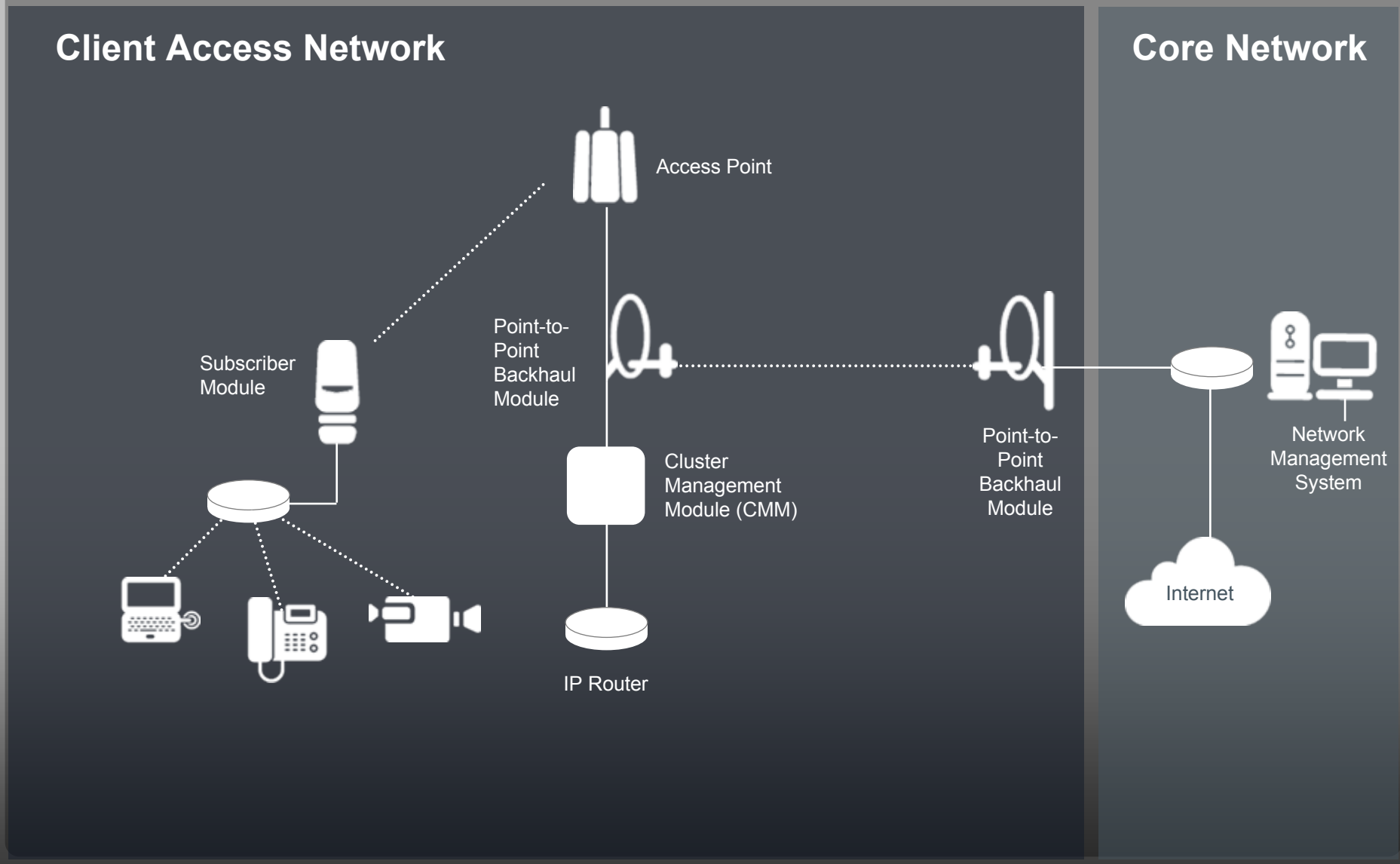
Access Point

Shown with a cluster of 6 AP's

Subscriber Module

360˚ coverage	*Up to 21 Mbps Throughput*
Ability to Co-locate frequencies	*Outdoor/Indoor Option*
120 Mbps signal rate per frequency	*Range Extension Accessories*
GPS Synchronized	*Simple Installation*
Coverage area ~12 – 20 square miles (31-51 sq km)	*Power over Ethernet (7W)*

Access Network Architecture



Motorola PMP Superior Design

Built From the Ground-up for Broadband Access in Outdoor Environments

Line-of-Sight or Non Line-of-Sight

GPS-sync'd For Best Signal

Robust Security

"Zero Footprint" Access Point Installation

Fast, Simple Deployment

Reliable Hardware Performance over Time

Attractive Total Cost of Ownership

Motorola's Broad Range Of PMP Solutions

	500 Series	400 Series	200 Series	100 Series
Typical Application	Residential Enterprise Government	Residential Enterprise Government	Enterprise Government	Residential Enterprise
Total Aggregate Throughput	13.5 Mbps	21 Mbps	14 Mbps	7 Mbps
VoIP Channels	Multiple	Multiple	Multiple	Multiple
Non Line Of Sight	Yes	Yes	No	No
Standards	Compatible with 802.16e CPE	Proprietary	Proprietary	Proprietary

PMP Frequency Options

	500 Series	400 Series	200 Series	100 Series
900 MHz			●	
2.4 GHz			●	●
3.5 GHz Licensed	●			
4.9 GHz Licensed		●		
5.1 GHz			●	●
5.2 GHz			●	●
5.4 GHz		●	●	●
5.7 GHz		●	●	●
5.9 GHz			●	●

PMP 400 Series Overview

- 5.4 GHz unlicensed bands
- 5.7 GHz and 4.9 GHz in 2009
- Up to 21 Mbps Ethernet data rate
- Up to 10 mile (16km) LOS range
- nLoS capable
- 10 / 100 Base T (RJ-45)
- Small footprint
- Easy to deploy and use

PMP 200 Series Overview

- 2.4, 5.2, 5.4 and 5.8 GHz unlicensed bands
- Up to 14 Mbps Ethernet data rate
- Up to 15 mile (24 km) LOS range with passive reflector
- Robust security – unique scrambling plus optional 128/256-bit AES Encryption
- 10 / 100 Base T (RJ-45)
- Small footprint
- Easy to deploy and use

PMP 100 Series Overview

- 2.4, 5.2, 5.4 and 5.8 GHz unlicensed bands
- Up to 7 Mbps Ethernet data rate
- Up to 15 mile (24 km) LOS range with passive reflector
- Robust security – unique scrambling plus optional 128/256-bit AES Encryption
- 10 / 100 Base T (RJ-45)
- Small footprint
- Easy to deploy and use

Mesh Networks

- *Remote Outdoor Access Networks including high-speed mobile handoffs*
- *Video Surveillance Networks*

A MOTOMESH Network Defined

A network of radio transceivers (nodes)

Every node contributes to the network and makes it stronger

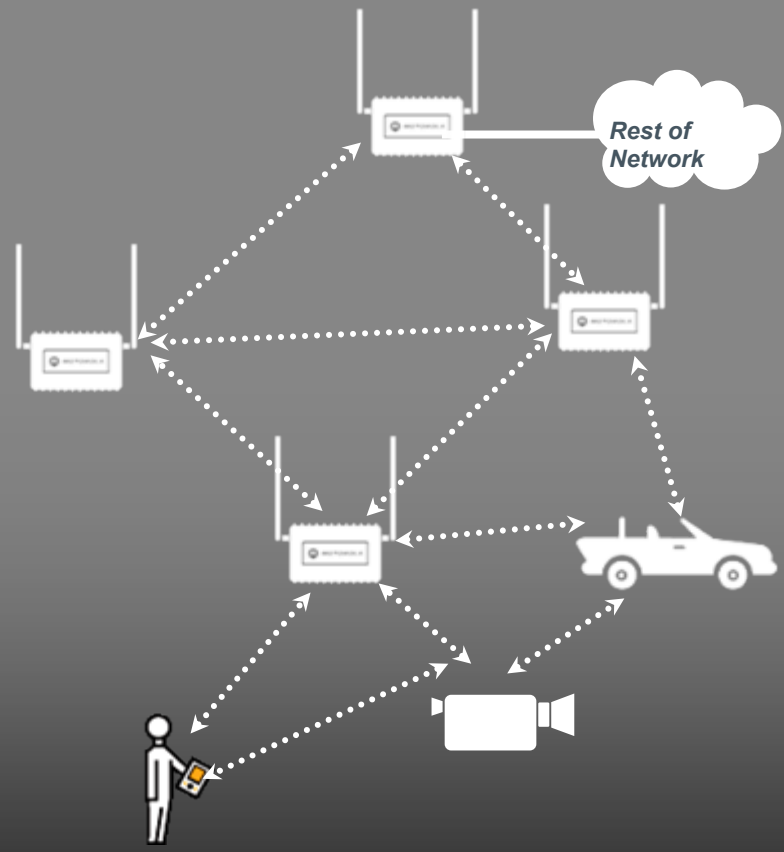
Provides “multi-hop” connectivity between nodes and there is no single point of failure

Benefits of a MOTOMESH Network

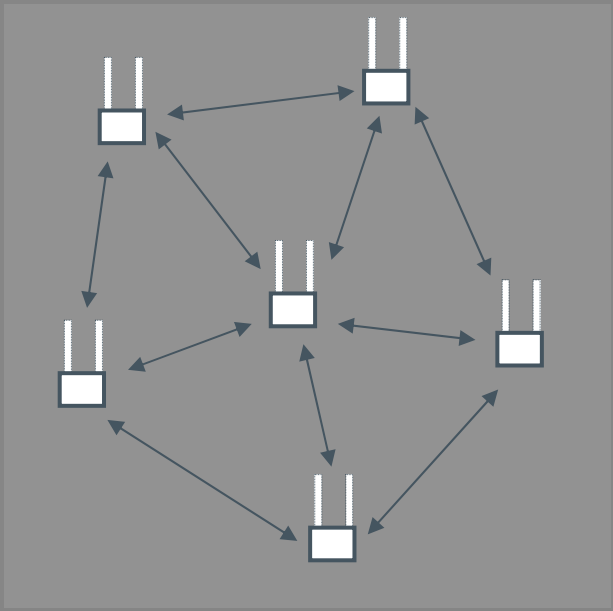
Decentralized architecture

Self-forming, self-healing network that is scalable and flexible

High level of reliability and resiliency



MeshConnex - Offers Different Kinds of Routing

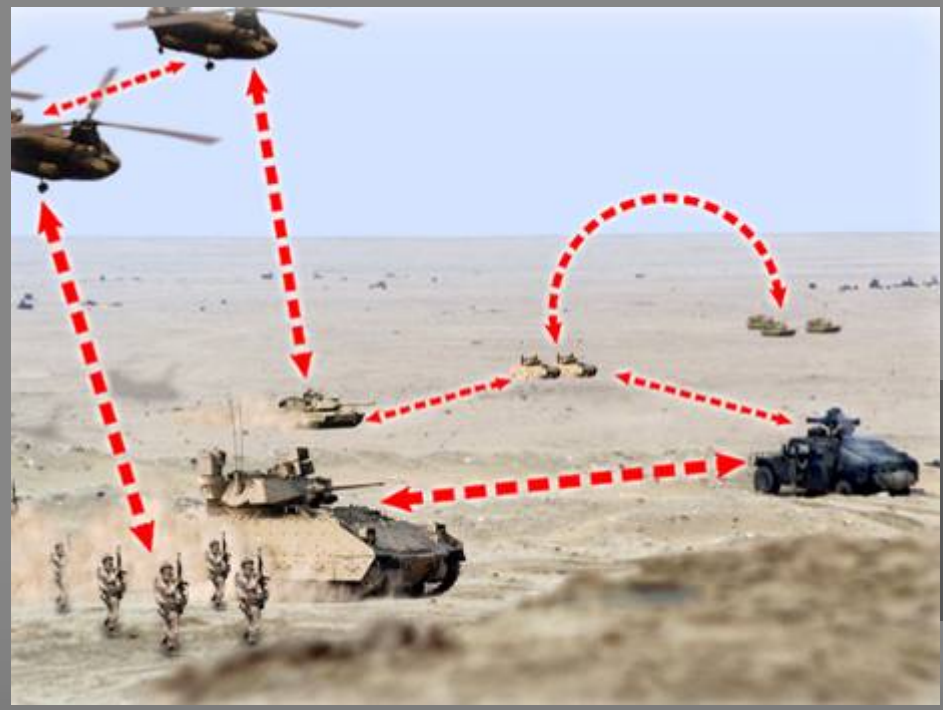


Motorola's MeshConnex™ Routing Engine uses a hybrid proactive and reactive solution, resulting in ultra-fast and scalable networking with low overhead.

- *Proactive*
  - *Pro:* ***All routes are constantly updated for fast communication***
  - *Con:* ***Large networks require too much time to develop and correct routing tables, leading to high overhead and poor scalability***
- *Reactive*
  - *Pro:* ***Only maintains neighbor list***
  - *Con:* ***Slow to react to adverse conditions and increases latency***
- *Hybrid*
  - ***Offers the best of both options by maintaining the primary and secondary routes to the gateway nodes at all times***

Mobility Enabled Access (MEA)

- *An industrial strength technology specifically designed to perform in high interference mobile environments*
- *Technology was originally developed for the US Department of Defense for battlefield communications*
- *Users access the network through purpose built client devices*



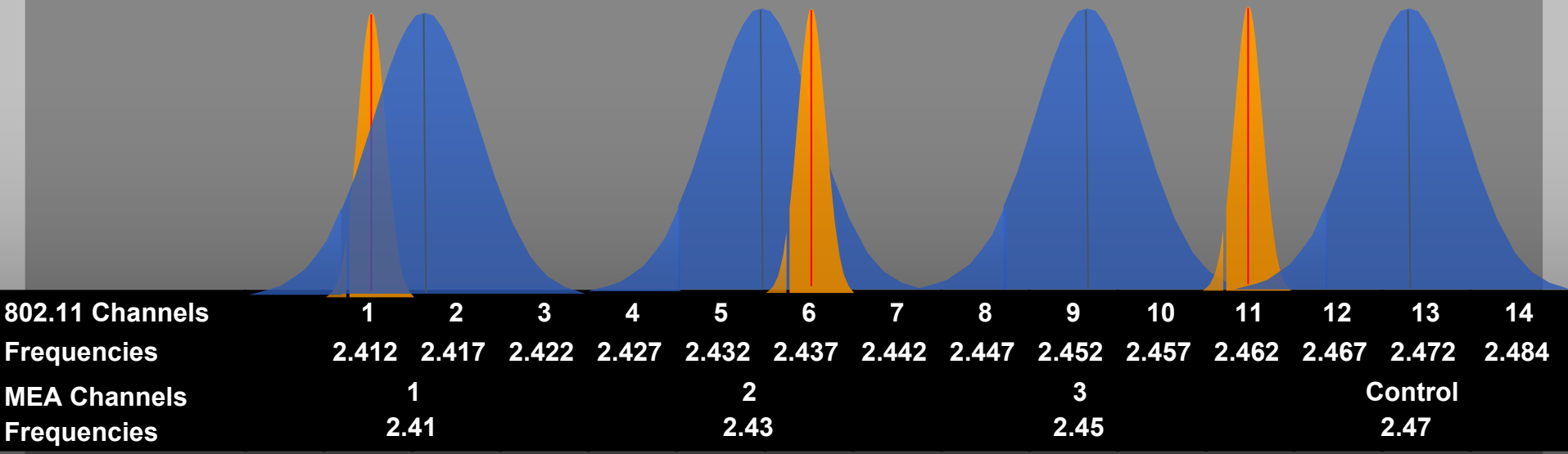
Selecting MEA or WiFi

MEA – Four Channel Radio

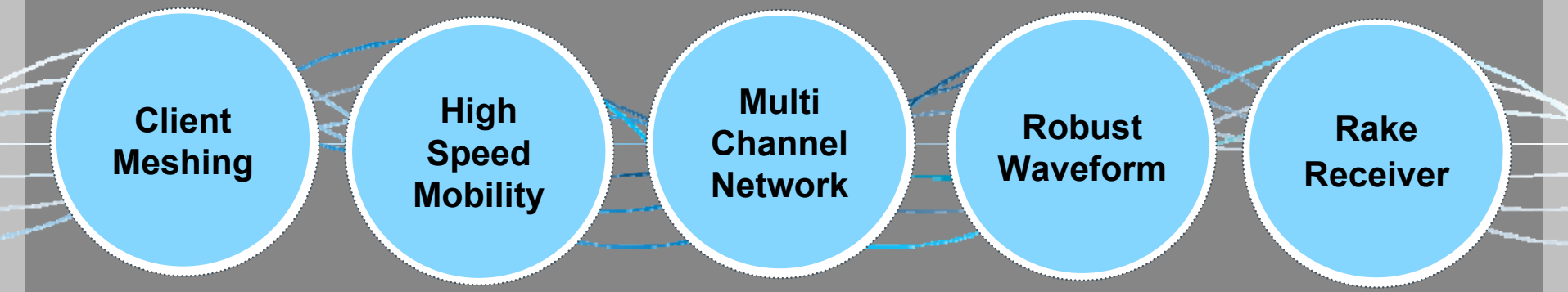
- *Offset channels to limit standard interference*
- *Per packet channel agility*
- *Resilient to normal interference or jamming*
- *Forward error correction handles multi-path*

802.11 - Single Channel Radio

- *Usually channels 1, 6 or 11*
- *No frequency agility*
- *Susceptible to interference, jamming and flooding*
- *Less overhead maximizes throughput*



Solo Succeeds in Harsh Environments



Client Meshing	High Speed Mobility	Multi Channel Network	Robust Waveform	Rake Receiver
Every client is a mesh router, so clients extend the network	Fast moving, changing environment is no problem for a MEA network	Picks best 2.4 GHz channel on a per packet basis	Sends resync probes every 250 uSec	6 uSec equalizer window - absorbs multi-path errors

MOTOMESH Solo Serves Many Markets

Surface Mining
Includes Aggregate and Landfills

Transportation
Light Rail, Buses and Traffic Lights

Public Safety
Police, EMS and Fire

Logistics
Ports, Rail Yards and Airports

What is MOTOMESH Duo?

A lightweight two-radio Wi-Fi meshed network

2.4 GHz Wi-Fi radio (802.11b/g) for access and an 5.8 GHz or 5.4 GHz radio for meshing

Uses advanced software features and network management that meet the needs of small enterprises as well as large citywide deployments

Typical Applications

- Video Surveillance
- High Speed Mobility With Handoffs
- Client Access In Remote / Large Areas
- AMR, Parking Meters

MOTOMESH Duo Network Components

Network Components

- Intelligent Access Points (IAPs) connect to the upstream IP network
- Mesh Wireless Routers (MWRs) extend the mesh network coverage

Client Devices

- All standards-based 802.11 b/g cards
- MC75 and other Symbol devices
- WiFi enabled camera

Element Manager

- Managed by the Motorola One Point Wireless Manager

IAP/MWR

802.11 Cards

MC75

Camera

Management

One Point Wireless Suite

Gov't and enterprise IP networks are evolving.

They are becoming primarily wireless - choosing *wireless by default, wired by exception*.

The Motorola One Point Wireless Suite is a powerful set of software solutions that helps design, deploy and manage wireless networks

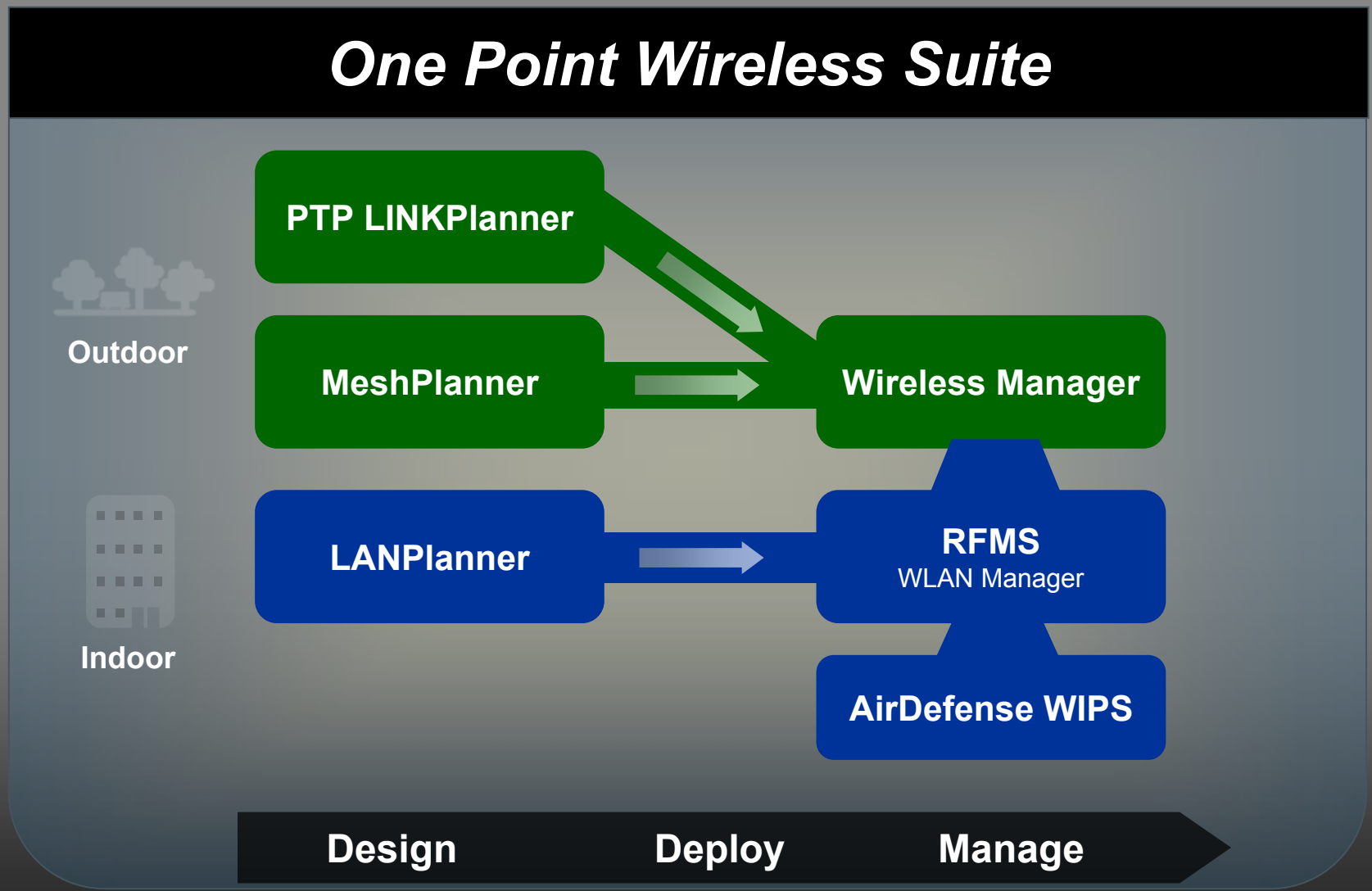
Design – better design leads to more optimal capex spend

Deploy – faster deployment lowers cost and delivers performance

Manage – easier management yields better response to network outages

Design, Deploy and Manage The Network

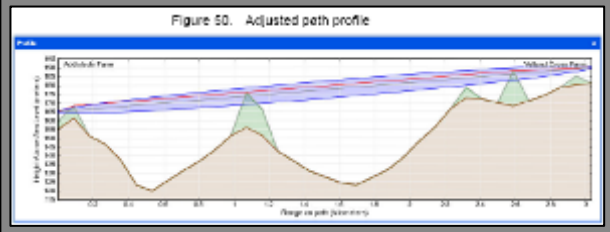
Innovative Motorola Software That Delivers Value



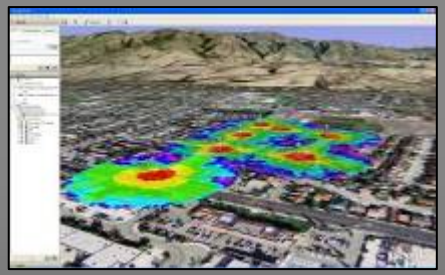
One Point Wireless Suite: Design & Deploy

No More "Spray And Pray"

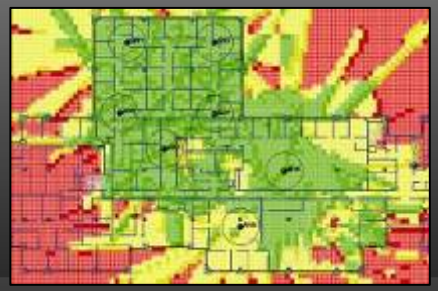
PTP LINKPlanner

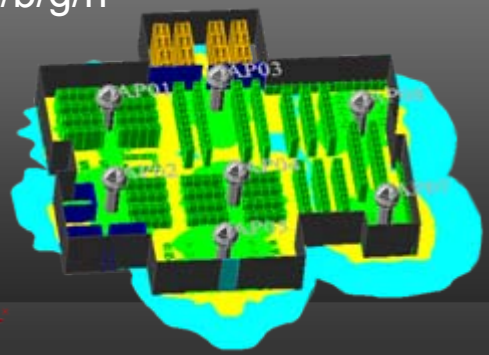


MeshPlanner Mesh and PMP



LANPlanner 802.11a/b/g/n





Features

- **Advanced prediction engines**
- **Factor in environment**
  (terrain, foliage, obstructions, indoor features)
- **Design for LOS, nLOS, NLOS**
- **Auto-place nodes**
- **Intuitive map-based interface**
- **Built-in verification tools**

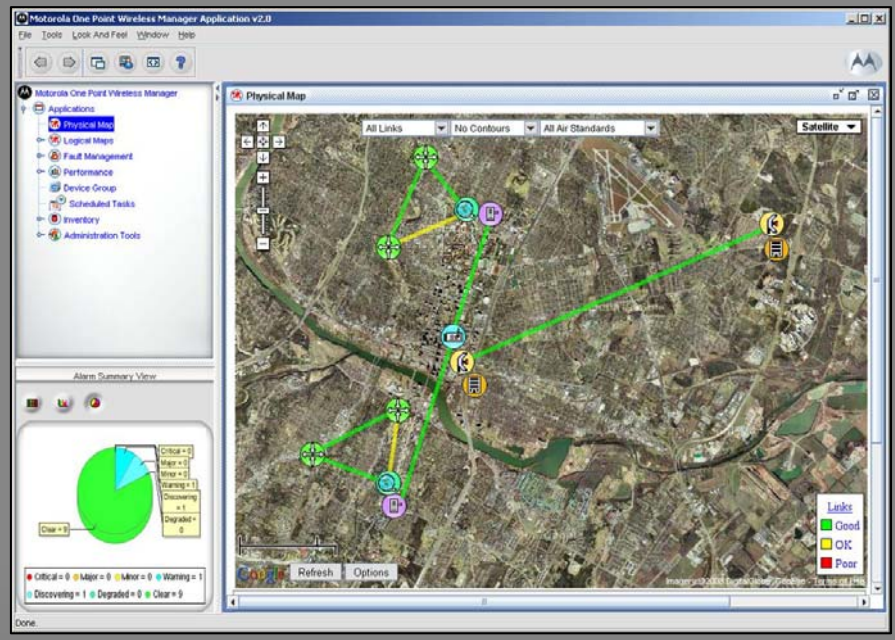
One Point Wireless Manager 2.0

Embedded Google Maps
- Network displayed on a dynamic Google map with pan/zoom
- Live network performance displayed for all wireless network layers

RFMS (WLAN) Integration
- WLAN site real-time performance metrics, alerts, alarms
- Drill-down into RFMS with one click

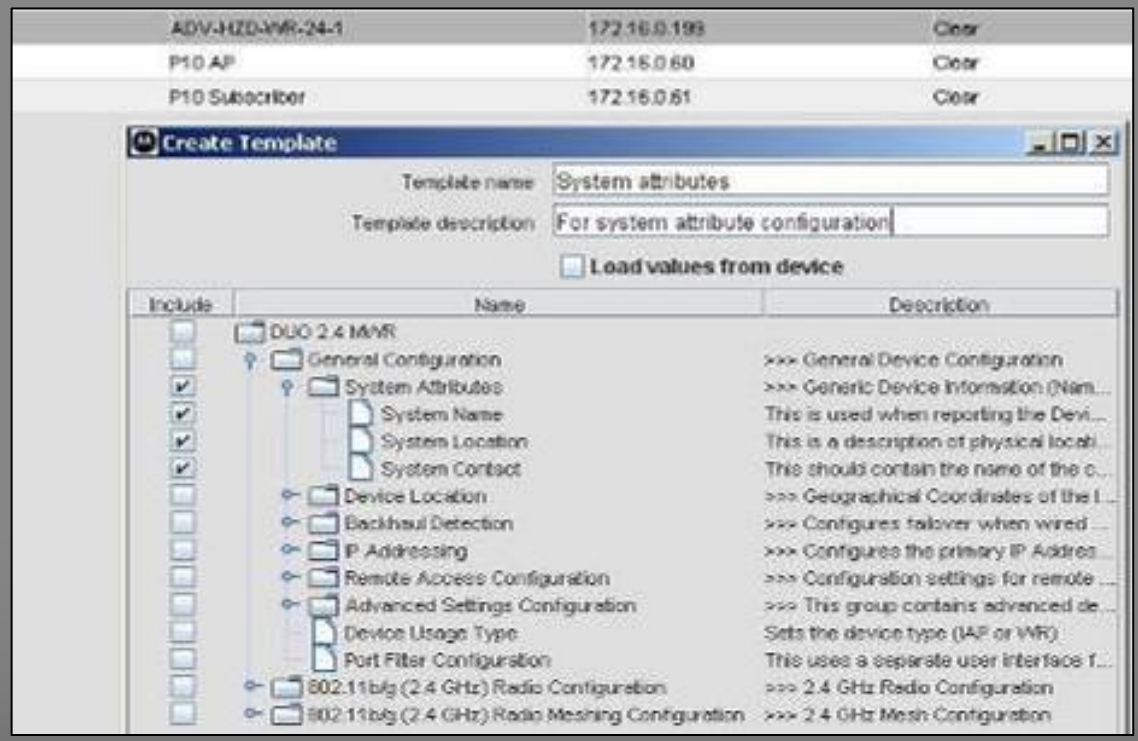
PTP Product Support
- Support configuration management for PTP products
- Integration between PTP LINKPlanner & Wireless Manager

Ongoing MOTOMESH Product Support



Feature Highlights
One Point Wireless Manager 2.0

Configuration Templates



Streamlined provisioning through applying template-based configurations to devices

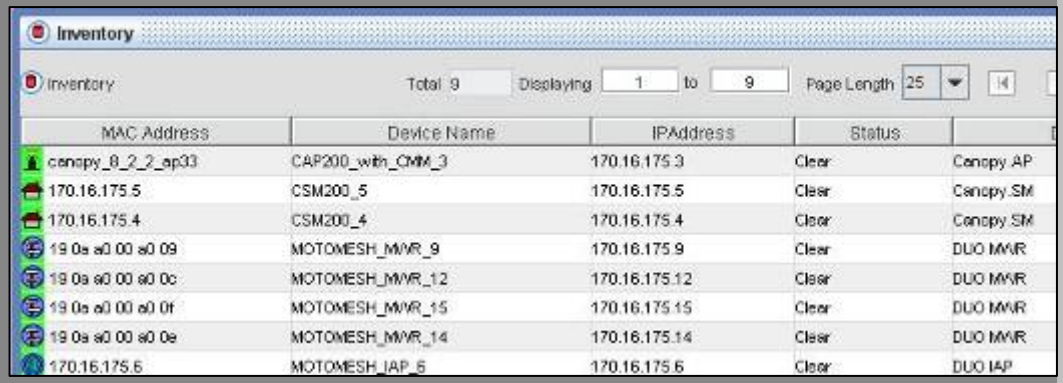
Feature Highlights
One Point Wireless Manager 2.0

Configuration Templates

Auto Discovery and Provisioning

Install Equipment

Appears in inventory list



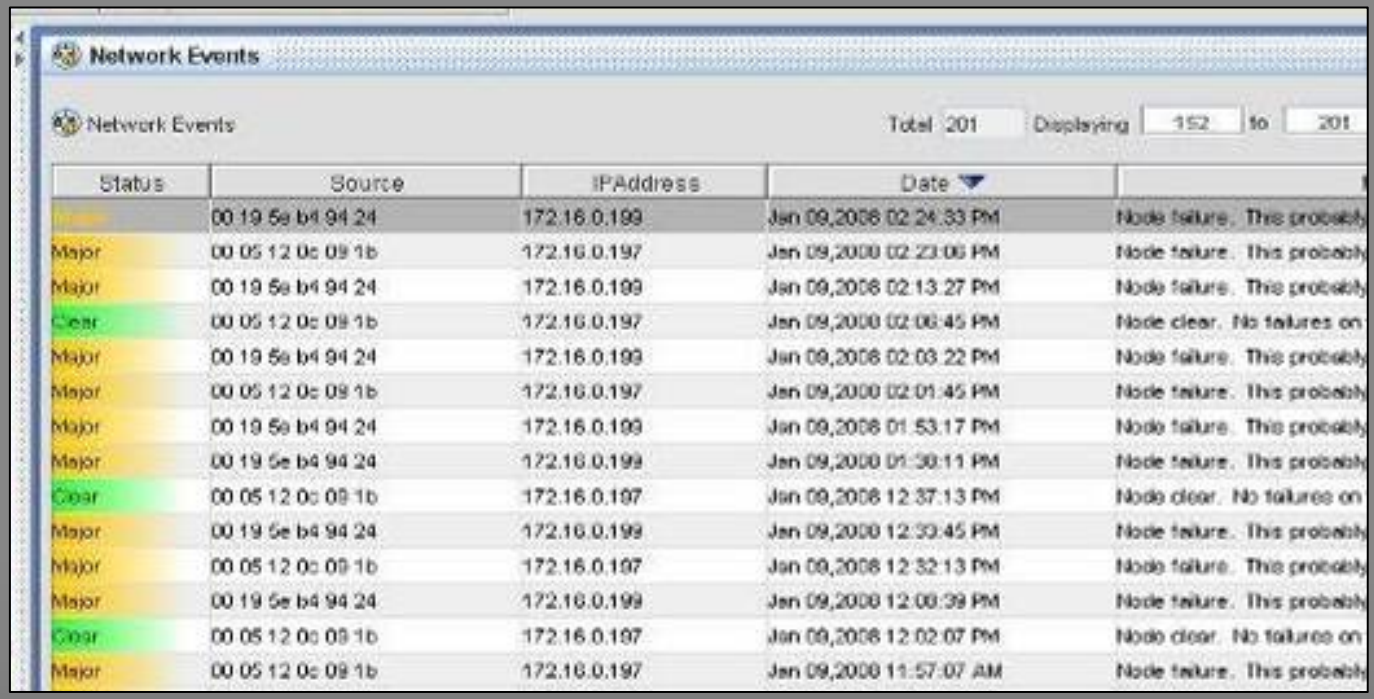
Visualize on map

Feature Highlights
One Point Wireless Manager 2.0

Configuration Templates

Auto Discovery and Provisioning

Fault Management



Enables quick detection and resolution of problems that impact network performance and user satisfaction.

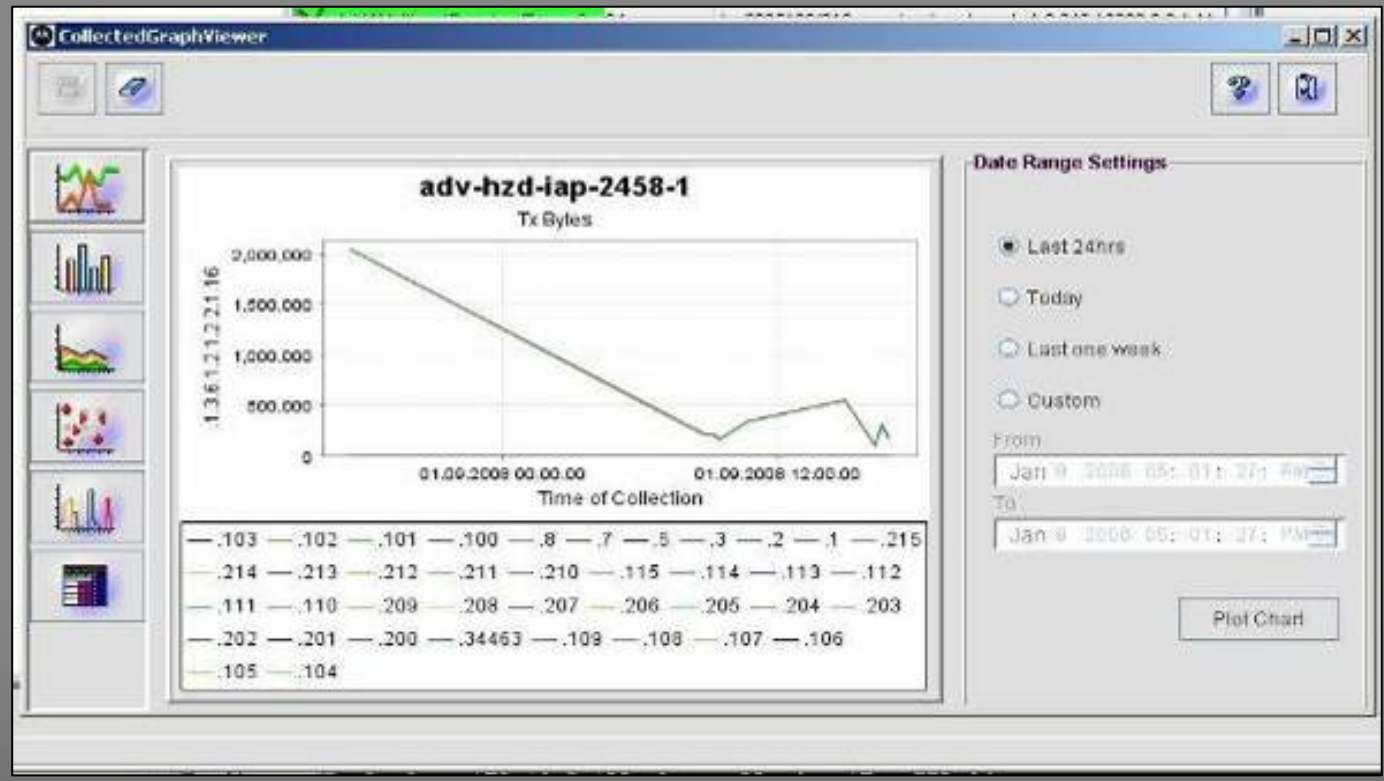
Feature Highlights
One Point Wireless Manager 2.0

Configuration Templates

Auto Discovery and Provisioning

Fault Management

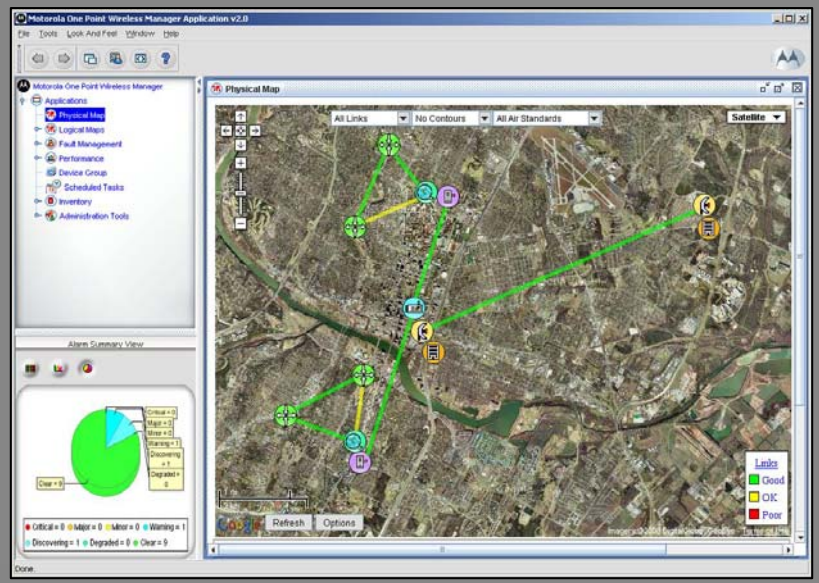
Performance Reporting



View pre-defined or custom reports for a health check of the network at any given point in time.

Feature Highlights
One Point Wireless Manager 2.0

- Configuration Templates
- Auto Discovery and Provisioning
- Fault Management
- Performance Reporting
- Map Visualization

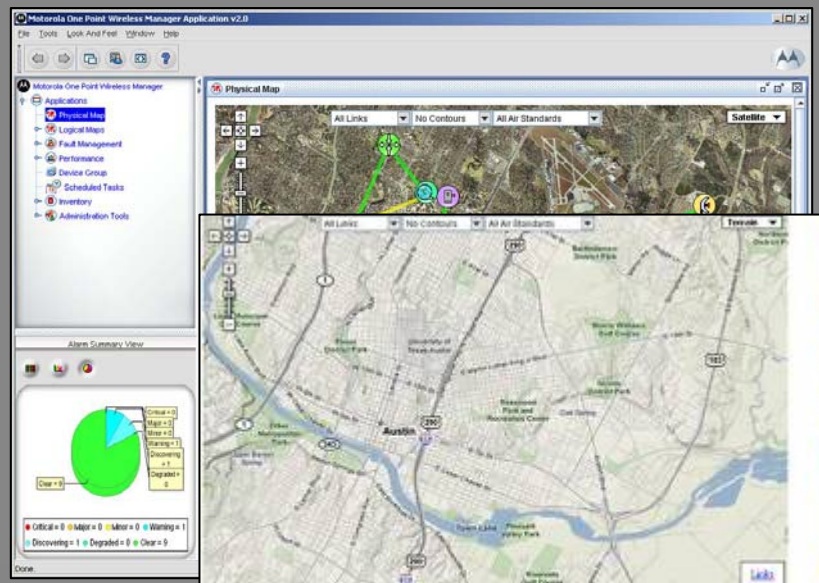


Coverage Estimate

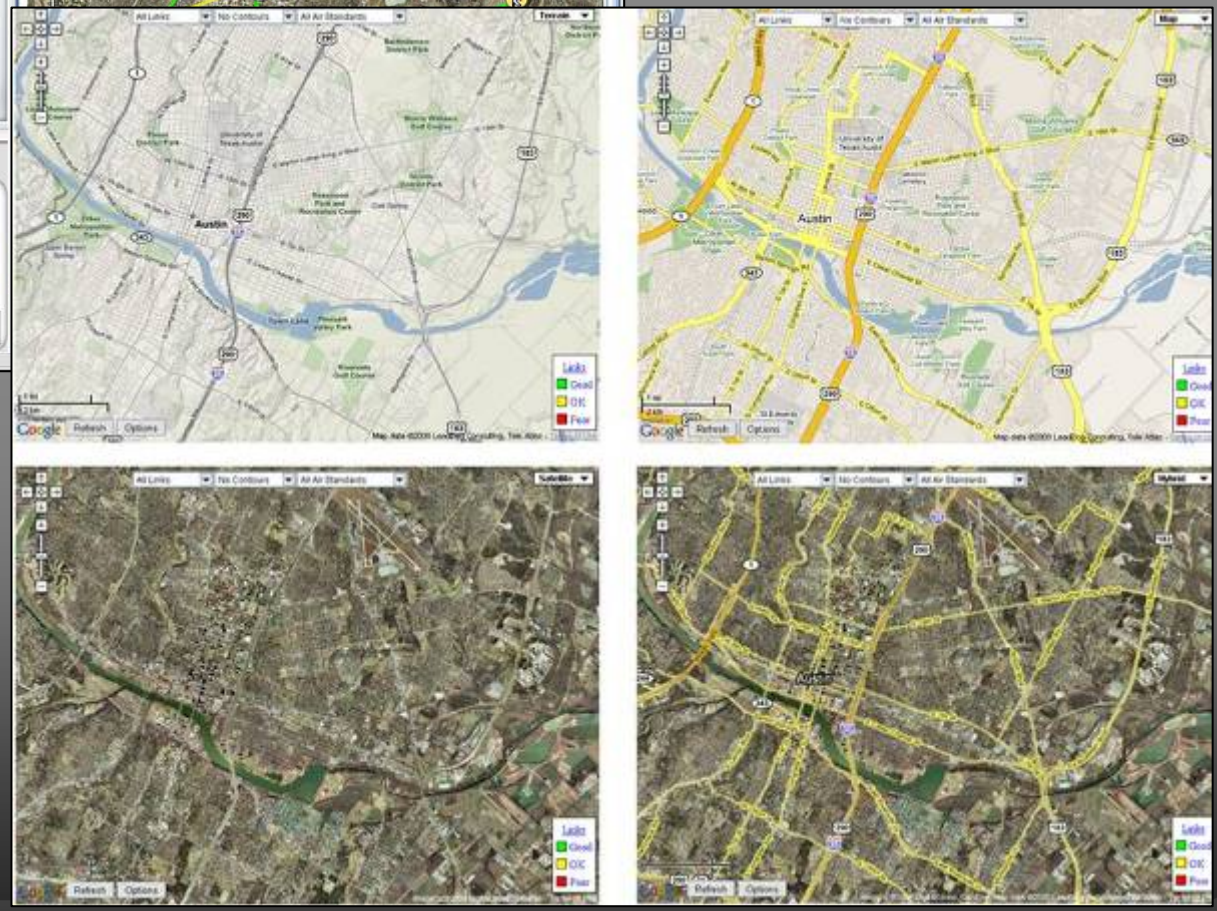
Unified Network View

Feature Highlights
One Point Wireless Manager 2.0

- Configuration Templates
- Auto Discovery and Provisioning
- Fault Management
- Performance Reporting
- Map Visualization

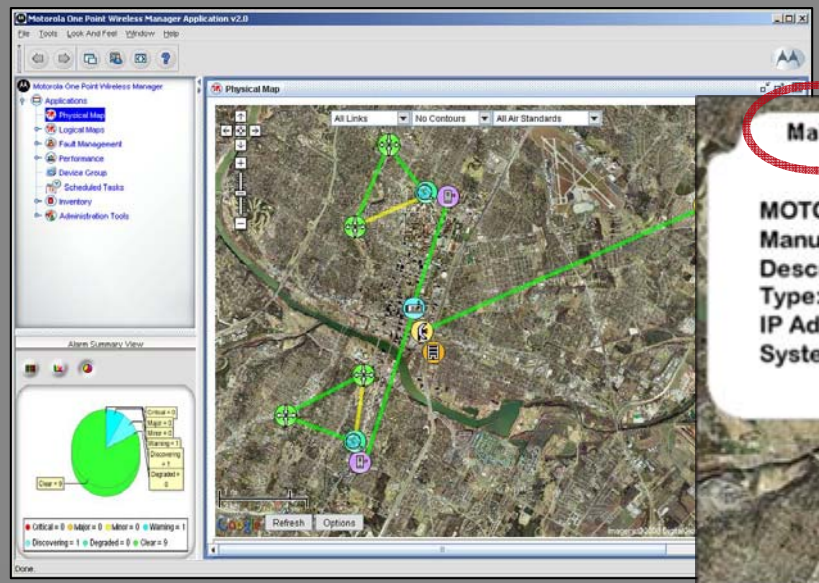


Map View Options

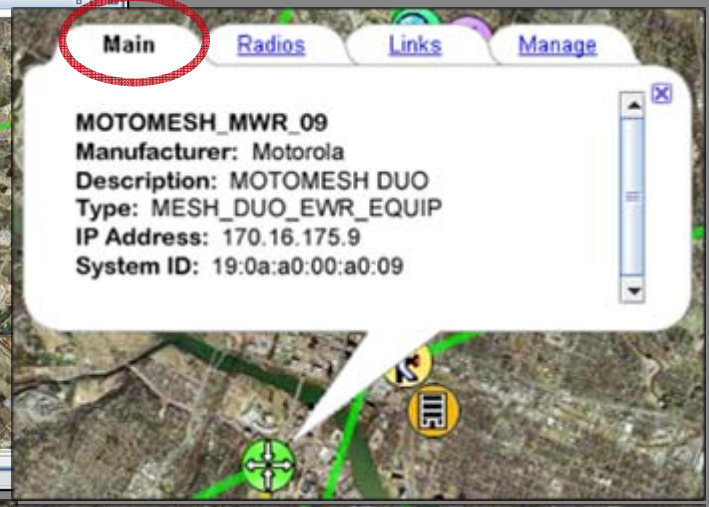


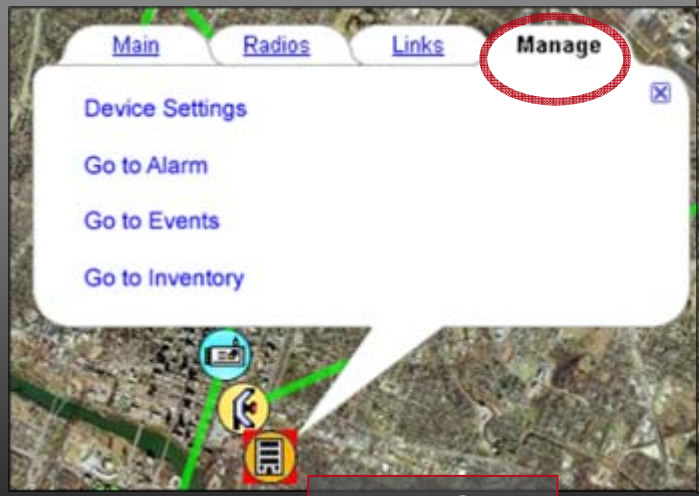
Feature Highlights
One Point Wireless Manager 2.0

- Configuration Templates
- Auto Discovery and Provisioning
- Fault Management
- Performance Reporting
- Map Visualization



Node Management

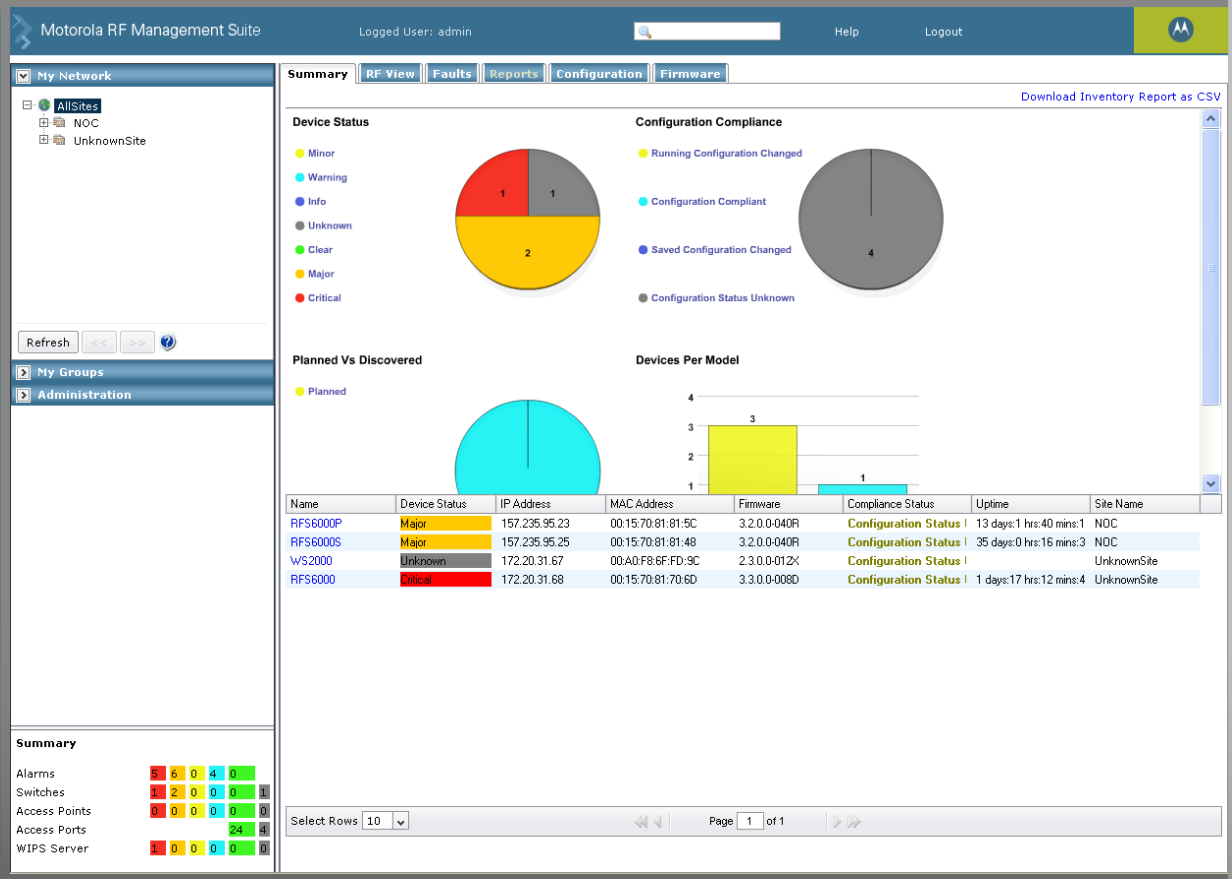




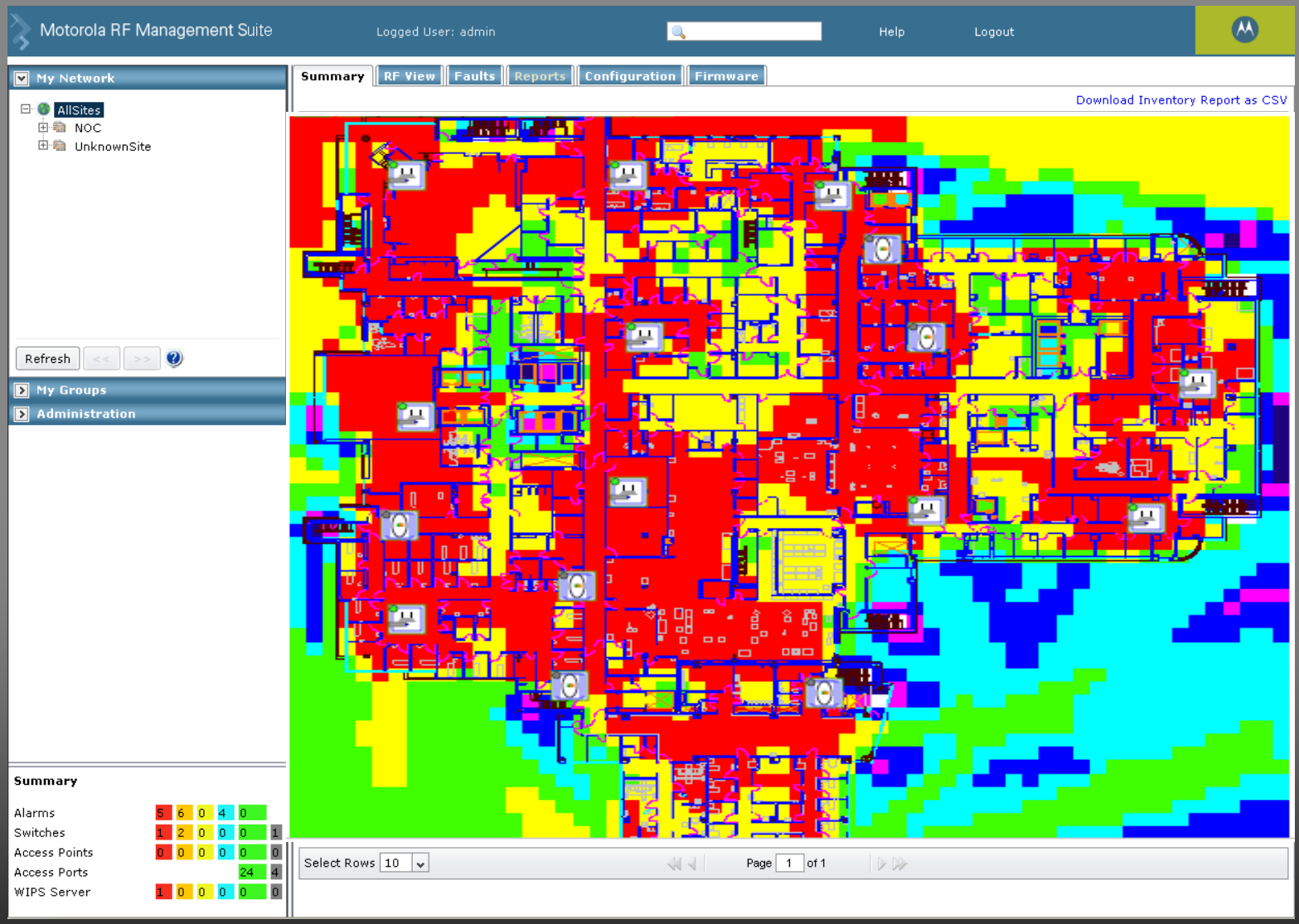
WLAN Site

One Point RF Management System

- Device Count, Alarm Status, Configuration Compliance
- Planned vs. Discovered Devices
- Breakdown By Model
- Customized Graphs For Key Statistics Based On Sites, Floors And Individual Devices
- Heat Map Of Coverage
- Channel Map Visualization
- Ability To Recognize Interference Across Multi-floor Environments



RFMS Prediction of Network Performance



Broadband Outdoor Security Features

Wireless Security is a must in today's enterprise

AES	FIPS 197 Certified Advanced Encryption Standard (AES) encryption is a 128-bit encryption standard that meets the security requirements of federal, municipal, financial and health care institutions.
DES	DES (Data Encryption Standard) encryption that provides 56-bit encryption.
BRAID Key Encryption	The AES key is encrypted by Motorola's 128-bit Telecommunications Industry Association (TIA) standard BRAID algorithm making it more secure than others in the market.
GPS Syncronization	The PMP system's unique synchronization technique provides higher security than 802.11 alternatives by requiring precise synchronization from all modules in the network.
Authentication	PMP modules can be scheduled to periodically exchange a random number "challenge" to authenticate system users and keep out "rogue" modules.
Add'l Signal Scrambling	PTP 300/500/600 have these add'l security features: - Reed Solomon forward error correction. - Scrambling code that repeats every eight Reed-Solomon code words (about 1 ms). - Interleaver where the signal is then changed in order - Convolutional Encoding : signal is scrambled into two streams and then sent serially with some bits unsent. - Encoding into BPSK, QPSK, 16QAM or 64QAM waveforms - Interleaving across a 1024 carrier OFDM wave form.
Wi-Fi Security	WPA2 (IEEE 802.11i) with AES

Proven Solutions From Motorola

Motorola Wireless Broadband solutions are proven and deployed in more than 120 countries today.

10,000+ Networks
Enterprise
Service Provider
Government

Applications
Video
Data
Voice

Climates
High Altitude
Dense Urban
Long Range Over Water
Desert

Over 100 Case Studies Available

Industry Awards

Respected by the Industry for Innovation, Leadership and Reliability

2008	• RuraliTIC Award for Innovation in Infrastructure and Services • The Queen's Award for Enterprise in Innovation • Network Products Guide 2008 Product Innovation Award
2007	• WiMAX World Europe – Innovation Award for WiMAX CPEi200/300 • NXTComm Award for Innovation • Wireless Broadband Innovation Award • The Queen's Award for Enterprise in Innovation • NXTComm Award for Network Design/Services
2006	• Network Computing Well-Connected Award • CTIA Innovation Contest Runner Up
2005	• TIA SUPERQuest Award • Network Computing Editor's Choice Award For Best Fixed Wireless System • America's Network Best of WiMAX World
2004	• PART15.ORG Manufacturer of the Year

Motorola Wireless Broadband Solutions

- *Field proven reliability*
- *Industry leading technology*
- *Proven ROI*
- *Broad portfolio of Solutions*
- *Heritage in Outdoor Wireless Connectivity*
- *Relentless Focus on Quality*

FOR FURTHER INFORMATION PLEASE CONTACT:
AZOTEL TECHNOLOGIES LTD
RIVER HOUSE
BLACKPOOL PARK
CORK
IRELAND
T: +353 21 467 1600
E: INFO@AZOTEL.COM
W: WWW.AZOTEL.COM