

## Introduction

Service providers and equipment manufacturers have successfully driven wide adoption and deployment of broadband networks and access to the Internet. These providers are now moving beyond providing only “access” to networks and are now focused on providing a wide range of **Cloud Services** to their customer base to leverage the infrastructure they have created.

Cloud services refer to access to software applications, computing capabilities, and services made available over the Internet via offsite computing infrastructure and software applications managed by service providers. Ubiquitous access to broadband and Internet are driving adoption and deployment of cloud services. These services are available “on demand” and enable users to customize and optimize their cost structure in using them. Cloud services are designed to provide easy, scalable access to applications, resources and services, which are fully managed by a cloud services provider and are expected to open the era of on-demand micro-services.

Examples of Cloud services include communication, collaboration, data storage, e-mail, and business productivity tools. They are increasingly being adopted by a wide range of customers, including of enterprise, commercial, industrial, automotive, campuses, hospitals, residential, and governmental agencies.



**Figure 1. A wide range of Cloud-enabled devices benefit from Cloud Services**

Cloud services are enabling customers to have access to services that were often too complex and expensive for customers to manage by themselves. For example, in terms of communication and collaboration, cloud services enable access from multiple devices and multiple locations, often leading to the term “Unified Communications.”

## Cloud-Enabled Endpoints

What is driving the cloud services revolution? Increasingly, equipment manufacturers and service providers are working on developing, deploying, and servicing **Cloud-Enabled Endpoints**. Initially, personal computers were the focus of cloud-services since these computers were natively network-enabled and came with web browsers built into their software. Moving beyond that narrow focus, the market today is deploying a much wider range of cloud-enabled endpoints:

- Communication system: IP Phones are serviced by cloud-based PBX, voice mail, and messaging systems.
- Security systems: access control devices, security cameras, intrusion detection devices are managed by cloud-based Monitoring and Alarm systems.
- Health-care systems: patient monitoring devices are managed by cloud-based Monitoring and Medical Care Dispatch systems.
- Medical devices: collaboration on use of medical devices and diagnosis with offsite experts using cloud-based systems.

An example of cloud-enabled endpoints leveraging Cloud Services is shown in Figure 2; in this scenario cloud-enabled endpoints are located on customer premises whereas the infrastructure and servers providing services is located and managed by the Cloud Service Providers. Other than natively mobile devices, such as smartphones, customers prefer wired solutions for devices because of robust security, resilience, powering options using Power-over-Ethernet (PoE).

In recent years, substantial interest in the Internet-of-Things (IoT) is further driving development and deployment of cloud-enabled endpoints.

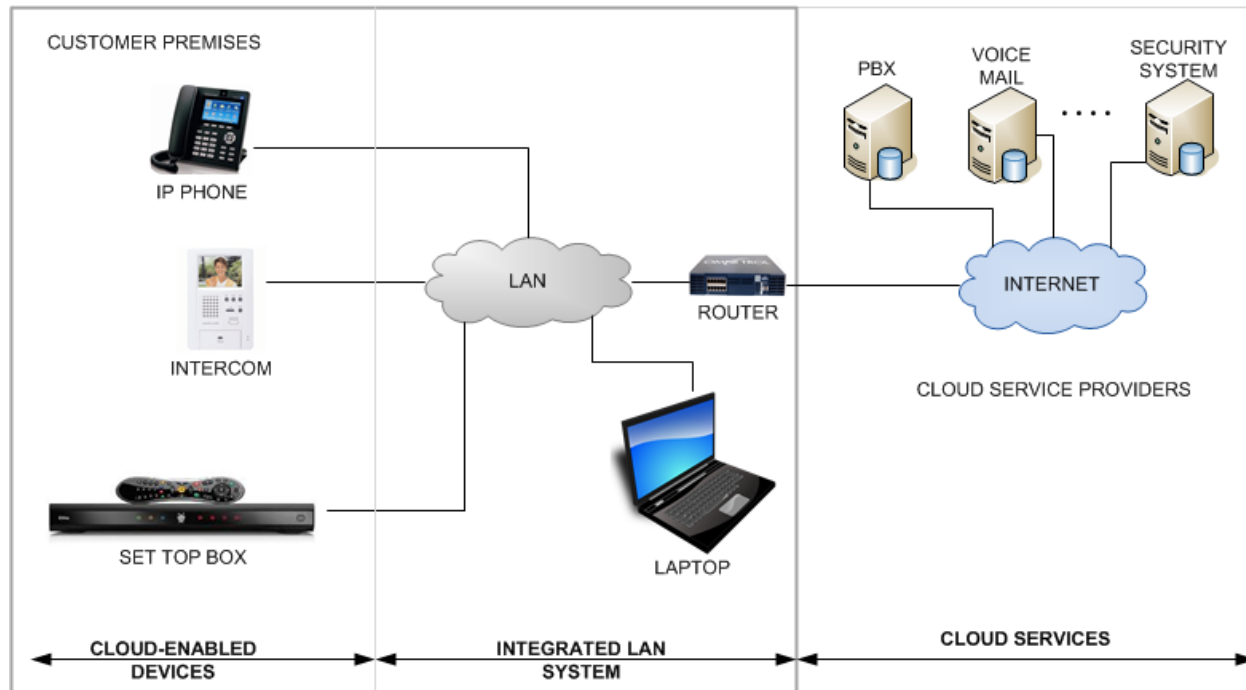


Figure 2. Cloud Services deployed at an Enterprise

## Migration to Cloud-Enabled Endpoints

The case for Cloud Services is compelling; however, often customers want to leverage investment in existing infrastructure to the extent possible. Migration of the installed base, largely analog, is enabled by **IP-Adaptation Devices** that bridge legacy endpoints to cloud-enabled IP networks. Device manufacturers are changing their products to meet customer demand, which is evolving from traditional analog systems to IP-based products to leverage widespread innovation in IP-based cloud services.

Consider a legacy enterprise communication and networking system shown in Figure 3. This basic system consists of analog phones controlled by a local PBX system and voice mail system to serve the analog phones. It also includes a paging system also controlled via the analog phones and the PBX. Networking is provided by a separate LAN connected to the internet. The phone system and the LAN are not connected and operate independently.

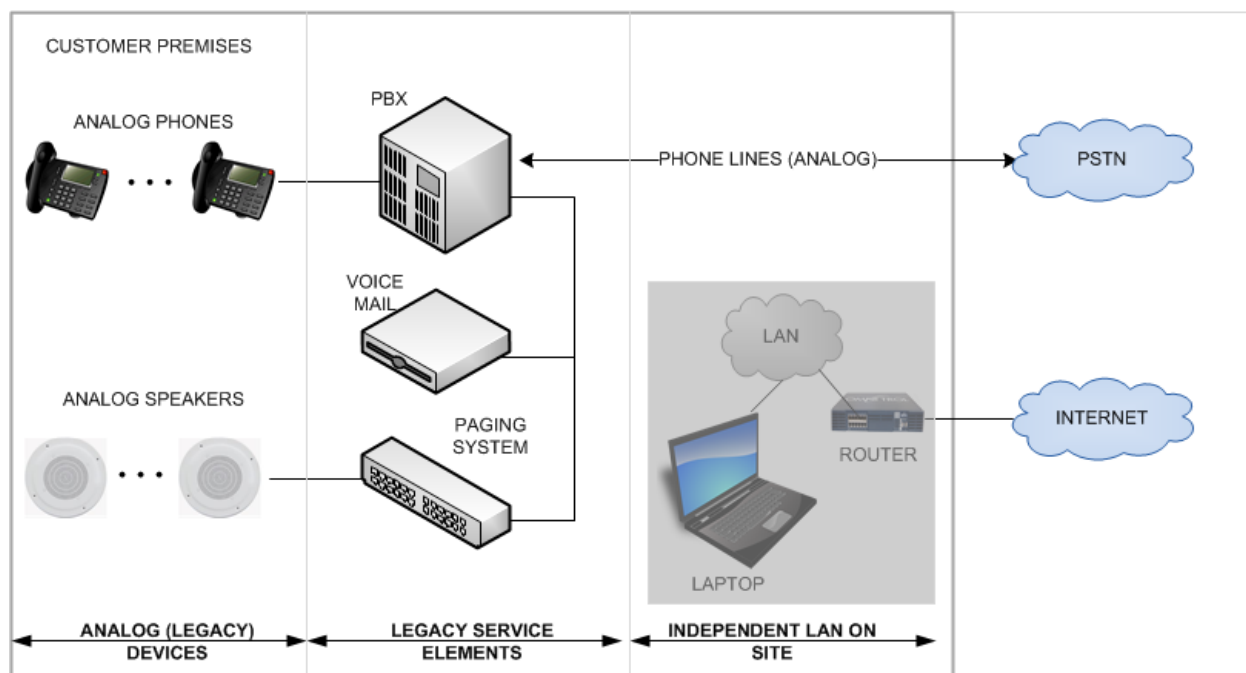


Figure 3. Legacy enterprise communication and networking system

Communication system manufacturers have created several IP-Adaptation Devices that enable migration of legacy communication systems to cloud services. This has led to a “convergence” of legacy communication systems and modern networking systems.

As shown in see Figure 4, Analog Telephone Adapters (ATA), which are IP-Adaptation Devices, enable analog phones to be connected to the LAN and serviced with cloud-based PBX systems. Similarly, IP-based Paging Gateways allow enterprises to leverage investment in existing installations. These “adaptation” devices enable hybrid systems where analog and digital devices co-exist, and advanced cloud-services services can be now offered by the legacy analog solutions.

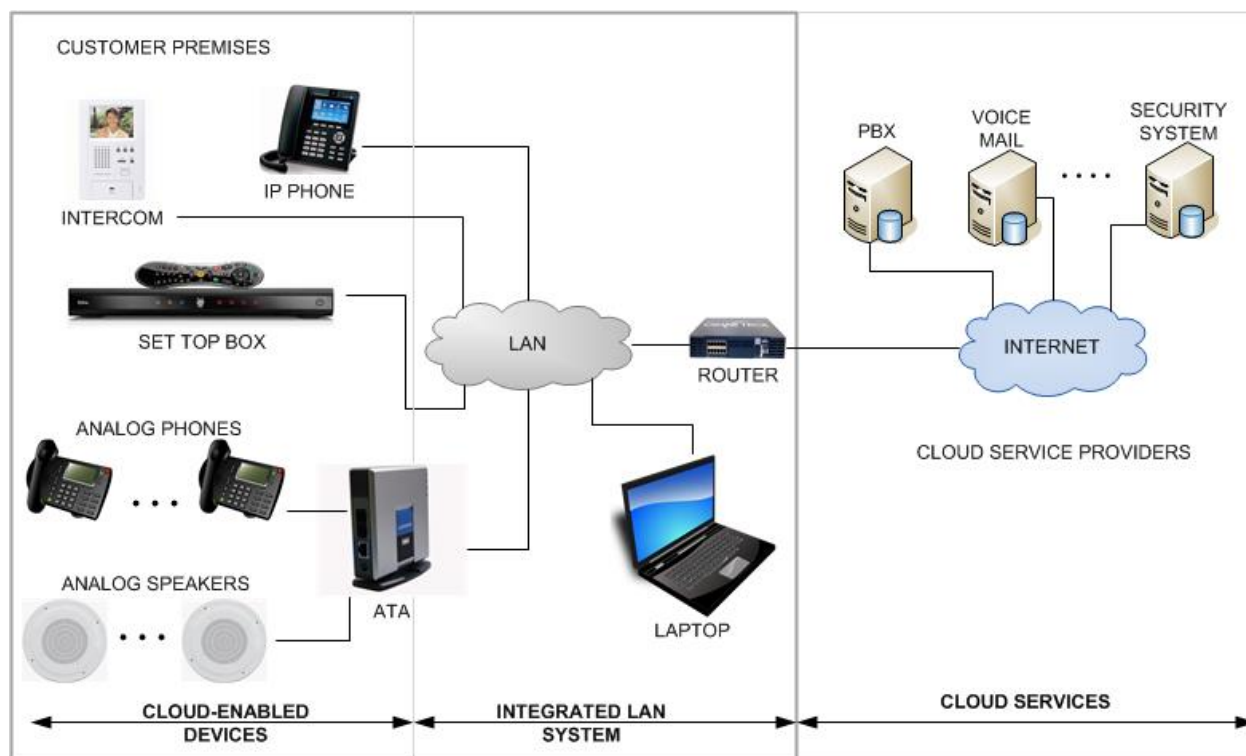


Figure 4. Hybrid Cloud-enabled System

## Benefits of Cloud Services

Cloud services provide several benefits in terms of services, deployment efficiency, and operational efficiency.

- **Reduced Capital Expenditure (CapEx):** Cloud services enable users to pay for services as they are used rather than investing in infrastructure upfront. This can significantly reduce users' CapEx.
- **Reduced Information Technology (IT) complexity:** Most users still consider managing servers onsite and associated IT as complex and fragile. Cloud services push this complexity to the service providers allowing users to focus on their own core business.
- **Ease of adaptability:** With cloud services, add-on services, upgrades and even modifications can be implemented with ease.
- **Integration with a modern mobile workforce:** Cloud services are built to support access from multiple devices, including mobile devices, and in a 24/7 manner. This enhances productivity of mobile users and further leverages Bring Your Own Device (BYOD).
- **Voice-activated devices:** Cloud services are enabling users to leverage next generation voice-activated services; these new features can significantly enhance worker productivity.
- **Reduced cost:** Cloud services are deployed by service providers on a "shared infrastructure" which allows these services to scale efficiently and thus reduce cost. This reduced cost is driving mass adoption of these services.

## Micrel's Solutions for Cloud-Enabled Endpoints

Micrel's KSZ8382 and KSZ8342 families of System-on-Chip (SoC) provide complete solutions for supporting cloud services. These SoCs can be used to create a wide range of Cloud-Enabled Endpoints or to create IP-Adaptation Devices to cloud-enable legacy devices.

Micrel's SoCs have built-in support for interfaces required to create these solutions – hence only a few additional external devices are needed to create a fully functional component. Micrel's SoCs are the ideal choice for cloud-enabled systems, backed by Micrel's high-reliability and solution robustness proven in commercial, industrial, and automotive applications around the globe.

Both the SoC families implement a multiprocessor architecture with embedded RISC CPU and powerful DSP, providing a flexible development platform.

### Embedded Processing Resources

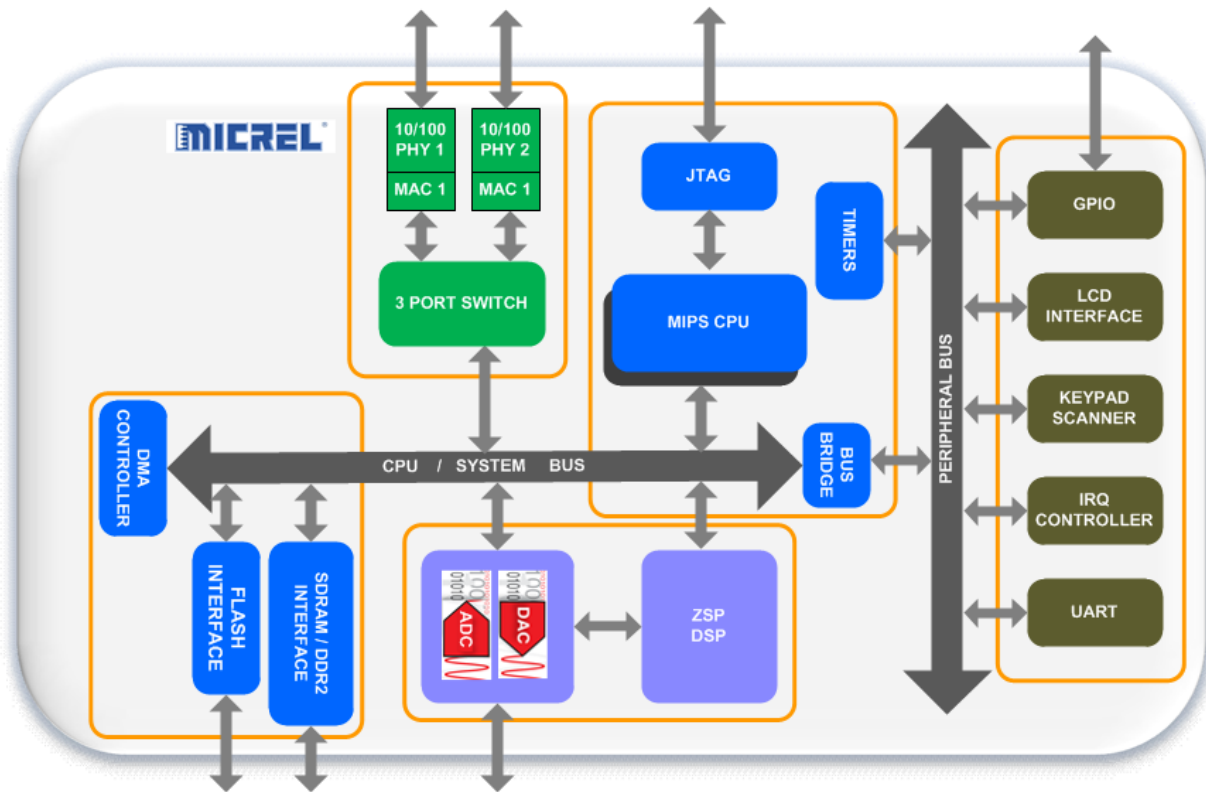
- CPU and memory: The SoC has a MIPS32 RISC processor for configuration and network protocol processing, SDRAM and DDR2 interfaces, and Flash interface
- DSP: ZSP400 DSP offers high-quality digital signal processing, 8kHz/16kHz sampling, and 16-bit ADC/DAC with integrated amplifiers.

### Endpoint Interfaces

- Audio and Video:
  - Audio support for handset, headset, and microphone and speaker
  - Video support for network-enabled cameras
- Network: 3-port 10/100BaseT Ethernet Switch; Integrated low-power PHY transceivers
  - IGMP snooping to handle multicast traffic (RFC 4541)
  - VLAN support (IEEE 802.1Q)
  - Energy Efficient Ethernet (IEEE 802.3az)
- GPIO: can be used for a variety of functions including LEDs and indicators
- Keypad Scanner: can be used to support push buttons and even a full telephony keypad
- LCD Interface: supports SPI (8-bit parallel interface)

## KSZ8382 SoC Family

The KSZ8382 SoC is the ideal choice for developing Cloud-Enabled Endpoints (see Figure 5 for a block diagram). The chip's extensive integration increases performance and reduces BOM cost, featuring a high-performance audio subsystem, LCD interface, keypad scanner, memory controllers for both SDRAM and DDR2, and flexible GPIO. The LCD Interface supports SPI (8-bit parallel interface). The keypad scanner can be used to support push buttons and even a full telephony keypad. GPIO can be used for a variety of functions including monitoring elements, door controls, indicators, etc.



**Figure 5. Block diagram of Micrel's KSZ8382 SoC**

## Firmware: CPU and DSP

The firmware has a modular architecture to provide developers with a variety of choices in developing their Endpoint Applications (see Figure 6).

- 1) **SIP Call Control:** For a turnkey solution, developers can leverage the built-in SIP call manager from the Endpoint Application. The layers below handle media transport and DSP functionality.
- 2) **SIP-less Application:** For developers who have their own SIP software (or want to implement other call control protocols) can use the RTP/RTCP access for media transport. As described above, the layers below handle network and DSP functionality.
- 3) **Custom Media Transport Application:** For developers who want their own call control and media transport (standards-based or even proprietary) can access the DSP resources directly.

The above three options are shown in Figure 6 (access points from the application to the firmware).

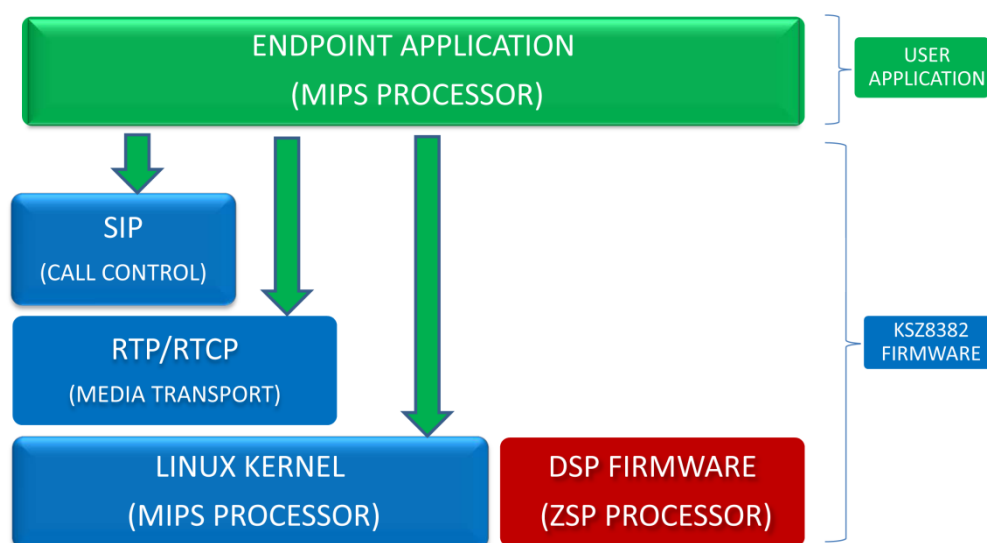


Figure 6: KSZ8382 Firmware Block Diagram

### Endpoint Application Software

Using the features in Micrel's KSZ8382 SoC and the associated firmware, developers can create a variety of cloud-enabled endpoint applications. These applications could support many communication modes including:

- **Push-To-Talk (PTT):** The network stack can be used with industry-standard protocols to create access for fast, easy voice connections.
- **Broadcast:** To call all stations for announcements and alerts.
- **Multicast:** For efficient use of network bandwidth, multicast can support group calling.
- **Private Calls:** provides the flexibility for an endpoint to be in a private call with another.
- **3-way Conference call:** The embedded DSP provides firmware supports 3-way conference calling. The API can be used to mix audio from two network-side channels and the local audio port to create a conference bridge.

Developers can use these communication modes in any combination to create customized solutions to suit their application.

### KSZ8342 SoC Family

Micrel's KSZ8342Q System-on-Chip (SoC) provides a complete solution for developing IP-Adaption Devices. The chip bridges Digital and Analog systems enabling IP-based communication. It addresses a wide range of applications including Analog Telephone Adapters (ATA) and gateways. The highly-integrated SoC has built-in support for interfaces which reduces the need for external components. As shown in Figure 7, the KSZ8342 includes a PCM Controller which can be coupled with a SLIC interface to create FXS and FXO ports as needed.

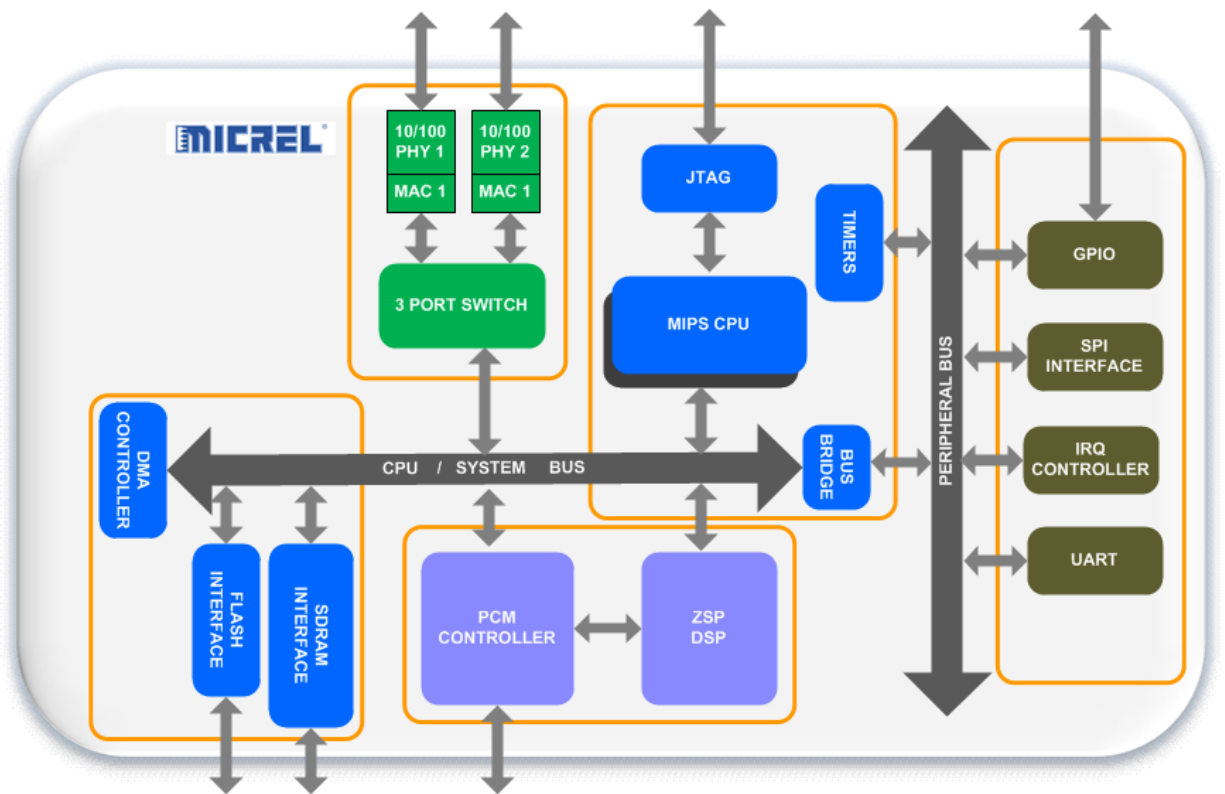


Figure 7: Micrel's KSZ8342 SoC block diagram

Conclusion

Innovation in IP-based communication systems is driving the rapid pace of migration to cloud services across a wide range of applications. Micrel's KSZ8382 and KSZ8342 families of SoCs provide complete solutions for Cloud-Enabled Endpoints and IP-Adaptation Devices that can be used to add cloud services to current Analog platforms or to build new application. These SoCs have a high level of integration through the integration of a 3-Port switch, PHY, amplifiers, audio interface, and PCM interface. Because of their built-in support for interfaces required for embedded and endpoint components, only a few additional external devices are needed to create a full-featured component. The firmware for these SoCs has a modular architecture to enable developers many choices in developing application software for these IP-based security components. Together, these SoCs and associated firmware can be used to create a wide range of cloud-enabled solutions.

Revision History

Date	Change Description/Edits by:	Rev.
2/12/2014	First Release	1.0



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