Centellis 4100

AdvancedTCA 10GbE Platform

Embedded Computing for Business-Critical Continuity™

The Centellis 4100 can be used to achieve high density at the rack level, to support front maintenance and rear cabling requirements for the central office

- AdvancedTCA® shelf to deliver 5NINES availability into central office environments
- 13U/19" chassis with 14 vertical blade slots
- Fault-resilient design to minimize hardware induced failures
- AdvancedTCA hot swap maintenance of the running system
- Integrated shelf management for inventory data, remote upgrade, electronic keying, thermal management, and network based remote access
- Redundant PICMG 3.0 & 3.1 base/fabric switching blades
- Combined 10 Gigabit Ethernet (GbE) switch/control blades to maximize billable application slots

The Emerson Network Power Centellis™ 4100 platform integrates the chassis, cooling, power distribution, shelf management, and managed networks into an off-the-shelf platform solution on which you can add your service-related hardware and software.

With architecture designed for 5NINES availability, the Centellis 4100 PICMG® 3.0 compliant embedded AdvancedTCA packet switching backplane platform minimizes both planned and unplanned downtime and provides continuous service during fault recovery. The Centellis 4100 provides this level of protection through a combination of redundancy on the component level to avoid single points of failure; repair and upgrade of the running system without impacting the system service; remote access for monitoring, control, and upgrade; and unmistakable guidance through component replacement procedures.

The result is a high availability server ideally suited for data-intensive central office and networking applications, including media gateway controllers, VoIP concentrators, multimedia servers, signaling gateways, cable head-end, IP/DSLAM, IP PBX, and next generation wireless base station controller (BSC) systems.

In addition to redundancy of all active system components, the Centellis 4100 series supports high availability through hot-swappable key system components. Power distribution, cooling blower trays, and shelf management controllers are all hot-swappable to minimize downtime and mean time to repair (MTTR).

AdvancedTCA boards are also hot-swappable so they can be added, removed, or replaced without bringing down the system. If heat is a concern for system reliability, the chassis has been tested for cooling capacity of 200W per front slot and additional 15W per rear slot to support active components even on rear transition modules (RTMs).

RoHS 5/6 Pb SOLDER EXEMPT

AdvancedTCA®

EMERSON™ Network Power

Hardware

CHASSIS

- 13U chassis for 19" racks
- 14 slots for 8U AdvancedTCA blades
- 14 slots for 8U RTMs
- Front to rear air flow
- Rear connection for power cables
- Dimensions (overall): 575 mm high; 483 mm wide; 505 mm deep

BACKPLANE

- Dual star base channel routing
- Dual star fabric channel routing
- Update channels between adjacent slots
- Redundant intelligent platform management busses (IPMB)
- Bussed clock lines for I/O synchronization

POWER DISTRIBUTION

- Redundant –48V to –60V routing to each slot
- Four (4) hot-swappable power entry modules (PEMs) with EMC filters, breakers, and sensors
- Split power distribution

COOLING

- Four speed-controlled blower trays with thermal sensors for front blade and RTM cooling
- Fault-tolerant design covering the loss of a single blower
- Average cooling capacity for 200W per front board and additional 15W for each RTM

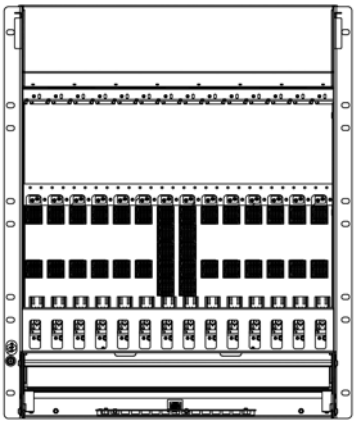
SHELF MANAGEMENT

- Remote access to shelf and field replaceable units (FRUs) for inventory management, alarming, and control
- HPI 1.0 based remote access (C-library for remote console)
- Standard objects in accordance with PICMG 3.0
- Abstracted objects for a chassis independent and generic interface
- SNMPv3 for encrypted communication

BASE AND FABRIC CHANNEL NETWORK

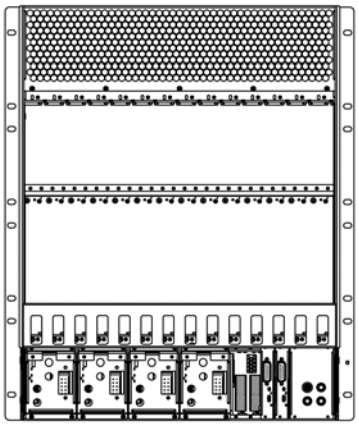
- Gigabit Ethernet interfaces to backplane
- Port based VLANs for base and fabric switches
- Additional managed functions for base switches
- Eight Gigabit Ethernet uplinks to base channel network
- Redundant gateway functionality

Chassis Layout and Dimensions



Front View
(top to bottom)

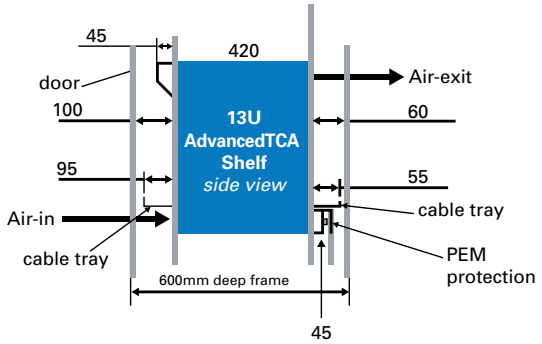
- Four blower trays behind cover
- 14 vertical 8U slots for front blades with 6HP (30.48 mm) horizontal pitch
- Air filter in air inlet at bottom



Rear View
(top to bottom)

- Air outlet
- 14 vertical 8U/6HP slots for RTM
- Four PEMs
- Two shelf manager boards (ShMB)
- Two alarm I/O modules

Centellis 4100 Chassis Dimensions
Height: 575 mm
Width: 483 mm overall
Depth: 505 mm (390 mm sub-rack)



Power Distribution

Four (4) field maintainable PEMs provide studs for power cable connection. The PEMs route the current to the redundant power rails of the AdvancedTCA backplane. The four have been integrated for redundancy purposes. The working voltage levels are –40V to –72V supporting nominal voltages of –48V and –60V. Each PEM contains an automatic breaker and a filter to reduce conducted emissions. The PEMs also monitor the input voltage and measure the air intake temperature. All sensor data is propagated to the shelf manager board.

Cooling

The Centellis 4100 provides fault-tolerant cooling to front mounted boards and to RTMs based on four front-maintainable blower trays. The blowers are mounted in the chassis top and pull the air through the slot area. The cooling system is sized to support a heat dissipation of 200W per front slot and an additional 15W for each rear slot. This assumes an appropriate population of the system and sufficient heat sinks on the individual blades. The blowers are sized to provide cooling at up to 75% of their maximum speed assuming 45°C ambient air temperature. Intelligent forward-looking cooling control ensures optimal cooling at lowest possible audible noise at all times. In the case of a single blower failure or higher air temperature, the remaining blowers will speed up to 100%. The shelf manager (ShM) monitors and controls the speed of each individual blower. The ShM bases this task on air intake temperature, the air exhaust temperature and standard thermal data provided by the blades. A system management instance can consider additional sensor data as provided by the individual blades and can take over control of the cooling subsystem through the ShM. All blowers automatically run at full speed if they lose their connection to the ShM.

Shelf Management

The purpose of System Management is to assure proper operation of AdvancedTCA blades and other shelf components within one or several shelves. The ShM is a shelf functionality providing the system manager with appropriate information (inventory, sensor, and status data) as well as control access. Beyond this interfacing task, it also automatically administrates the AdvancedTCA shelf manager power budget, checks for compatibility of newly inserted components, monitors the overall stability of the system, and reports anomalies. Thermal management is also a task of the ShM as described above. Shelf Management is a distributed functionality, which is based on two redundant shelf manager boards (ShMB), a redundant intelligent platform management interface (IPMI) network and intelligent peripheral management controllers (IPMC) on each FRU within the shelf. Furthermore, the shelf management provides inventory data (manufacturer, serial number, etc.) and remote upgrade functionality of all field replaceable units.

Shelf Manager Board

The Centellis 4100 contains two ShMBs in a redundant active/standby mode. The active ShMB can access all FRUs within the shelf via two redundant IPMI busses (IPMB). The standby ShMB permanently monitors the physical condition of the currently active counterpart and takes over service and IP address automatically in the case of a failure. The result is a fault-tolerant and continuous remote access to the shelf.

Remote access either via network cable plugged to the ShMB, or via base channel network of the shelf. The hardware platform interface (HPI) is either accessible via an HPI client library which can be used on remote Intel® Pentium®/Linux nodes. The protocol interface to the ShMB is HPI 1.0. HPI provides access to shelf-internal IPMI objects in accordance with PICMG 3.0 defined rules.

A defined set of objects provides generic access to the following domains:

- Cooling subsystem (e.g., default policies to adjust noise vs. temperature)
- FRU slots (e.g., power-up behavior)
- FRUs by themselves (e.g., general thermal and health status)
- FRU maintenance (e.g., access to blade provided status LEDs)

It is the purpose of this abstraction to define a set of objects, which is independent of the specific instance of an AdvancedTCA system. It can be assumed that the management software that is exclusively using this abstraction layer can be easily transferred between current and future systems from Emerson.

All shelf components provide inventory data, status information, and control hooks if applicable. Key objects are:

- Chassis for inventory data and shelf address
- PEMs to monitor the power distribution
- Cooling subsystem to monitor and control cooling
- Each AdvancedTCA blade

The ShMB is also responsible for validating each newly inserted blade before it gets powered (electronic keying). This method avoids the potential danger that a defined power budget might get exceeded and checks the compatibility of blade interfaces, which are connected to each other via the fabric area of the backplane.

IPMI Controller

The IPMC is the counterpart of the ShMB on the individual FRUs on the shelf. IPMCs are located in the PEMs, in the blower, and on the alarm boards. The protocol used between ShMB and IPMC is IPMI in a Emerson AdvancedTCA system. For a highly reliable design, Emerson IPMCs are based on two independent microcontrollers, one connected to IPMB-A, the other to IPMB-B. This method eliminates any single point of failure.

Shelf FRU Information

The shelf FRU information is used on the rack and office level to deliver a unique identity for each shelf. It also provides information on the backplane topology. The ShMB provides access to this data.

Blade Connections

Besides power distribution and IPMI busses for shelf management, the backplane provides the following connections for communication between and for synchronization of blades:

BASE CHANNELS

- Update channels (10x 3.125Gbps)
- Dual star fabric channels (8x3.125Gbps) dependent on product type
- Synchronization clocks

Slots are numbered from left to right as shown:
Dual star backplane
13=11-9=7-5=3-1=2-4=6-8=10-12=14

Each pair of slots in the list above with a "=" in between has an AdvancedTCA update channel interconnect. Switches mounted in logical slots 1 and 2 complement this backplane routing to a complete communication and synchronization infrastructure.

ATCA-F120 System Controller and 10GbE Switch

The Emerson ATCA-F120 system controller and 10GbE switching blade is a key element within any Emerson Centellis and Avantellis 4000 communications servers. This blade combines standard PICMG 3.0 base interface and PICMG 3.1 fabric interface 10Gb Ethernet switching (hub functionality) with two AMC slots to support a wide variety of applications, including shelf-wide and/or frame-wide management. By combining these essential functions on a single blade, the ATCA-F120 can provide a completely redundant switching and system management environment while consuming only two slots in the shelf, maximizing the number of slots available for billable applications.

Standard Networking Support

The Emerson ATCA-F120 blade provides dual star, hub switching functions for the PICMG 3.0 base interface and the PICMG 3.1 fabric 10GbE interface within the AXP series of telecom shelves. The ATCA-F120 blade is designed to occupy logical slots 1 and 2 within the shelf as specified in the PICMG 3.0 standard.

The PICMG 3.0 base interface switch supports redundant Gigabit Ethernet links to all slots within the AXP series of telecom shelves. The PICMG 3.1 fabric interface switch supports PICMG 3.1 Option 1 Gigabit Ethernet and PICMG 3.1 Option 9 10 Gigabit Ethernet

links to all slots, providing a bandwidth to support high bandwidth and/or latency sensitive traffic.

The ATCA-F120 provides base and fabric extension interfaces which allow multiple AXP telecom shelves to be interconnected within, or across, a frame, creating a single access point for management and control. These extensions can be used to scale the networks to multiple shelves or frames—for example in a large distributed application environment. Multiple network extension interfaces provide redundant connections to reduce fault domains in the event of connectivity failure.

The ATCA-F120 blade uses the PICMG standard Update Channel to create a high performance, low latency data synchronization channels between redundant ATCA-F120 blades. This provides seamless, stateful system fail-over in the event of connectivity and/or blade failure.

Intelligent Platform Management Controller

The PICMG 3.0 AdvancedTCA standard specifies a low-level, environmental management architecture referred to as Intelligent Platform Management Interface (IPMI). The ATCA-F120 blade implements this functionality utilizing an off-the-shelf hardware and software based IPM controller (IPMC) that monitors all local, blade specific environmental information. Management access to this information is provided through the Service Availability Forum™ (SA Forum) defined HPI.

External Interfaces

The ATCA-F120 blade supports a full suite of standard external interfaces including a RS-232 serial and management Ethernet interfaces. An IPMI controller debug interface is also provided.

Hardware

PROCESSOR

- MPC8548E PowerQuicc III processor

MEMORY

- 512MB ECC-protected SDRAM
- 2GB NAND flash (user flash)
- Two (2) redundant banks of boot flash (32MB each)
- 16MB CPU reset-persistent memory

COUNTERS/TIMERS

- Four 32-bit programmable timer/counters
- Watchdog timer

BASE AND FABRIC INTERFACES

- Dual star configuration
- PICMG 3.0 base interface switching – Gigabit Ethernet (1.0Gbps)
- PICMG 3.1, Option 1, 9 fabric interface – Gigabit Ethernet (1.0Gbps, 10Gbps)

EXPANSION

- AMC slots (2)

EXTERNAL INTERFACES

- Front Panel
  - Management, 1GbE
  - Base interface, 1GbE
  - From AMC slot 1, 1GbE
  - Serial, mini DB-9 (1)
- Via Optional RTM
  - Base interface extension, 10GbE CX4 (2), 1GbE RJ-45 (4)
  - Fabric interface extension, 10GbE CX4 (4), 1GbE RJ-45 (4)

BLADE SIZE

- 8U form factor, 280 mm x 322.5 mm, single slot

RELEVANT STANDARDS

- PICMG 3.0 (form factor, IPMI, base interface, hot swap, RTM)
- PICMG 3.1, Options 1 and 9

POWER REQUIREMENTS

- Dual redundant –48V rails
- Input range: -39.5 VDC to -72 VDC

THERMAL CHARACTERISTICS

- Operating range: –5° C to 55° C

Update Channel

The update channel is comprised of 10 differential signal pairs at 3.125Gbps each in a point-to-point connection between any two adjacent physical slots. Pairs of compatible blades may use those lines for their proprietary purpose.

Fabric Channel

Fabric channels, available on the ATCA-F120 switch blade only, are optional peer-to-peer connections between any two blades on the backplane. The most typical subset is the dual star topology with fabric channel switches in logical slots 1 and 2 providing star-coupled connectivity to the remaining blades of the shelf.

The preinstalled ATCA-F120 blade provides a fabric channel switch in addition to the base channel switch. It is a 10Gb Ethernet switch for non-blocking peer-to-peer communication between any two nodes on the backplane. The extended feature set of the fabric channel switch on the ATCA-F120 blade is limited to the configuration of port-based VLANs.

Synchronization Clocks

A set of clock busses is provided for TDM clock synchronization. Line cards with integrated clock generation and recovery may use those lines to distribute their clocks over the backplane.

Centellis Services

The Centellis 4100 optionally offers a set of services to node blades:

- A DHCP server located on the ATCA-F120 blade responds to shelf internal DHCP requests with a geographical IP address containing shelf and slot address. This DHCP server ignores DHCP requests from outside the shelf.
- The ShMB offers update services to update the firmware of all IPMCs and of the ShMB itself. Such an update can be completed remotely through the network and does not affect the application layer.
- The ShMB offers a TTY console to each BIOS of Emerson blades based on Intel Pentium processors.

The following services are provided if the system is already preconfigured with two Intel Pentium processor based blades with on-board disks:

- Services supporting PXE based boot of diskless clients
- Services for rolling upgrade of application software

Centellis 4000 Series Software

All Emerson AdvancedTCA blades within a Centellis 4000 series communications server come complete with software that, when combined with the hardware, creates a fully integrated and verified telecom platform. This software is referred to as the Centellis 4000 software package.

The Centellis 4000 software package comes complete with, and are verified to, a standard Carrier Grade Linux (CGL) distribution. Wind River Platform for Network Equipment Linux Edition 1.4 (PNE-LE 1.4) includes all required Linux Support Packages (LSPs) to support Emerson ATCA blades.

The Centellis 4000 software package includes:

- Wind River PNE-LE 1.4
- Basic Blade Services

Basic Blades Services (BBS) software is provided to enable a set of ATCA hardware and software components into a fully integrated and verified telecom platform – the Centellis 4000 platform. This platform is ready for a customer's HA middleware and application environment.

Basic Blade Services (generic to all ATCA blades):

- Hardware Platform Management including local IPMC, LED, EKeying and blade extraction software
- Firmware upgrade utility
- Local management access (SNMP, CLI)

Basic Blade Services (ATCA-F120 specific):

- OpenHPI support – Centralized access to blade specific HPI information from the shelf manager and presentation to a higher level systems management application.
- Switch management software – Includes hardened network drivers, default network configuration scripts and network configuration tools.

RELEVANT STANDARDS

- Linux Foundation
- SA Forum
  - Hardware Platform Interface (HPI), B.01.01
  - HPI to ATCA mapping HPI-B.01.01-ATCA

Payload Options

Part Number	Description
ATCA-7221	ATCA processor blade with PICMG 3.1 interfaces, based on Dual Intel® Xeon® processor

Regulatory Compliance

Item	Description
Designed to comply with NEBS, Level 3	GR-63-CORE, NEBS Physical Protection, Level 3
	GR-1089-CORE, Electromagnetic Compatibility and Electrical Safety — Generic Criteria for Network Telecommunications Equipment. Equipment Type 2
ETSI Environmental Conditions	Storage ETSI EN 300 019-1-1, Class 1.2
	Transport ETSI EN 300 019-1-2, Class 2.3
	Storage ETSI EN 300 019-1-3, Class 3.2
EMC	ETSI EN 300 386 (Europe); FCC part 15 (US)
Safety	IEC 60950-1; EN 60950-1; UL 60950-1/CAN/CSA C22.2 No. 60950-1

SOLUTION SERVICES

Emerson Network Power provides a portfolio of solution services optimized to meet your needs throughout the product lifecycle. Design services help speed time-to-market. Deployment services include global 24x7 technical support. Renewal services enable product longevity and technology refresh.

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The global leader in enabling Business-Critical Continuity™.

- AC Power Systems
- Connectivity
- DC Power Systems
- **Embedded Computing**
- Embedded Power
- Integrated Cabinet Solutions
- Outside Plant
- Power Switching & Control
- Precision Cooling
- Services
- Site Monitoring
- Surge & Signal Protection

Emerson Network Power

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