



MEA 3.1

Mesh Networks Network Operators Guide

Document Revision 3.1.1

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Table of Contents

INTRODUCTION 3

SCOPE 3

ACRONYMS 3

TOOLS..... 3

JAVA Runtime Environment 3

WS_Ping Pro 3

ESTABLISHING A NETWORK BASELINE 3

Neighbor Tables..... 4

 Purpose..... 4

 Procedure..... 4

Route Tables 4

 Additional Information 4

Clearing Channel Statistics 5

 Purpose..... 5

Network Throughput..... 5

 Purpose..... 5

 Procedure..... 5

Gathering Channel Statistics..... 6

 Purpose..... 6

Device IAP Association Report 6

Status Ping Poll..... 7

SNMP Status Poll 7

 Additional Information 8



MAINTENANCE SCHEDULE.....	9
Assumptions	9
Daily Maintenance.....	9
Bi-Weekly Maintenance	9
Monthly Maintenance	9
Quarterly Maintenance	9
TROUBLESHOOTING GUIDE	9
Intermittent WR or EWR Connectivity.....	9
Checking for Incompatible Software Versions	10
Checking Location.....	10
Checking for Interference	10
Faulty Hardware.....	11
Non-Existent WR or EWR Connectivity	11
Checking Power	11
Checking Location.....	11
CUSTOMER SERVICE INFORMATION	12
Obtaining Support	12
System Information	12
Return Material Request.....	13
Radio Products and Services Division	13
Radio Products and Services Division Telephone Numbers.....	13
Returning System Components to Motorola.....	13
Returning FREs.....	13
PRODUCT WARRANTY INFORMATION	14

Introduction

Maintenance and troubleshooting techniques are the two focal points of this paper and are detailed here from a wireless perspective only. For information related to the wired side of a Mesh Network refer to your MEA MiSC Configuration Guide located on your MeshManger CD.

Scope

Detailed network documentation, along with routine maintenance, are two very important topics to take into account while maintaining any network. Not only will routine maintenance help identify immediate problems within the network, it will also allow ample time to react by identifying network nodes which may be degrading.

It is assumed the reader of this document has a general understanding of the Motorola MeshManager suite of network management tools.

Acronyms

EWR	Enhanced Wireless Routers
IAP	Intelligence Access Points
MiSC	Mobile Internet Switching Controller
SNMP	Simple Network Management Protocol
WR	Wireless Routers

Tools

You will need to install the following software prior to executing the steps outlined in this paper.

JAVA Runtime Environment

If the operator is monitoring the network from a remote location, using a windows box, via remote MeshManager, it is necessary that he/she download the latest java runtime environment (JRE). Navigate to <http://java.sun.com>. Select JRE for download. *NOTE: Download only (JRE).* Do not download the software developer kit (SDK).

WS_Ping Pro

Ipswitch offers a 30 day evaluation of a throughput tool named WS_Ping Pro http://www.ipswitch.com/products/ws_ping. This is the test tool we use when testing throughput performance to fixed infrastructure devices (IAP, WR, EWR.) The tool itself is not a true indicator of throughput since it generates ICMP low priority traffic. However, the results are consistent and when used properly can paint a picture of which network nodes perform better than others.

Establishing a Network Baseline

In an effort to baseline network performance the following data should be gathered just prior to releasing the network to the customer.



Neighbor Tables

The following steps should be carried out for every infrastructure node within the network!

Purpose

Neighbor tables illustrate how well a particular network node is interacting with their neighbors (nodes which are 1 hop away). By studying all neighbor tables, the operator will gain an understanding of how much redundancy there is within the network. In addition, the quality of neighboring links are a good indicator of how well geo-location may perform within that vicinity.

Procedure

1. Open the MeshManager application
2. Double click an infrastructure device from the device tree.
3. Next, click on the neighbor tab.
4. Next, click on the signal level header column, this will arrange the neighbors either in ascending or descending order based upon their corresponding signal levels.
5. Use the print option at the bottom of the screen.
6. Label data appropriately and store in a binder.
7. Repeat steps for all network nodes.

Route Tables

The following steps should be carried out for every infrastructure node within the network!

Purpose:

Route tables are very helpful in evaluating the quality of your deployment location decisions. In addition this table provides the number of hops a device is taking to reach its destination. Hop count is directly related to throughput performance.

Procedure:

1. Open the MeshManager application
2. Double click the selected infrastructure device from the device tree.
3. Next, click on the neighbor tab.
4. At the bottom of the screen select the *Get Route Table* option.
5. Use the print option at the bottom of the screen.
6. Label and store data in a binder
7. Repeat steps for all network infrastructure.

Additional Information

Route tables illustrate active routes (on demand algorithmically decided paths). WR & EWR nodes, which are only 1 hop from an IAP are display as such within the route table. Likewise, WR & EWR nodes further than one hop from an IAP are displayed as such with the exception of showing the next hop taken.

Clearing Channel Statistics

Purpose

Clearing the statistics is only necessary when troubleshooting a network node or while performing a network baseline. Channel statistics should be cleared *just prior* to executing procedures in the Network Throughput section and gathered directly thereafter.

Procedure

1. Open MeshManager
2. Navigate to Tools/Channel Management/Channel Statistics
3. To populate the table with all network nodes highlight the word *Network* within the device tree.
4. Once table has been populated click on *Clear Statistics on Devices*.

Network Throughput

NOTE: Perform task detailed in the *Clearing Channel Statistics* section prior to executing this task.

Purpose

The operator should have an understanding of each node's throughput capability prior to releasing the network to the customer. The best way to do this is to perform a throughput test to each fixed infrastructure device (IAP,WR,EWR) and record your results.

This test is only beneficial if the operator performs it onsite. Results will be skewed if performed remotely over a VPN. The best method of performing this remotely is by setting up an onsite computer for remote desktop management. When collecting data either onsite or via a remote desktop managed computer, ensure the computer is connected directly to the same switch the MiSC is connected to. This will reassure that the customer's own LAN is not the bottleneck in the event the results are below expectations.

Procedure

1. Download the **WS_Ping Pro** application and open it
2. Select the throughput tab.
3. Configure the application as follows:
4. Packet Count = 100
5. Packet Size = 1450
6. Delay (ms) = 150
7. Timeout (ms) = 1000
8. Enter the node's IP address to be tested and press start.
9. Upon completion the tool will average the results.
10. Record this appropriately and move on to the next node.

Additional Information



The test should be performed twice to each node and the results obtained from the second test should be used as the average. Results are most useful if recorded on a infrastructure map of the city.

Once again, the tool itself is not a true indicator of throughput since it generates ICMP low priority traffic. However, the results are consistent and when used properly can paint a picture of which network nodes perform better than others.

Gathering Channel Statistics

For a network baseline channel statistics are most accurate if gathered after the network has been tuned in. After tuning the network the operator should clear all channel statistics (see *Clearing Channel Statistics*), record network throughput (see *Clearing Channel Statistics*), then gather new statistics.

Purpose

Channel performance statistics illustrate a network node's transmission/reception success percentages on a per channel basis. Channel success completions are a direct indicator of network health. The tool can be used on an individual node basis or the entire network.

Procedure

1. Open MeshManager
2. Navigate to Tools/Channel Management/Channel Statistics
3. To populate the table with all network nodes, highlight the word *Network* within the device tree
4. Once table has been populated click on *Retrieve*
5. Use the print option and store log in a binder. Label with current date.

Additional Information

Nodes, which have low success percentages on individual, or all channels, will be highlighted in yellow within MeshManager. Channels, which have previously been blocked, will be illustrated in red. Low success percentages are the direct result of factors such as: poor location, interference, or degrading hardware.

Pay particular attention to nodes whose completion percentages drop below 65%.

For procedures on how to manipulate the channels refer to the *MeshManagers User Guide* located in the documentation directory on your MeshManager CD.

Device IAP Association Report

Purpose

The purpose of this task is to verify that all WRs & EWRs are associated with their intended IAPs

When designing the MeshNetwork the design engineer may have opted to set default IAP associations within their deployed WRs & EWRs. A default IAP association is a field within the WR or EWR configuration page, which can be populated by the network operator. Once a WR or EWR is assigned a default IAP, the devices will attempt association with this particular IAP first. If the default IAP is unavailable, then the WR or EWR will choose an alternate IAP, if

available. Setting the default IAP association is typically done during the tuning phase of a deployment. Reasons for doing so could be to enhance stability, control congestion, or improve throughput.

Procedure

1. Open MeshManager
2. Navigate to Tools/Default IAP Association Report
3. To populate the table with all network nodes, highlight the word *Network* within the device tree
4. Once table has been populated click on Start
5. Use the print option and store log in a binder. Label with current date.

Additional Information

If the design engineer does take advantage of the default IAP feature, they should document each WR or EWR's configuration settings within a table or infrastructure map. Color coded default IAP association infrastructure maps are a good choice.

Status Ping Poll

Purpose

The purpose of this task is to gain an understanding of the overall responsiveness of the network. This tool can be used on an individual node basis or across the entire network.

Procedure

1. Open MeshManager
2. Navigate to Tools/Ping Status Poll
3. To populate the table with all network nodes, highlight the word *Network* within the device tree
4. Once table has been populated click on Start
5. Use the print option and store log in a binder. Label with current date.

SNMP Status Poll

Purpose

Besides verifying connectivity amongst network nodes, this task will help in identifying network nodes, which consistently have poor uptimes due to suspect hardware. Suspect hardware could mean, either, the IAP, WR, EWR, streetlight photo-cell, conduit run, faulty wiring...etc.

Procedure

1. Open MeshManger
2. Navigate to Tools/SNMP Status Poll
3. Click Start. MeshManager will poll each device for its uptime.
4. Print the results and log them in a binder.



Additional Information

Uptimes are not entirely indicative of faulty hardware. Storms moving through the area can cause brief power glitches, which may cause a section or even the entire network to reset. Look for devices that consistently have uptimes 2 days or less.

Maintenance Schedule

Assumptions

At this point it is assumed that all deployment guidelines were followed during the installation of the MeshNetwork. The performance of each network node has been tested, verified and does indeed fulfill any network requirements agreed upon prior to deploying.

In addition, baseline reports for each network node have been compiled and recorded prior to turning the network over to the customer.

NOTE: This data is essential and should be used as reference upon completion of these routine maintenance checks.

Daily Maintenance

SNMP Status Poll (Refer to section 4.7)

Bi-Weekly Maintenance

Channel Performance Statistics (Refer to section 4.4.2)

Monthly Maintenance

Throughput (Refer to section 4.3)

IAP Association Report (Refer to section 4.5)

Status Ping Poll (Refer to section 4.6)

Quarterly Maintenance

Collect Neighbors Tables (Refer to section 4.1)

Collect Route Tables (Refer to section 4.2)

Troubleshooting Guide

The scenarios and techniques depicted here are only viable for troubleshooting the wireless side of the mesh network.

Intermittent WR or EWR Connectivity

This scenario is one in which the operator frequently experiences a SNMP timeout when polling a particular device within the MeshManager application.

Possible reasons for intermittent WR or EWR connectivity include:

1. Incompatible Software Versions
2. Location
3. Interference
4. Faulty Hardware



Checking for Incompatible Software Versions

1. Open MeshManager and double click suspect node within device tree
2. Open node's status table and make note of all software versions
3. Compare this to the IAP
4. Update device if different

Checking Location

1. Determine which IAP the node is associated with.
2. Open that IAP's neighbor table
3. If the node is one hop away from an IAP it will be listed within the IAP's neighbor table. Look at the signal level (dBm). If the signal level is less than -83 dBm, this means the node has been deployed in a poor location, and that the node is attempting a one hop IAP association route, because it simply has no other *quality* alternative.
4. If the node is not in the IAP's neighbor table then open the IAP's trace route page.
5. Populate the trace route table with the suspect node by clicking the node within the device tree.
6. Click Trace
7. Make note of all hops.
8. Re-open the IAP's neighbor table.
9. Find the 1st hop node within this table
10. If the IAP has a signal level of less than -83 dBm to this next hop, then you have deployed your network wrong.
11. If this next hop link is okay then, open the 1st hop node's neighbor table.
12. Find the 2nd hop node within this table and check the quality of the link
13. Continue doing this until you find the poor link along the path.
14. If there are no poor links along the path then proceed to the next section.

Checking for Interference

1. Double click the suspect node within the device tree
2. Open the node's performance page. If any one or two channels have a significantly lower completion % than the other channels you may have an interferer. However, if all channels are bad then the router has been poorly deployed. If on the other hand all channels are good, the problems then lies somewhere along the route back to the associated IAP.
3. Repeat the steps above for checking interference on the IAP and all subsequent hops.
4. Refer to your *MeshManagers User Guide* located on your MeshManger CD for instructions on how to block channels.

Faulty Hardware

If all checks above prove to be okay, then you may have a faulty WR or EWR.

Non-Existent WR or EWR Connectivity

This scenario is one in which the network operator is completely in-capable of polling the suspect node.

Possible Reasons

1. Problem with device's power supply
2. Location
3. Incompatible Software Versions
4. Incorrect Spreading Code
5. Incorrect Addressing Scheme
6. Faulty Hardware

Checking Power

1. Look at your infrastructure network map, pick an infrastructure node, which you believe should have the best chance of hearing the suspect nodes transmissions (line of sight).
2. Open the neighbor table of this best choice node.
3. If the suspect node is not within the neighbor table then either the suspect node has no power, has a weak transmitter, or is on a different spreading code.
4. Check the power supply
5. If the power supply is okay then place a Mesh Subscriber Device beside the suspect device.
6. Open MeshTray on the Subscriber Device laptop.
7. If the device is listed with the neighbor table, the device may have a weak transmitter, continue range testing to verify.
8. If the device is not listed within MeshTray neighbor table than device may be on another spreading code or defunct.
9. Call MeshNetworks customer support.

Checking Location

1. Drive to suspect node location
2. Check for any foliage or new building construction that may have isolated router.
3. Take subscriber device out to location and check power as outlined above.



Customer Service Information

If you have read this document and made every effort to resolve installation or operation issues yourself and still require help, please contact Motorola System Support Center (SSC) using the following contact information:

Hours of Operation

7 days a week, 24 hours

Technical Support: 800-221-7144 (USA)

Obtaining Support

Motorola provides technical support services for your system and recommends that you coordinate warranty and repair activities through the Motorola System Support Center (SSC). When you consult the Motorola SSC, you increase the likelihood that problems are rectified in a timely fashion and that warranty requirements are satisfied. Check your contract for specific warranty and service information.

System Information

To be provided with the best possible opportunity for support, collect the following system information and have it available when obtaining support.

- Location of the system
- Date the system was put into service
- Software or firmware version information for components of your system
- Serial number(s) of the device(s) or component(s) requiring support
- A written description of the symptom or observation of the problem:
 - When did it first appear?
 - Can it be reproduced?
 - What is the step-by-step procedure to cause it?
- Do other circumstances contribute to the problem? For example, changes in weather or other conditions?
- Maintenance action preceding problem:
 - Upgrade of software or equipment
 - Change in the hardware or software configuration
 - Software reload - from backup or from CD-ROM (note the version and date)

Return Material Request

After collecting system information, contact the Motorola System Support Center for assistance or to obtain a Return Material Authorization (RMA) number for faulty Field Replaceable Entities (FREs):

North America: 800-221-7144

Radio Products and Services Division

The Radio Products and Services Division is your source for manuals and replacement parts.

Radio Products and Services Division Telephone Numbers

The telephone numbers for ordering are: (800)-422-4210 (US and Canada orders)

The Fax numbers are: (800)-622-6210 (US and Canada orders)

The number for help identifying an item or part number is (800)-422-4210; select choice “3” from the menu

Returning System Components to Motorola

Motorola's service philosophy is based on field replaceable entities (FREs). FREs are system components identified by Motorola to be returned to Motorola for repair. In turn, Motorola sends you a replacement FRE component to help you maintain maximum operating performance for your system.

Returning FREs

Return faulty FREs to Motorola for repair. When you return an assembly for service, follow these best practices:

- Place any assembly containing CMOS devices in a static-proof bag or container for shipment.
- Obtain a return authorization (RA) number from the Motorola System Support Center.
- Include the warranty, model, kit numbers, and serial numbers on the job ticket, as necessary.
- If the warranty is out of date, you must have a purchase order.
- Print the return address clearly, in block letters.
- Provide a phone number where your repair technician can be reached.
- Include the contact person's name for return.
- Pack this assembly tightly and securely, preferably in its original shipping container.



Product Warranty Information

This warranty applies within the fifty (50) United States, the District of Columbia and Canada.

LIMITED WARRANTY MOTOROLA COMMUNICATION PRODUCTS

If the affected product is being purchased pursuant to a written Communications System Agreement signed by Motorola, the warranty contained in that written agreement will apply. Otherwise, the following warranty applies.

I. WHAT THIS WARRANTY COVERS AND FOR HOW LONG:

Motorola Inc. or, if applicable, Motorola Canada Limited ("Motorola") warrants the Motorola manufactured Broadband Data communications product, against material defects in material and workmanship under normal use and service for a period of One (1) Year from the date of shipment.

Motorola, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it with the same or equivalent Product (using new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided purchaser notifies Motorola according to the terms of this warranty. Repaired or replaced Product is warranted for the balance of the original applicable warranty period. All replaced parts of the Product shall become the property of Motorola.

This express limited warranty is extended by Motorola to the original end user purchaser purchasing the Product for purposes of leasing or for commercial, industrial, or governmental use only, and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by Motorola. Motorola assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of Motorola. Unless made in a separate written agreement between Motorola and the original end user purchaser, Motorola does not warrant the installation, maintenance or service of the Product.

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II. GENERAL PROVISIONS:

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III. HOW TO GET WARRANTY SERVICE:

Purchaser must notify Motorola's representative or call Motorola's Customer Response Center at 1-800-247-2346 within the applicable warranty period for information regarding warranty service.

IV. WHAT THIS WARRANTY DOES NOT COVER:

- A) Defects or damage resulting from use of the Product in other than its normal and customary manner.
- B) Defects or damage from misuse, accident, water, or neglect.
- C) Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.
- D) Breakage or damage to antennas unless caused directly by defects in material workmanship.
- E) A Product subjected to unauthorized Product modifications, disassemblies or repairs (including, without limitation, the addition to the Product of non-Motorola supplied equipment) which adversely affect performance of the Product or interfere with Motorola's normal warranty inspection and testing of the Product to verify any warranty claim.
- F) Product which has had the serial number removed or made illegible.
- G) Batteries (they carry their own separate limited warranty).
- H) Freight costs to the repair depot.
- I) A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with Motorola's published specifications or with the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from Motorola.
- J) Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- K) That the software in the Product will meet the purchaser's requirements or that the operation of the software will be uninterrupted or error-free.
- L) Normal and customary wear and tear.
- M) Non-Motorola manufactured equipment unless bearing a Motorola Part Number in the form of an alpha numeric number (i.e., TDE6030B).
- N) Lift trucks for installation, removal, replacement or repair of the Motorola supplied products from light, power, telephone poles etc.
- O) Dispatch to remote site locations
- P) Loading of software upgrades or fixes into the devices.

V. GOVERNING LAW

In the case of a Product sold in the United States and Canada, this Warranty is governed by the laws of the State of Illinois and the Province of Ontario, respectively.

VI. PATENT AND SOFTWARE PROVISIONS:

Motorola will defend, at its own expense, any suit brought against the end user purchaser to the extent that it is based on a claim that the Product or its parts infringe a United States patent, and Motorola will pay those costs and damages finally awarded against the end user purchaser in any such suit which are attributable to any such claim, but such defense and payments are conditioned on the following:

- A) that Motorola will be notified promptly in writing by such purchaser of any notice of such claim;
- B) that Motorola will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and



C) should the Product or its parts become, or in Motorola's opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit Motorola, at its option and expense, either to procure for such purchaser the right to continue using the Product or its parts or to replace or modify the same so that it becomes non-infringing or to grant such purchaser a credit for the Product or its parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or its parts as established by Motorola.

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