



ASR 5500 Hardware Platform Overview

This chapter describes the hardware components that comprise the ASR 5500 chassis. The ASR 5500 is designed to provide subscriber management services for high-capacity 4G wireless networks.

Figure 1: The ASR 5500



This chapter includes the following sections:

- [Chassis, page 2](#)

- [Midplane, page 5](#)
- [Card Types, page 6](#)
- [LED Indicators, page 12](#)

Chassis

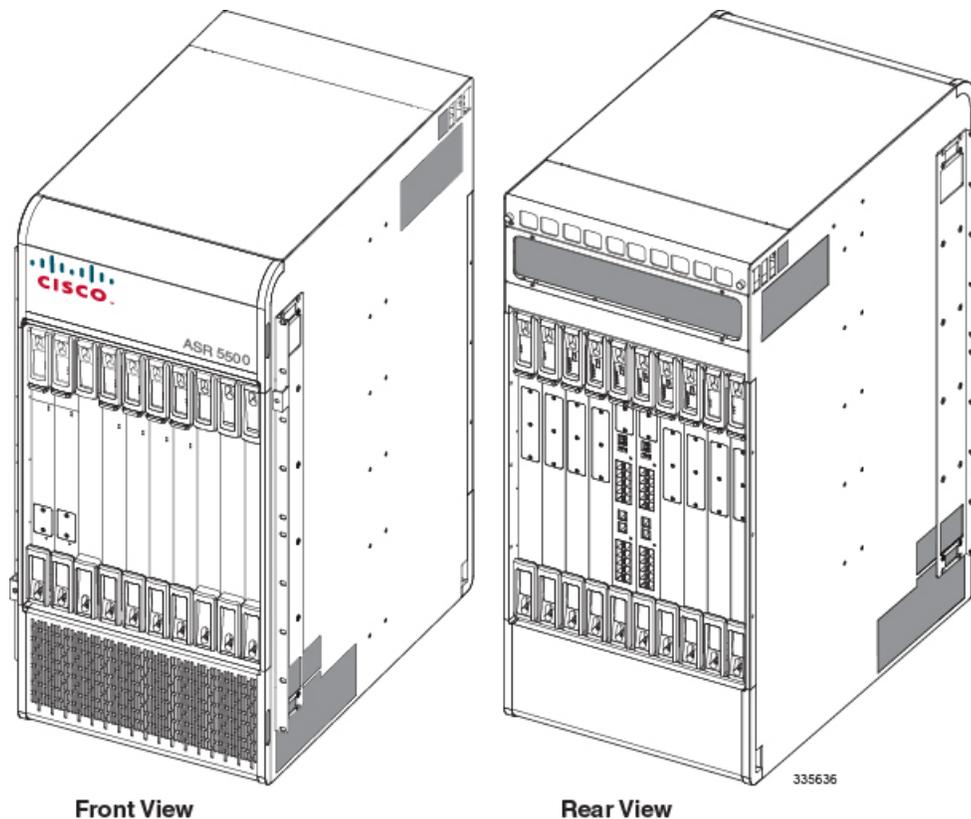
The ASR 5500 is a 21RU, 19" rack-mount midplane-based chassis with input/output (I/O) and processing cards in the rear, and fabric cards in the front. Two ASR 5500 chassis fit into 42RU of rack space. However, the typical deployment will be a single chassis per rack with other equipment in the same rack.

The rear cards are larger and used for chassis management, I/O and session processing. The smaller front cards are used for fabric crossbars and persistent storage. There are 10 slots at the front and rear of the chassis.

The rear slots have a common midplane connector that is shared between the supported cards. This allows for different mixes of I/O and processing capacity depending on the customer's intended use.

The chassis can be flush-mounted or mid-mounted in a rack or equipment cabinet.

Figure 2: Front and Rear Views of the ASR 5500 Chassis



Power

The chassis accepts up to eight 80-amp, -48 VDC power feeds across redundant power filter units (PFUs). The connections are made at the top-rear of the chassis. The front-mounted PFUs incorporate separate circuit breakers for each power feed.

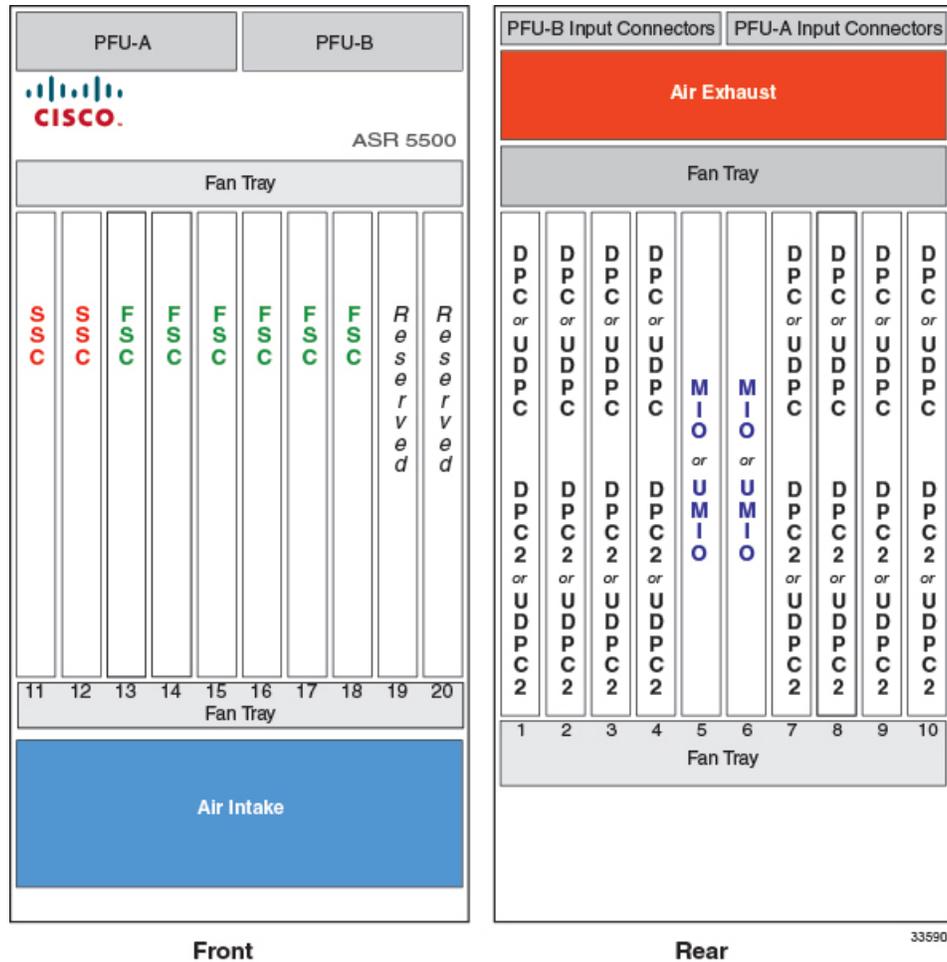
Cooling

The ASR 5500 uses two types of fan tray units and a total of four fan trays per chassis – two front fan trays and two rear fan trays. Air is drawn from the front and sides of the chassis and exhausted out the top rear and sides. Two fan trays are mounted at the bottom of the chassis with another two at the top. The bottom fan trays incorporate replaceable particulate air filters.

Slot Numbering

The rear slots are numbered 1 through 10 with slots 5 and 6 used for the chassis management cards. The front slots are numbered 11 through 20. Lower slot numbers begin at the left side. There are no direct relationships between front and rear cards.

Figure 3: ASR 5500 Slot Numbering – MIO/UMIO



Power Filter Units (PFUs)

Two PFUs mount at the top front of the chassis. Each PFU supports four power planes.

A total of eight -48 VDC, 80-amp power feeds are required for a full chassis. The eight feeds operate in a 4+4 redundant configuration. In lab environments where power redundancy is not required, four 80-amp lines can be used. For additional information on power requirements, see the *Technical Specifications* chapter.

Cable Management System

The ASR 5500 cable management system consists of two components. The first is a tray that mounts at the rear of the chassis immediately below the card cage. The second is a cable management bracket that mounts to the front panel of each Management Input/Output card (MIO/UMIO).

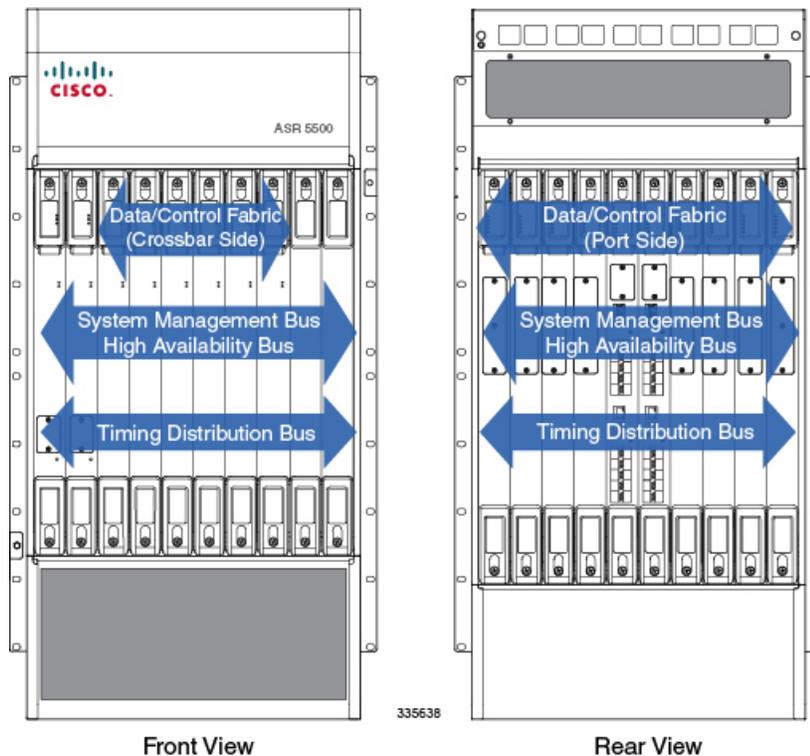
Network cables are fed from either side or both sides of the tray and are then routed to the MIO/UMIO ports. The cables are secured to the cable management brackets on the MIO/UMIOs via cable ties or hook-and-loop straps, and within the cable management tray via hook-and-loop straps.

Midplane

The midplane within the ASR 5500 chassis interconnects rear input/output ports and processing cards with front fabric cards. The larger rear cards support chassis management, input/output, and session processing. The smaller front cards provide fabric crossbars, persistent storage and system status monitoring.

The rear slots have a common midplane connector that is shared between the supported cards. This allows for different mixes of input/output and processing capacity depending on the customer's intended use. The two MIO/UMIO slots (5 and 6) have additional midplane connections to perform chassis control operations, including support for a serial Console port and dual remote management ports.

Figure 4: ASR 5500 Midplane Buses



Card Types

The ASR 5500 supports rear cards and front cards. Rear cards are larger and perform node management, packet processing and I/O functions (traffic sources). Front cards determine the amount of bandwidth for the

switching fabric (crossbars), and indicate the operating and alarm status of the ASR 5500. See the simplified block diagram below showing the ASR 5500 card architecture.

Figure 5: Block Diagram of Card Architecture – MIO/UMIO

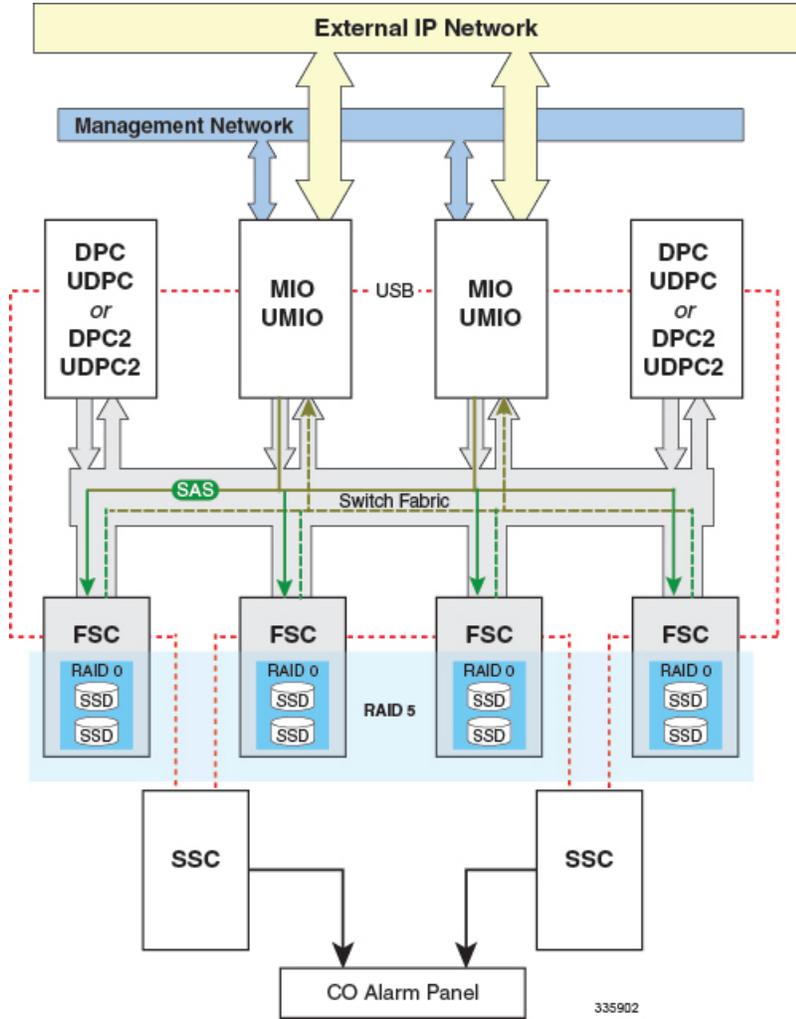
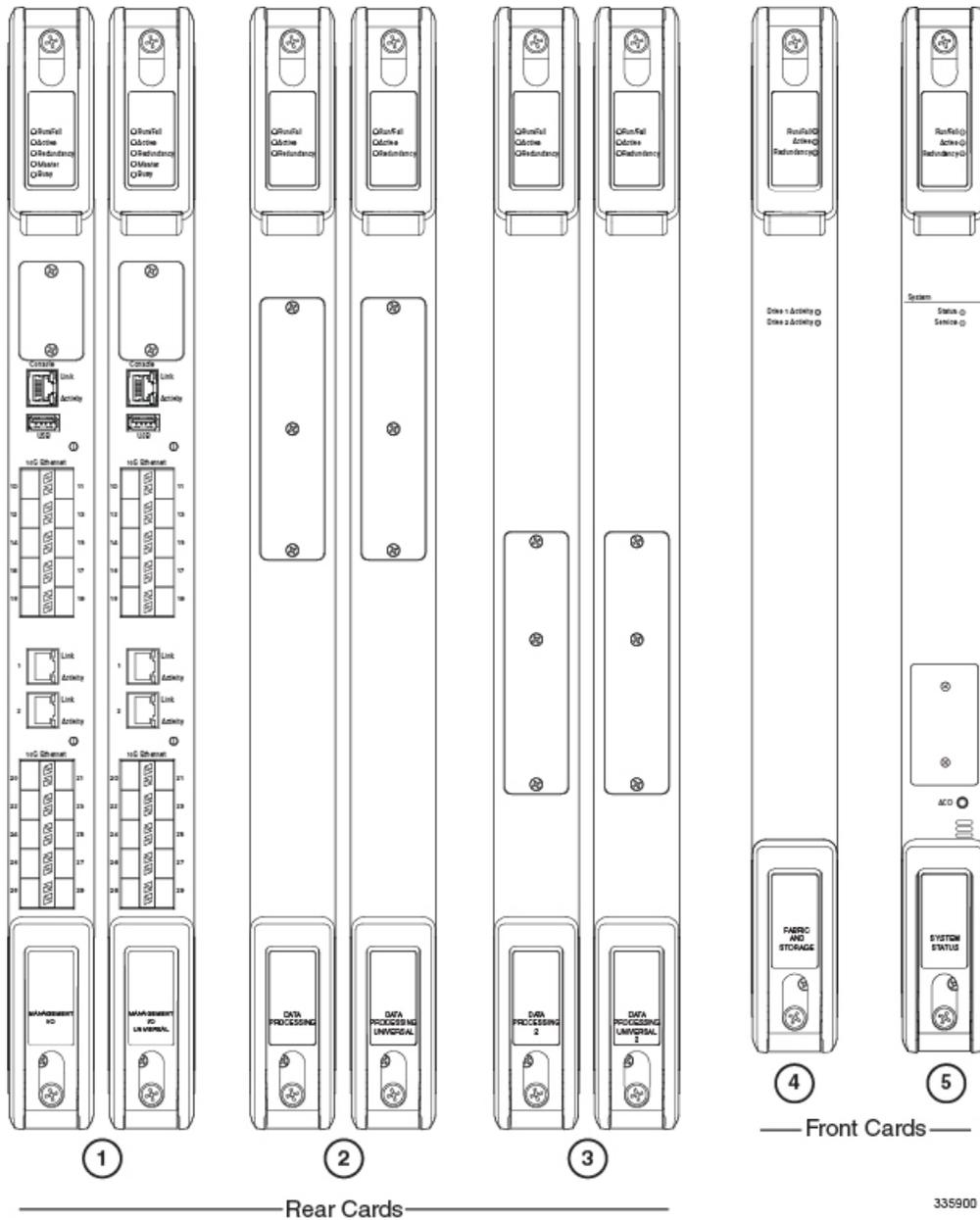


Figure 6: ASR 5500 Card Types – MIO/UMIO

Card Types



1	[LF] Management I/O (MIO) [RT] Management I/O Universal (UMIO)	2	[LF] Data Processing Card (DPC) [RT] Data Processing Card Universal (UDPC)
3	[LF] Data Processing Card 2 (DPC2) [RT] Data Processing Card Universal 2 (UDPC2)	4	Fabric and Storage Card (FSC)
5	System Status Card (SSC)	[LF] = Left image, [RT] = Right image	

Rear Cards

The ASR 5500 supports several types of rear-mounted cards:

- [Management I/O, on page 9](#)
- [Data Processing Card, on page 10](#)
- OR–
- [Data Processing Card version 2, on page 10](#)

The ASR 5500 supports ten rear cards. Each card is interconnected with the others via the switching fabric.

**Important**

UMIO cards, UDPCs and UDPC2s are direct replacements for MIO cards and DPC/DPC2s. However, a special Universal PID license must be purchased and installed on the chassis for each installed UMIO and UDPC/UDPC2. Contact your Cisco account representative for additional information.

Management I/O

The ASR 5500 chassis supports two MIO /UMIO cards placed in the rear facing slots of the chassis. These cards perform chassis management, as well as local context and non-local context external I/O operations.

**Important**

The MIO/UMIO cards automatically implement 1:1 port redundancy (active/standby). Ports are 1:1 redundant across slots 5 and 6. For example, port 10 on the MIO in slot 5 is redundant with port 10 on the MIO in slot 6.

Each MIO/UMIO has:

- One CPU subsystem with 96 GB of RAM
- Four NPU subsystems

The two 10/100/1000Base-T (1GbE) ports on the front panel of MIO/UMIO cards can only be used for local context (OAM). An MIO/UMIO includes support for:

- Midplane connections for chassis control operations
- SAS storage controller for FSC solid state drives (SSDs)
- RS-232 serial console (RJ45) for CLI management
- USB port for an external flash device
- 32 GB SDHC internal flash device

MIO/UMIO cards support two daughter card (DCs) for external I/O interfaces (100 Gbps aggregate per DC). The optical ports on the daughter cards can only be used for non-local context. The currently available DC supports ten 10 GbE interfaces. The interface ports accept SFP+ SR and LR transceivers.

For additional information see the *MIO Cabling* chapter.



Important MIO/UMIO daughter cards are not user installable or replaceable.



Important MIO/UMIO cards are shipped with SFP+ SR or LR transceivers installed.

Data Processing Card

The ASR 5500 chassis supports multiple DPCs/UDPCs in the rear facing slots of the chassis.

The DPC/UDPC has two identical CPU subsystems with each containing:

- Two six-core processors for a total of 24 cores per card
- 96 GB of RAM
- NPU for session data flow offload
- Crypto offload engines located on a daughter card

DPC/UDPCs manage subscriber sessions and control traffic.

Data Processing Card version 2

The DPC2/UDPC2 is the second generation Data Processing Card (DPC) for the ASR5500. It offers increased performance versus the first generation DPC, while maintaining backwards compatibility with other ASR 5500 cards. The raw input/output has been increased from 80Gbps (DPC/UDPC) to 150Gbps (DPC2/UDPC2).



Important The DPC2 requires StarOS 18.0 or higher. The UDPC2 requires StarOS 18.2 or higher with a special Universal PID chassis license. See the *Chassis, UMIO, UDPC and UDPC2 License Requirements* appendix for additional information.

The DPC2/UDPC2 has three CPU subsystems. Each subsystem consists of two twelve-core processors that are paired with a Platform Controller Hub (PCH). This CPU configuration supports a total of 72 cores per card.

Each CPU subsystem is associated with 32 GB of DDR4 memory (total of 192 GB per DPC2) and a latest generation crypto offload engine.

The DPC2/UDPC2 is equipped with the Cisco Anti-Counterfeit Technology 2 (ACT2) chip. The ACT2 services multiple functions including:

- IEEE 802.1AR standard based Immutable Identity
- Extensible set of cryptographic functions
- Secure storage capabilities (cryptographic keys and credential storage).
- Installation of customers' own identity certificates (802.1AR LDevID)
- Source for true random entropy (NIST SP-800-90 certifiable)

The DPC2/UDPC2 is not equipped with NPUs.

**Important**

The DPC2/UDPC2 must not be intermixed with the DPC/UDPC in an ASR 5500 chassis. All data processing cards in the chassis must be of the same type.

Front Cards

The ASR 5500 supports two types of front-mounted cards:

- [Fabric and Storage Card \(FSC\)](#), on page 11
- [System Status Card \(SSC\)](#), on page 12

The crossbars that comprise the switching fabric are on the FSCs. The ASR 5500 supports multiple FSCs. Each FSC provides six physical fabric planes. When fully populated, there are 24 fabric planes in the system. A physical fabric plane provides full-mesh connectivity between all traffic sources.

Fabric and Storage Card (FSC)

The ASR 5500 chassis supports multiple FSCs in front facing slots of the chassis.

The FSC features:

- Fabric cross-bars providing in aggregate:
 - 120 Gbps full-duplex fabric connection to each MIO/UMIO
 - 60 Gbps full-duplex fabric connection to each DPC/UDPC or DPC2/UDPC2
- FSC-200GB – Two 2.5" serial attached SCSI (SAS), 200GB solid state drives (SSDs) with a 6 Gbps SAS connection to each MIO/UMIO. The SSDs support a RAID 0 configuration on the card.
–OR–
- FSC-400GB – One 2.5" serial attached SCSI (SAS), 400GB solid state drive (SSD) with a 6 Gbps SAS connection to each MIO/UMIO. The FSC-400GB is interchangeable with the FSC-200GB, as long as the StarOS release supports the non-RAID 0 configuration of the single 400GB drive.

Every FSC adds to the available fabric bandwidth to each card. Each FSC connects to all MIO/UMIOs and data processing cards, with a varying number of links depending on the MIO/UMIO or data processing card slot. Three FSCs provide sufficient bandwidth while the fourth FSC supports redundancy.

**Important**

Although four FSCs are required for redundancy, the system can operate with three FSCs in the presence of a fourth failed FSC. However, you must install four FSCs for normal operation.

The ASR 5500 uses an array of solid state drives (SSDs) for short-term persistent storage. The RAID 5 configuration has each pair of drives on an FSC-200GB striped into a RAID 0 array; all the arrays are then grouped into a RAID 5 array. The single SSD on the FCS-400GB does not support RAID 0 but participates in the RAID 5 array.

Each FSC provides the storage for one quarter of the RAID 5 array in a four-FSC configuration. Data is striped across all four FSCs with each FSC providing parity data for the other three FSCs. The array is managed by the active MIO/UMIO.

When equipped with six FSCs, four of the FSCs are active (switch fabric) and form the RAID 5 array (all their SSDs are active). FSC-5 and FSC-6 are active (switch fabric) with their SSDs in Standby mode. Their SSDs will only become active in the event of an array failure.



Important The SSDs are not field replaceable units (FRUs). If an SSD fails the FSC must be replaced.



Important A minimum of three FSCs must be online at all times for the array to operate. When an FSC is removed, one RAID 0 array (FCS-200GB) is lost with the RAID 5 array providing redundancy. When equipped with six FSCs and one FSC in the RAID array fails, the SSDs on FSC-5 or FSC-6 will become active.



Important Removal of an FSC while the array is degraded or rebuilding may result in data loss.

The array appears under /hd-raid and is available to all data processing cards and MIO/UMIOs.

System Status Card (SSC)

The ASR 5500 chassis supports two SSCs in front facing slots of the chassis. SSCs use dedicated slots (11 and 12) on the front side of the chassis.

The SSC card features:

- Three alarm relays (Form C contacts)
- Audible alarm with front panel Alarm Cutoff (ACO)
- System status LEDs

LED Indicators

All ASR 5500 circuit cards incorporate light emitting diode (LED) status indicators. A base group appears on all cards. Card-specific indicators show the status of ancillary functions.

LED Indicators Common to All Cards

Table 1: Base LED Group

Label	State	Meaning
Run/Fail	Off	Offline
	Green – Blink	Transitioning
	Green – Solid	Online
	Red	Failure
Active	Off	Not applicable
	Green – Blink	Transitioning
	Green – Solid	Active
Redundancy	Off	Not applicable
	Amber – Solid	Non-redundant
	Amber – Blink	Transitioning
	Green	Redundant

LED Indicators on Specific Cards

Table 2: Card-specific LED Group

Label	State	Meaning
MIO/UMIO		
Master	Off	Not applicable
	Green – Blink	Transitioning
	Green – Solid	Master
Busy	Off	No activity
	Green	Storage activity
Interface Ports		
Link	Off	No link with network
	Amber – Blink	Transitioning
	Green – Solid	Linked with network

Label	State	Meaning
Activity	Off	No activity
	Green – Blink	Data exchange
FSC		
Drive 1 Activity	Off	No activity
	Green	Activity
Drive 2 Activity	Off	No activity
	Green	Activity
SSC		
System Status	Off	System offline
	Green	System online
	Red	Service loss
System Service	Off	System OK
	Amber	Failed component