MESH
NETWORKS

mēa

Setup and Deployment

User's Guide

For

Infrastructure Mode

DMM000009-03

Foreword

This document describes in detail the confidential and proprietary technology of MeshNetworks' mēa™ Architecture. MeshNetworks products and technology are protected by US and international patent and patent pending technology. This document represents the current mēa design; the contents are subject to change at any time at the discretion of MeshNetworks, Inc.

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Table of Contents

SECTION 1 - OVERVIEW....1

Introduction....1

Documentation Overview....1

Acronyms....1

Related Documentation....2

SECTION 2 - DESCRIPTION OF THE mēa SYSTEM....3

Introduction....3

Subscriber Devices (SDs)....4

Wireless Routers (WRs)....4

Intelligent Access Points (IAPs)....5

Mobile Internet Switching Controller (MiSC)....5

Operational View of the mēa System....6

Network Architecture....7

SECTION 3 - SETUP AND DEPLOYMENT....8

Subscriber Device (SD)....8

Equipment....8

Record MAC Address of the WMC6300....8

Loading and Verifying Software....8

Testing....11

Intelligent Access Point (IAP)....11

Equipment....2

Record MAC Address of the IAP....3

IAP Assembly....3

Deployment..5

Initial IAP Configuration..6

Testing 6

Wireless Router (WR) 7

Equipment...7

Record MAC Address of the MWR6300 8

MWR6300 Assembly...9

Deployment...9

Initial Configuration...9

Testing 10

Mobile Internet Switching Controller (MiSC)...11

Equipment...11

Network Setup Description 12

MiSC Assembly...13

Onsite Configuration of Routers 14

Network Configuration – Device Manager 15

Network Configuration – IAP Configuration Via Web Interface 15

Testing 22

Default Addresses and Logins..23

SECTION 4 - MAC ADDRESS TABLES 25

IAP MAC Addresses 25

WR MAC Addresses 25

WMC MAC Addresses...26

SECTION 5 - SITE SELECTION/DEPLOYMENT GUIDELINES.......................27

General Site Selection Guidelines 27

Antenna Guidelines 27

Lab Checkout 28

General Deployment Guidelines 28

It is recommended that field deployment follow the same steps as described in General Site Selection Guidelines 28

Antenna Guidelines .... Error! Bookmark not defined.

SECTION 6 - CUSTOMER SERVICE INFORMATION 30

SECTION 7 - WMC INSTALLATION DEBUG PROCEDURES 31

SECTION 8 - LICENSE AND WARRANTY INFORMATION 33

SECTION 9 - FCC REGULATORY INFORMATION 38

FCC Information 38

FCC RF Radiation Exposure Statement 38

Safety Information for the mēa Products 40

SECTION 10 - SAFETY CERTIFICATION 40

Section 1 - Overview

Introduction

The mēa wireless broadband system allows a network operator to deploy a wireless, multi-hopping ad hoc network. This document describes how to setup, configure, and deploy a mēa system to operate in infrastructure mode. Infrastructure mode allows the user's to have access to a wired network. For a deployment that does not need access to a wired network, refer to the "mēa Setup and Deployment for Peer-to-Peer Mode" document.

The mēa system is designed for easy installation. The infrastructure components of a mēa system are preinstalled with a default configuration for connection to a wired network. Any configuration items described in this document are for site-specific information.

MeshNetworks recommends that the Network Operator receive setup and deployment training at MeshNetworks' facility prior to deploying the mēa network. MeshNetworks may optionally provide the Network Operator assistance with site surveys and deployment.

Note: The mēa MWR6300 Wireless Routers and IAP6300 Intelligent Access Points require "professional installation" to ensure the installation is performed in accordance with FCC licensing regulations.

Documentation Overview

The mēa Setup and Deployment User's Guide is arranged in the following sections:

Section 1 - Overview provides an overview of the mēa Starter Kit and the organization of the User's Guide.

Section 2 – Description of the mēa System provides a general overview of a complete mēa Network.

Section 3 - Starter Kit Setup and Deployment provides installation and configuration information for the Subscriber Device, Wireless Router, Intelligent Access Point, and the MiSC.

Section 4 - MAC Address Tables provides three convenient tables to record network configuration data.

Section 5 – Site Selection Guidelines provides deployment and installation suggestions.

Section 6 - The Customer Service Information section provides contact information if you need assistance with your mēa Starter Kit.

Section 7 - License and Warranty Information contains MeshNetworks' License Agreement and Warranty for the mēa products.

Section 8 - FCC Regulatory Information provides important warnings and safety information.

Acronyms

HAS	Hardware Authentication Server
IAP	Intelligent Access Point
mēa	Mesh Enabled Architecture

MiSC	Mobile Internet Switching Controller
SD	Subscriber Device (a host device with a WMC6300 installed and operational)
WMC	Wireless Modem Card
WR	Wireless Router

Related Documentation

mēa Setup and Deployment User's Guide for Peer-to-Peer Mode

mēa WMC6300 Wireless Modem Card User's Guide for Windows 2000

mēa WMC6300 Wireless Modem Card User's Guide for Windows XP

MeshView Administration Tool User's Guide

MeshManager User's Guide

MeshFlash User's Guide

Location Analyzer Deployment Tool User's Guide

Section 2 - Description of the mēa System

Introduction

MeshNetworks develops Mobile Broadband communications systems with "meshed" architectures. That is, each node can connect directly, or indirectly (by hopping through other nodes), with any other node in the network. The peer-to-peer nature of the mesh architecture combined with data rate control in each subscriber and infrastructure node in the network insures reliable delivery while providing increased network capacity through geographic reuse of the frequency spectrum.

The network comprises four distinct elements:

- Subscriber Devices (SDs)
- Wireless Routers (WRs)
- Intelligent Access Points (IAPs)
- Mobile Internet Switching Controllers (MiSCs)

The overwhelming portion of the value that MeshNetworks provides is in the Wireless Modem Card (WMC). The WMC is used in Subscriber Devices as well as in the Wireless Router and Intelligent Access Point (IAP), both of which are types of infrastructure equipment. MeshNetworks provides a Mobile Internet Switching Controller (MiSC) which is assembled from industry standard equipment and conforms to industry standards. MeshNetworks also provides the network applications, which are required for proper operation and value extraction from the mēa mobile Internet system.

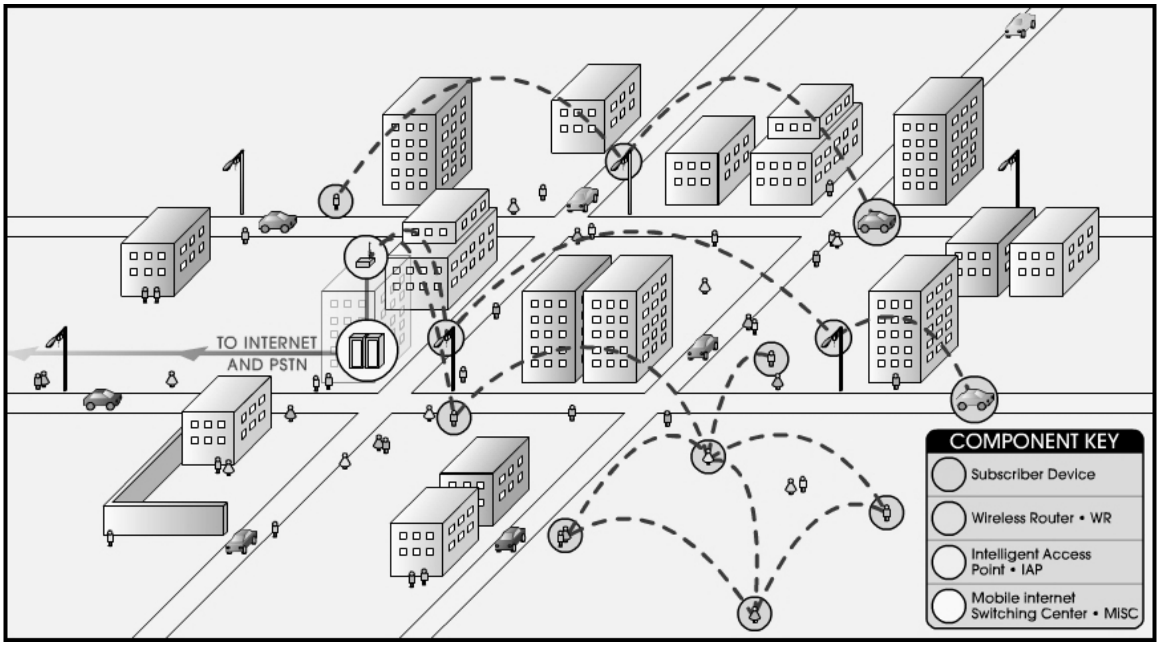

TO INTERNET
AND PSTN
COMPONENT KEY
Subscriber Device
Wireless Router • WR
Intelligent Access Point • IAP
Mobile internet Switching Center • MISC

Figure 1. Elements of the mēa System

All network elements are designed to support mobile applications. Subscriber Devices can be either mobile or fixed, while the remaining components are typically fixed. Wireless Routers and

IAPs can be mounted on utility poles, light poles, traffic apparatus, billboards, and buildings. Their fixed positions allow the Subscriber Device to pinpoint its location within one second. WRs and IAPs can also be mobile, attached to emergency vehicles, utility vehicles, or fleet vehicles. It is important to note that the WMC technology within a Subscriber Device is identical to the WMC technology in Wireless Routers and IAPs.

The mēa system was designed to minimize the cost associated with deploying a mobile Internet with end user data access rates on the order of DSL or Cable Modem. The chosen metric of network efficiency for a data centric network is bits per second per Hertz per square kilometer per dollar (bps/hz/km^2/\$). This metric balances the user data rates, allocated bandwidth, coverage area, and cost. One of the most important factors in optimizing this metric is the choice of network architecture.

Subscriber Devices (SDs)

The MeshNetworks' Wireless Modem Card (WMC) is provided as a PCMCIA form factor device. The WMC is used with an off-the-shelf IP-enabled laptop computer. These two devices together make up a Subscriber Device (SD).

The WMC provides access to the fixed infrastructure network and other networks, such as the Internet, and it can also function as a Wireless Router and repeater for other SDs.

SDs can therefore be a key part of the network infrastructure. Adding subscribers can effectively increase the number of Wireless Routers in the network, which increases the number of alternative paths that subscribers may utilize. This can reduce both the time and cost to deploy network infrastructure, while also increasing the spectral efficiency and therefore the capacity of the network. In addition, because SDs can also operate in an ad hoc peer-to-peer mode, two or more SDs can form a network without the need for any fixed infrastructure.

Wireless Routers (WRs)

The Wireless Router (WR) is a low-cost small-sized wireless device that is primarily deployed to seed a geographical area, extending the range between IAPs and subscribers, and to simultaneously increase the network's spectral efficiency. Wireless Routers provide a number of functions in the network, such as:

- Range Extension for Subscriber Devices and IAPs
- Hopping Points for subscriber peer-to-peer networking
- Automatic Load Balancing
- Route Selection
- Network capacity optimization through small packet consolidation
- Fixed reference for geo-location services

The Wireless Router's small size and light weight allow it to be mounted almost anywhere. No towers are required. WR software can be updated via over-the-air downloads.

Intelligent Access Points (IAPs)

The Intelligent Access Point (IAP) is a low-cost small device that acts as the transition point from the wireless network to the wired core network and from there, through media gateways, out to the Internet. Each IAP offers up to 6 Mbps burst data rate to subscribers. IAPs support the 10/100 base-T Ethernet interface. Other interfaces are supported through commercially available media translation devices. If additional network capacity is required, more IAPs can be easily deployed - without the need for extensive RF or site planning. IAPs provide functions such as:

- Local mobility management of SDs
- Fixed reference for geo-location services
- Hopping points for subscriber peer-to-peer networking
- Transition point from the wireless to the wired portions of the network
- Route Selection

The IAP's small size and light weight allow it to be mounted anywhere power and network connectivity are available. No towers are required. IAP software can be updated via over-the-wire downloads.

Mobile Internet Switching Controller (MiSC)

The Mobile Internet Switching Controller (MiSC) provides connectivity between the IAPs and wired world, and hosts the network's management and provisioning functions. The MiSC is composed of off-the-shelf hardware components, such as LAN routers and application servers. MiSC software consists of both off-the-shelf and MeshNetworks' proprietary software, MeshManager. The MeshManager software provides functions for the network such as:

- Subscriber Provisioning, Management, and Authentication
- Configuration and Fault Management
- Network Monitoring and Reporting

Operational View of the mēa System

Figure 2 shows the different ways in which a subscriber can reach an IAP. It can connect directly, or hop through any number or combination of WRs and SDs. Additionally, if the subscriber wishes to execute a peer-to-peer application such as a file transfer, the subscriber can communicate directly, or through any combination of SDs, WRs, and IAPs.

The ability to use ad hoc routing to forward traffic improves the scalability of the mobile wireless Internet. In particular, the ability for the user to accomplish a peer-to-peer application without the use of infrastructure has tremendous advantages. A significant problem in every mobile wireless network is backhaul. The mēa architecture provides the ability to route traffic from applications through SDs and WRs without ever reaching an IAP or the wired Internet. This reduces the amount of backhaul required by enabling the SDs to accomplish the backhaul whenever the opportunity arises. This results in lower deployment costs, reduced backhaul, and lower operating expenditures. The service provider can provide the same level of service with less equipment by empowering the SDs with ad hoc networking capability.

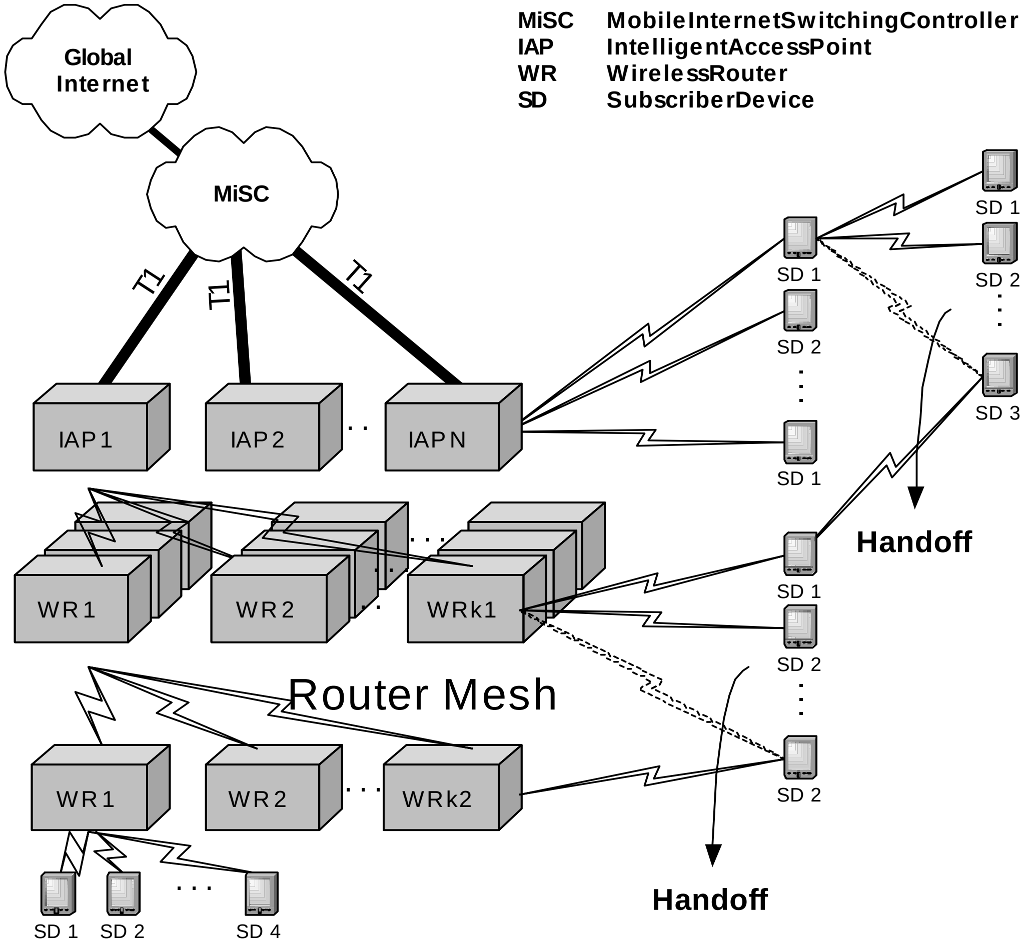


Figure 2. Operational View of the mēa System

Network Architecture

The mēa network utilizes two subnets, one for the mēa wireless elements and one for the server elements. All of the mēa wireless elements must be in a single subnet. The subnets are connected together by the core router, and the edge router provides Internet connectivity.

Figure 3 shows the logical network layout of a mēa network.

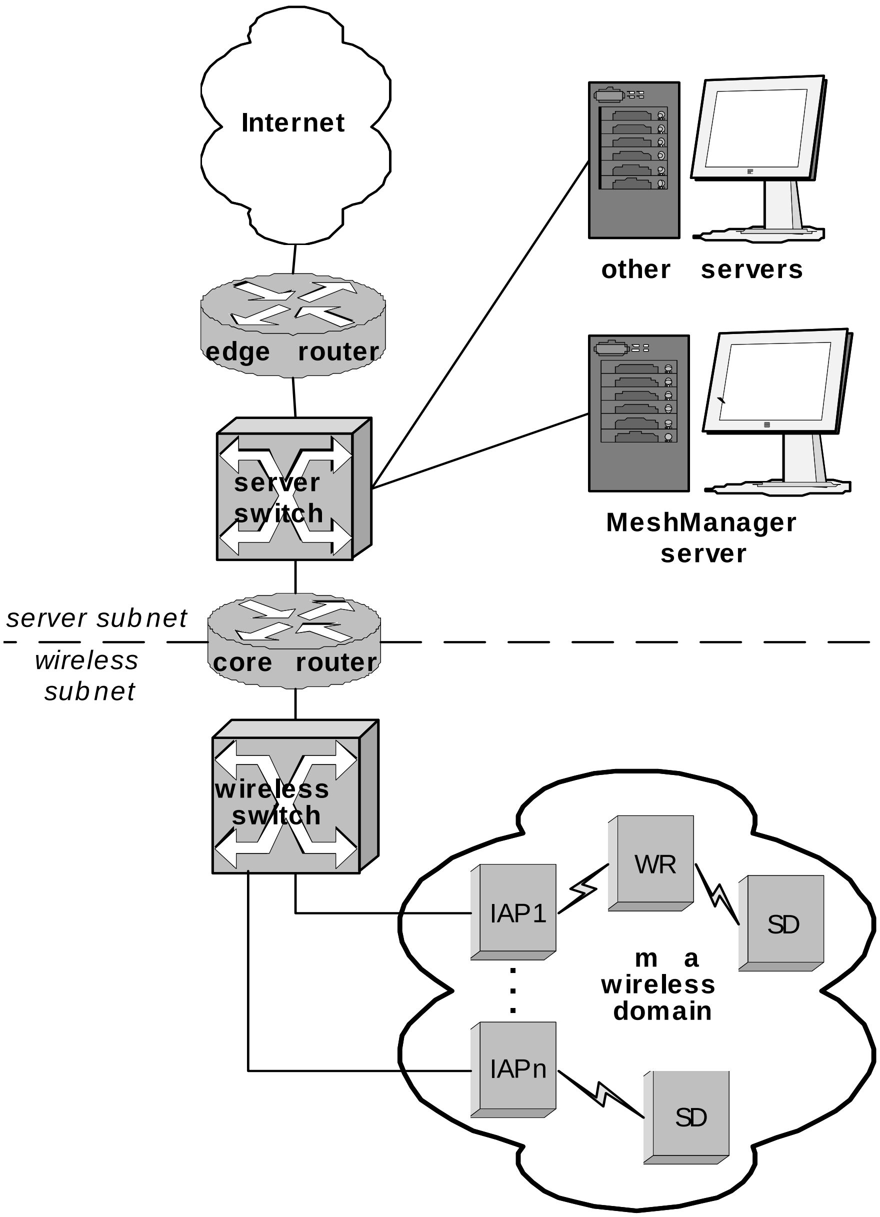


Figure 3. mēa Network Architecture

Section 3 - Setup and Deployment

Subscriber Device (SD)

A Subscriber Device consists of both a Wireless Modem Card (WMC6300) and an End User provided host device such as a notebook computer. The WMC6300 is designed for insertion into an industry-standard Type II PCMCIA card slot located in a Host device. The WMC6300 has an antenna port to connect the external antenna and two LED Indicators. The Red LED is the transmit indicator and the Green LED is the receive indicator as shown in Figure 4.

Equipment

The following list defines the mēa hardware components required to setup the WMC6300:

- WMC6300 Wireless Modem Card
- Antenna with a MMCX connector
- WMC6300 Software and Documentation CD for Windows 2000™ and Windows XP™

Equipment that must be supplied by the End User includes the following:

- Notebook PCs running the Microsoft Windows 2000 or Windows XP Operating System

Optional Equipment

- Refer to the mēa data sheets for a list of optional equipment

Record MAC Address of the WMC6300

The transceiver MAC address is recorded on the back of the WMC6300 cards. Record this number in **Section 4 - MAC Address Tables**, as it will be required later to configure and test the device.

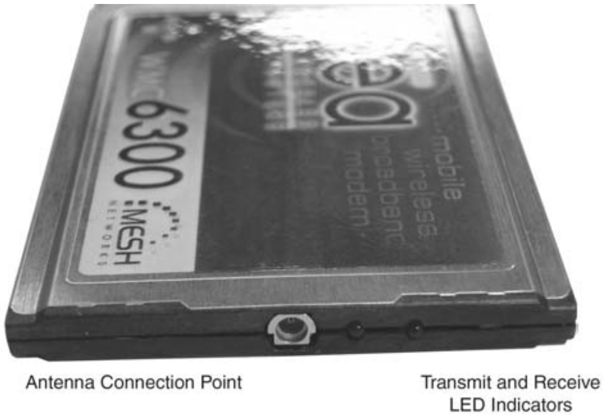

6300
mesh networks
mēa
mobile wireless broadband modem
Antenna Connection Point
Transmit and Receive LED Indicators

Figure 4. WMC6300 Antenna Port and LED Indicators

Loading and Verifying Software

The mēa WMC6300 Software and Documentation CD contains the mēa drivers and MeshTray software for use on the End User's equipment. Please review the instructions for each operating system as there is a different sequence of events depending on the operating system.

Detailed instructions can be found in the WMC6300 User’s Guide for each operating system.

In addition, the mēa Administration Software and Documentation CD includes installation software to load the MeshView Administration Tool. MeshView may be installed as an option on a subscriber device to assist the Network Operator with network deployment. Refer to the mēa MeshView Administration Tool User’s Guide for additional information on this application.

Installing the WMC6300 Software for Windows 2000

The mēa WMC6300 Wireless Modem Card User’s Guide for Windows 2000 provides complete step-by-step instructions for use during the installation and configuration of the WMC6300. The following is an abbreviated version of the installation process.

Note: *Please install the mēa Software* ***before*** *you insert the WMC6300 card.*

Complete the following procedure to install the WMC6300 software and drivers:

1. Insert the mēa Software and Documentation CD into the computer’s CD-ROM drive.
2. The mēa Setup program will be displayed.

   Note: If the installation program does not start automatically, open the Windows **Start** menu, click on **Run**, and then type **d:setup.exe** (where **d** is the letter of the CD-ROM drive) and click the “**OK**” button.
3. Click the “**Next**” button to continue the software installation process.
4. Follow the onscreen prompts to complete the installation process.
5. Insert the antenna into the WMC6300 card.
6. Insert theWMC6300 card into the PCMCIA slot of the host computer.

If MeshView is desired, insert the mēa Administration Software and Documentation CD, open the Windows **Start** menu, click on **Run**, and then type **d:setupmv.exe** (where **d** is the letter of the CD-ROM drive) and click the “**OK**” button. Follow onscreen prompts to complete the installation process.

Installing the WMC6300 Software for Windows XP

The mēa WMC6300 Wireless Modem Card User’s Guide for Windows XP provides complete step-by-step instructions for use during the installation and configuration of the WMC6300. The following is an abbreviated version of the installation process.

Note: *Please install the mēa Software* ***after*** *you insert the WMC6300 card. .*

Complete the following procedure to install the WMC6300 software and drivers:

1. Insert the antenna into the WMC6300 card.
2. Insert the WMC6300 card into the computer.
3. Click the “**Cancel**” button for the 2 “Found New Hardware” windows.
4. Click the “**Close**” button for the “Found New Hardware information” window.
5. Insert the WMC6300 Software and Documentation CD into the computer’s CD-ROM drive.

6. The mēa Setup program will be displayed.

   Note: If the installation program does not start automatically, open the Windows **Start** menu, click on **Run**, and then type **d:setup.exe** (where **d** is the letter of the CD-ROM drive) and click the **OK** button.

7. Click the "**Next**" button to continue the software installation process.
8. Follow the onscreen prompts to complete the software installation process.
9. Eject the WMC6300 card. Wait 10 seconds and reinsert the WMC6300 card.
10. For the 2 Found New Hardware windows, ensure the **Install Software Automatically** button is selected, click on the **Next** button, and follow the onscreen prompts.

Installing the MeshView Administration Tool

Complete the following procedure to install MeshView:

1. Insert the mēa Administration Software and Documentation CD into the CD-ROM drive.
2. Click the Windows "**Start**" menu. Click on "**Run**" and enter **d:setupmv.exe** in the textbox (Note: **d** is the letter of the CD-ROM drive). Click the "**OK**" button to continue the installation process.
3. Follow onscreen prompts to complete the installation process.

DNS Server Configuration

The DNS server IP address is automatically supplied to the Subscriber Device upon successfully connecting to the Network. If there are problems with resolving web URLs, the DNS address can also be manually configured. The Network Operator must supply the DNS IP address for the Internet connection.

Instructions to setup a Windows 2000 Host:

1. Start/Settings/Network and Dial-up Connections/Local Area Connection
   (choose the Local Area Connection Corresponding to the Wireless Modem Card)
2. Click on the "**Properties**" button.
3. Highlight **Internet Protocol (TCP/IP)** in the Components window.
4. Click on the "**Properties**" button.
5. Click on the "**Advanced**" button.
6. Click on the **DNS** tab
7. Click on the DNS "**Add**" button.
8. Enter the "DNS Server IP Address" provided by the network administrator and then click the "**Add**" button.
9. Click the "**OK**" button to close the Advanced TCP/IP Settings windows.
10. Click the "**OK**" button to close the Internet Protocol (TCP/IP) Properties windows.
11. Click the "**OK**" button to close the Local Area Connection Properties windows.
12. Click the "**Close**" button to close the Local Area Connection Status window.

This configuration should remain in the Windows 2000 host.

Instructions to setup a Windows XP host:

4. Click on Start/Control Panel/Network and Dial-up Connections/Local Area Connection
5. Right click on the Local Area Connection Corresponding to the Wireless Modem Card and select "**Properties**" from the pop up menu.
6. Highlight **Internet Protocol (TCP/IP)** in the Components window.
7. Click on the "**Properties**" button.
8. Click on the "**Advanced**" button.
9. Click on the **DNS** tab
10. Click on the DNS "**Add**" button.
11. Enter the "DNS Server IP Address" provided by the network administrator and then click the "**Add**" button.
12. Click the "**OK**" button to close the Advanced TCP/IP Settings windows.
13. Click the "**OK**" button to close the Internet Protocol (TCP/IP) Properties windows.
14. Click the "**OK**" button to close the Local Area Connection Properties windows.
15. Click the "**Close**" button to close the Local Area Connection Status window.

This configuration should remain in the Windows XP host.

Testing

When the WMC6300 is inserted, you may receive an audible indicator that the device has been recognized. (If there is a problem with the drivers, Windows will prompt you for a new device installation.)

Using MeshTray, configure the WMC6300 for peer-to-peer mode. Click on the Windows "**Start**" button and select "**Run**" from the popup menu. Enter the command "**ipconfig**" in the textbox and click on the "**OK**" button to check your IP address. If an IP address in the range of 10.x.y.2 is displayed, the transceiver is working properly. Change the WMC6300 back to Infrastructure mode.

Intelligent Access Point (IAP)

The IAP is an infrastructure device that is positioned at a fixed location such as a building rooftop. The IAP6300 requires professional installation to ensure that the installation is performed in accordance with FCC licensing regulations.

The principle function of the IAP is to provide the Subscriber Devices in the coverage area of the IAP access to wired services. The IAP also provides a fixed location reference for Geo-Location (optional feature), provides wireless routing for units in the IAPs coverage area, and is the principal network management interface to associated Wireless Routers and Subscriber Devices.

The mēa IAP provides a mounting point for a mounting bracket that can be attached to either a pole or a flat surface. For a mēa deployment, a permanent AC power source for each IAP must be provided. The RJ-45 weatherproof plug can be terminated in the field, allowing custom lengths to be assembled quickly on site.

Equipment

The following list defines the standard mēa hardware components for the IAP:

- IAP Box with N-type Female Antenna Connector
- 120V A/C Power Cable with a NEMA 5-15 plug
- Antenna with N-type Male Antenna Connector
- Weatherproof RJ-45 Connector
- Mounting Bracket

The Network Operator must supply the following:

- Mounting Location
- 120V A/C Power Source
- Ethernet connection between the IAP and the MiSC
- Hand tools for bracket installation (??)

Optional Equipment

Typical optional equipment includes the following:

- Net-to-Net boxes for T1 deployment
- Power Cords terminating in PE cell connector

Approved Antennas Options

Manufacturer	Part Number	Gain	Type
Maxrad	Z1578	8 dBi	Onmi
Maxrad	Z1576	4 dBi	Onmi
Hyperlink	HG2409MU	8 dBi	Onmi
Hyperlink	HG2407U	7.5 dBi	Onmi

Refer to the IAP data sheet for a complete list of options.

Record MAC Address of the IAP

The transceiver MAC address is recorded on a label located on the antenna side of the IAP as shown in Figure 5. Record this number in **Section 4 - MAC Address Tables**, because it will be required later to configure and test the device.

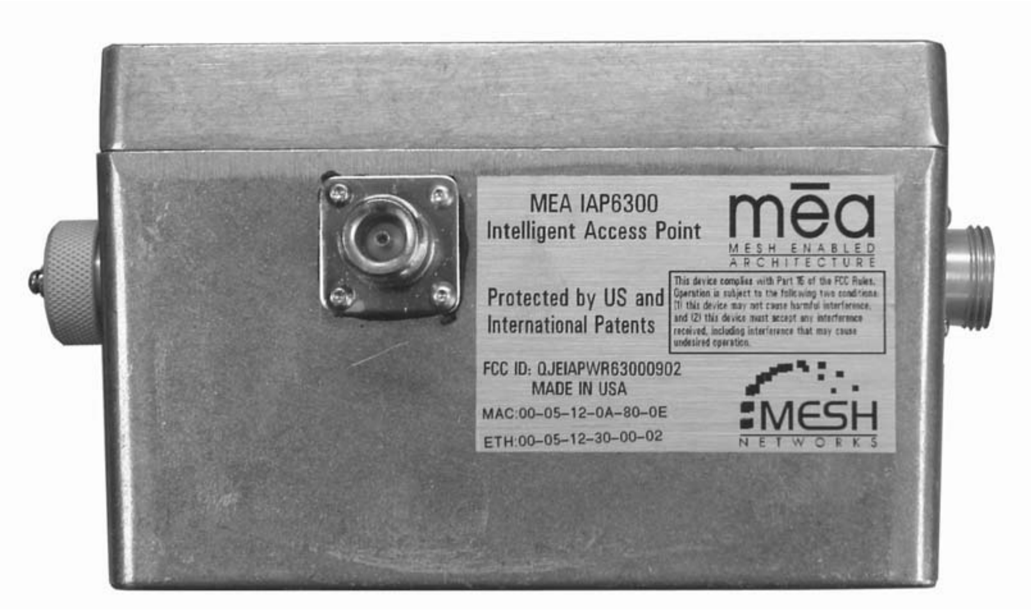

MEA IAP6300
Intelligent Access Point
mēa
MESH ENABLED ARCHITECTURE
Protected by US and International Patents
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
FCC ID: QJEIAPWR63000902
MADE IN USA
MAC:00-05-12-0A-80-0E
ETH:00-05-12-30-00-02
MESH NETWORKS

Figure 5 IAP6300 Identification Label

IAP Assembly

The Figure 6 shows the external connection points on an IAP6300 box.

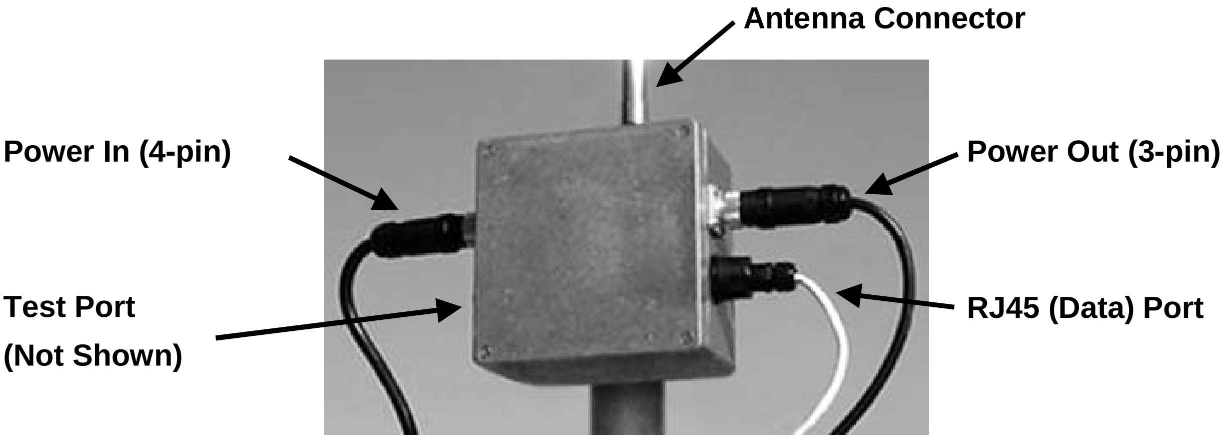


Figure 6. IAP6300 Connection Points

Figure 7 Mounting Bracket Assembly

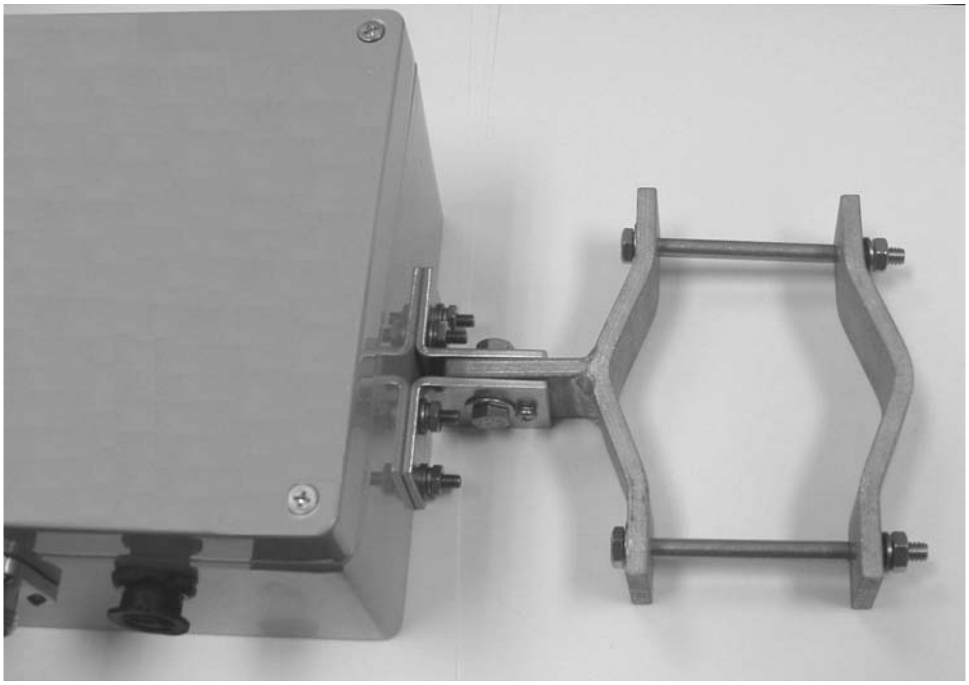


Figure 8. Bracket Attached to the IAP6300

Assemble the IAP using the following procedure:

1. If desired, mount the IAP6300 box using the enclosed bracket. Refer to Figure 8.
2. Place the bracket at the desired position on the pole The bracket can accommodate pole diameters between 1-3.5 inches. The bolts supplied with the bracket will accommodate pole diameters of 2.75 – 3.5 inches. If needed, obtain a ¼-20 hex bolt of an appropriate length for pole diameters between 1-2.75 inches (stainless steel bolts are recommended).
3. Adjust the position of the box so that the antenna will be in a vertical position. Tighten the pivot and angle locking bolts on the shaft of the bracket as shown in Figure 9
4. Insert the antenna into the N-type Connector on the top of the box, and rotate to close.
5. Insert the IAP Power Plug into the 4-pin connector.
6. Install the weatherproof connector on the Ethernet cable as described at: http://www.siemon.com/installation_instructions/pdf/IMAXIndustrialUTPPlug.pdf
7. Insert the Ethernet Cable into the RJ-45 port and tighten the connector to ensure a weatherproof seal.
8. If used, insert the Media Converter Power Cable into the 3-pin connector.
9. The Test Port is unused during deployment

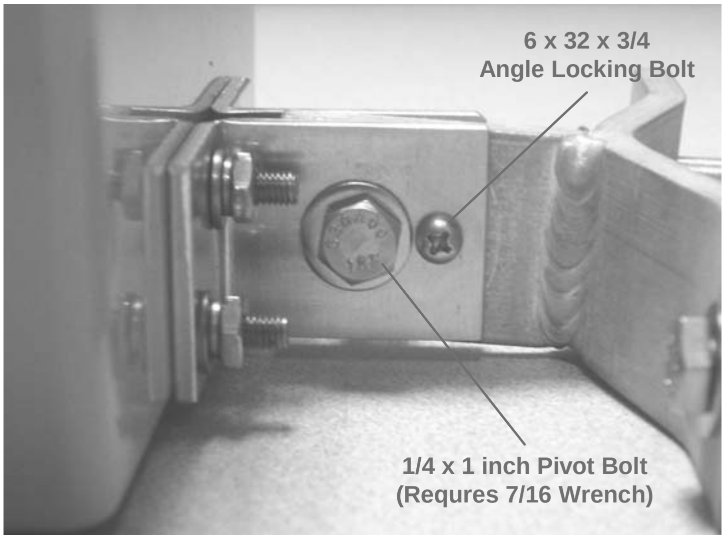


Figure 9. Bracket Adjustment Bolts

Deployment

The IAP may be mounted on a pole having a diameter of 1-3.5 inches, utilizing the provided bracket. The antenna must have a separation distance of at least 2 meters from the body of all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Users and installers must be provided with antenna installation and transmitter operating conditions to satisfy RF exposure compliance.

When deploying the IAP, the antenna should be a minimum of 30 inches from any nearby metal poles to avoid distortion of the RF pattern.

The IAP must have an Ethernet connection to the MiSC. If the distance between the IAP and the MiSC is greater than 100 meters, the Network Operator may utilize a T1 with the optional Net-to-Net boxes. The IAP has a 5V, 3-pin, power out connection on the side of the box to power the Net-to-Net boxes. Other media converters may be used at the network operator's discretion.

The installation location must provide AC power to the IAP.

It is the responsibility of the Network Operator to ensure that the installation complies with any local building codes and permits.

Initial IAP Configuration

Prior to attempting configuration of the IAP, the IAP must be powered on and have connectivity to the MiSC.

Geo-location is an optional configuration item that is entered into an infrastructure device via the Device Manager tool, located on the MeshManager server (refer to the MeshManager User's Guide). MeshNetworks recommends that a DGPS receiver be used to obtain accurate GPS coordinates, and that the longitude, latitude, and altitude values have 5 digits following the decimal point.

Testing

Once there is an Ethernet connection to the MiSC, verify the health of the IAP with the following procedure:

1. Apply power to the IAP.
2. Obtain the transceiver MAC address that was recorded in **Section 4 - MAC Address Tables**. The address will be in the format 00-05-12-0A-xx-yy.
3. From MeshManager, display devices using the MAC address.
4. Select the appropriate IAP in the device tree, and then ping the device (right click and select ping).

A response to the ping commands verifies that both the transceiver and SBC are communicating.

Wireless Router (WR)

The MWR6300 (Wireless Router) is an infrastructure device positioned in a fixed location, such as on a pole, wall, or rooftop. The MWR6300 requires professional installation to ensure the installation is performed in accordance with FCC licensing regulations.

The Wireless Routers provides range extension, a means to route around obstructions, and a fixed location reference for use in Geo-Location (an optional feature).

The mēa MWR6300s comes with a mounting bracket that can be attached to a pole with a diameter of 1-3.5 inches . For a mēa deployment, a permanent AC power source for each WR must be provided.

Equipment

The following list defines the mēa hardware components needed to setup a WR:

- WR Box with N-type Antenna Connector
- 120V A/C Power Cable with a NEMA 5-15 plug
- Antenna with N-type Male Antenna Connector
- Mounting Bracket

The Network Operator must supply the following:

- Mounting Location
- 120V A/C Power Source
- Hand tools for bracket installation

Optional Configurations:

- Power Cable to connect to a Fisher-Pierce 7570B photoelectric cell

Approved Antennas Options:

Manufacturer	Part Number	Gain	Type
Maxrad	Z1578	8 dBi	Onmi
Maxrad	Z1576	4 dBi	Onmi
Hyperlink	HG2409MU	8 dBi	Onmi
Hyperlink	HG2407U	7.5 dBi	Onmi

Refer to the WR data sheet for a complete list of options.

Record MAC Address of the MWR6300

The transceiver MAC address is recorded on the label located on the antenna side of the MWR6300 as shown in Figure 10.

Record this number in **Section 4 - MAC Address Tables**, because it will be required later to configure and test the device.

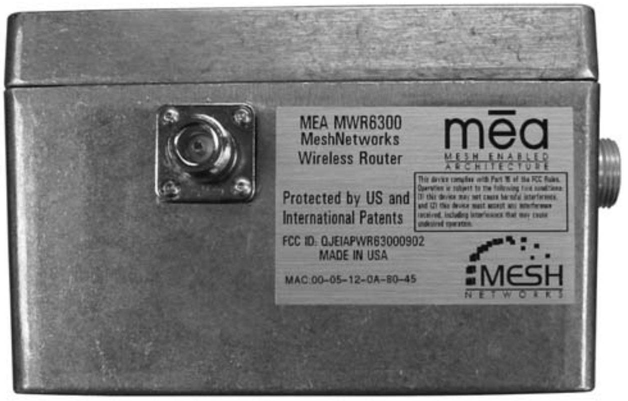

MEA MWR6300
MeshNetworks
Wireless Router
mēa
MESH ENABLED ARCHITECTURE
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Protected by US and International Patents
FCC ID: QJEIAPWR63000902
MADE IN USA
MAC:00-05-12-0A-80-45
MESH
NETWORKS

Figure 10. MWR6300 Identification Label

MWR6300 Assembly

Figure 11 shows the external; connection points on a MWR6300 box.

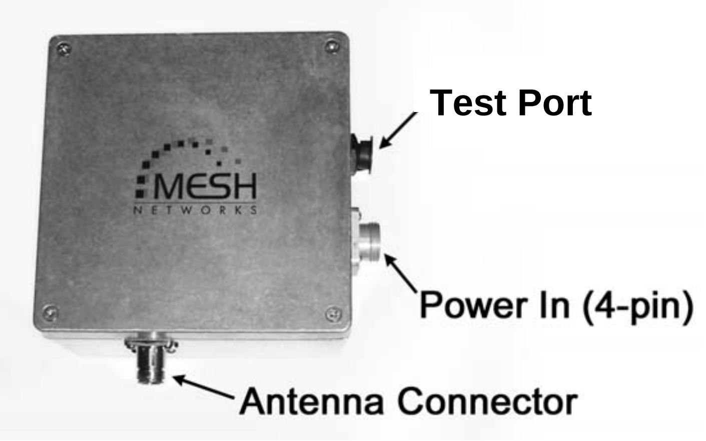


Figure 11. MWR6300 External Connection Points

Assemble the WR using the following procedure:

1. If desired, mount the WR box using the enclosed bracket. Refer to the procedure in the IAP assembly section of this document.
2. Insert the Antenna into the N-type Connector on the top of the box, and rotate to close.
3. Insert the Power Plug into the 4-pin Connector.
4. The transceiver MAC address is recorded on the back of the WR. Record this number in **Section 4 - MAC Address Tables**, as it will be required to configure and test the device.
5. The Test Port is unused during deployment.

Deployment

The MWR6300 can be mounted on a pole by using the provided bracket.

When deploying the MWR6300, the antenna should be a minimum of 30 inches from any nearby metal poles to avoid distortion of the RF pattern. The antenna must have a separation distance of at least 2 meters from the body of all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Users and installers must be provided with antenna installation and transmitter operating conditions to satisfy RF exposure compliance.

Typically, wireless routers are distributed within a network to extend range and guarantee coverage. A rule of thumb is to deploy 3-4 hop networks to optimize range, latency, and throughput.

The MWR6300 installation location must provide AC power for the device.

It is the responsibility of the Network Operator to ensure that the installation complies with any local building codes and permits.

Initial Configuration

The optional configuration process for Geo-Location is the same as the IAP.

Testing

Verify the operation of the MWR6300 using the following procedure:

1. Apply power to the MWR6300.
2. Obtain the transceiver MAC address that was recorded in **Section 4 - MAC Address Tables**. The address will be in the format 00-05-12-0A-xx-yy.
3. From MeshManager, display devices using the MAC address.
4. Select the appropriate WR in the device tree, and then ping the device (right click and select ping).

A response to the ping command verifies that the transceiver is communicating.

Mobile Internet Switching Controller (MiSC)

The MiSC provides routing, switching, and management functions for the wireless network, and the connection to the wired world.

Equipment

The following list defines the standard mēa components needed for the MiSC:

- SMC 24 Port Switch
- Cisco 1720 – Edge Router
- Cisco 1720 – Core Router
- MeshManager Server (Server, Monitor, Keyboard, Mouse), pre-installed with the MeshManager software
- 5 Ethernet Cables

The Network Operator must supply the following:

- Physical location and AC power for the routers, switch, and server(s)
- Ethernet connection(s) from the switch to the IAP(s)
- Ethernet connection to Internet or to Network Operator's private network (Custom IP network configuration may be required depending on Network Operator's network configuration)
- Public address for Edge Router, DNS resolver address
- PC running Windows 2000 with an Ethernet Port for MiSC Configuration and MeshView
- Optional Equipment:
- Geo Server
- T1 Network Extenders

Refer to the MiSC data sheet for a complete list of options.

Network Setup Description

The basic MiSC hardware configuration is shown in Figure 12.

Figure 12. Basic MiSC Configuration

The following describes the parameters for setting up the network:

- All mēa wireless devices must be within the same subnet.
- mēa currently uses the non-routable 10.x.x.x (8 bit) subnet as defined in RFC 1918.
- The IAPs, WRs, and SDs will use DHCP to obtain an IP address, the default configuration returns a 10.x.x.x address.
- All MeshNetworks devices have a default gateway of 10.0.0.1
- The Network Operator provides the address of the DNS server. The Subscriber Devices must be manually configured to access the DNS server in order to resolve web URLs. (See WMC6300 User’s Guide for instructions on this.)

MiSC Assembly

The MiSC hardware consists of commercial off-the-shelf components. The components are pre-configured with a basic configuration that requires minimal site-specific changes.

The SMC switch arrives configured as two virtual LANs. The upper row of Ethernet ports is for the server subnet; the lower row of ports is for the wireless subnet.

Unpack the SMC switch and mount as desired (either in a rack or on a table top). Connect the switch to a power source.

Unpack the Cisco router labeled "EdgeRTR" and connect to a power source. Plug interface labeled "10BT Ethernet" into the Internet or the Network Operator's private network. (The network operator supplies this cable; it will be an Ethernet cable for connecting to a hub or switch, or an Ethernet crossover cable if connecting to another router.) Plug interface labeled "10/100 Ethernet" into the SMC switch on port 1.

Unpack the Cisco router labeled "CoreRTR" and connect to a power source. Plug interface labeled "10BT Ethernet" into the SMC switch on port 12. Plug the interface labeled "10/100 Ethernet" into the SMC switch on port 24.

Unpack the Sun Blade/MeshManager server and monitor and connect to a power source. Plug the network interface into any of the ports 2-11 on the SMC Switch.

Connect Network Operator supplied computer running Windows 2000. Plug the network interface into any of the ports 2-11 on the SMC Switch.

Connect the IAPs to any of the ports 13-23 on the SMC switch.

Onsite Configuration of Routers

EdgeRTR Configuration

The EdgeRTR must have on-site configuration done if there is a desire to connect to the Internet. Prior to performing the following steps, obtain the IP address, netmask, and default gateway for the public interface from the Internet Service Provider. These are shown as ***ip.ip.ip.ip***, ***nm.nm.nm.nm***, and ***gw.gw.gw.gw***, respectively, in the instructions below. Also, obtain the IP address of the EdgeRTR, it will be in the form of 172.a.0.1.

Telnet into the EdgeRTR from a computer connected to the server subnet. Use the address 172.a.0.1 to connect to the EdgeRTR.

Update the public IP information using the commands below

```
Password:g0ld1
EdgeRTR>enable
Password:g0ld11
EdgeRTR#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
EdgeRTR(config)#interface Ethernet0
EdgeRTR(config-if)#ip address ip.ip.ip.ip mm.nm.nm.nm
EdgeRTR(config-if)#exit
EdgeRTR(config)#no ip route 0.0.0.0 0.0.0.0
EdgeRTR(config)#ip route 0.0.0.0 0.0.0.0 gw.gw.gw.gw
EdgeRTR(config)#exit
EdgeRTR#copy running-config startup-config
Destination filename [startup-config]? <return>
Building configuration...
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![OK]
EdgeRTR#exit
```

EdgeRTR TEST

Use a computer connected to the switch (in either the server or wireless subnet) to ping to the ISP gateway IP. Next, test access to the Internet using a web browser. If this fails troubleshoot and retry.

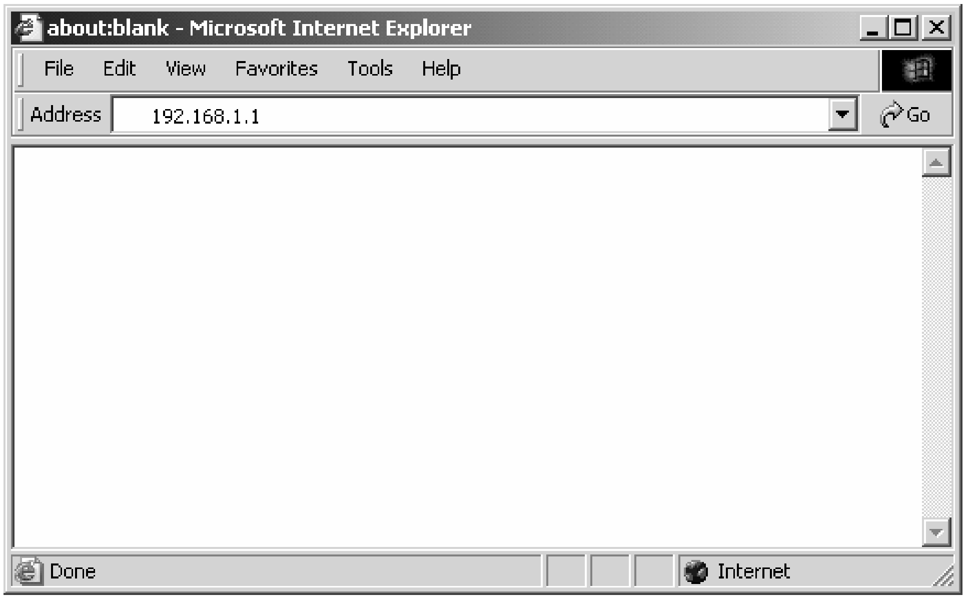
Network Configuration – Device Manager

“Device Manager” is a utility located on the MeshManager server. It is used to configure and monitor the deployed network. Refer to the MeshManager User’s Guide for detailed instructions on how to use the Device Manager.

Mea systems are delivered with the initial configuration of IAPs, WRs, and SDs in the MeshManager system. This allows for easy testing of the system as units are tested on site. There are two basic tests to verify correct operation the system. The first test is to perform ping tests to each device and the second test is to verify access the Internet.

Network Configuration – IAP Configuration Via Web Interface

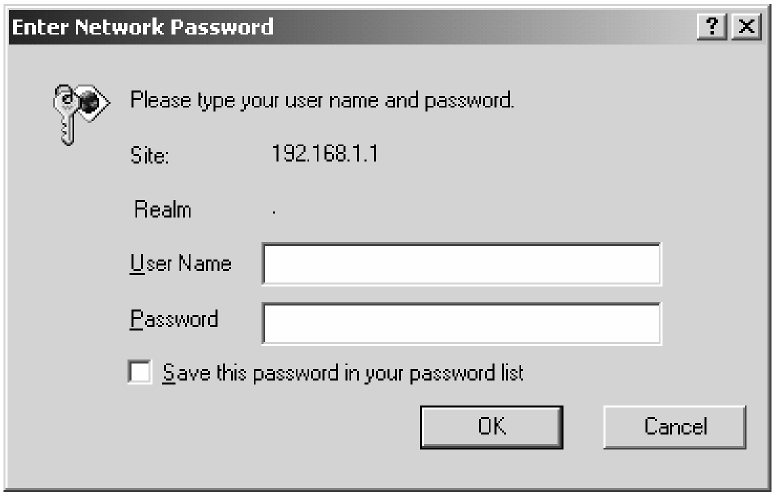
A second method of performing various network configuration functions for an IAP may be accomplished using a standard web browser. Connect a host PC to the switch in the MiSC. Using a standard Internet Browser such as Microsoft’s Internet Explorer or Netscape, enter the IP Address corresponding to the IAP to be configured as shown in Figure 13. If you do not know the IP address of the IAP then contact the system administrator. Optionally, if the network has been configured with a DHCP Server and a DNS Server, you may use the Device System Name. Since all IAPs ship with the same default Device System Name, it is recommended that you install and configure the IAPs one at a time.


about:blank - Microsoft Internet Explorer

Address 192.168.1.1

Figure 13. MEA Device Administration Connection

A Log On window for the Configuration Utility will be displayed in the browser, as shown in Figure 14. Before the Configuration Utility is displayed, the user must complete the simple logon procedure before proceeding. When the Log On is complete, the Configuration Utility will be displayed. The default login is “admin’ and the password is “admin”. The password can be changed, as described further in this document.



Enter Network Password

Please type your user name and password.

Site: 192.168.1.1

Realm .

User Name

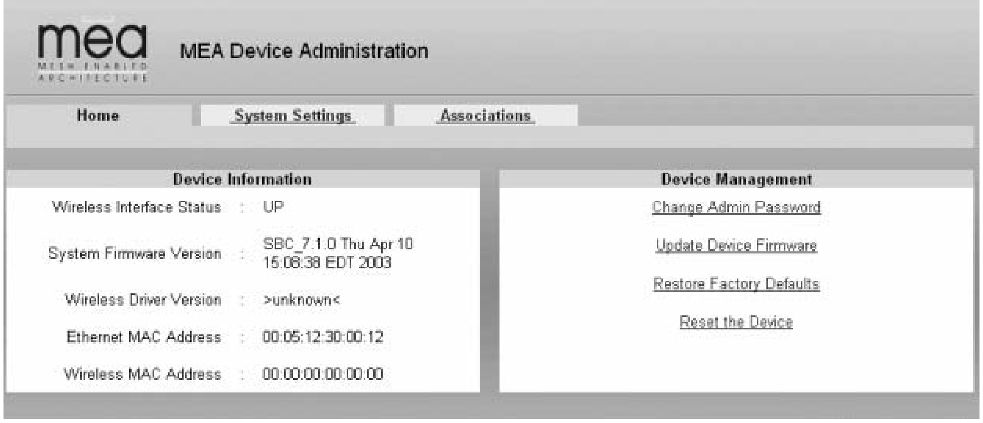
Password

☐ Save this password in your password list

Figure 14. MEA Device Administration Logon Window

At the completion of the logon, the Home Tab screen will be displayed as shown in Figure 15.

Home Tab



Device Information

Wireless Interface Status	:	UP
System Firmware Version	:	SBC_7.1.0 Thu Apr 10 15:08:38 EDT 2003
Wireless Driver Version	:	>unknown<
Ethernet MAC Address	:	00:05:12:30:00:12
Wireless MAC Address	:	00:00:00:00:00:00

Figure 15. MEA Device Administration Home Tab

The Device Information window provides data on:

Wireless Interface Status (up or down)

System Firmware Version (software running on the SBC in the IAP)

Ethernet MAC Address (address of the SBC)

Wireless MAC Address (address of the transceiver)

Also located on the Home Tab are Device Management options for

Change Administration Password

Update Device Firmware

Restore Factory Defaults

Reset the Device

The Device Management options are detailed below.

Home Tab – Change Admin Password

From the Home tab, the user can select the "**Change Admin Password**" to change the administrator password of the device.

WARNING – If the password is lost, the password can only be reset at the factory. Do not forget to record the information in an appropriate location for future use.

1. To change the password, select "**Change Admin Password**".
2. "Enter the new password" will be displayed on the Change Password window as shown in Figure 16. Enter the new password in the "**New Password**" textbox.
3. Enter the new password <u>again</u> in the "**New Password (again)"** textbox.

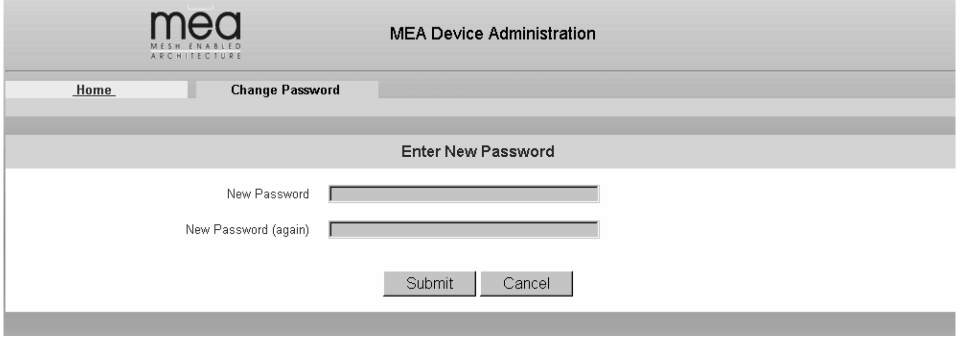
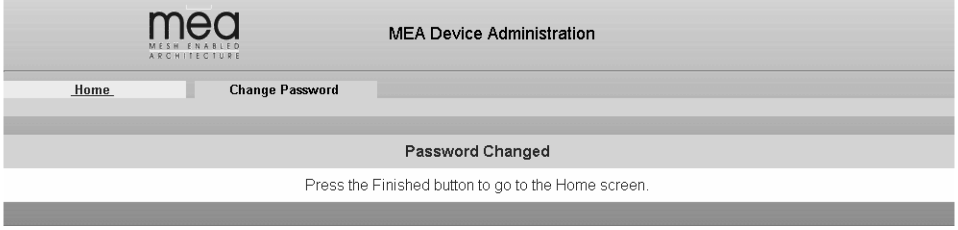


Figure 16. MEA Device Administration Enter New Password Window

4. Click on the "**Submit**" button. The browser will display a message that confirms the password change as shown in Figure 17.



Password Changed

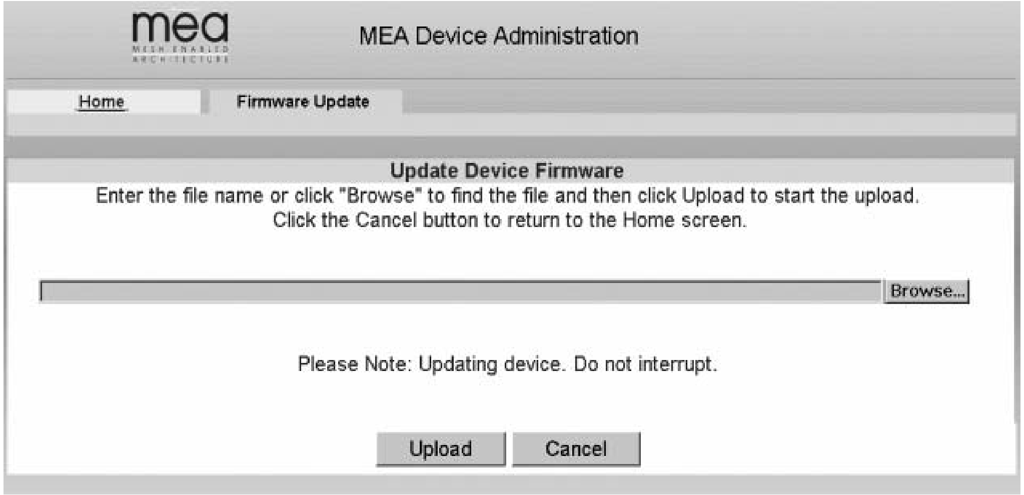
Press the Finished button to go to the Home screen.

Figure 17. MEA Device Administration Password Changed Window

Home Tab – Update Device Firmware

From the Home Tab, select "**Update Device Firmware**" to load a new version of the firmware into the IAP.

. A New Device Firmware window will be displayed as shown in Figure 18



Update Device Firmware

Enter the file name or click "Browse" to find the file and then click Upload to start the upload.
Click the Cancel button to return to the Home screen.

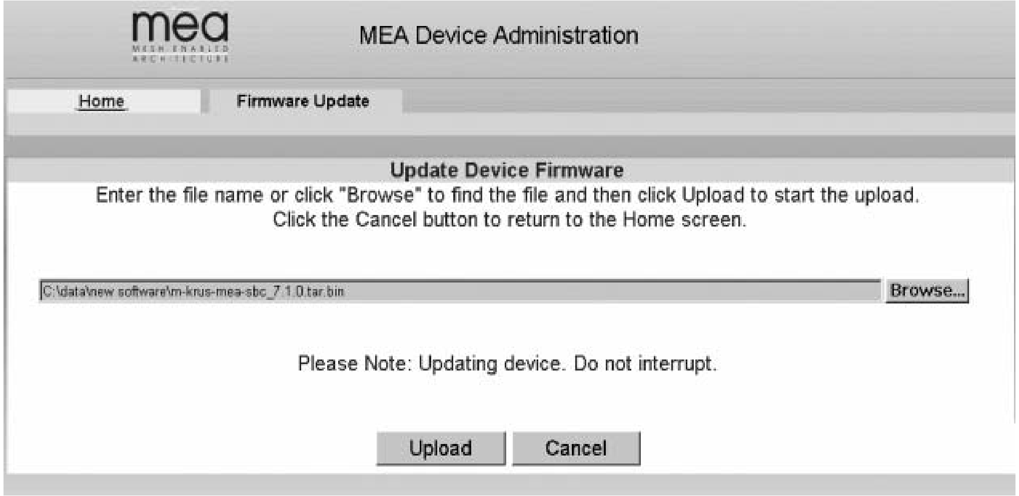
Please Note: Updating device. Do not interrupt.

Figure 18. MEA Device Administration Update Device Firmware Window

1. Click on the “**Browse**” button to navigate to the correct location of the firmware “bin” file, or specify the path and file name of the firmware “bin” file to be uploaded to the device.

If the “**Browse**” button is selected, the “**Choose file**” window is displayed. Selecting the filename starting with “m-krc” will overwrite any custom configurations which have been applied to the AP. Selecting the filename starting with “m-r” will retain any custom configurations. Locate and select the desired firmware “bin” file to be uploaded to the device. Then click on the “**OK**” button

The path and file name of the firmware “bin” file will be displayed in the Update Device Firmware window as shown in Figure 19. Click on the “**Upload**” button to continue the process or select “**Cancel**” to terminate the Firmware Update procedure



Update Device Firmware

Enter the file name or click "Browse" to find the file and then click Upload to start the upload.
Click the Cancel button to return to the Home screen.

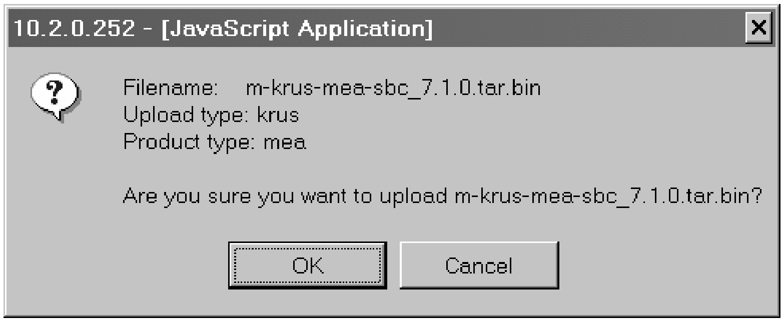
C:\data\new software\m-krus-mea-sbc_7.1.0.tar.bin

Please Note: Updating device. Do not interrupt.

Figure 19. MEA Device Administration Update Device Firmware Window (2)

2. If the “**Upload**” button is selected, an upload confirmation message is displayed as shown in Figure 20 to confirm that you want to continue the Firmware Update procedure.

Click on the “**OK**” button to continue or select “**Cancel**” to terminate the Firmware Update procedure.



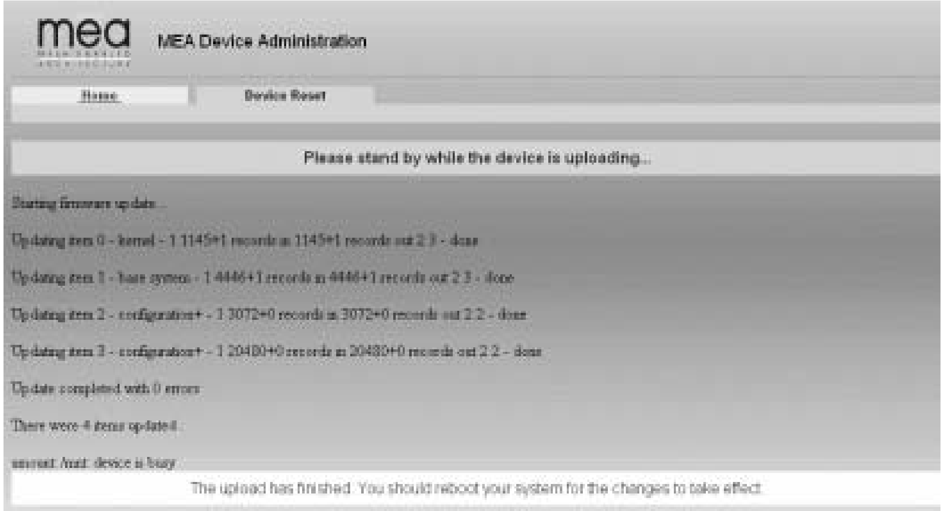
10.2.0.252 - [JavaScript Application]

Filename: m-krus-mea-sbc_7.1.0.tar.bin
Upload type: krus
Product type: mea

Are you sure you want to upload m-krus-mea-sbc_7.1.0.tar.bin?

Figure 20. MEA Device Administration Update Confirmation Window

3. If the “**OK**” button is selected, the new Firmware is loaded into the device. The Firmware Update window will then be displayed to indicate that the selected file was successfully uploaded and to recommend that you reboot the device.
4. As the Firmware is being uploaded, a status page is displayed as shown in Figure 21.



Please stand by while the device is uploading...

```
Starting firmware update...
Updating item 0 - kernel - 1 1145+1 records in 1145+1 records out 2.3 - done
Updating item 1 - base system - 1 4446+1 records in 4446+1 records out 2.3 - done
Updating item 2 - configuration+ - 1 3072+0 records in 3072+0 records out 2.2 - done
Updating item 3 - configuration+ - 1 20480+0 records in 20480+0 records out 2.2 - done
Update completed with 0 errors
There were 4 items updated.
umount: /mnt: device is busy
```

The upload has finished. You should reboot your system for the changes to take effect.

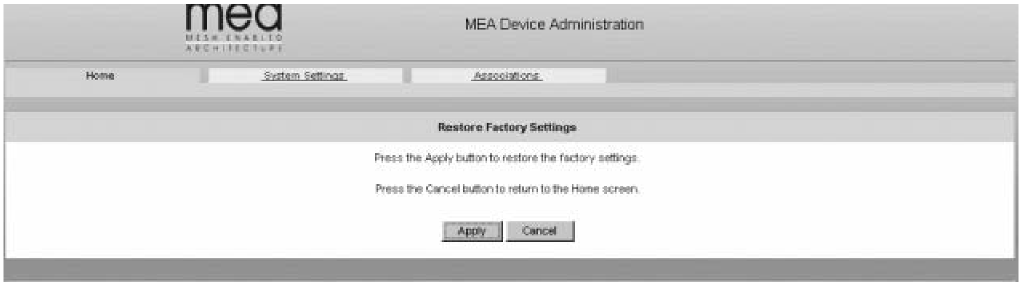
Figure 21. MEA Device Administration Update Device Status Window

5. At the completion of the update, the IAP’s SBC must be reset for the update to take effect. Select the “**Home**” tab and then click on the “**Reset Device**” button as described in the procedure located on page 21. The device will reset and return to the “**Home**” tab.

Note: Do not to close the browser until the process is complete.

Home Tab – Restore Factory Defaults

From the Home Tab, the user can select “**Restore Factory Defaults**” to restore the firmware to Factory Default settings. By selecting the “**Restore Factory Defaults**” button, the IAP setting will be returned to the default configuration. The user will receive a caution message before proceeding with the restore process as shownbe in Figure 22.



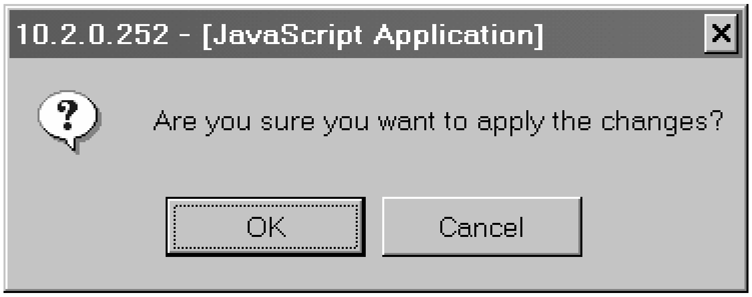
Restore Factory Settings

Press the Apply button to restore the factory settings.

Press the Cancel button to return to the Home screen.

Figure 22. MEA Device Administration Restore Factory Defaults Window

6. Click on the “**Apply**” button to continue the restore process or select the “**Cancel**” button to terminate the process with out changing the device settings.
7. If the “**Apply**” button is selected, a confirmation message is displayed as shown in Figure 23 to confirm that you want to continue the Restore Factory Settings procedure.



10.2.0.252 - [JavaScript Application]

Are you sure you want to apply the changes?

Figure 23. Restore Factory Defaults Confirmation Message

8. Click on the “**OK**” button to continue or select “**Cancel**” to terminate the procedure.

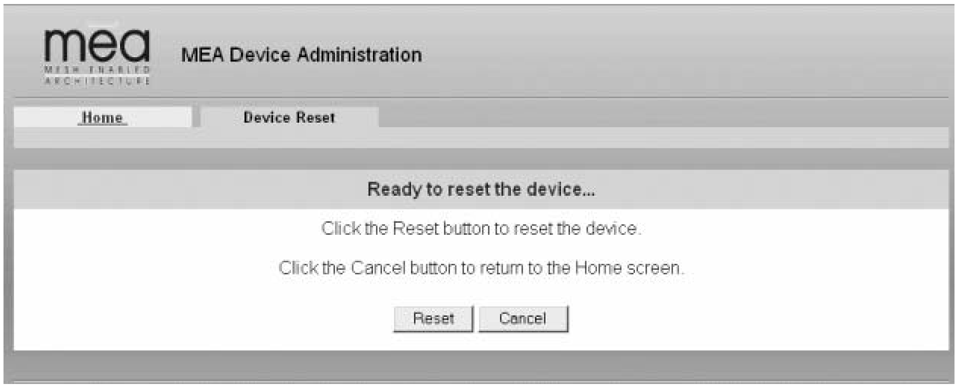
If the “OK” button is selected, the setting will be restored and the device will reset automatically. Upon completion of the process, the browser will return automatically to the “**Home**” tab.

Home Tab – Reset Device

From the Home tab, the user can select the “**Reset the Device**” button to reset the device and reinitialize the IAP. The configuration settings are preserved during the initialization process. The user will receive a caution message before proceeding with the reset.

1. Select the “**Reset the Device**” button to initiate the reset process on the IAP.
2. The Reset the Device window is displayed as shown in Figure 24. Select the “**Reset**” button to continue the process.

The Reset the Device window displays a message that describes the process and the time to completion as shown in Figure 25. The device will reset automatically upon completion of the update process and then return to the “**Home**” tab to display status information.

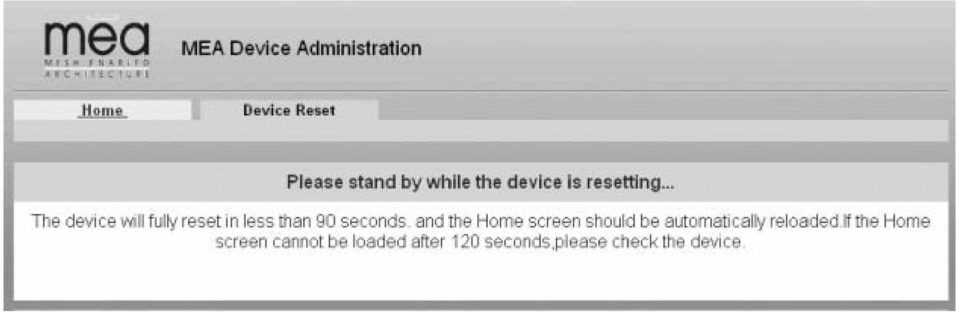


Ready to reset the device...

Click the Reset button to reset the device.

Click the Cancel button to return to the Home screen.

Figure 24. MEA Device Administration Device Reset Window



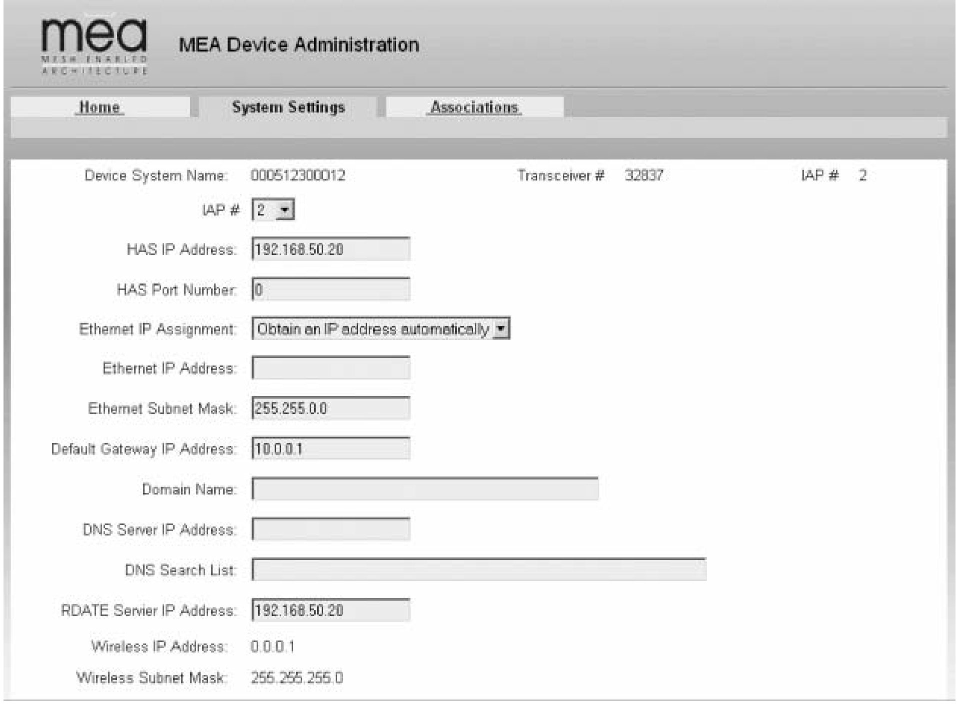
Please stand by while the device is resetting...

The device will fully reset in less than 90 seconds. and the Home screen should be automatically reloaded.If the Home screen cannot be loaded after 120 seconds,please check the device.

Figure 25. MEA Device Administration Device Reset Window (2)

System Settings Tab

The System Settings Tab is shown in Figure 26



Device System Name: 000512300012 Transceiver # 32837 IAP # 2

IAP #: 2

HAS IP Address: 192.168.50.20

HAS Port Number: 0

Ethernet IP Assignment: Obtain an IP address automatically

Ethernet IP Address:

Ethernet Subnet Mask: 255.255.0.0

Default Gateway IP Address: 10.0.0.1

Domain Name:

DNS Server IP Address:

DNS Search List:

RDATE Servier IP Address: 192.168.50.20

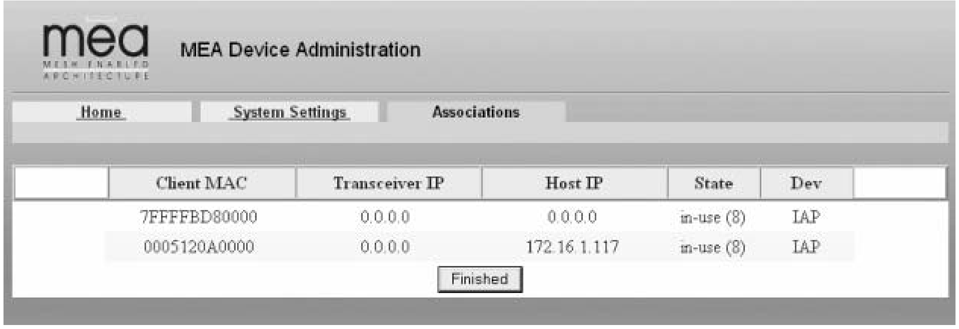
Wireless IP Address: 0.0.0.1

Wireless Subnet Mask: 255.255.255.0

Figure 26. MEA Device Administration System Settings Tab

Associations Tab

The Associations Tab is an information only window as is shown in Figure 27



Client MAC	Transceiver IP	Host IP	State	Dev
7FFFFBD80000	0.0.0.0	0.0.0.0	in-use (8)	IAP
0005120A0000	0.0.0.0	172.16.1.117	in-use (8)	IAP

Figure 27. MEA Device Administration Associations Tab

This window displays all devices currently associated with an IAP. There will always be at least 2 entries: one for the IAP's SBC and one for the IAP's transceiver.

Testing

Basic MiSC Tests

To verify the basic connectivity of the MiSC, conduct the following from the MeshManager server using the Device Manager application:

- Ping an IAP
- Ping the NAT Router
- Ping the Edge Router

Wireless System Tests

From Device Manager, complete the following to verify correct operation of the system:

1. Ping the SBC of the deployed IAPs
   - From the Device Manager drop down menu, select Preferences/Use SBC Address
   - For each IAP in the device tree, right click and select **Ping Device**
2. Ping the transceiver of the deployed IAPs
   - From the Device Manager drop down menu, select Preferences/Use Transceiver Address
   - For each IAP in the device tree, right click and select **Ping Device**
3. Ping the transceiver of the deployed WRs
   - From the Device Manager drop down menu, select Preferences/Use Transceiver Address
   - For each WR in the device tree, right click and select **Ping Device**
4. Ping the transceiver of each Subscriber Devices
   - From the Device Manager drop down menu, select Preferences/Use Transceiver Address
   - For each SD in the device tree, right click and select **Ping Device**

Internet Test

If the mēa system has been configured to access the Internet, complete one of the two following tests to verify correct network setup:

1. From a provisioned SD, start the web browser and enter a URL such as http://www.MeshNetworks.com.
2. From a SD, open a DOS/cmd window and ping an URL, e.g., **ping www.meshnetworks.com**.

Default Addresses and Logins

The following are the default values for the system components. These may be updated during installation.

Device	Description	Default
Core Router	login password	**g0ld1**
Core Router	enable password	**g0ld11**
Core Router	IP address on Sever	**172.31.0.2**

Device	Description	Default
Core Router	Wireless subnet IP address for Core Router	**10.0.0.1**
Edge Router	login password	**g0ld1**
Edge Router	enable password	**g0ld11**
Edge Router	IP address on Server	**172.31.0.1**
Sun Blade	root password	**g0ld11**
Sun Blade	node name	**MeshManager**
Sun Blade	IP address for next-level hierarchical DNS server	**(none**)
Sun Blade	IP address if Mesh VPN support is provided	**172.31.0.20**
Sun Blade	Secondary IP address for IAP rdate server	**192.168.50.20**
Sun Blade	Secondary IP address for IAP HAS server	**192.168.50.20**
Sun Blade	Secondary IP address for IAP syslog server	**172.18.0.50**
Sun Blade	Server subnet DHCP range	**172.31.1.1 to 172.31.1.254**
Sun Blade	Wireless subnet DHCP range	**10.2.0.1 to 10.2.0.254**
IAP	Default Gateway	**10.0.0.1**
IAP	IP address for rdate server	**192.168.50.20**
IAP	IP address for HAS server	**192.168.50.20**
IAP	IP address for syslog server	**172.18.0.50**
Subscriber Device	Default Gateway	**10.0.0.1**
Subscriber Device	DNS Server	**192.168.50.20**

Section 4 - MAC Address Tables

IAP MAC Addresses

IAP MAC Address **00-05-12-0A-xx-yy**

WR MAC Addresses

WR MAC Address **00-05-12-0A-xx-yy**

WMC MAC Addresses

WMC MAC Address 00-05-12-0A-xx-yy

Section 5 - Site Selection/Deployment Guidelines

General Site Selection Guidelines

The IAP location(s) should be selected first since they have the additional requirement of routing information back to the MiSC. This may be done via an Ethernet cable if the IAP and MiSC are located within 100 meters (the max length permitted for standard Ethernet) of each other. If the distance is greater than 100 meters, a mechanism for extending the Ethernet connection will be required, e.g., using fiber or T1. (MeshNetworks recommends T1 backhaul equipment from Net-to-Net Technologies.)

Once the IAPs have been placed, then the location of the WRs can be determined. Optimally, the devices should be distributed such that a SD has no more than 3 hops to an IAP.

AC power must be available for both IAPs and WRs.

Lastly, any local building/structure codes must be adhered to, as well as proper permits for placing devices on structures that are not owned by the Network Operator (e.g., light poles).

MeshNetworks has developed the “Location Analyzer” tool to assist in the placement of infrastructure. This tool runs on a Windows 2000 SD. The tool collects and analyzes data, ultimately resulting in a deployment quality indication. Refer to the Location Analyzer documentation for information on configuring and using this tool.

Antenna Guidelines

The location of fixed infrastructure antennas must address proper antenna orientation, selection of elevation pattern for the specific locale, the avoidance of pattern distortion, and the impact of obscuration and non-line-of-sight paths.

Polarization - Most of the antennas used in deployment will be vertically polarized. To maximize line-of-sight signal reception, both the transmitting and receiving antennas should be vertically oriented to avoid signal loss due to polarization mismatch. This applies to mobile and stationary antennas. For example, placing a magnetically mounted vehicle antenna on a curved portion of the vehicle roof so that its axis is not vertical risks a measure of signal loss at range, dependent upon the specific elevation pattern details, as discussed above.

Local obstructions - Antennas should be mounted either above or below the plane of obstructions as shown in Figure 28.

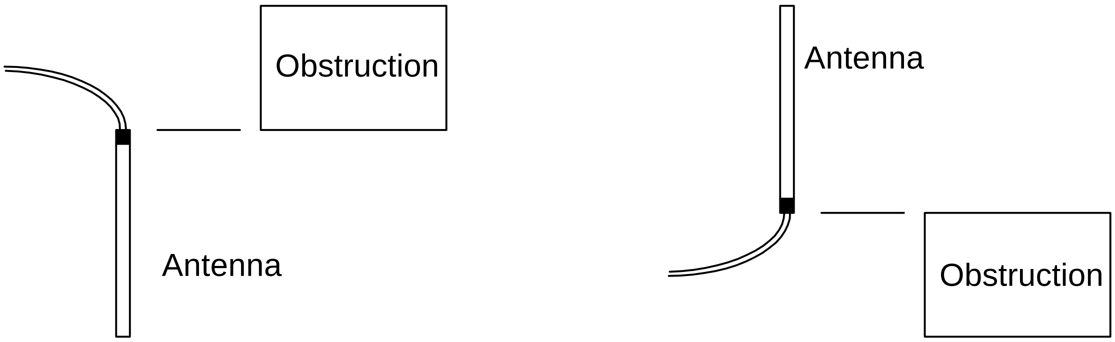


Figure 28. Antenna Mounting

Low gain “rubber duck” antennas that are mounted directly to Mesh transceivers are designed for transmitting and receiving vertically polarized radiation. Hence, care must be taken to insure close-to-vertical orientation of these antennas to avoid substantial signal loss due to polarization mismatch. Additionally, attenuation sustained by use of these antennas inside vehicles can be as high as 10 dB. Typically, losses are in the 4 to 7 dB range if the antenna is above the "metal can" of the vehicle so that radiation and reception occur at window level.

Lab Checkout

Prior to deploying any equipment in the field, it is recommended to test the equipment in a lab environment to ensure the equipment is functioning.

Step 1 - Verify MiSC

Set up the MiSC as discussed in the MiSC Assembly section. Attach a Windows computer to the SMC switch. Verify that the following can be pinged: edge router, core router, MeshManager. Refer to the Default Addresses and Logins section for the addresses.

Step 2 – Verify IAPs.

Using an Ethernet cable, attach the IAPs, one at a time, to the SMC switch. Using either the MAC or ETH address on the IAP box for reference, use MeshManager to verify that the IAP can be reached, and that it is obtaining an address from the DHCP server. Next, start an SD in infrastructure mode, and ensure that it also receives an IP address from the DHCP server. This verifies that both the SBC and the transceiver in the IAP are functioning.

Step 3 – Verify WRs

Connect an IAP as described in Step 2. Power up the WRs one at a time. Using the MAC address on the WR box for reference, verify that the MeshManager console can reach each WR, and that an appropriate IP address is displayed.

Step 4 – Verify PCMCIA cards

Connect an IAP as described in Step 2, Load a host computer with the WMC6300 drivers as described in section ??. Insert a WMC6300 card into the host device. Start MeshTray. Verify that the status tab displays a valid IP address. Eject the WMC6300 card utilizing the "Unplug or Eject Hardware" icon. Insert another WMC6300 card and repeat the MeshTray test.

General Deployment Guidelines

It is recommended that field deployment follow the same steps as described in General Site Selection Guidelines

The IAP location(s) should be selected first since they have the additional requirement of routing information back to the MiSC. This may be done via an Ethernet cable if the IAP and MiSC are located within 100 meters (the max length permitted for standard Ethernet) of each other. If the distance is greater than 100 meters, a mechanism for extending the Ethernet connection will be required, e.g., using fiber or T1. (MeshNetworks recommends T1 backhaul equipment from Net-to-Net Technologies.)

Once the IAPs have been placed, then the location of the WRs can be determined. Optimally, the devices should be distributed such that a SD has no more than 3 hops to an IAP.

AC power must be available for both IAPs and WRs.

Lastly, any local building/structure codes must be adhered to, as well as proper permits for placing devices on structures that are not owned by the Network Operator (e.g., light poles).

MeshNetworks has developed the “Location Analyzer” tool to assist in the placement of infrastructure. This tool runs on a Windows 2000 SD. The tool collects and analyzes data, ultimately resulting in a deployment quality indication. Refer to the Location Analyzer documentation for information on configuring and using this tool.

Antenna Guidelines

The location of fixed infrastructure antennas must address proper antenna orientation, selection of elevation pattern for the specific locale, the avoidance of pattern distortion, and the impact of obscuration and non-line-of-sight paths.

Polarization - Most of the antennas used in deployment will be vertically polarized. To maximize line-of-sight signal reception, both the transmitting and receiving antennas should be vertically oriented to avoid signal loss due to polarization mismatch. This applies to mobile and stationary antennas. For example, placing a magnetically mounted vehicle antenna on a curved portion of the vehicle roof so that its axis is not vertical risks a measure of signal loss at range, dependent upon the specific elevation pattern details, as discussed above.

Local obstructions - Antennas should be mounted either above or below the plane of obstructions as shown in Figure 28.

Figure 28. Antenna Mounting

Low gain “rubber duck” antennas that are mounted directly to Mesh transceivers are designed for transmitting and receiving vertically polarized radiation. Hence, care must be taken to insure close-to-vertical orientation of these antennas to avoid substantial signal loss due to polarization mismatch. Additionally, attenuation sustained by use of these antennas inside vehicles can be as high as 10 dB. Typically, losses are in the 4 to 7 dB range if the antenna is above the “metal can” of the vehicle so that radiation and reception occur at window level.

Lab Checkout. IAPs should be deployed first and verified as functional. Next the WRs should be deployed in a “near to far” pattern; in other words, WRs that are 1 hop from an IAP should be deployed first, followed by WRs that are 2 hops from an IAP, etc. This allows the functionality of each WR to be determined at the time of installation, thus eliminating any extra truck rolls to trouble-shoot a WR.

Section 6 - Customer Service Information

For information about solving difficulties in deploying your mēa System, please see the Frequently Asked Questions in the support page at **http://www.meshnetworks.com/**.

If you have read this document, reviewed the FAQ, and made every effort to resolve installation or operation issues yourself and still require help, please contact MeshNetworks Customer Support using the following contact information:

MeshNetworks, Inc.
Attention: Customer Support
PO Box 948133
Maitland, Florida 32794-8133

Hours of Operation

Monday through Friday	**8:00 AM – 5:00 PM (Eastern Standard Time)**
Technical Support:	**(800) 311 – 3365 (USA)**
	(407) 659 – 5300
e-mail	**measupport@meshnetworks.com**

Section 7 - WMC Installation Debug Procedures

<add in document from Glen>

Due to the multi-function driver which is installed as part of the WMC6300 software, there are occasionally some problems encountered during the installation. The following is a set of procedures for correcting problem installations.

Section 8 - License and Warranty Information

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Section 9 - FCC Regulatory Information

FCC Information

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received; including interference that may cause undesired operation.

The IAP6300 (Intelligent Access Point) is an infrastructure device that is positioned at a fixed location such as a building rooftop. The IAP6300 requires professional installation to ensure that the installation is performed in accordance with FCC licensing regulations.

The MWR6300 (Wireless Router) is an infrastructure device positioned in a fixed location, such as on a pole, wall, or rooftop. The MWR6300 requires professional installation to ensure the installation is performed in accordance with FCC licensing regulations.

Federal Communications Commission (FCC) Statement:

This Equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by MeshNetworks could void the user’s authority to operate the equipment.

FCC RF Radiation Exposure Statement

1. **CAUTION:** This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 2 meters between the antenna and your body.
2. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Safety Information for the mēa Products

The Federal Communications Commission (FCC) with its action in ET Docket 96-8 has adopted a safety standard for human exposure to radio frequency (RF) electromagnetic energy emitted by FCC certified equipment. MeshNetworks' mēa products meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this radio according to the instructions found in this manual and the hardware and software guides on the mēa CD will result in user exposure that is substantially below the FCC recommended limits.

- Do not touch or move the antenna(s) while the unit is transmitting or receiving.
- Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.
- Do not operate the radio or attempt to transmit data unless the antenna is connected; otherwise, the radio may be damaged.
- Antenna use:
  - In order to comply with FCC RF exposure limits, dipole antennas should be located at a minimum distance of 2 meters or more from the body of all persons.

Section 10 - Safety Certification

c ETL® us
LISTED

XXXXXX (6 digit control # assigned by Follow Up Services, upon completion of the listing report)

Conforms to UL STD ANSI/UL 60950 3rd Edition

Certified to CAN/CSA C22.2 NO. 60950-00

Equipment shall be suitable for use in Air pressure: 86kPa to106kPa.