



Motorola's NBBS WiMAX Solution





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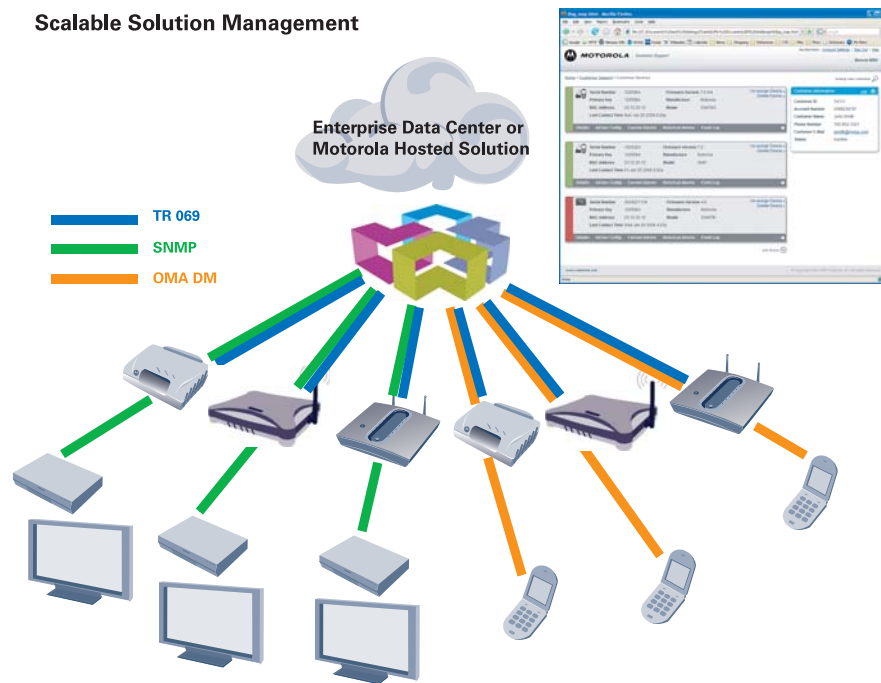
Introduction

Motorola NBBS Device Management Platform enables operators to remotely access the subscriber devices they deploy. It enables automated deployment, monitoring, and issue resolution of the full portfolio of consumer devices, including mobiles phones, residential gateways, VoIP terminal adapter and set-tops. NBBS is a scalable, carrier-grade system that goes beyond management of devices to support the full network of the subscriber's devices and to enable the rapid introduction and support of services.

This Solution Brief describes how the Motorola NBBS solution solves critical challenges related to WiMAX service deployments. Motorola NBBS is a device management engine that supports a broad array of standard device management protocols. It is specifically architected to address the challenges of managing millions of devices with a single server. NBBS supports the full portfolio of WiMAX devices, including CPEs, PC Cards, and handsets, via TR-069 and OAM-DM management protocols. Motorola NBBS complies with WiMAX Forum OTA device management specifications.

Motorola NBBS also provides extensible northbound interfaces to service providers' existing OSS systems for seamless integration into billing, network management, customer support, or other established systems.

Scalable Solution Management



NBBS Core Platform Overview

Motorola NBBS is a carrier-grade software application that runs on standard third-party hardware — typically Sun Solaris servers. NBBS manages auto-configuration, monitoring, and management of IP-based devices over multiple protocols. NBBS offers enhanced device management capabilities, including:

- The ability to manage devices using TR-069, OMA-DM, SNMP, CLI, HTTP, and LAN-side proxy applets. Service providers can manage many different devices from different vendors at the network edge or on the LAN behind the gateway.
- GUI-based scripting language, which provides the flexibility to create and modify work flows for executing policy across any group of elements and interfaces.
- Consistent policy management across multiple device types.
- Hierarchical architecture, which allows device partitioning with secure access levels for a variety of domains and users.

- Extensible northbound interfaces to service providers' existing OSS systems for seamless integration into billing, settlement, customer support, or other established systems.
- SNMP interface to higher level NMS / Fault management system.
- Subscriber Network –WiMAX CPE LAN side- management. This may include PCs, terminal adapters, and IPTV set-top boxes.
- Role-Based Access Control.

Motorola NBBS interacts with various types of system users to manage the provisioning of IP Services to devices. Typical NBBS users may include subscribers (or end-users), network administrators, help desk personnel, and order processing personnel and/or product managers. These users provide input to NBBS or extract data from NBBS at various stages of the IP service provisioning process. NBBS coordinates the exchange of information with these users through its system interfaces and ultimately translates their input into configuration changes that are applied to IP equipment to enable/monitor IP Services.

NBBS WiMAX Solution

The NBBS WiMAX solution provides WiMAX device management capabilities using both OAM-DM and TR-069 management protocols, as defined by the WiMAX Forum's standards. The main functions provided by the NBBS platform are:

- WiMAX Activation and Continuous Provisioning
- WiMAX Monitoring and Trending
- WiMAX Alarming
- WiMAX Troubleshooting
- WiMAX Reporting
- Management of group devices through campaigns

Because the NBBS WiMAX solution is based on industry standard, it can manage Motorola and third-party WiMAX devices. Motorola provides certification and integration services for third party devices to verify compliance to WiMAX provisioning standards and to integrate those devices into NBBS.

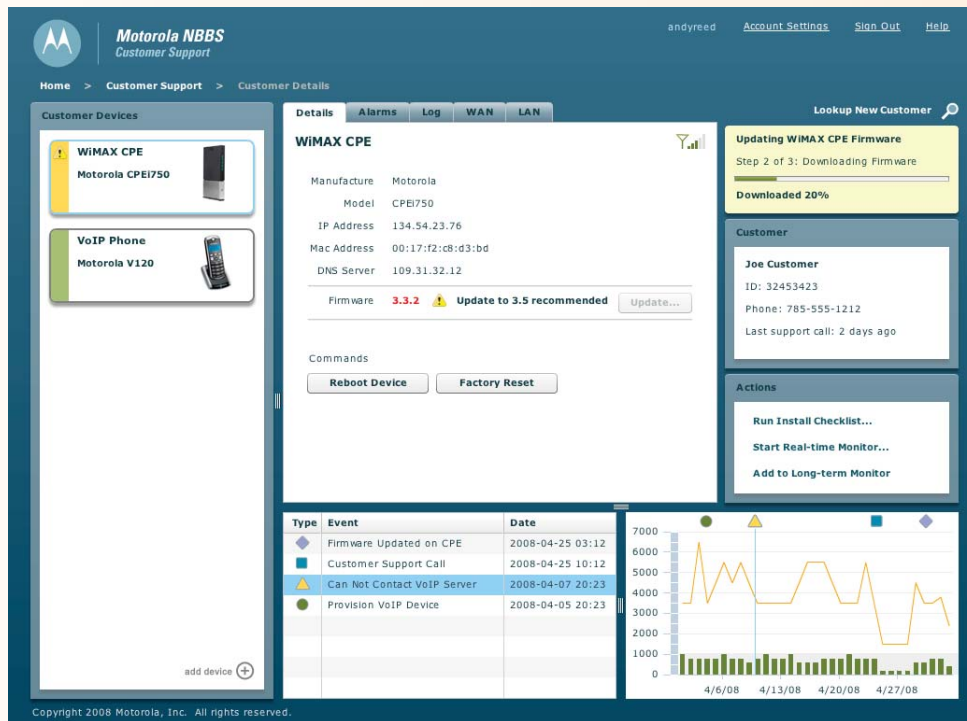
The focus of this Solution Brief is the use of NBBS for management of WiMAX devices. It is important to note, however, that NBBS is inherently designed for and capable of management of all categories of devices. NBBS has the ability to view and manage the entire subscriber network, not just the WiMAX devices. For example, NBBS can view the devices on the LAN side of a WiMAX CPE; this may include PCs, terminal adapters, and IPTV Set-tops. NBBS has the ability to monitor and correlate all the devices on the LAN side, which gives the provider a comprehensive view of the interactions on the LAN and assists in fault isolation, resulting in potential time and cost savings.

WiMAX Activation and Continuous Provisioning

Activation

The NBBS WiMAX solution supports zero-touch device activation and service provisioning. The device will automatically connect to the network when powered up without any customer intervention.

Device activation involves enabling a device to access the WiMAX network services. The device can be an unlocked/un-subsidized or a prepaid purchased through a retail store or direct mail order. NBBS also allows the operator to deactivate a device (or group of devices) in a network.



WiMAX configuration

WiMAX configuration includes provisioning the device with the parameters necessary to operate in a particular network. The device stores the data and reports the status as requested by the device management server. If some network configuration changes, WiMAX devices can be re-provisioned at any time.

Service Configuration

The device may support service beyond baseline WiMAX. NBBS enables enhanced services, such as VoIP and Wi-Fi®, to be configured. When a service provider changes its platform for a data service, an updating campaign can be scheduled to automatically re-provision a group of devices.

Software and Firmware Management

NBBS supports policy-based software management. During activation, the system will verify the software/firmware version on the device, and can automatically upgrade the software to the latest supported version, as appropriate.

Personalization

Personalization is typically used for mobile device management. It allows the service provider and/or the device owner to download multi-media objects (backdrops, ring-tones, music, etc.) from a content server. For example, this can enable retail mobile devices to automatically be loaded with the carrier's standard desktop.

WiMAX Monitoring and Trending

Motorola has deployed the WiMAX access network, IMS core, network /device management elements, and professional services to Wateen Telecom, a company offering residential and corporate voice, applications, and data services nationwide. This is the largest Commercial 802.16e WiMAX and IMS deployment in the world today. There are currently 300,000 paying subscribers on this network (with plans to expand to 1M Subs by 2009).

This Motorola end-to-end solution is comprised of:

- Provides residential and corporate users with high-speed Internet, voice, and applications via VoIP technology.
- Offers corporations efficient hosted PBX and IP Centrex Solution.
- Enables sophisticated IMS based applications today, with a path to a true Fixed Mobile Convergent network for the future.



The Motorola NBBS provides added value monitoring and trending of remote devices, including the ability to collect, analyze, and store events over a longer span of time than the device is able to support due to memory limitations. Monitoring and trending can be used to track network performance against SLAs and can be requested on-demand or scheduled to run periodically.

The Motorola NBBS WiMAX solution offers the carrier the ability to monitor and trend data in three categories:

- General Trending — Entire population and infrequent interval
- Aggressive Trending — Small groups of devices with greater frequency
- Debug Trending — High frequency, highly detailed data collection

The NBBS WiMAX solution lets the carrier decide what statistics to trend and how long to keep the data. Some typical trending data sets might include signal strength, frame error rate, carrier to interference and noise ratio, availability, and throughput.

General Trending

General trending is always enabled and collects information to provide insight into the long-term growth and quality of the WiMAX solution. The data is collected at relatively infrequent intervals, such as daily or weekly. It is the responsibility of the device to collect and maintain this data over that time period until it is passed to the NBBS server.

General trending applies to the entire population of WiMAX devices in the database, which may be millions of devices. The amount of data collected, how long it is stored, and its value to maintaining the service offering must be balanced against the computing resources and database storage needed for that data.

Aggressive Trending

Aggressive Trending monitors a small group of devices (100 to 1000) with greater frequency than general trending and also collects more detailed data. Aggressive Trending is not enabled by default. It is designed to help network operations diagnose the scope of a service issue at the edge of the network. Aggressive Trending may run for hours or days, during which alarms are created for error conditions. The real time results are displayed in the help desk user interface. The operator has the option of saving results in report form in the NBBS database for future reference.

Debug Trending

Debug Trending is a high frequency, highly detailed data collection tool. Debug Trending is limited to a few WiMAX devices at a time — typically no more than five — and is used to track down issues within the subscriber's device or service. When enabled it collects data at a very high rate and is intended to help a support agent diagnosis of a problem in real time. The results are displayed in the help desk user interface and data is not kept once the support session is over.

WiMAX Alarming

Given the large number of devices present in typical WiMAX deployments, it is critical to have event-driven alarming rather than relying on traditional device polling solutions. NBBS provides event-driven alarming by utilizing the active and passive notifications for both CPE and mobile devices. The NBBS WiMAX solution supports two types of alarms: Device Alarms and Derived Alarms.

The screenshot shows the Motorola NBBS Monitor interface. The top navigation bar includes 'Home > Monitor > Alarms'. The main content area is titled 'Alarms' and contains a table with the following data:

Location	Type	Alarm	Time
(3) North Bay			
(5) South Bay			
(1) ASN-GW 02			
STB 32998798762	IPTV	Hard Disk Failure	2008-06-11 20:12:12
(2) ASN-GW 05			
WIMAX 32998345644	WIMAX	Can not contact AAA server	2008-06-11 19:33:36
Multiple CPE's	Derived	Multiple CPE's (32) can't contact the DNS server	2008-06-11 19:33:36
(2) ASN-GW 15			

Total Alarms: 8

Device Alarms

Device Alarms are initiated by the device and are asynchronously sent to NBBS. Active or critical device alarms are sent immediately when they occur. Passive or minor device alarms are not passed to the server until the next regular contact, typically once a day or so. Classifying alarms into these two categories help keep the server from getting overloaded with alarm storms.

Typical Device Alarms include:

- Security / Integrity violation Alarm
- Availability Alarm
- QoS Alarm
- Local Configuration change Event

Derived Alarms

Derived Alarms are created using the NBBS correlation engine. NBBS uses the general and aggressive trending data to find data patterns and correlations. These alarms are derived from the data.

WiMAX Resolution Toolset

The NBBS WiMAX solution extends the NBBS help desk user interface to include real time resolution tools specifically tailored to reduce the time needed to detect, diagnose, and resolve WiMAX problems pertaining to the device or the network. There are four classes of functionality:

- Diagnostics
- Service Restoration
- Policy Enforcement
- Administration

Diagnostics

Diagnostics allow the service provider help desk to proactively view status and run diagnostics on managed devices. These tools assist in finding actual or potential problems through remote device interrogation and trouble isolation.

- Device Self Test Diagnostics — NBBS invokes the general hardware device diagnostic (provided by the device manufacturer) and displays the results in the help desk user interface.
- View Device logs — Retrieve the device logs and display in the help desk user interface.
- View Device Parameters — The agent can look at all (or a subset) of the parameters that the device supports. This is typically a Tier 2 support function.
- Set Device Parameters — The agent can look at all, or a subset, of the parameters that the device supports and modify the writable parameters. This is typically a Tier 3 support function.

Service Restoration

The following features assist the help desk agent in restoring device functionality.

- Backup and Restore — The operator and/or user can initiate a backup of the device configuration as well as the personal information. Personal backup information is typically used for mobile devices and can include backup of the subscriber's phonebook, images, ringtones, pictures etc. The backup is maintained on the NBBS database. The information can be restored to the device through device restoration feature.
- Reboot the Device — The device can be rebooted from the support user interface. The system will indicate when the device re-contacts the server after rebooting.
- Updating Device firmware — The device is updated with a new firmware image.

Policy Enforcement

Policies define a set of rules that are enforced by the management server. The policies should be able to be applied to either specific device instances or classifications of devices (dynamically applied based on serving AP, manufacturer, model, etc). The Motorola NBBS WiMAX solution includes the following default policy:

- Firmware Policy — For every device model, the server can ensure that the device is running the target firmware version. For devices that are out of policy, the system can either schedule an upgrade or log an event.
- VoIP Service Policy — If VoIP service is activated for a specific device, NBBS verifies the WiMAX device is properly configured to provide the service.

Administration

The following features are designed to aid the service provider in managing devices that have security, service or billing issues.

- Device hot-lining — Hot-lining is a useful feature for service providers to resolve service problems or billing issues with subscriber devices. From a remote device management perspective, the DMS is used to flag or de-activate the service/device when the device is hot-lined. Hot-lining is a network-wide operation that involves filtering and re-routing all network traffic emanating from the device to a specific set of endpoints; for example, a subscriber who has not paid their bill can be limited to viewing the carrier's billing portal.

- Security quarantine — Security quarantine is a network-wide operation that allows the service provider to quarantine a device that is behaving suspiciously or that has insecure firmware. The quarantine can remain in effect until the situation that caused the quarantine is resolved. The DMS is used to deactivate the service/device.

WiMAX Reporting

Reporting provides a visual representation of the device operational data. Reports can combine collected alarms, events, and performance information with static information (such as the network topology/ geography or by subscriber group) to help provide analysis and insight into the trends and operational issues of the WiMAX service. Report categories include Performance, Fault, and Inventory.

Performance and Fault Reporting

Reports can be defined through the NBBS GUI by selecting a defined report, the target devices, and the collection period of time. A report is defined by selecting a group of parameters from the available counters set. The list of available parameters include Downlink RSSI and CINR, channel quality indicator (CQICH), transmit power level, total number of received and transmitted frames, transmit headroom, occupied bandwidth, number of transmitted Hybrid Automatic Request (HARQ) frames, number of retransmitted Automatic Repeat reQuest (ARQ) frames, handover attempts / successes / failures, initial ranging successes / failures, airlink connect time, airlink security status, number of received and transmitted packets, downlink and uplink traffic rate, rate limiter stats, etc.

The NBBS WiMAX solution provides for the three types of reporting for performance and fault information:

- General Trending Data Reporting
- Aggressive Trending Data Reporting
- Debug Trending Data Reporting

General trending reports provide information collected from the entire device population and help identify trends in the overall service. Reports can be customized; standard reports include:

- Utilization Report
- WAN Link Warning Areas — This report presents a predictive summary of the locations that are having (or close to having) WiMAX service issues related to insufficient bandwidth. This can include a network topology view or a physical mapping view.

Aggressive trending reports are available as both printed reports and interactive reports in the help desk user interface. These reports are commonly used by the network operations staff to track down system problems at the edge of the network. Reports can be customized; however, popular reports include:

- WiMAX Exception Report — This report scans the trended data for devices that have parameter values outside specified ranges. The tabular report highlights the parameters in question for a specified time period over a defined set of locations. This can include a network topology view or a physical mapping view.
- Monitor WiMAX Errors — Errors are displayed over a definable time period for a specified set of devices. For example all devices connected to a particular WiMAX access point. The display is updated dynamically when new samples are available.

Debug trending reports are interactive reports in the help desk user interface. The subscriber support staff can monitor the subscriber's device or home network using these reports. Reports can be customized, with an example report being:

- Monitor Overall WiMAX — Statistics are displayed over a definable period of time for the specified device(s). The display is updated dynamically when new samples are available.

Inventory Reports

- System Inventory Report — This report provides the list of software version and hardware identifications of the device.
- Change Audit Report

Groups and Campaigns

One of the most powerful aspects of the NBBS is its ability to define and manage groups of devices. These capabilities improve the efficiency of the carrier's operations through the gamut of tasks, including deployment, monitoring, and issue resolution.

An example group is all the devices connected to a WiMAX access point. The service provider can then monitor the performance of this group of devices to get a detailed view of network performance, and to anticipate the need to add capacity to the network.

A second group example is an enterprise set of devices. The service provider may be delivering broadband wireless services to an enterprise with distributed locations and dozens (or more) of access points. The 'group' capability allows the carrier to monitor all of the enterprise devices from a single screen, and to verify SLA compliance.

If an issue is seen, resolution procedures can be applied to individual devices, or to all devices in the group.

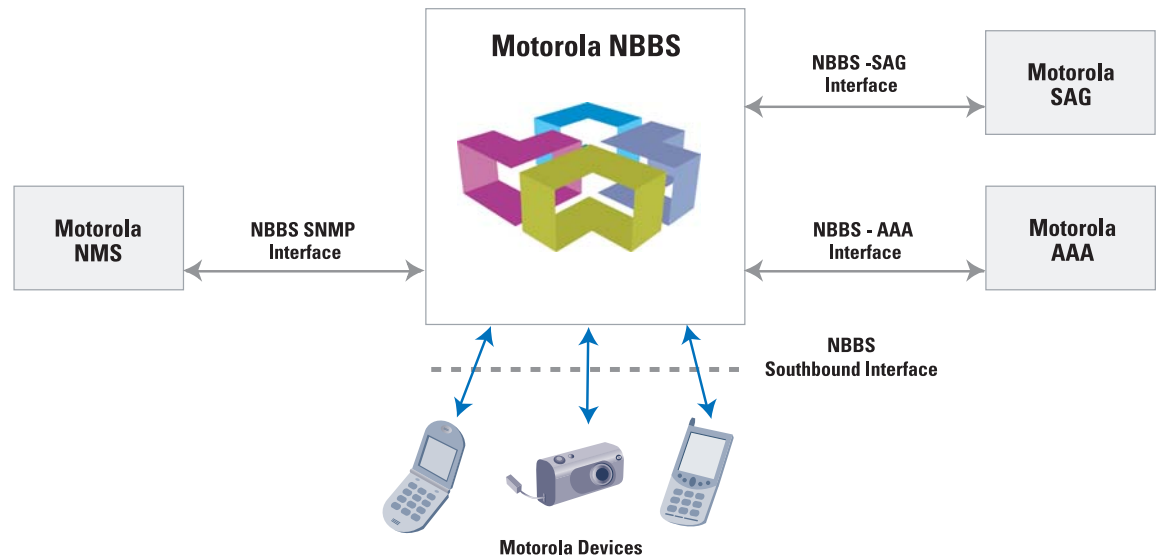
The screenshot displays the Motorola NBBS Network Operations interface. The top navigation bar includes the Motorola logo, the text 'Motorola NBBS Network Operations', and user options like 'andyreed', 'Account Settings', 'Sign Out', and 'Help'. Below this is a breadcrumb trail: 'Home > Network Operations' and a menu: 'Tasks | Device Groups | Firmware Library | Maintenance Windows | Monitoring Data Sets'. The main content area is titled 'Device Groups' and contains an 'Edit Device Group' form. The form has the following fields: 'Name' (text input with 'South Bay WiMAX Upgrade'), 'Created' (Mon Mar 5 2008 14:12:32 CST), 'Last Modified' (Wed Mar 8 2008 08:23:32 CST), and 'Description' (text area with 'This is a trial upgrade for WiMAX CPE in the South Bay area.'). Below the description is a section for 'Selection criteria for devices to include in this group.' This section is titled 'Group Definition' and shows 'Devices Matching All of these criteria'. There are two criteria listed: 'Group' set to 'South Bay Zips' with an 'Equals' operator, and 'Current Firmware' set to '3.2.3' with a 'Less Than' operator. An 'Estimated devices' box shows '31,321'. At the bottom of the form are 'Save' and 'Cancel' buttons. The footer of the page reads 'Copyright 2008 Motorola, Inc. All rights reserved.'

Specific Group management features include:

- Group Definition — NBBS supports the ability to define and name logical CPE groups. This can be by geography, by network (e.g., all devices connected to an AP), by device version, by company (e.g., all uses from a particular enterprise or wholesaler). Monitoring and campaigns can then be applied against these groups.
- Group Correlation and Trending — NBBS reporting and trending features can be applied to the group. For example, the service provider can view capacity utilization and performance and get a report on the inventory within the group.
- Group Campaigns — Campaigns are high-value management functions designed for groups of devices; a campaign can include configuration update, policy update, or firmware update. The NBBS campaign feature allows policy design, scheduling, and reporting.

OSS Interface

NBBS is designed to be integrated into the carrier OSS environment using well defined APIs and standard integration protocols. This allows automation of common functions such as subscriber and device installation.



Platform Management

Motorola NBBS provides SNMP interface to higher level NMS management system.

- Event and Alarm Propagation — NBBS is able to propagate alarms to higher-level NMS. NBBS allows configuring the type and severity of alarms that are injected into the NOC stream when some abnormal condition arises.
- NBBS application monitoring — NBBS allows monitoring the usage of critical platform and application resources.
- DB Management — Database backups are performed automatically at scheduled intervals.

Customer Care

The WiMAX NBBS solution provides API to integrate external customer care applications. This API supports retrieval of device diagnostics/health check information.



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