Media Gateway with IP and ATM Interworking

Overview

With the growth in data network traffic driving major changes in public networks, the convergence of existing voice traffic onto the data network infrastructure promises significant benefits (such as reduced costs and simplified network management) for carriers and enterprises alike. Media gateways and switches that support the integration of Voice over Internet Protocol (VoIP), legacy public switched telephone network (PSTN), and ATM networks make this convergence possible.
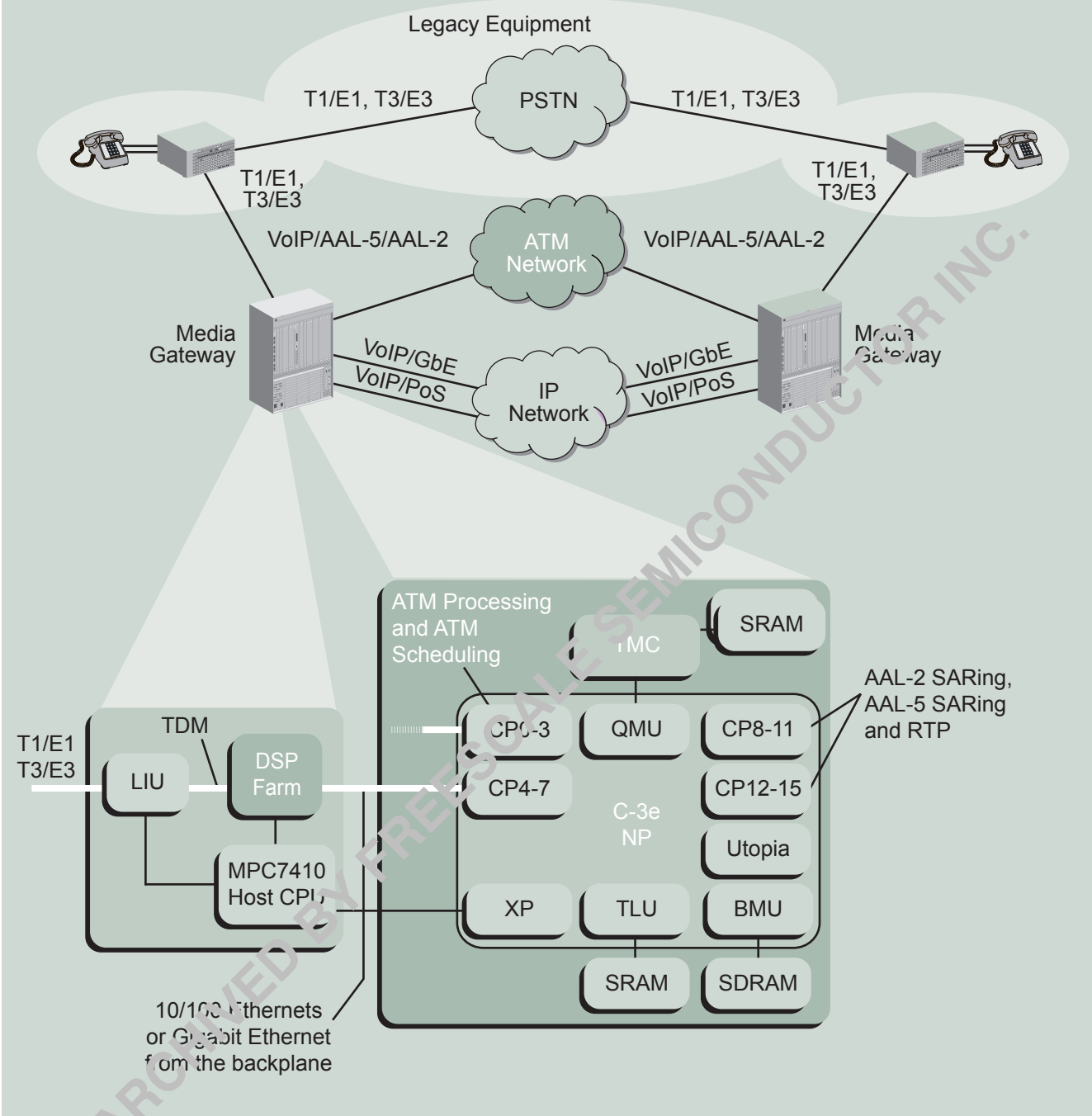
Media gateway functions are being implemented in standalone devices, or as modules in multi-service switches, edge routers, remote access concentrators, or PSTN switches. In all cases, media gateways share common hardware and software design challenges.

Key Benefits

> Scalable implementation of high-performance and high density voice/data capabilities, from 2000 to 8000 voice channels at G.711, for a wide range of applications

> Single "platform" architecture for both IP-based and ATM oriented systems, including interworking between them

> True, fine-grained, multiservice support for high numbers of users

> Simplified line card design with lower power and board real estate plus ability to leverage single-vendor solution

Launched by Motorola

freescale™
semiconductor

MEDIA GATEWAY SOLUTION WITH IP AND ATM INTERWORKING

Legacy Equipment

PSTN

T1/E1, T3/E3

T1/E1, T3/E3

T1/E1, T3/E3

T1/E1, T3/E3

VoIP/AAL-5/AAL-2

ATM Network

VoIP/AAL-5/AAL-2

Media Gateway

VoIP/GbE

VoIP/PoS

IP Network

VoIP/GbE

VoIP/PoS

Media Gateway

ATM Processing and ATM Scheduling

TMC

SRAM

AAL-2 SARing, AAL-5 SARing and RTP

TDM

T1/E1 T3/E3

LIU

DSP Farm

CP0-3

QMU

CP8-11

CP4-7

CP12-15

C-3e NP

Utopia

MPC7410 Host CPU

XP

TLU

BMU

SRAM

SDRAM

10/100 Ethernets or Gigabit Ethernet from the backplane

SG2126-2

Freescale Ordering Information

Part Number	Product Highlights	Additional Information
PCC3E0RX180WB0B	C-3e NP	5.5 W @ 180 MHz freescale.com/networkprocessors
PCC5E0RX266WB0B	C-5e NP	9 W @ 266 MHz freescale.com/networkprocessors
PCQ500RX000WA0A	Q-5 TMC	5Gbps throughput freescale.com/networkprocessors
MPC8260	PowerQUICC™ ISA	freescale.com/PowerQUICC
MSC8101 MSC8102	DSP Farm	freescale.com/DSP
CSTC501W Note 1	C-Ware Software Toolset	Web site download of current CST release (Windows and UNIX)
CDEV101A Note 2	C-Ware Development System	CDS Base Unit (Chassis, Power Supply, Single Board Computer)

Notes:
1. The CST can be downloaded from freescale.cportcorp.com/support.
2. Ask your sales representative or distributor for details and availability of system modules, which you order separately.

Design Challenges

Media gateway implementations are complicated by the wide variety of technologies that make up existing networks. These include the circuit-switched PSTN, ATM and Frame Relay based public data networks, and the IP-based Internet, all of which may be carried over the same SONET transport network.

Functions required of media gateways typically include the conversion (and compression) of time-division-multiplexed (TDM) voice circuits onto ATM networks using a variety of adaptation protocols (AAL-0, AAL-1, AAL-2 and AAL-5), or onto packet-based networks using IP (including RTP), frame relay, or extensions of both. Voice switches that support the switching of voice circuits among the various network interfaces may require interworking between different protocols (such as between ATM and IP-based networks) as well.

The specific design challenges for media gateways include:

> Accommodating increasing numbers of voice (or fax and modem) circuits per slot within a specific networking device.

> Supporting the increasing number of different network interfaces and speeds required, ranging from channelized T1/E1 lines through OC-12 SONET and Gigabit Ethernet interfaces.

> Adapting to the number of different protocols used (such as ATM AAL-2, AAL-5, VoIP/RTP, Packet-over-SONET/PPP, MPLS, and so on, even as the protocol standards evolve and improve.

> Managing quality of service (QoS) to ensure prioritization of latency-sensitive traffic such as voice.

> Providing the flexibility to add new features and functions through software as market demands dictate in the future.

Freescale Semiconductor Solution

Freescale Semiconductor® offers complete solutions for all aspects of media gateway and switch implementations. This includes the StarCore® digital signal processors (DSPs) required to convert and compress TDM voice circuits into packet or cell-based flows, the C-Port™ network processors (NPs) required to terminate or switch the packet or cell-based circuits, and the PowerPC® ISA host processors required to implement the control functions that manage each voice connection. The network processing function is the focus of this document.

Freescale Semiconductor's C-Port family, including network processors, traffic management coprocessors, and interface adaptors, provides the flexibility to support the wide range of protocols required for today's media gateway implementations. The internal processing resources of the C-3e NP are particularly well suited to be used at the "uplink" aggregation level in media gateway designs, where extensive protocol conversion and switching functions are required.

The figure illustrates a VoIP/VoATM network and details the tasks handled by the NP. On one side of the gateway, TDM traffic converted and compressed by Freescale Semiconductor DSPs is aggregated on to high density line cards (capable of supporting 2000 voice channels per line card with the C-3e NP, and over 8000 with the C-5e NP) and then passed on to an internal Ethernet bus (or other media).

These newly created packets are forwarded to the C-3e NP, which formats the voice packets into the desired network protocol, which may include IP and ATM. With IP, the voice packet is formatted into a specific VoIP protocol (such as RTP), possibly tagged as part of an MPLS session, and forwarded onto an IP-based network (over Ethernet or SONET), where QoS may be guaranteed through the use of various protocols including DiffServ.

ATM is suitable for carrying voice because of its built-in QoS features. Options for ATM processing in media gateways might include VoIP over AAL-5 over ATM, where voice packets from the DSPs are formatted into a specific VoIP protocol (such as RTP), which are then converted into AAL-5 PDUs, and segmented into ATM cells. Alternatively, voice packets may be formatted into ATM AAL-2 "mini-packets", one or more of which are encapsulated into ATM cells.

Interworking between IP and ATM, such as switching within and between RTP and AAL-2 flows, can be achieved easily with the C-Port network processor architecture.

Fine grained QoS capabilities can also be added using Freescale Semiconductor's traffic management coprocessors (TMCs). These TMCs are multi-protocol and can thus provide traffic policing, shaping, monitoring, and scheduling for both ATM and IP traffic, even simultaneously. They ensure that voice traffic is accorded the correct priority and that users receive toll-quality service.

The flexibility and performance of the C-Port family allows a variety of media gateway applications to be created all based on a common software base. Applications are written in C-language using applications programming interfaces (APIs), which enables you to easily upgrade functionality and scale software to higher bandwidths.

Development Environment

The C-Port family development environment consists of the following components:

> **C-Ware™ Applications Library (CAL).** Comprehensive set of reference applications for building networking systems based on Freescale Semiconductor's C-Port family, The CAL significantly accelerates customer software development by providing extensive reference source code that is instrumented for and tested with the CST.

> **C-Ware Software Toolset (CST).** Functional and performance accurate simulation environment, standard GNU-based compiler and debugger, GUI performance analysis tool, traffic scripting tools, and comprehensive C-Ware APIs.

> **C-Ware Development System (CDS).** Compact PCI chassis with Freescale Semiconductor MPC750 host application module, which can also include NP switch modules, TMC daughter cards, and various physical interface modules (PIMS). Complete hardware reference designs also available.

Vendors may also select Wind River Systems Tornado® for Managed Switches (TMS) to program the host processor/control plane software. Freescale Semiconductor has established an alliance with Wind River to provide integration of the C-Port network processors with TMS 2.0 supporting both Layer 2 and Layer 3 services. In addition, the host application module in the CDS runs VxWorks® on the MPC750.

Development Tools			
Tool Type	Product Name	Vendor	Description
Software Kit	C-Ware Software Toolset (CST)	Freescale Semiconductor	Provides a comprehensive software development environment for building networking systems based on Freescale Semiconductor's C-Port network processor family. By providing a simple programming model, standard tools, a robust simulation environment, and a host application environment, the CST can significantly accelerate your software development effort.
Reference Applications	C-Ware Applications Library (CAL)	Freescale Semiconductor	Offers a comprehensive set of reference applications for building networking systems based on Freescale Semiconductor's C-Port network processor family. The CAL significantly accelerates customer software development by providing extensive reference source code that is instrumented for and tested with the C-Ware Software Toolset.
Development Kit	C-Ware Development System (CDS)	Freescale Semiconductor	Provides an environment for you to prototype an entire product that leverages C-Port network processors. This chassis-based system allows you to develop your unique software and then integrate and test it in an actual hardware environment, well before your target product is available.

Third Party Support

Vendor	Description	Contact Information
Corrent	For High-Performance Security Processing	Tel: 480-648-2300 sales@corrent.com
IDT	For Advanced Classification	Tel: 613-724-6004 Fax: 613-724-6008
Wind River Systems	For Tornado for Managed Switches and RTOS	Tel: 800-545-9463 Fax: 510-814-2010

Notes

Learn More: Contact the Technical Information Center at +1-800-521-6247 or +1-480-768-2130.

For more information about Freescale products, please visit **www.freescale.com**.

SG2126
REV 2
12/2004

December2004

Launched by Motorola

freescale™
semiconductor