

**Megisto Mobile Services Delivery System
MS650 Installation and Maintenance Guide**

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Chapter 1: About This Guide

Objective

This document provides instructions to install and configure the hardware of Megisto Systems®'s MS650, which is a component of Megisto's Mobile Services Delivery System. This document provides instructions on each installation and maintenance task in detail, along with the configuration steps.

The MS650 may be configured with many options. Your system may differ from the system illustrated throughout this manual.

Related Publications

The Megisto Systems documentation set consists of:

- *MS650 Installation and Maintenance Guide*: Provides instructions to install and maintain the MS650.
- *Megisto Services Switch Configuration Guide, Release 3.0*: Provides instructions to configure the MS650.
- *Megisto Services Switch Command Reference, Release 3.0*: Describes all command line interface (CLI) commands.
- *Services Manager User Manual, Release 3.0*: Describes use of the Services Manager application.

In This Chapter

- Objective
- Related Publications
- Intended Audience
- Conventions
- CD-ROM Structure
- Getting Help

Intended Audience



About This Guide

Intended Audience

This guide is intended for use by network installers and system and network administrators who have experience with telecommunications hardware.

Conventions

The following conventions are used throughout this manual.

Convention	Description
<i>Courier</i>	Indicates CLI inputs or outputs.
Bold	CLI command names, or indicates that you should type data exactly as shown.
<i>Italics</i>	CLI arguments in which you must supply a value.
[]	Optional CLI arguments.
{ }	Required CLI arguments.
A B	The pipe indicates CLI alternative parameters (A or B).
>	This CLI prompt indicates Operator Exec mode.
#	This CLI prompt indicates Administrator exec mode.
	Indicates that a potential hazard to the equipment is present.
	Indicates that a potential hazard to the health of the installer is present.

CD-ROM Structure

On the CD-ROM that accompanies your MS650 you can find an electronic copy of this manual in HTML format. You also can find HTML versions of all other available documentation on the CD-ROM.

Getting Help

If you need hardware installation assistance, then please contact Megisto immediately by e-mail at support@megisto.com. Megisto's web address is <http://www.megisto.com>. You also can send correspondence to the addresses in the table below.

Megisto USA	Megisto Europe
20251 Century Boulevard Suite 250 Germantown, MD 20874 USA Attention: Support	Thames Court 1 Victoria Street Windsor Berkshire SL4 1YB United Kingdom Attention: Support

CLI help is provided for the command or the command mode and is available via CLI by typing a question mark (?) at any command line. (If you are experiencing difficulty with initial configuration, then consult the separate document, *Megisto Services Switch Command Reference and Megisto Services Switch Configuration Guide*.)

Getting Help

About This Guide

Chapter 2: Getting Started



Megisto's Mobile Services Delivery System (MSDS) is a carrier-grade services system designed uniquely to cater to mobile users. The MSDS is designed for effectively delivering services to professional and consumer mobile users from various access networks including 2.5G GPRS, 3G UMTS, and WLANs. The MSDS consists of the software running on one or more Megisto Service Switches (MSSs) (such as the MS650). An optional Services Manager can be used to assist with the configuration of MSDS services.

Megisto's MS650 is a Linux-based carrier-grade subscriber services switch that supports prepaid subscriber control, content and event-based charging, and service package personalization. Content classification and state awareness features enable operators to charge based on content and event type, source, subscriber identity, usage history, time, and volume. This architecture also provides full call state resiliency allowing subscriber data sessions to continue, in the event of a MS650 component failure, without requiring subscribers to reconnect.

The MS650 is based on the new generation of carrier-grade telecom platform infrastructure that makes use of a standards-based telecom computing platform and a real-time LINUX operating system. A key strength of the MS650 is its distributed architecture allowing for incremental scaling of subscribers, signaling, and throughput – allowing for optimum tailoring for a diverse set of network environments and charging practices.

In This Chapter

- Introduction to the MS650
- The MS650 Switch Work
- Subscriber Capacity
- Authentication and Authorization
- Service Capacity
- Data Plane
- Specifications

Getting Started

The MS650 supports the full array of MSDS service control and charging features with service selector access (deployed on the Internet side of an access node in GPRS/EDGE/UMTS, CDMA, or WLAN networks).

The MS650 switch supports:

- Incremental scaling supporting from 10,000 to 350,000+ simultaneous subscribers per switch instance
- Flexible subscriber identity determination, including AAA proxy and AAA broadcast
- Full component of MSDS service control and charging capabilities, including:
 - Real-time session control and roaming control
 - Personalized service package policies
 - Bearer metering, bearer pre-correlation, content classification
 - Event metering, event pre-correlation
 - Subscriber redirection
- Layers 2 and 3 protocol failover mechanisms
- Distributed fault detection system
- Redundancy for every component including redundant subscriber connection state and redundant accounting data
- Standard CLI
- RADIUS, DHCP, and local addressing
- RADIUS and FTP CDR transmission

The MS650 maintains critical subscriber state information, such as linking subscriber identity to IP address, service profile, charging profile, usage, and access network type. Combined with real-time inspection of packet data content up to layer 7 (over WAP1.x, WAP2.0, and HTTP), and the ability to distinguish event types such as MMS and URI-specific content, these capabilities enable the MS650 to support sophisticated content charging. The MS650 service package structure allows operators to tailor specific policies to specific subscribers or subscriber groups without requiring such definitions in any other network components.

The MS650 system is a collection of one or more Application Service Engine (ASE) cards each running an identical set of content control and charging applications. Each ASE is somewhat independent - in that it does both the control and the bearer processing, and differential and

application charging for subscriber traffic. Each preceding GGSN (and for that matter any access node such as PDSN or access point router) is served by a single ASE. The ASEs communicate with other ASEs in the MS650 via Ethernet for system management, redundancy and configuration functions.

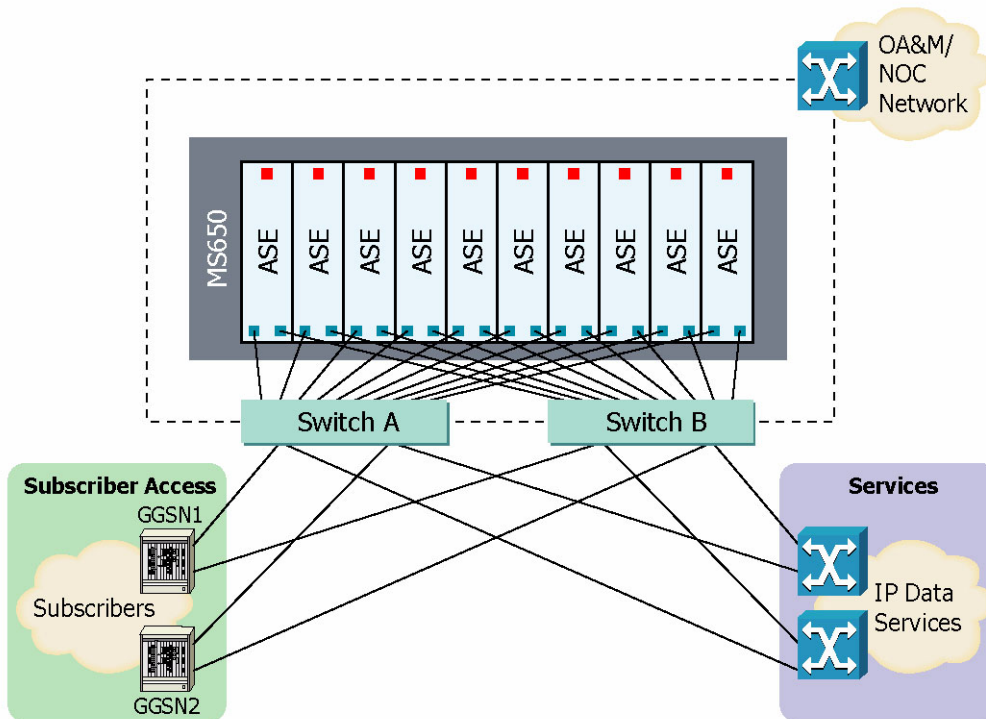
Each ASE is an autonomous processing element that cooperates with other ASEs within a collective group to provide a single MS650 entity. Each ASE provides control, data and management planes (although connection to network management components appears as a single entity).

As shown below, the MS650 is deployed between the subscriber access network and the services network. On the “Subscriber Access” side, each access network node (i.e. GGSN, PDSN or access point router) is served by a single ASE. The ASEs communicate with other ASEs in the MS650 over an Ethernet “backplane” that provides communications for system

Data and Control

Getting Started

management, redundancy and configuration functions. The MS650 is connected to the preceding GGSNs, PDSNs, etc. as their next-hop router.



On the “Services” side, after processing, the MS650 forwards traffic to the IP data services network. In the downlink direction, the traffic arrives at the correct ASE since each ASE advertises their respective subscriber address pool towards the IP Data Services network.

Data and Control

Each MS650 switch instance consists of one or more 19-inch rack mountable chassis, each with one or more of ASE cards. Each chassis accommodates up to a maximum of seven ASE cards, however an MS650 switch instance can span multiple chassis (supporting up to 10 active ASEs per switch instance and from 1 to 10 redundant ASEs). A single chassis can also support multiple logical MS650 switch instances.

Note: The MS650 supports a M:N redundancy model. Therefore, the MS650 may have one ASE card dedicated as a standby for all active ASE cards, or may have multiple designated standby cards as desired.

The MS650 is designed to carrier-class standards so that there is no single point of failure. The MS650 is designed to meet and/or exceed the requirements of many telephone company certifications.

MS650 Switch Architecture

As indicated above, each MS650 switch instance may span chassis, and multiple switch instances may be supported within a single chassis.

Each chassis consists of the following components:

- a passive backplane
- a hot-swappable blower tray
- three (3) N+1 redundant power supplies
- as many as seven (7) ASEs

All ASEs in an MS650 chassis are identical. Each ASE consists of a single CPU board with dual Pentium III processor. Flexible expansion is provided with the addition of ASE service cards. An MS650 switch instance may include as many as 10 active ASEs, providing for incremental expansion of the subscriber, signaling, and throughput capabilities of the switch.

The MSS software architecture operating on the MS650 also can take advantage of additional processors and memory as the carrier-class server hardware on which the MS650 is based continues to evolve and advance. This scalability expands the product's ability to support additional subscribers, services, and packet throughput.

Each ASE has three Ethernet interfaces: two 10/100/1000 Ethernet interfaces for user data traffic and one 10/100 Ethernet interface for out-of-band management and control traffic. Each ASE supports one serial port and is fitted with a hard drive for storage of configuration and for logging and other data for which persistence is desirable.

Redundancy

Getting Started

The ASEs within the MS650 communicate with one another via Ethernet for distribution of configuration, redundancy management, and for any other data that requires aggregation. One ASE port may be used for this dedicated Ethernet switching function (with ports from each ASE bridged together in a common subnet).

At startup, the ASEs participate in an arbitration protocol to elect one of them as the master ASE. This master ASE functions as the control point for the entire MS650 switch instance for the purpose of configuration creation and changes. The master function can be initiated on another ASE using a built-in election mechanism such that the loss of a master ASE will not result in the loss of master functionality. The MS650 offers a single point of configuration and management (regardless of whether hosted on a single or multiple physical chassis) while providing a highly resilient architecture in which each ASE maintains its own copy of configuration and control state. The ASEs support internal protocols to ensure that they all maintain common configuration and manage updates to configuration.

Redundancy

The ASEs within the MS650 share a common backup(s) for an M:N type redundancy model. Because all the ASEs have identical hardware, it is possible for any ASE in the system to back up any other ASE. (It should be noted that any ASE can function as the master or control card. The lack of pre-fixed control card allows the MS650 to maintain carrier-class hot standby redundancy without dedicating an extra card exclusively for control-level resiliency.) All the ASEs in a MS650 switch instance form a redundancy group with N ASEs (a configurable number) backing up the M active ASEs.

All ASEs have continuous fault monitoring checks running in the background. In addition, the presently active master ASE monitors on all the ASEs in the system. If there is fault detected and an active ASE cannot provide service, then it initiates switchover procedures to the backup. There also is a master ASE failure detection mechanism so that failures in the master ASE do not leave the system vulnerable. Whenever a master ASE fails, any ASE, including the backup, within the MS650 system can

take over the role of the master ASE. The determination of the master ASE is made by an arbitration protocol.

The MS650 supports rapid failure detection and switchover. Component failures are detected within two seconds. A backup ASE card then is switched in to recover all services associated with the failed service engine, with full operation available within 15 seconds.

Subscriber Capacity

Each MS650 switch instance supports between 10,000 and 350,000+ active subscribers, using the ASEs available today. Because the MS650 is based on a new generation of industry-standard telecommunication computing platforms, customers of the MS650 can take advantage of the rapid processing enhancements on these platforms (resulting in the release of additional Megisto ASE options in the near future) to increase the MS650 capacity inexpensively to support an increased number of subscribers in a short period of time.

Authentication and Authorization Signaling Capacity

Based on a typical configuration, the MS650 supports up to 250 subscriber authentication and prepaid transactions/sec sustained and 1000 transactions per second burst. The MS650 signaling capacity scales incrementally with added service engines (with up to 10 ASEs supported per MS650 switch instance). These capabilities mean that each switch instance can support extremely high signaling capacities as required for subscriber authentication and prepaid processing in large networks.

Industry enhancements to the ASE service cards will allow customers to take advantage of increased processing power as and if ever required to process an increased number of transactions.

Service Capacity

Data Plane Throughput and Latency

Getting Started

The MS650 supports the flexible scaling of service capacity, including (per ASE):

- 6-tuple classifications that support 256 sets of classification rules for charging purposes, with each set capable of holding as many as 32 rules for matching packets.
- Application-level classification means a virtually unlimited number of URIs.
- Significant resources are devoted to context state, billing data, and configuration storage.

Each of these capacities is per ASE, and each scales linearly as ASEs are added to the system (with a maximum of 10 ASEs supported in a single MS650 switch instance).

Data Plane Throughput and Latency

The MS650 supports typical packet processing throughput rates of 75 Mbps per ASE (with up to 10 ASEs supported per MS650 switch instance), assuming processing of packets at Layer3–Layer 7. This means a single MS650 switch instance can support a minimum of 75 Mbps of traffic throughput with a single ASE service engine, and that large installations through the addition of ASEs as the MS650 throughput scales incrementally with added service engines (with up to 10 ASEs supported per MS650 switch instance).

Industry enhancements to the ASE service cards again allow customers to take advantage of increased processing power as and if ever required to process an increased number of transactions. New service cards can be used within the same switch instance as existing service cards, minimizing any operational issues due to taking advantage of this rapid technological progress.

Specifications

Chassis and Components

Board capability	8 slots (7 slots available for use by boards)
Boards	Hot-swappable
	Interface capability with Fast Ethernet (10/100) and copper Gigabit Ethernet (1000) with supported data rates: <ul style="list-style-type: none"> • 10 Mbps • 100 Mbps • 1000 Mbps
Fan tray	Hot-swappable
Power Supplies	Hot-swappable
	As many as three (3) 250 W power supplies

Physical (4U Configuration)

Dimensions	Height 178mm/7.0" Width 436 mm/17.2" ñ without rack mount Depth 311 mm/12.25"
Mounting	Standard 48.26 cm (19") rack-mountable
Weight	Weight 16 kg/30.5 lb

Power

Input voltage	As many as three (3) 250 W DC power feeds (–60 vdc min to –36 vdc max)
	Note: Power input wiring must be rated for 50° C (122° F) (min).
DC input power (fully populated chassis)	3 U x 8 HP 250 W

Specifications

Getting Started

Boards	Hot-swappable Interface capability with Fast Ethernet (10/100) and copper Gigabit Ethernet (1000) with supported data rates: <ul style="list-style-type: none">• 10 Mbps• 100 Mbps• 1000 Mbps
Fan tray	Hot-swappable
Power Supplies	Hot-swappable As many as three (3)250 W power supplies

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DC input power (fully populated chassis)	3 U x 8 HP 250 W

Environmental

Operating temperature (min)	5° C (41° F)
Operating temperature (max)	40° C (104° F)
Storage temperature range	-40° C to 70° C (-40° F to 158° F)
Operating relative humidity	10% to 95% @ 40° non-condensing
Cooling	200 LFM/slot
Fan MTBF	50,000 hrs at 65° C (149° F)
Operating shock	10 G per ASTM 0775
Non-operating vibration	5 Hz to 300 Hz at 1.03 Gs
Operating vibration	16 Hz to 200 Hz at 0.25 G

Certifications

Safety	Safety CE Mark, Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety Safety for Information Technology Equipment—UL/cUL 60950 Safety for Information Technology Equipment—EN/IEC 60950 CB certificate and Report—CB Report Scheme
EMC emissions	Emissions test regulations FCC Part 15 Subpart B EN 55022 CISPR 22 Bellcore GR-1098 EN 50081-1 emissions GR-1089-CORE Sections 2 and 3 Class A Radiated—EN 55022 Power Line Conducted Emissions—EN 55022 Power Line Harmonic Emissions—EN 61000-3-2 Power Line Fluctuation and Flicker—EN 61000-3-3
EMC immunity	EN 55024 immunity GR-1089-CORE Sections 2 and 3 Electro-Static Discharge (ESD)—EN 61000-4-2 Radiated Susceptibility—EN 61000-4-3 Electrical Fast Transient Burst—EN 61000-4-4 Power Line Surge—EN 61000-4-5 Frequency Magnetic Fields—EN 61000-4-6 Voltage Dips, Variations, and Short Interruptions—EN 61000-4-11

Specifications

Getting Started

Emissions test regulations	FCC Part 15 Subpart B EN 55022 CISPR 22 Bellcore GR-1098
EN 50081-1 emissions	GR-1089-CORE Sections 2 and 3 Class A Radiated—EN 55022 Power Line Conducted Emissions—EN 55022 Power Line Harmonic Emissions—EN 61000-3-2 Power Line Fluctuation and Flicker—EN 61000-3-3
EN 55024 immunity	GR-1089-CORE Sections 2 and 3 Electro-Static Discharge (ESD)—EN 61000-4-2 Radiated Susceptibility—EN 61000-4-3 Electrical Fast Transient Burst—EN 61000-4-4 Power Line Surge—EN 61000-4-5 Frequency Magnetic Fields—EN 61000-4-6 Voltage Dips, Variations, and Short Interruptions—EN 61000-4-11

Regulatory Information

FCC (USA)	<p>This product 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 when the equipment is operated in a commercial environment.</p> <p>This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.</p> <p>Note: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:</p> <ul style="list-style-type: none">• This device may not cause harmful interference.• This device must accept any interference received, including interference that may cause undesired operation. <p>Caution: If you make any modification to the equipment not expressly approved by Megisto, you could void your authority to operate the equipment.</p>
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Industry Canada (Canada)	<p>Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Class A prescrites dans la norme sur le matériel brouilleur: “Appareils Numériques,” NMB–003 édictée par le Ministre Canadien des Communications.</p> <p>This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled: “Digital Apparatus,” ICES–003 of the Canadian Department of Communications. Refer to Intel ZT5090 Specification pages 60-62 for more detail.</p>
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Interfaces

Network interfaces	<p>10/100/1000 Base-T RJ–45 Fast Ethernet or Gigabit Ethernet (A B; 2 per ES-950-ASE board)</p> <p>10/100Base-T RJ–45 Fast Ethernet (C; 1 per board)</p>
Other interfaces	<p>Video (1)</p> <p>Keyboard/mouse (1)</p> <p>USB (1)</p> <p>Serial (COM1) (1 per board)</p> <p>Floppy drive (rear panel)</p>

Indicators

Power supply	<p>Input Good LED</p> <p>Power Supply Fault LED</p>
Board panel LEDs	<p>Power/Reset LED</p> <p>IDE Activity LED</p> <p>Ethernet A</p> <p>Ethernet B</p> <p>Ethernet C</p> <p>Hotswap LED</p> <p>Status LED</p>
Board panel switches	<p>Injector/Ejector handles (2 per board)</p> <p>Abort Request/Alarm Cutoff switch</p> <p>CPU Reset switch</p>

Performance

Throughput	<p>10 Mbps (min) to 1000 Mbps (max) packet processing—Ethernet interfaces A and B (Fast Ethernet and Gigabit Ethernet)</p> <p>10 Mbps (min) to 100 Mbps (max) packet processing—Ethernet interface C (Fast Ethernet only)</p>
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Specifications

Getting Started

Redundancy Features

Hardware redundancy	N:1
	1 + 1 -48 vdc power feeds
Hot swap (all field-replaceable components)	Boards
	Fan tray
	Power supplies

Chapter 3: Installation and Maintenance

This chapter describes the installation of the MS650 into a rack. It then provides descriptions of power connections, generic installation instructions for cards, and system monitoring.

To install the MS650:

1. Unpack the MS650. See “Unpacking the MS650” on page 3-2.
2. Mount the MS650 chassis in a rack. See “Rackmounting the MS650 Chassis” on page 3-8.
3. Ground the MS650 chassis. See “Grounding the System” on page 3-9.
4. Connect the power source. See “Attaching Power” on page 3-9.
5. Insert power supply units, if necessary. See “Working with Power Supplies” on page 3-11.
6. Insert the fan tray, if necessary. See “Working with the Fan Tray” on page 3-13.
7. Install the MS650 board, if necessary. See “Installing MS650 Boards” on page 3-15.
8. Connect I/O devices. See “Connecting I/O Devices” on page 3-21.
9. Connect the network. See “Connecting to a Network” on page 3-21.
10. Install the operating system, if necessary. See “Installing New Releases” on page 3-26.

The sections below provide detailed information on the operation of the MS650, its setup, its installation, and its maintenance.

In This Chapter

- Unpacking the MS650
- The Front of the MS650
- The Rear of the MS650
- Installation
- Installing New Releases

Unpacking the MS650

Prior to installing the MS650, inventory all of the delivered equipment. Use your packing slip or purchase order for verification. If the delivered equipment does not match your packing slip or purchase order, then contact your Megisto Systems sales representative immediately by e-mail at sales@megisto.com.



CAUTION: During shipping, this system is protected by special packing material. It is critical that you save the packing material after you unpack the enclosure. Shipping the unit without the original packing material may void the warranty. Replacement packing material can be purchased from Megisto Systems. Contact your Megisto Systems sales representative by e-mail at sales@megisto.com.



CAUTION: This system contains board-level components that must be protected from electrostatic discharge (ESD) and physical shock. Wear a wrist strap grounded through one of the system's ESD ground jacks (on the cover panel on the front of the chassis, and on the power input panel on the rear of the chassis) whenever you handle system components.



WARNING: Components are vulnerable to damage by electrostatic electricity. Be sure to set aside all cards and equipment that are not required during the chassis installation. Place all such components inside the electrostatic bags in which they were delivered.

Shipping Contents

The MS650 may be ordered with many options. The system is shipped fully assembled and tested and may be accompanied by several accessories. The basic system configuration and most common options and accessories are listed in the table below.

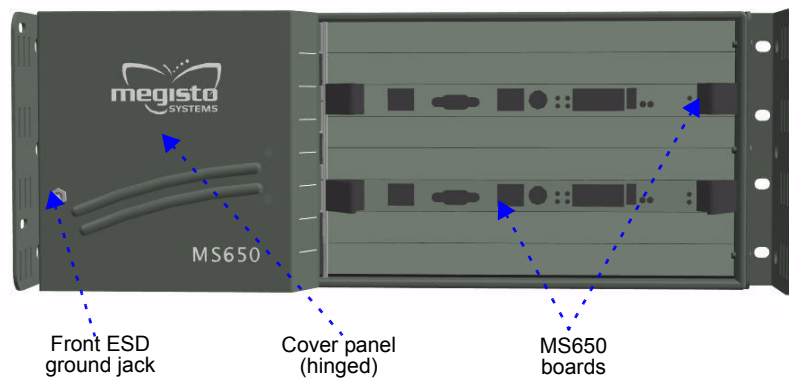
Note: Your system may differ from the system illustrated in this manual.

For a complete list of MS650 parts and current part numbers, contact your Megisto Systems sales representative by e-mail at sales@megisto.com

Component to Be Installed or Connected	Component Name	Qty.
Chassis	Enclosure, 4 U, 19" rackmountable	1
	Assembly, cover panel	1
	DC power input panel	1
	DC input modular power supply	up to 3
	Fan tray with two blowers	1
	Air management board (for slots in front of chassis)	up to 7
	Blank filler panel, dot ten, shielded (for slots in rear of chassis)	8
Board-level options	MS650 processor board	up to 7

The Front of the MS650

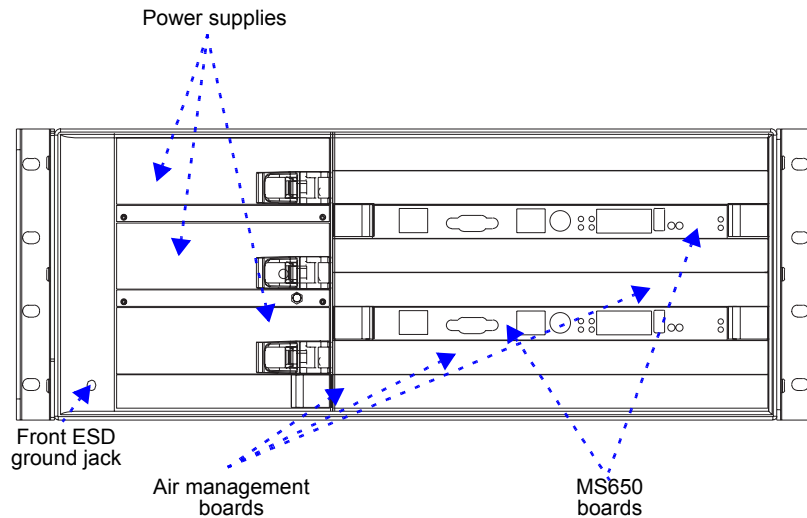
The figure below shows the front panel of the MS650, with the cover panel in the closed position.



The Rear of the MS650

Installation and Maintenance

The figure below shows the front panel of the MS650, with the cover panel in the open position to reveal the components underneath.



Note: Your MS650 may have a different quantity of boards or boards positioned in different slots than the figures above.

The following table provides an overview of the front elements of the MS650 platform.

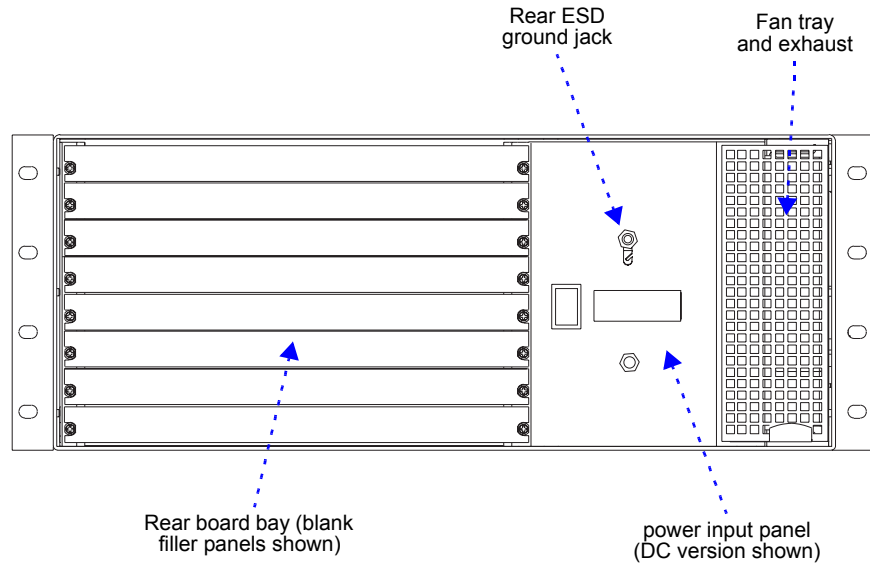
Element	Qty.	Description
Cover panel, hinged	1	Protects power supply area and provides convenient access to front ESD ground jack.
Power supply	up to 3	Provides power to the chassis and all components.
Front ESD ground jack	2	Grounds installation and maintenance personnel and protects equipment from ESD.
MS650 board	up to 7	Processes packet traffic and facilitates advanced charging services for the MS650.
Air management board	up to 7	Occupies slot if no board needs the slot. Maintains optimum airflow inside chassis.

The Rear of the MS650

The figure below shows the rear panel of the MS650.

Note: Because the MS650 supports only MS650 boards, that are installed on the front of the chassis, your chassis should have only blank filler panels installed in the rear bay area.

The table below the figure lists the quantity of each component and then describes each component.



Note: The figure above shows the rear panel of an enclosure equipped to operate on AC power. If your configuration requires an AC-powered MS650, then contact your Megisto Systems sales representative by e-mail at sales@megisto.com.

The following table provides an overview of the rear elements of the MS650 platform.

Element	Qty.	Description
Rear ESD ground jack	1	Grounds installation and maintenance personnel and protects equipment from ESD.
Fan tray	1	Cools the chassis and all components.
DC power input panel	1	Provides the connection to power for the chassis and all components.
Blank filler panel	8	Occupies slot if no board needs the slot. Maintains optimum airflow inside chassis and EMC shielding.

Installation

Pre-installation Considerations

Importance of Cover Panels

Before you install and use the MS650, ensure that all component slots are populated with a component, filled with an air management board (front), or covered with a blank filler panel (rear). Use the provided standard blank filler panels with EMI gaskets for the rear panel. Air management boards and blank filler panels may be purchased from Megisto Systems. To contact your sales representative, send an e-mail sales@megisto.com. Refer to the following parameters:

- To fill a front slot, use an EMC air management board, 6 U x 160
- To fill a rear slot, use panels that are 6 U x 4HP (horizontal pitch=0.2")



WARNING: Empty slots **must** be filled with air management boards (front) or covered with a blank filler panel (rear) for proper operation and airflow and to complete EMC shield. Failure to do so may cause overheating of power supplies, boards, or other components, and could damage the system and violate emissions requirements.

Note: Slot 1 (Switch) is reserved. Install an air management board to maintain system cooling.

Rack Parameters and Equipment Handling

The MS650 fits standard 19" EIA racks. Mounting flanges are attached to the front of the enclosure to facilitate front mounting. The mounting flanges shipped on the MS650 are used for front mounting to a rack enclosure. If the unit is mounted in a relay rack, be careful to review weight distribution of all equipment in the rack and also the relay rack base or attachment to the floor. An alternative for front mounting in a relay rack is to use the mid-mounting rack brackets supplied with the MS650. These brackets center the unit in a relay rack for the best weight distribution.

Note: Do not remove the front mounting brackets as they are used for cable routing and attachment of the front cover.



WARNING: It is intended that the MS650 be installed in a restricted access location, and in the same rack occupied by the MS650 it will service.



CAUTION: To prevent damage to the components, never use component handles or cables to lift or move the system.

This system is intended for stationary mounting in a rack designed to meet the physical strength requirements of NEBS GR-63-CORE and NEBS GR 487. Be sure to mount the system that ensures even weight distribution in the rack. Uneven mechanical loading can result in a hazardous condition. Secure all mounting bolts when installing the enclosure to the frame/rack.

Environmental Requirements

The maximum ambient temperature at which a factory-configured MS650 system should operate is 40° C (104° F) at 5 percent to 85 percent relative humidity. This is the same maximum operating temperature as the MS650's, with which the MS650 should be installed in the same facility.



WARNING: If the MS650 is installed with its ventilation intakes near another system's exhaust or in a closed or multi-unit rack assembly, then the operating ambient temperature inside the enclosure may be greater than the room's ambient temperature. Install the MS650 in an environment that is compatible with the recommended maximum ambient temperature.



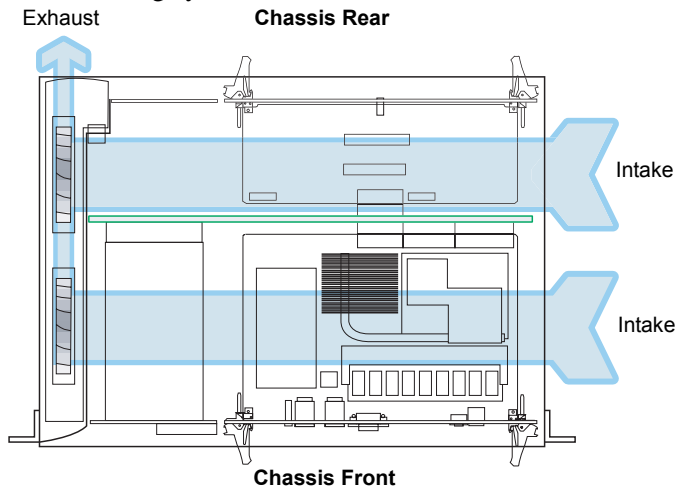
WARNING: Because of the modular design of the MS650, components may be installed that alter the system's operating requirements. Please refer to product-specific documentation for the maximum recommended ambient temperature for individual components.

Safe operation of the MS650 is depended on the 200 LFM/slot of forced-air cooling provided by the system's cooling fans. Be sure to install the system in an environment that does not compromise this recommended

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minimum air flow requirement. The figure below shows the airflow vector of the MS650's cooling system.



Rackmounting the MS650 Chassis

Note: These instructions assume that you are mounting the MS650 chassis into a cabinet rack. If you are mounting the MS650 chassis into a relay rack, then pay attention to the notes in the instructions that pertain to relay rack environments.

Note: The flanges can be repositioned for center-mounting the enclosure.

To install the MS650 chassis into a rack:

1. Disconnect all power sources and external connections/cables prior to installing or removing the MS650 from a rack.
2. Select a position in the rack that does not interfere with other equipment and that provides safe weight distribution.



WARNING: Take care not to compromise the stability of the rack by the installation of this equipment.

3. For efficient cooling, the area around the MS650's intake and exhaust vents should be clear of obstructions. You should direct the intake away from the exhaust of any other system. See "Environmental Requirements" on page 3-7.

4. Secure the mounting flanges to the front or middle of the enclosure.
5. Bolt the enclosure to the rack.

Note: Rack hardware is not included.

Grounding the System

Before you make any connections to the system, you must ground the enclosure properly.

- Attach a grounded strap or cable, with a #10 ring terminal, to the chassis ground post on the MS650's power input panel. See "The Rear of the MS650" on page 3-4 for the location of the chassis ground post.
- ESD ground jacks are located at the front and rear of the system. To protect components from static shock when handling system components, wear a wrist strap plugged into the more convenient ESD ground jack. See "The Front of the MS650" on page 3-3 and "The Rear of the MS650" on page 3-4 for the locations of the ESD ground jacks.

Attaching Power

The power input panel at the rear of the enclosure allows DC power to be connected to the system. The configuration of the power input panel must match the configuration of the voltage input of the power supplies that you intend to use with the system. See the figure in the subsection below for the location of the power connectors.

The MS650 must be connected to a properly rated supply. For permanently connected equipment, a readily accessible disconnect device should be incorporated in the facility's wiring installation.

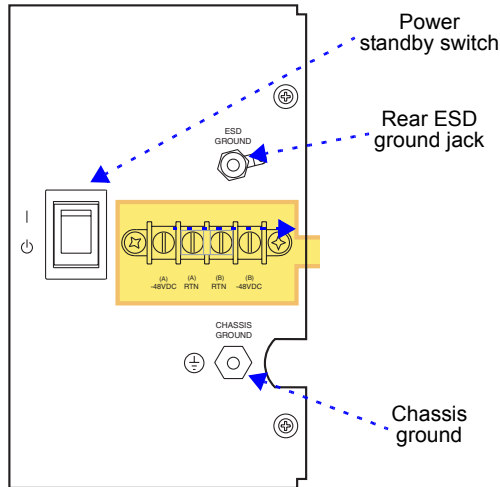
This product relies on the facility's wiring installation for short-circuit (overcurrent) protection. Ensure that a listed and certified fuse or circuit breaker no larger than –75 vdc, 15 A, is used on all current-carrying conductors.

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Attaching DC Power



1. Ensure that the standby power switch is in the “standby” (⏻) position. See the figure above for the location of the switch.
2. Remove the protective cover from the DC terminal block by rotating it upward.
3. The **(A) RTN** and **(B) RTN** terminals should be tied together with a suitable jumper. A jumper comes pre-installed on the terminal block.
4. Connect the DC supply terminals to the terminal block. Connections should be made with 18–14 AWG wire with #8 ring terminals (use copper conductors only). To provide DC input power redundancy, connect both the (A) and (B) inputs. See the figure above for terminal assignments.
5. Replace the protective cover on the terminal block.
6. Complete the connection to the DC power source.
7. Once power is connected, the power standby switch may be used to turn on the system.

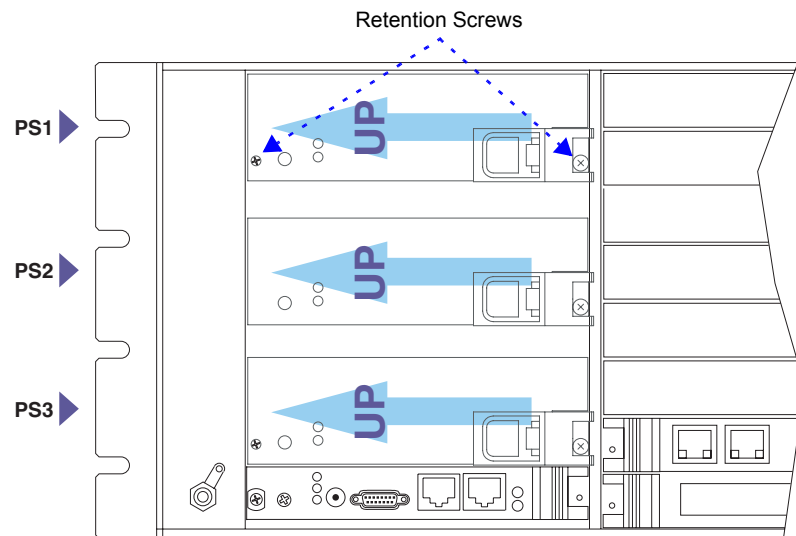
Note: Measure to verify -72 to -36V is present.



SAFETY WARNING: The power standby switch does not turn off power to the system. The system must be disconnected from the power source.

Working with Power Supplies

The MS650 accommodates as many as three 250 W modular power supplies. The power supplies are load-sharing and hot-swappable and plug directly into the backplane. See figure below for the location of the power supplies.



Note: Megisto recommends that you configure each MS650 to use three power supplies and the unit is shipped with three supplies already configured.

Note: Your system may have a different configuration than the one depicted in the drawing above.



SAFETY WARNING: Only trained personnel should perform maintenance of power supplies. When the system is plugged in, high voltages are present on the backplane. Do not reach into the enclosure.

Installing a Power Supply

To install a power supply:

Note: System power does not need to be off to install a power supply.

Installation

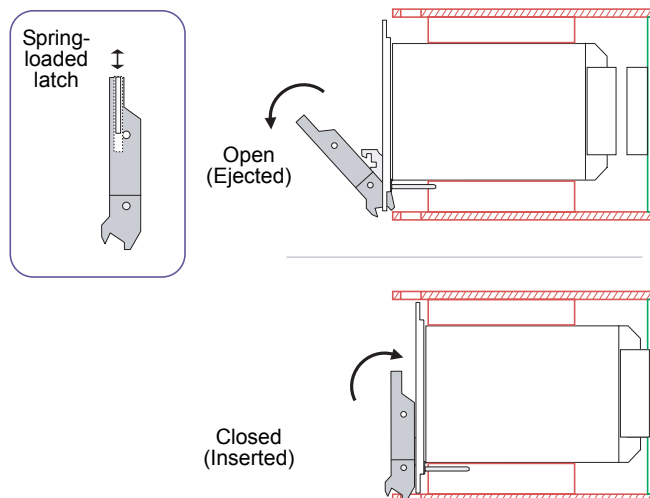
Installation and Maintenance

1. Put an ESD strap on your wrist and plug it into the ESD ground jack (on the cover panel on the front of the chassis, and on the power input panel on the rear of the chassis).

It is important to use the ESD strap before inserting or removing any cards so that you do not inadvertently give an electric charge to the cards when you touch them.

2. Open the door that covers the power supply bay.
3. Select an empty power supply slot.
4. Align the rails on the power supply with the guides inside the slot.
5. It may be helpful to look into the enclosure to verify correct alignment of the rails in the guides.
6. Slide the power supply in the guides and press firmly to seat the connector.

See figure below for details on the movement of the injector/ejector mechanisms.



7. Tighten the two retention screws on the front panel of the power supply.
8. Close the door that covers the power supply bays.

Removing a Power Supply

To remove a power supply:

Note: System power does not need to be off to remove a power supply.

1. Put an ESD strap on your wrist and plug it into the ESD ground jack (on the cover panel on the front of the chassis, and on the power input panel on the rear of the chassis).

It is important to use the ESD strap before inserting or removing any cards so that you do not inadvertently give an electric charge to the cards when you touch them.

2. Open the door that covers the power supply bay.
3. Unscrew the two retention screws on the front of the power supply you wish to remove.

See figure under “Working with Power Supplies” on page 3-11 for the location of the retention screws on the power supplies.

4. Push down the spring-loaded latch on the ejector and rotate the ejector away from the power supply's faceplate.

This levers the power supply away from the backplane. See figure under “Installing a Power Supply” on page 3-11 for details on the movement of the injector/ejector mechanisms.

5. Pull the power supply away from its backplane connection and slide it out of the enclosure.
6. Install a replacement power supply or cover the empty slot with a filler panel to maintain the enclosure's shielding and cooling performance.
7. Close the door that covers the power supply bay.

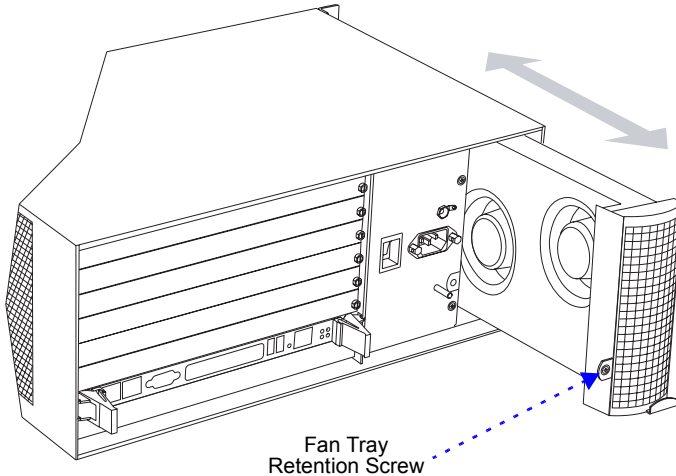
Working with the Fan Tray

Two blowers housed inside a removable fan tray occupy the right side of the MS650's enclosure (when viewed from the rear). The fan tray is secured by a captive screw and plugs into a blind mate receptacle inside

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the enclosure. See figure below for the orientation of the fan tray inside the enclosure.



WARNING: System cooling should not be absent for more than three minutes on an operating MS650. Failure to follow this guideline may cause overheating of power supplies, boards, or other components, and could damage the system.

Installing the Fan Tray

To install the fan tray:

Note: Use a Phillips #2 screwdriver to install the fan tray.

Note: System power does not need to be off to install the fan tray.

1. The fan tray slides into the fan bay at the right rear of the enclosure. The fan tray should be oriented with the handle at the bottom.
2. Slide the fan tray into the enclosure.
3. Turn (clockwise) the captive screw to start the threads.
When the threads engage properly, lightly tighten the screw.

Removing the Fan Tray

To remove the fan tray:

Note: Use a Phillips #2 screwdriver to remove the fan tray.

Note: System power does not need to be off to remove the fan tray.

1. Loosen (turn counterclockwise) the captive retention screw on the fan tray grille until it releases the tray from the enclosure.
2. The grille and fan tray comprise one assembly.

Use the handle at the bottom of the grille to pull the fan assembly out of the enclosure.

Note: Pull the tray firmly.

3. Perform the necessary maintenance or obtain a new fan tray.

Installing MS650 Boards

The MS650 Expansion Shelf houses one or more Megisto Application Services Engine (ASE) boards. This section describes the installation and maintenance of this board.

Description MS650 Faceplate Elements

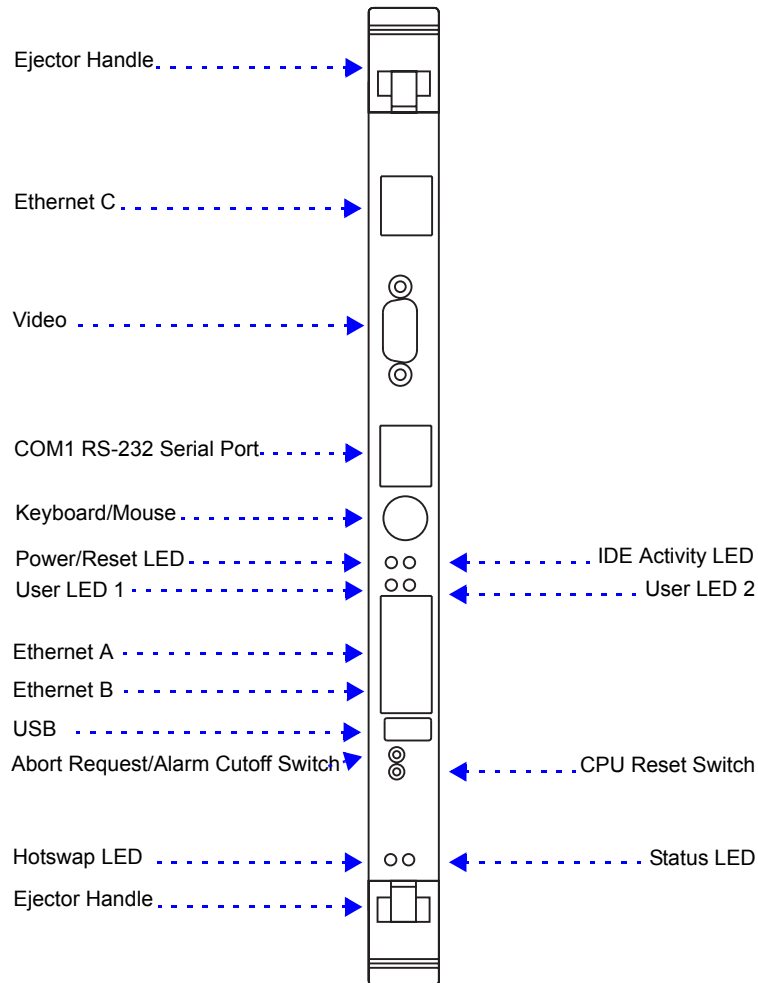
The MS650 faceplate provides:

- quick-access switches
- connectivity for certain devices


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





Installation and Maintenance

- status indicators








The following table provides an overview of the elements of the front panel of the MS650 board.

Element	Qty.	Icon	Description
Ejector/injector handle	2	n/a	Allows release and locking of board.
Video interface	1		Allows the attachment of a standard video monitor.

Element	Qty.	Icon	Description
COM1 RS-232 serial port	1		Allows the attachment of a serial cable.
Keyboard/mouse interface	1		Allows the attachment of a standard keyboard or mouse.
IDE activity LED	1		Indicates operational status of internal fixed drive. Green LED: Disk is active. LED off: Disk is inactive.
Power/reset LED	1		Indicates status of power to board. Green LED: Power to board is enabled; no reset is in progress. Amber LED: Power to board is enabled; active reset is in progress. LED off: Power to board is disabled.
User LED 2	1		LED off: Reserved for future use.
User LED 1	1		LED off: Reserved for future use.
Ethernet A interface	1		10/100/1000 Mbit/s Ethernet (Gigabit Ethernet) interface. Flashing green LED: Activity. Green LED: Link. Off: 10 Mbps. Green: 100 Mbps. Amber: 1000 Mbps.
Ethernet B interface	1		10/100/1000 Mbit/s Ethernet (Gigabit Ethernet) interface. Flashing green LED: Activity. Green LED: Link. Off: 10 Mbps. Green: 100 Mbps. Amber: 1000 Mbps.
Ethernet C interface	1		Single 10/100 Mbit/s Ethernet interface. Flashing green LED: Activity. Green LED: Link. LED off: 10 Mbps. Green LED: 100 Mbps.

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Element	Qty.	Icon	Description
USB interface	1		Allows the attachment of a standard USB device.
Abort request/alarm cutoff switch	1		Aborts hardware actions or clears alarms.
CPU reset switch	1		Resets the board.
Status LED	1		Indicates overall status of board. Green LED: Normal operation. Amber LED: Board requires service. Use debug commands via the CLI to determine the problem. See separate document, <i>MS650 and MS650 Configuration Guide</i> .
Hotswap LED	1		Indicates whether the board is ready for hot removal. Blue LED: Safe to extract board. LED off: Not safe to extract board. See “Removing MS650 Boards” on page 3-20.

Before you proceed with chassis installation, familiarize yourself with the MS650 board and the network in which you want the system to operate.

The MS650 supports a maximum of seven MS650 boards. Any unused MS650 slots should be filled with air management boards.

Installing MS650 Boards

The following instructions cover the installation and removal of MS650 boards.

Note: These instructions assume that you already successfully connected the MS650 chassis to a DC power source, earth ground, and terminal alarm.

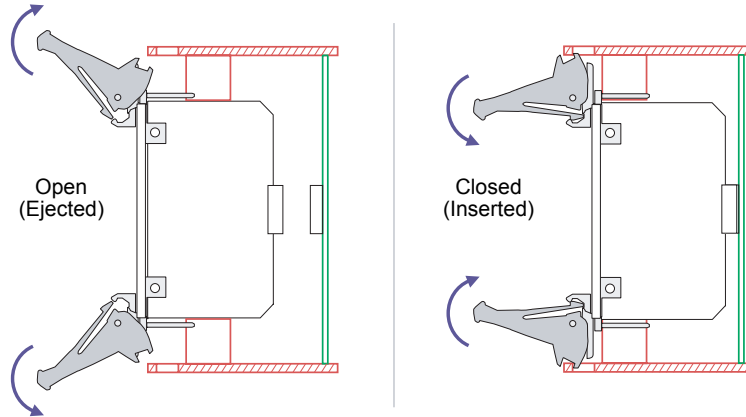
To install an MS650 board:

Note: System power does not need to be off to insert the MS650 board.

1. Put an ESD strap on your wrist and plug it into the ESD ground jack (on the cover panel on the front of the chassis or the chassis inside cover.

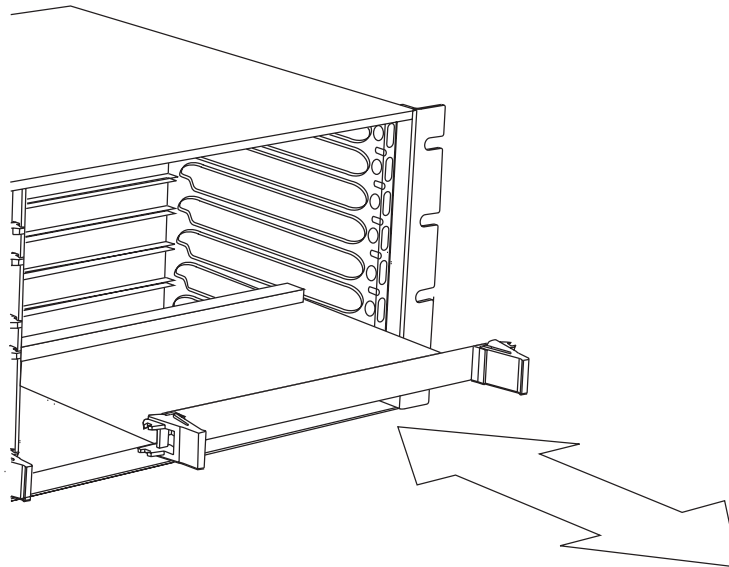
It is important to use the ESD strap before inserting or removing any cards so that you do not inadvertently give an electric charge to the cards when you touch them.

2. Prepare the board by opening the injector/ejector mechanisms. For an illustration of the operation of these mechanisms, see the figure below.)



3. Carefully align the edges of the board with the left and right card guides in the appropriate slot, as the figure below shows.

Note: It may be helpful to look into the enclosure to verify correct alignment of the rails in the guides.



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4. Taking care to keep the board aligned in the guides, slide the board in until the injector/ejector mechanisms engage the retention bars.

If you can visually see the boards connector to the backplane, make sure that they are mating correctly with no interference.

5. Simultaneously push in the board and rotate the injector/ejector mechanisms to their closed positions (rotate inward) to seat the backplane connectors.

When the processor board is in place and system power is on, the status light on the board turns green and the board boots. Secure the retention screws.

6. Make the desired connections at the faceplate and configure the board.

Removing MS650 Boards

To remove an MS650 board:

Note: System power does not need to be off to remove an MS650 board.

1. Release both ejector handles on each board to give the board's internal drive and processor time to power down.



WARNING: Do not release the ejector handles fully until step 7.

2. Wait for the Hotswap LED to illuminate.
3. Disconnect connections at the board's faceplate (Fast Ethernet, Gigabit Ethernet, etc.).
4. Disconnect any retention screws that secure the board to the enclosure.
5. Put an ESD strap on your wrist and plug it into an ESD ground jack (on the cover panel on the front of the chassis or the chassis inside cover).

It is important to use the ESD strap before inserting or removing any cards so that you do not inadvertently give an electric charge to the cards when you touch them.

6. Open the ejectors fully, rotating the handles outward until the board disengages from the backplane.

See the figure under "Installing MS650 Boards" on page 3-18 for details on the movement of the ejector mechanism.

7. Slide the board evenly out of the enclosure.

Store the removed board in an ESD foil bag (anti-static bag).

8. Install the replacement MS650 or cover the empty slot with an air management board to maintain the shielding and cooling performance of the MS650 chassis.

Connecting I/O Devices

The front-panel board-level components in the MS650 system offer connections for many different I/O devices, including a monitor, keyboard, mouse, network, and serial devices.

The rear-panel board-level connectors offer added cabling flexibility and should not be used to connect extra devices to a given processor board. Unpredictable behavior may occur if you use the same front-panel connections simultaneously (for example, by connecting two keyboards).

Note: Card connections in the rear of the chassis are not supported.

Refer to the documentation that accompanies each board for connectivity options and limitations.

Connecting to a Network

The MS650 is deployed between the subscriber access network and the services network. On the “Subscriber Access” side, access network node (i.e. GGSN, PDSN or access point router) is served by a single ASE. The ASEs communicate with other ASEs in the MS650 over an Ethernet “backplane” that provides communications for system management, redundancy and configuration functions. The MS650 is connected to the preceding GGSNs, PDSNs, etc. as their next-hop router.

On the “Services” side, the MS650 forwards processed uplink traffic to the IP data services network. In the downlink direction, the traffic arrives at the correct ASE since each ASE advertises their respective subscriber address pool towards the IP Data Services network.

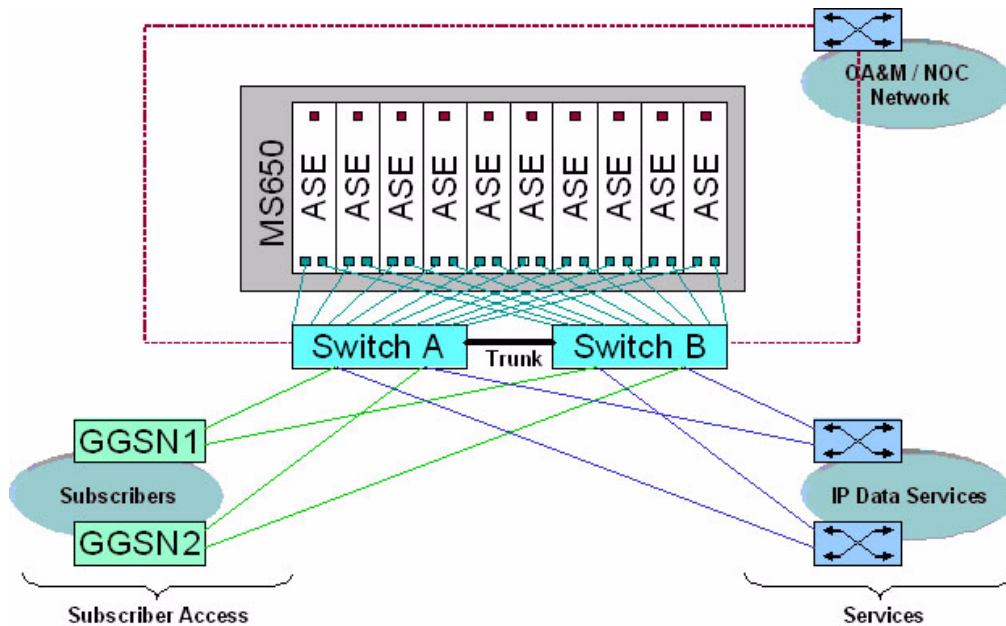
The topology in the figure below also provides dual homing of all in-band connections across Switch A and Switch B to redundant subscriber-access-side equipment (e.g. GGSN) and to redundant services-side equipment (e.g. routers). It should be noted that two switches are used in

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order to minimize the complete loss of the backbone due to a single switch failure.

Each MS650 switch instance consists of one or more 19-inch rack mountable chassis, each with one or more of ASE service cards. Each chassis accommodates up to a maximum of seven service ASE cards, however an MS650 switch instance can span multiple chassis (supporting up to 10 active ASEs per switch instance and from M to 10 redundant ASEs). A single chassis can also support multiple logical MS650 switch instances.



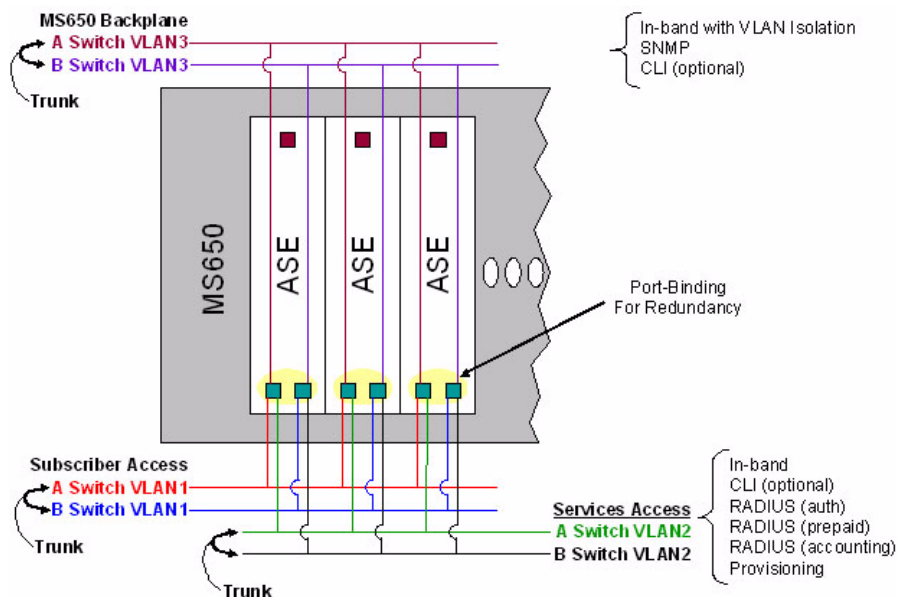
Note: The MS650 supports a M:N redundancy model. Therefore, the MS650 may have one ASE card dedicated as a standby for all active ASE cards, or may have multiple designated standby cards as desired

Switch Configuration and Interconnect

The figure below shows the recommended configuration for the MS650 when running the MSS Release 2.1

Each ASE has three Ethernet interfaces, however only the two 10/100/1000 Ethernet interfaces are used. Since the 10/100/1000 Ethernet interfaces are related for resiliency purposes using a “Port-Binding” feature, Release 2.1 takes advantage of this capability and provides all inter-ASE backplane communication over a separate VLAN over these same ports. This allows continuance of both data and backplane traffic transfer over one Ethernet port in the event the other has failed – resulting in no service interruption with improved backplane resiliency. Therefore, to take advantage of port binding, Switch A is connected to one port of each ASE, while Switch B is connected other port for each ASE. It is recommended that switches A & B support the trunking feature for interswitch connectivity.

Note: It is strongly recommended that a redundant connection be made between switches A & B such that there is no single connection point of failure between the two switches for VLAN1, VLAN2, or VLAN3. Please consult with Megisto for a list of recommended switches that have been tested and support the appropriate trunking feature for resilient switch interconnection.



One-Arm vs. Two Arm Configuration

The recommended topologies described assume a two-armed connection. This effectively segregates subscriber-access-side traffic from services-side traffic using VLANs. For example:

- VLAN1 - (Network Side) connected to GGSNs
- VLAN2 - (Services Side) connected to IP Data Services Switches

This means that traffic must pass through the MS650 and cannot pass directly between from the subscriber-access network to the services network (e.g. GGSN to services router). This is typically the desired behavior and is recommended.

However, a single-armed connectivity can be achieved simply by not using VLANs (although it is recommended that a VLAN still be used for backplane traffic isolation in R2.1 and later installations). Effectively, in such a configuration, all traffic shares the same layer-2 broadcast domain.

OA&M Connections

SNMP-based network management must be supported over the backbone connection (e.g. for connection to network monitoring equipment such as SNMP managers). Connection for CLI provisioning can be provided either out-of-band over the backbone connection or in-band over the 10/100/1000 ports. All other back office support systems (BSS) components such as RADIUS servers) are provided over the in-band connection.

Backplane Connections

As part of the MS650 resiliency mechanism, all ASE service cards maintain communications over the backplane. In the event that interruption of the backplane connectivity is detected (e.g. switch or port failure), all ASEs shall attempt to determine where connectivity is interrupted. For this reason, a list of non MS650 IP addresses on the OA&M subnet that can be periodically pinged can be configured to help the MS650 determine where the failure might be so that it can take appropriate action.

Note: The MS650 uses IP multicast for resiliency communications between ASE cards. Therefore, switch ports used for backplane interconnection must support multicast traffic. Also, if multiple switches are used as recommended, both switches must provide support multicast forwarding between the switches over the trunk links.

Routing/Switch Interconnection Requirements

Release 2.1 typically is configured such that access network equipment (e.g. GGSNs) share the same IP subnet (e.g. layer-2 switch connection). Alternative routing/switching connectivity options are also available. Please contact your Megisto representative for further details.

RADIUS Inspection Mode

The MSDS supports two RADIUS modes for subscriber identification functions. The first is called “proxy” mode and the second is called “broadcast” mode:

1. Proxy mode – In proxy mode the MSDS is viewed as explicit RADIUS server by the subscriber access device. The MSDS receives, parses, and processes the RADIUS requests. It passes them on to the actual RADIUS server, receives responses from this server, and after processing, sends the response on to the access device.
2. Broadcast mode - In broadcast mode, the MSDS receives copies of the RADIUS requests either from the access device or from the RADIUS server. In this case, the only RADIUS requests generated by the MSDS are those required for service assignment, session control, and prepaid metering reservations. In this case, it is necessary for the MSDS to explicitly communicate with the access device to terminate the session. It should be cautioned that this is a non-standard function and is not supported by all access nodes.

While the MSDS supports both of the above configurations, RADIUS proxy mode is the recommended deployment configuration. RADIUS proxy mode is a simpler configuration that uses the standard configuration of the access devices. The proxy configuration is also very robust as if there is a need to terminate a session, in proxy mode, the session is terminated using standard RADIUS processes on all devices.

Installing New Releases

Installation and Maintenance

Some operators use a broadcast mode where the MSDS is sent copies of the RADIUS transactions. While supported by the MSDS, the ability of an operator to use RADIUS broadcast mode in its network is dependent on the access node being used. Cisco supports broadcast mode, however, this mode is not universally supported by all access nodes/RADIUS infrastructure devices.

Installing New Releases

The following steps install MS650 software releases.

To install software releases:

1. SSH to the desired blade (usually the master) as root and copy in the *Release_name.tar.gz* file:
2. Untar the package using the command `tar -zxvf Release_name.tar.gz`.

The `Untar` command creates following directories:

Directory	Contents
bin	The executable files ased and ms320cli .
config	The files radius.dct and server.conf .
lib	None.
scripts	The file ased , the startup script used during boot sequence to start the MS650 daemon. The file install , which installs the MS650 software; initializes the operating system and the MS650 software environment. The file uninstall , which removes the MS650 software environments. The file startase , which starts the MS650 daemon. The file stopase , which stops the MS650 daemon.

3. If desired, Execute `uninstall.sh` script from `./script` directory to clean up the operating system's environment.
4. Change the to the OS directory.
5. Execute the `install.sh` script from `./script` at least the first time any LINUX kernel patches are to be installed.
6. Execute the `install` script from `./script`, which sets up operating system environment and installs the release.

The `install` script displays status of the environment with `[OK]` for successful setup or `[FAILED]` for unsuccessful setup.

7. When installation is complete, reboot the system and set the boot device order in the Setup boot menu.

The Flash Write Protect/Write Enable switch, SW4-1, must be open while you install an operating system image into flash.

8. Execute any of the following to start the daemon.
 - `/etc/rc.d/init.d/ms650d start`
 - from any dir type `ms650d`. The process will go in background. Use remote shell to gain access to shell
 - from any dir type `ms650d -d` to use foreground mode (only for debugging)
 - `/etc/rc.d/init.d/ms650d stop` to stop

Installing New Releases

Installation and Maintenance

Chapter 4: Troubleshooting

Troubleshooting

Problem	Possible cause	Possible solution
No prompt on terminal device at startup	Incorrect settings on the MS650 for interfacing with the terminal device.	Verify correct settings and replace incorrect settings. See
	Serial cable does not comply with the specification.	Verify pinout compliance. If cable does not comply, then replace it with one that does.
	COM port on the terminal device is not working.	Verify proper operation of COM port on terminal device by connecting it to a different device.
No LEDs illuminate on any component	MS650 power turned off.	Turn MS650 on.
	The power supply, or all power supplies, failed.	Replace the power supply or all power supplies.
MS650 board reboots by itself	The internal watchdog timer was unable to run. This failure can be caused by hardware, software, or both.	Make the startup sequence the same as a power-on startup.
Power/reset LED does not illuminate	Power turned off to chassis.	Turn MS650 on.
	Board not installed properly.	Reinstall the board.

In This Chapter

- Problem
- Possible Cause
- Solution

Troubleshooting

Troubleshooting

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