Dialogic

Implementing the SCSA Hardware Model Using SCbus and H.100 CT Bus Components

A Dialogic White Paper

This paper will help you gain a better understanding of the evolution of telephony buses, how the SCbus and the new H.100 CT Bus fit into the SCSA Hardware Model™, and how easy it is to incorporate this new standard in your solution set.

There are two competing buses for computer telephony that are widely deployed in the industry today: SCbus™ and MVIP-90™. The difficulties in either choosing one bus over the other or supporting both buses within the same market window created industry demand for a single, universal bus standard that eliminates compatibility issues and offers the capacity to support complex multi-resource systems in the future.

To meet this need, the Enterprise Computer Telephony Forum (ECTF) initiated a working group to create a new hardware specification that would end the "bus wars." The result of this group's work is the ECTF H.100 hardware compatibility specification, which defines the new CT Bus™ and its implementation on the PCI computing platform. The H.100 CT Bus supports up to 4096 time slots at 8 MHz, includes redundancy, and provides for interoperability with existing MVIP-90, H-MVIP™, and SCbus products.

Dialogic fully supports this new bus standard and its inclusion in the set of SCSA™ reference specifications. Similar to the SCbus, the CT Bus is another means to implement the SCSA Hardware Model. To minimize the impact of migration on application development, Dialogic is developing PCI products that will fully support ECTF H.100 and can be easily combined with existing SCbus products. This flexibility is essential because while the PCI computing platform is replacing ISA at a rapid pace for new development, ISA and mixed ISA/PCI systems will continue to exist for quite some time. In addition to giving system developers the maximum flexibility possible in building telephony systems for the ISA and PCI platforms, Dialogic will continue to offer SCbus products for the VME platform, where it is the only industry-approved telephony bus (ANSI/VITA 6-1994) for very high density systems.

CT Innovation

Dialogic Leads the Way

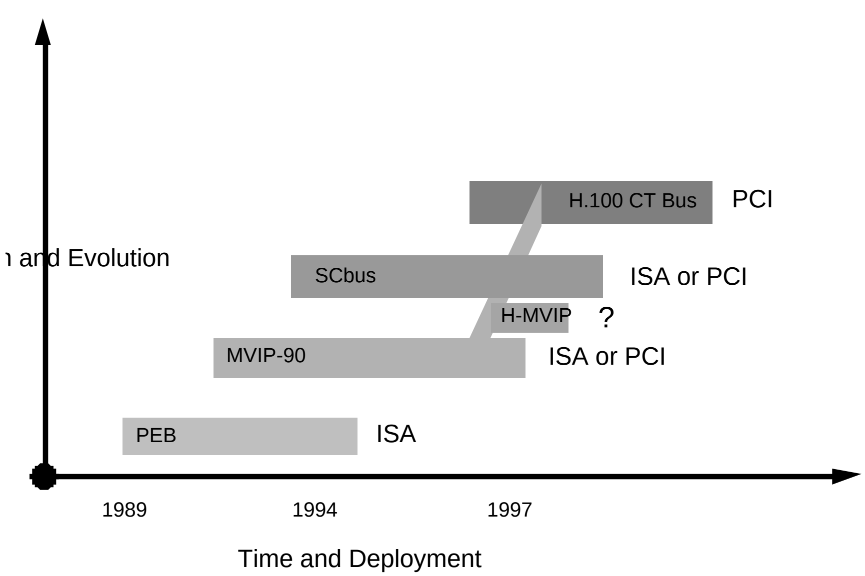
- 1983 - Nick Zwick, one of the founders of Dialogic, begins designing the first, open multiline voice board
- 1984 - Hank Magnuski (GammaLink Division) develops the first computer-based fax board
- 1985 - Carl Strathmeyer (CT Division) develops the first CTI computer-PBX link
- 1986 - Dialogic introduces the first telephony bus (AEB) for resource sharing
- 1989 - Dialogic introduces the first 12 channel DSP-based voice processing board, the first T-1 interface board for voice processing, and the first digital TDM bus for resource sharing (PEB)
- 1993 - Dialogic leads 70 companies in defining the first architecture for building CT systems based on open standards (SCSA) and introduces the third-generation TDM telephony bus
- 1994 - SCSA working groups develop the first software interoperability specification (SCSA TAO)
- 1995 - Dialogic and other SCSA working group members form the ECTF to better focus on vendor interoperablity issues, such as those addressed by the SCSA TAO
- 1995 - VITA and ANSI approve the SCbus for the VME platform (ANSI/VITA 6-1994)
- 1996 - ECTF approves the S.100 API standard for software interoperability
- 1997 - ECTF approves the H.100 CT Bus hardware standard and begins work on H.110

CT Bus Evolution

The seeds of the computer telephony (CT) industry started to germinate in the early 1980's, when the computer industry, as a whole, began to focus on standards for open computing. In keeping with the emphasis on open systems, Dialogic Corporation introduced the first, open multiline voice board in 1985, and by 1986, gave the industry the means to connect multiple analog voice resources together through a special telephony bus designed for carrying the audio and signaling information. Called the Analog Expansion Bus™ (AEB™), this bus was similar to a bundle of two-wire analog connections. This revolutionary concept of a separate telephony bus eliminated the need for host processing of time-critical data and made the rapid growth of the CT industry possible.

As the industry continued to grow, it became necessary to create a more powerful digital telephony bus to handle the size and complexity of newer systems (see Figure 1). In 1989, Dialogic developed the PCM Expansion Bus™ (PEB™), the first digital bus standard for connecting devices from multiple suppliers, featuring pulse code modulation (PCM) and digital time division multiplexing (TDM) for connectivity similar to that offered by a digital T-1 or E-1 trunk line. The following year, a group of seven board vendors, led by Natural Microsystems (NMS) and Mitel, defined another TDM bus standard, called the Multivendor Integration Protocol, or MVIP-90™.

Figure 1: ISA/PCI Telephony Bus Evolution



Despite its name, MVIP-90 was adopted by only a portion of the industry, touching off the start of the CT "bus wars." While both PEB and MVIP-90 used a similar mezzanine bus at the top of the boards for communication, the two standards were completely incompatible. Developers wanting to take advantage of the new 512 time slot, 2 MHz MVIP-90 bus would need to abandon earlier technological investments. In addition, it was evident that newly emerging technologies would need even more bandwidth and higher performance than was available with the MVIP-90 standard.

In 1993, Dialogic led 70 companies in the SCSA initiative, creating the first open standards-based architecture for computer telephony servers, and simplifying the integration of multiple hardware and software components from multiple vendors within a single system.

To improve the situation, 70 companies joined forces with Dialogic in early 1993 to put together an open standards-based model for building computer telephony servers that would not only define a more robust telephony bus, but would also address software compatibility issues. Under the umbrella of the Signal Computing System Architecture™ (SCSA™), these standards gave developers a complete framework for building CT servers that integrate and manage hardware and software components from multiple vendors.

To meet the requirements of the SCSA Hardware Model, an SCSA working group defined the SCbus™, a third-generation TDM bus. In addition to offering developers up to 2048 time slots using an 8 MHz clock, the SCbus pioneered a distributed switching model that simplified the way applications access devices and made it easier to scale systems from small to very high densities. By July of 1995, the American National Standards Institute (ANSI) formally recognized the power and versatility of the SCbus for high density applications by adopting it as the only telephony bus standard for the VME platform (ANSI/VITA 6-1994).

"…Digital Equipment Corporation, Dialogic, Ericsson, Hewlett-Packard, and Nortel established the Enterprise Computer Telephony Forum (ECTF) to foster an open, competitive market for CT integration through multivendor implementations of industry standards."

Another key area of focus for the SCSA working groups was on software interoperability. A group of 30 SCSA supporters formed working groups that were backed by over 100 companies, who acted in an advisory role, to develop the SCSA TAO Framework™ specification. This specification defined the components necessary for multi-vendor resource management, call control, and application portability. This work highlighted the need for a new industry forum that could better focus on these and other interoperability issues.

In April of 1995, an ad hoc SCSA steering committee consisting of Digital Equipment Corporation, Dialogic, Ericsson, Hewlett-Packard, and Nortel established the Enterprise Computer Telephony Forum (ECTF) to foster an open, competitive market for CT integration through multivendor implementations of industry standards. The forum rapidly drew new membership as it began to tackle the SCSA TAO Framework 3.5 specification, part of which formed the basis for the recently adopted (1996) ECTF S.100 standard. Today, the ECTF has expanded its industry expertise to a principal membership of 39 companies, with another 48 companies serving as auditing members.

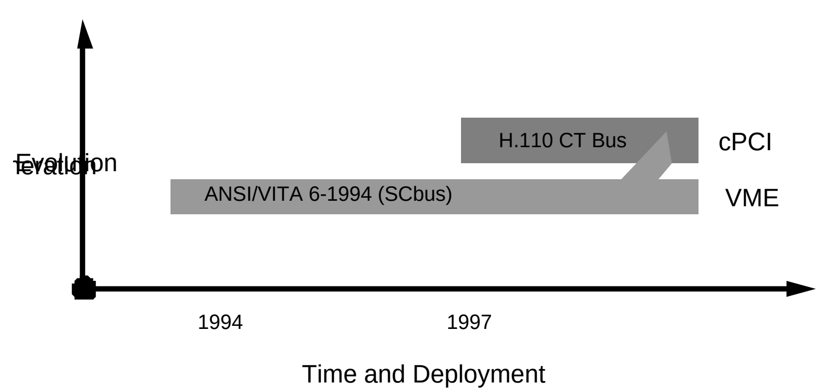
Towards the end of 1995, GO-MVIP (an organization formed by MVIP vendors to promote their products) announced another telephony bus, H-MVIP™. While this new bus was publicized as a powerful superset of the MVIP-90 standard, the new H-MVIP was never commercially implemented. The industry was demanding a new telephony bus that not only offered higher capacity and more bandwidth, but also offered a viable solution to the very real compatibility issues stemming from the increasing deployment of multiple buses in the market place.

As a founding member of the ECTF and an active participant in the H.100 working group, Dialogic helped shape the new H.100 CT Bus with innovative features like distributed switching and selectable 2/4/8 MHz operation that were first pioneered in the SCbus.

Rising to the challenge, the ECTF formed a working group to find a solution that could put an end to the industry "bus wars." Industry experts from Dialogic, IBM, Lucent Technologies, Mitel, Natural MicroSystems, Northern Telecom, and others joined together to devise and agree on a neutral bus specification that would be universally accepted and minimize migration concerns. The result of this ECTF working group's efforts is the new ECTF H.100 specification, which features:

- Increased capacity: 4096 time slots running at 8 MHz (vs. 2048 for SCbus and 512 for MVIP-90).
- Redundancy: dual clock and frame synchronization lines so that if one clock line is lost, all devices can be synchronized with the other clock signal.
- Interoperability: 16 of the 32 data lines can be selectively downgraded to 2 MHz for MVIP-90 or 4 MHz for certain SCbus modes. H.100 also supports telephony bus-specific features, such as an optional message channel.
- PCI implementation.

Figure 2: cPCI and VME Telephony Bus Evolution



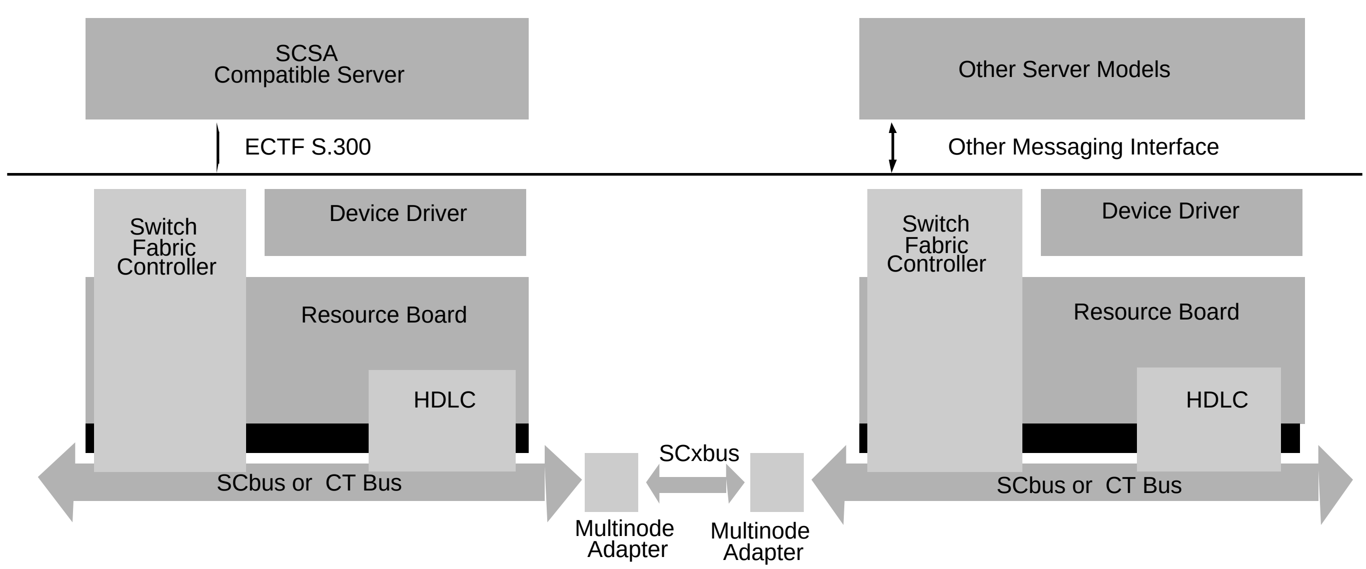
Because the computing industry is moving away from the ISA platform in favor of PCI, it is unlikely that the H.100 CT Bus™ will ever be adapted for ISA. Instead, vendors are expected to take advantage of the interoperability modes defined by the specification and implement hardware solutions with a split

ISA/PCI backplane when necessary. To address the needs of vendors moving towards the CompactPCI™ (cPCI) platform, the ECTF is currently working on an adaptation of the CT Bus for cPCI, which will be detailed in the upcoming H.110 specification. This specification will include provisions for compatibility with the SCbus (ANSI/VITA 6-1994), which is the only telephony bus defined for the VME platform (see Figure 2).

H.100 and the SCSA Hardware Model

The purpose of SCSA is to provide developers with a comprehensive reference architecture for building distributed computer telephony (CT) servers, based on industry standards. It focuses on *signal computing,* the manipulation of media (voice, fax, speech, etc.) and call processing signals, as well as *system architecture*, the modular framework that unifies industry standards in a way that provides flexibility in the size, technology, and performance of CT systems. The main divisions within SCSA are the *Software Model*, identifying the interfaces and services necessary for accessing and manipulating the media portion of the call, and the *Hardware Model*, making it possible to connect local or distributed resource hardware and share media and signaling information through a common telephony bus.

Figure 3: SCSA Hardware Model



SCSA

The Industry's First Comprehensive Architecture for CT Systems Design

SCSA was the industry's first comprehensive architecture (both hardware and software) for designing and building computer telephony servers. Its modular framework makes it possible to incorporate relevant standards as they evolve, such as the recently approved ECTF S.100 and H.100 interoperability specifications. And its support is the broadest in the industry today:

- Over 300 leaders in telecommunications and computing industries support SCSA
- There are over 100 board level products available from more than 30 suppliers
- Numerous toolkit and software applications are available, including Dialogic CT Media, which offers media resource management through the open ECTF S.100 interface. CT Media is the first product of its kind and is supported by 16 early adopter companies
- Supports a variety of open software interfaces (including ECTF S.100 and Microsoft TAPI) that give application developers greater flexibility in combining components from multiple vendors
- Supports a variety of hardware platforms with industry standards (SCbus for ISA, ECTF H.100 for PCI, and ANSI/VITA 6-1994 SCbus for VME), making it possible to incorporate telephony features in almost any communications solution

As shown in Figure 3, the SCSA Hardware Model identifies a high-bandwidth telephony bus and switching fabric (SCbus or CT Bus), and multinode connectivity (SCxbus™). The key element in this model is the high-bandwidth, time division multiplexed (TDM) telephony bus that provides distributed, symmetrical switching. It also features time slot bundling for high-bandwidth multimedia services, full frame buffering to guarantee data integrity, an optional message channel that allows signaling information to be carried on a dedicated bus without using time slots on the data bus, and automatic clock fallback and master switchover for fault resilient applications. This powerful and robust bus can be implemented as the SCbus for ISA and VME (ANSI/VITA 6-1994) computing platforms and the CT Bus (ECTF H.100) for the PCI platform. The CT Bus is very similar to the SCbus, using concepts pioneered during the development of the SCbus, such as the distributed switching model. The key differences between the two buses are shown in Table 1.

Table 1: CT Bus and SCbus Comparison

	H.100 CT Bus	SCbus
Ribbon Cable	68 pin, 50 mil pitch	26 pin, 100 mil pitch (ISA)
Data Lines	32	16
Clock Rate	2, 4, 8 MHz	2, 4, 8 MHz selectable
Time Slots	4096 max	512, 1024, 2048
Computing Bus	PCI	ISA, VME
Switching Model	Distributed	Distributed
Message Channel	Optional	Optional

Both the SCbus and CT Bus implementation of the SCSA Hardware Model provide the means for SCSA hardware devices (boards) to be connected electrically and switched as needed. The boards are treated as peers, capable of accessing any time slot on the bus through symmetrical switching. Switching is distributed and non-blocked, giving each resource the power to access the bus and communicate in a full duplex fashion, independent of the resource location on the bus. Each resource can also transmit or receive on any time slot, rather than having to work in fixed pairs of transmit and receive time slots, as is the case with MVIP-90. The efficiency of time slot usage is optimized, allowing data to be broadcast on a single time slot and all other resources to monitor (receive) the broadcast data without using any additional time slots. Development is also simplified because every SCSA-compatible board executes switching operations in exactly the same way, and peer resources can pass information to any other resource on the bus.

H.100 Compliance and Interoperability

The ECTF H.100 specification defines a single telephony bus that includes a superset of both SCbus and H-MVIP (including MVIP-90) features in addition to higher capacity, PCI implementation, and redundancy. It also identifies scalable levels of connectivity and de facto interoperability for those who have already made a significant investment in SCbus and MVIP-90 products (see Table 2). To be a fully H.100 compliant master, a product must support CT Bus signals, access all 4096 time slots on the bus at 8 MHz, and support all three compatibility modes (SCbus, MVIP-90, and H-MVIP) defined in the specification.

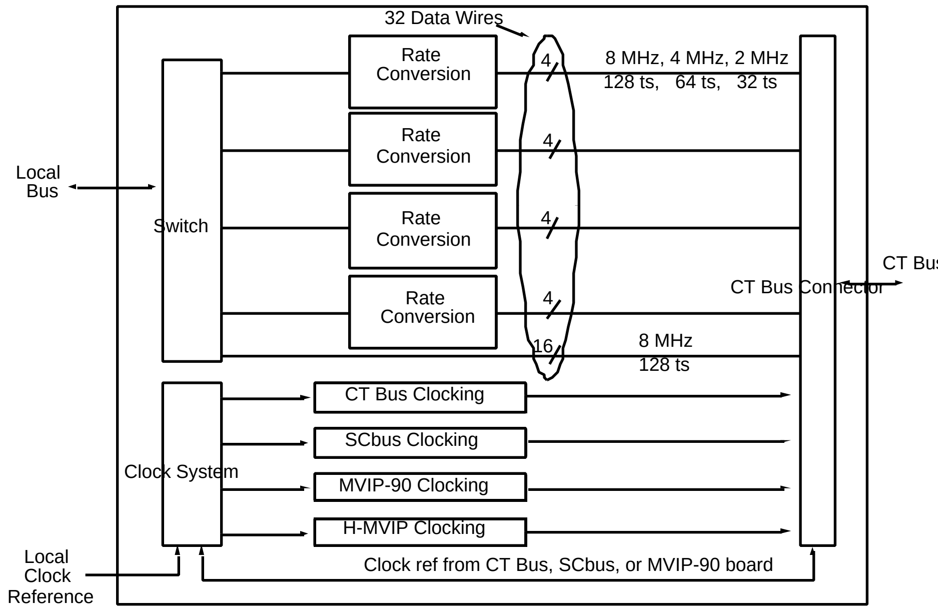
Table 2: Product Connectivity Options

Product Type	Connectivity Features
H.100 Compliant Master	Complies with all of the mandatory requirements of the ECTF H.100 specification. Implements all CT Bus Core and Compatibility signals, including dual clock and frame synchronization lines for redundancy. A bus master device must provide at least 128 time slots of bus-to-bus switching at any of the three data rates (2, 4, and 8 MHz). Up to 16 data lines can be run in one of the compatibility modes (using increments of 4 data lines at a time). Supports up to 4096 time slots when connected to another H.100 compliant device. May or may not provide an optional message channel.
H.100/SCbus	An SCbus product with an H.100 connector. Operates off of the H.100 Compatibility signals. Can provide a Clock Reference signal to the H.100 bus master. Supports data rates of 2, 4, and 8 MHz, and 512, 1024, or 2048 time slots. May or may not provide an optional message channel.
H.100/MVIP-90	An MVIP-90 product with an H.100 connector. Operates off of the H.100 Compatibility signals. Can provide a Clock Reference signal to the H.100 bus master. Supports a data rate of 2 MHz and 512 time slots.

The technical differences between a fully compliant H.100 master device and all other connectivity devices is significant. The H.100 master must provide master bus inter-rate switching support for interoperability among CT Bus, SCbus, and MVIP-90 devices in the system (see Figure 4). H.100 mandates that fully compliant devices supply a minimum of 128 time slots of cross-rate switching to allow compatible devices that operate at 2 MHz, 4 MHz, or 8 MHz to communicate over the bus. Note that this interoperability feature introduces centralized switching, which significantly complicates routing software. Compliant master devices must also be able to drive the core CT Bus signals and all compatibility mode clock signals (2 MHz, 4 MHz, or 8 MHz).

"The technical difference between a fully compliant H.100 master device and all other connectivity devices is significant."

Figure 4: Sample Block Diagram for An H.100 Compliant Master Device



There are four classes of signals on the H.100 CT Bus: *Core* signals, *Compatibility* signals, *Optional* signals, and *Reserved* signals. Core, Compatibility, and Reserved signals are required for all H.100 compliant devices. These signals are described in Table 3.

It is easy to combine ISA boards that have an SCbus connector to PCI boards that have an H.100 CT Bus connector. All that is needed is a simple cable adapter.

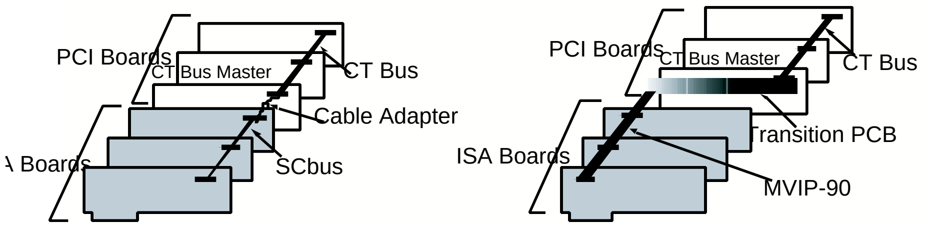
There are also differences in the type and physical location of the connectors used for the H.100 CT Bus, SCbus, and MVIP-90. The H.100 specification defines a fine pitch (50 mil), 68-conductor ribbon cable for the PCI CT Bus, while the ISA SCbus uses a 26-pin (100 mil) design, and ISA MVIP-90 uses a 40-pin (100 mil) design. While there are over twice as many conductors for the CT Bus as SCbus, the cable is only slightly wider because it uses a finer pitch conductor spacing. The CT Bus connector location is at the far end of the board edge, in roughly the same location as the SCbus, which is at the opposite end of the board from the MVIP-90 location.

Because of the connector locations (see Figure 5), the adapter needed for mixed SCbus (ISA) and H.100 (PCI) systems is small enough (less than one inch) to maintain the integrity of the bus signals. The type of adapter needed for mixed MVIP-90 (ISA) and H.100 (PCI) systems has a longer span (more than five inches), which may introduce signal distortion and can limit the maximum system capacity, depending on the number of boards being used.

Table 3: CT Bus Signaling Functions

Class	Signal	Function
Core	/CT_FRAME_A	Frame synchronization, driven by the "A" clock master.
	CT_C8_A	Bit clock, driven by the "A" clock master
	/CT_FRAME_B	Redundant frame synchronization, driven by the "B" clock master.
	CT_C8_B	Redundant Bit Clock - driven by "B" clock master.
	CT_D[0:31]	Serial data lines that are collectively carry 32 signals and are referred to as the CT_D bus. Each signal contains 128 time-slots per frame at a clock frequency of 8 MHz.
	CT_NETREF	Secondary network timing reference, providing backup network synchronization to the CT Bus.
Compatibility	/FR_COMP	Compatibility frame pulse, driven by current clock master, that serves as the frame synchronization signal for the SCbus (Fsync*) and MVIP (/F0) signals.
	SCLK	SCbus system clock, driven by current clock master. The clock is selectable (2, 4, or 8 MHz) and is used to identify the data bit positions on the SCbus.
	SCLKx2*	SCbus system clock times two, driven by current clock master.
	C2	MVIP-90 bit clock, driven by current clock master. The clock frequency is 2 MHz, nominally symmetrical.
	/C4	MVIP-90 bit clock times two, driven current by clock master. The clock frequency is exactly twice C2, and transitions of C2 are synchronous with the falling edge of /C4.
	/C16+, /C16-	H-MVIP 16 MHz Clock, driven by current clock master. This differential signal is used to read and write bits on the serial data lines by H-MVIP boards.
Optional	CT_MC	Message Channel for inter-device communication. This signal is terminated on each CT Bus interface in the system which has message bus capability.
	CT_+5Vdc	Provides power to active transition devices (cable adapters).
Reserved		Signals reserved for future use.

Figure 5: Connector Locations



Performance and Other Design Considerations

The H.100 telephony bus defines the CT Bus for the PCI platform. If you are creating solutions that will use PCI, or mixed ISA and PCI platforms, then you need to understand the connectivity options for incorporating the new H.100 CT Bus standard and their impact on overall system performance. In addition, you need to evaluate other factors (such as product availability, operating system support, and resource management) that can influence your overall system design.

How Does a Mixed Bus Affect System Performance?

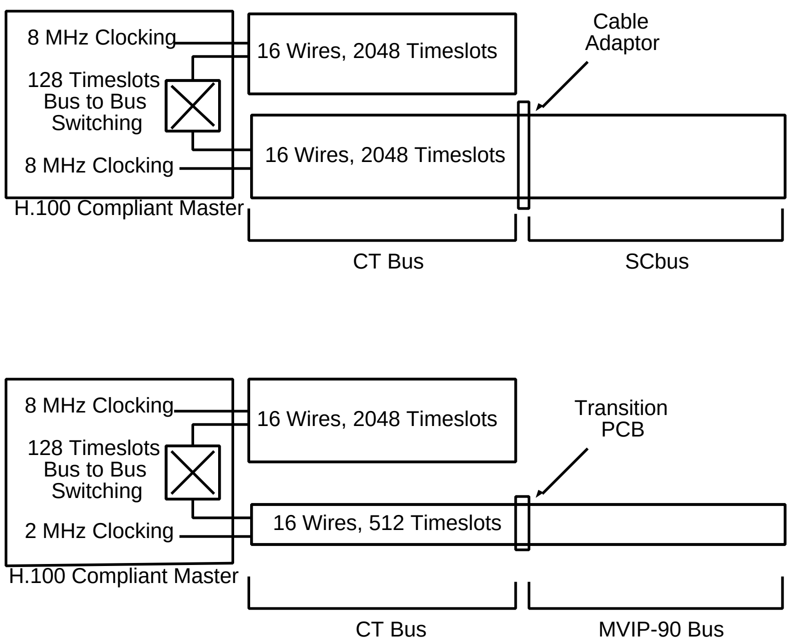
In a mixed system, the CT Bus master must handle multiple types of clock signals, selectively downgrade portions of the bus to slower speeds, and incorporate centralized switching… all of which can degrade system performance by that of the weakest bus in the system.

At its simplest level, the H.100 CT Bus functions very much like two 8 MHz SCbuses running in parallel. The CT Bus features 32 data lines and 4096 time slots operating at 8 MHz, while the SCbus features 16 data lines and 2048 time slots. Both buses can run at the same rate and maintain a distributed switching model. However, to provide compatibility modes for MVIP-90 and H-MVIP, the CT Bus must be able to handle multiple types of clock signals, selectively downgrade portions of the bus to run at slower speeds, and incorporate a centralized switching mechanism to allow data exchange with all supported buses. Therefore, in a mixed system, the overall performance will be partially degraded by the performance characteristics of the weakest bus in the system.

For example an H.100/SCbus device running at 8 MHz that is connected to an H.100 master allows the CT Bus to run all 32 data lines at 8 MHz (see Figure 6), making it possible to use up to 4096 time slots in the system. However, since there is a limitation in physical size of the PC chassis that are available today, it is unlikely that more than 2048 time slots (16 data lines) will be needed for mixed systems. Therefore, developers who take advantage of the H.100/SCbus and H.100 master combination can simplify application development by maintaining a single, distributed switching model that optimizes system performance by avoiding the need to send information through and manage two separate layers of switching.

By contrast, an H.100/MVIP-90 device that is connected to an H.100 compliant device forces the CT bus device to run anywhere from 4 to 16 of the 32 data lines at 2 MHz to share information with the H.100/MVIP-90 device, and to use the centralized bus-to-bus switching. The need to go through this second stage of switching can impede system performance and create a “media stream” bottle neck. In addition, the total number of time slots available in the system may be reduced by as many as 1536 time slots, because up to half of the CT Bus will be running at 2 MHz.

Figure 6: Mixed Bus Performance



What CT Bus Products Are Available Today?

Because the ECTF H.100 specification requires that all compliant devices support the new set of Core signals, and that bus masters provide compatibility signals for SCbus, MVIP-90, and H-MVIP, new chips need to be developed. ASIC development for chips that can support these H.100 CT Bus features is currently underway, and the ECTF has projected that the first wave of products can be expected by the end of 1997. In the mean time, component vendors must provide products to support their existing customer base, using SCbus or MVIP-90. For these products, the SCbus has a significant advantage over MVIP-90. The 8 MHz, 2048 time slot ribbon cable operation of the SCbus allows developers to create systems of much higher capacity per node than MVIP-90. In addition, the 8 MHz operation of the SCbus enables mixed systems that combine H.100/SCbus products with H.100 compliant products to make use of up to the full 4096 time slots available in pure CT Bus systems.

How Does the New Signaling Scheme Affect Connectivity?

Fully compliant H.100 master devices include a superset of the signals defined for SCbus, MVIP-90, and H-MVIP, as well as additional signals to support the additional lines, to power transition devices, and to switch among the various telephony buses in the system. While these signals require more pins, the CT Bus uses fine pitch conductor spacing, making the cable only slightly wider than the SCbus ribbon cable. In addition, the location of the H.100 CT Bus connector is at the far end of the card edge, in almost the same position as the SCbus connector, making it possible to use a very small transition device. This is important in reducing the signal distortion that can put the integrity of data into question when longer cables are used, such as the one required to connect an MVIP-90 ISA board to a CT Bus PCI board.

Are Software Changes Needed?

Changing your hardware from SCbus to CT Bus does not require code changes for applications based on the Dialogic application programming interfaces (APIs). While products designed for the PCI computing platform will have some firmware and driver enhancements to accommodate the new bus, these differences will not affect existing applications. Dialogic will develop API extensions that enable developers to take advantage of the new features, such as redundancy and clock fallback. The SCbus products for PCI (with H.100 connectors) will have firmware capability to selectively run the SCbus at 2 MHz, 4 MHz, or 8 MHz that can be selected through configuration file parameters. In addition, new drivers and switching software changes may be needed for developers who want to combine MVIP-90 products with SCbus products.

Will H.100 Make It Easier to Develop Systems that Combine Resources from Different Vendors?

While the H.100 CT Bus does make it possible to connect telephony resource devices from multiple vendors together, and to switch among those devices, the scope of the specification is for hardware interoperability only. It does not address software interoperability issues for sharing those devices at the application level. However, the ECTF is addressing software interoperability through other agreements, such as the recently approved ECTF S.100 specification. The S.100 standard defines a standard, open API that allows developers to share a common set of telephony resources. This software standard enables developers to create portable, interoperable applications that can be installed on any S.100 compliant telephony server and access the telephony resources managed by that server.

Products that incorporate this open standard, such as Dialogic CT Media™, offer software developers a standard interface for accessing telephony resources, making it possible to create computer telephony software without having to first become a technology expert or deal with a vast number of proprietary APIs. By providing this open interface, CT Media can support both SCbus and H.100 CT Bus products that incorporate third-party resources without requiring changes to existing applications. This level of support makes it easy to incorporate new technology from multiple vendors as it becomes available. Without it, application developers will be forced to integrate any number of proprietary APIs to support the telephony resources from multiple vendors.

What Other Features Can Ease the Migration to CT Bus?

All Dialogic products that implement DM3™ technology will fully implement the features of H.100 bus masters. For existing PCI resources, Dialogic will initially create H.100/SCbus products that feature an H.100 CT Bus connector to eliminate the need for a transition device (cable adapter). These products will, in effect, be running SCbus signals through a CT Bus ribbon cable. Firmware enhancements (which can be selected through configuration file parameters) will allow developers to run the SCbus in any one of the modes described in Table 4.

Table 4: H.100/SCbus Modes for CT Bus Interoperability

SCbus Mode	Description
8 MHz, 2048 time slots	Enables developers to take advantage of 2048 time slots of bandwidth today, with existing SCbus products, and without changes to application programming model. Interoperability with H.100 compliant products enables mixed systems of up to full 4096 timeslot capacity. (No sacrifice of time slotsis required as with MVIP-90 interoperation or SCbus 4 MHz products.) Virtually eliminates the need for switch extension.
4 MHz, 1024 time slots	Connect to existing ISA/SCbus product via simple cable adapter.
2 MHz, 512 time slots	Hardware interoperability with H.100/MVIP-90 products. Note that this may require additional device driver capabilities which are not available from Dialogic today.
All Modes	Direct connection to future H.100 compliant products without the need for a cable adapter.

What Computing Buses Are Supported for the CT Bus?

The ECTF H.100 specification is intended for creating PCI products. While the CT Bus could be implemented on ISA, there is no market demand to do so because PCI products are rapidly replacing ISA products, and the CT Bus offers compatibility modes for interoperation with SCbus and MVIP-90 products. To make the physical connection easy for customers implementing a split backplane system, Dialogic will offer a cable adapter to connect the 26 pin SCbus cable for ISA to the H.100 68 pin cable to support existing SCbus ISA products in the market.

The ECTF is currently working on another specification, ECTF H.110, which defines how to implement the CT Bus on the CompactPCI (cPCI) platform. Dialogic intends to implement ECTF H.110 on all cPCI products after this specification is finalized and approved.

What About Operating System Support for the New PCI Products?

Operating system support is another key consideration when designing CT systems that will be part of a larger communications network. With the robust features now available in Windows NT®, support for Windows® Telephony is becoming more and more important. And the power and versatility of the Unix® operating system has given rise to a vast and loyal customer base. In keeping with the broad support for applicable operating systems evident in the ISA product line, Dialogic will support its PCI products under Windows® 95, Windows NT®, Solaris™, and other UNIX® environments.

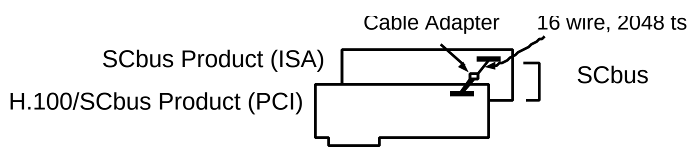
Migrating from SCbus to H.100

The transition to fully H.100 compliant products will be gradual because of the wide deployment of SCbus and MVIP-90 hardware in the marketplace, and because of the time needed to develop new chips that can support all of the features required for full bus master compliance with the standard. As new H.100 CT Bus products become available, they can be easily combined with the existing ISA products. In the meantime, you can expect to see a number of H.100/SCbus and H.100/MVIP-90 products on the market. These will be PCI boards that run in SCbus or MVIP-90 mode, but feature a CT Bus connector to be physically compatible, eliminating the need for a transition device (cable adapter) to connect to H.100 compliant products.

From the application perspective, transitioning from SCbus to CT Bus will not require code changes to existing applications. While there will be some firmware enhancements to support the new features of the CT Bus, these changes will not impact existing applications. To take advantage of features such as redundancy and clock fallback, Dialogic will add relevant extensions to the API, ensuring smooth migration and consistency in design and implementation.

Figures 7, 8, and 9 show the three combination scenarios that you are most likely to encounter during the transition from SCbus to H.100 CT Bus. Figure 7 shows an example of the first step in migration: combining H.100/SCbus boards with existing ISA boards. The SCbus ISA card will be attached to the SCbus PCI card (which has an H.100 CT Bus connector) using a simple cable adapter. There is no change to the application code or to system performance. The bus is a true SCbus, featuring a maximum of 16 lines and 2048 time slots at 8 MHz. The new H.100/SCbus board has a selectable clock, to ensure compatibility and consistent performance without code changes for the many 4 MHz, 1024 time slot SCbus products in the market.

Figure 7: Combining ISA and PCI SCbus Devices



The next step in migration is to add in H.100 compliant devices. Figure 8 shows how easy it is to combine ISA products with fully compliant H.100 products. The SCbus ISA card will be attached to the H.100 product using the same cable adapter as in the previous scenario. There is no change to the application code or to system performance because both buses use the same switching model and are fully compatible.

Figure 8: Combining ISA SCbus and PCI H.100 Devices

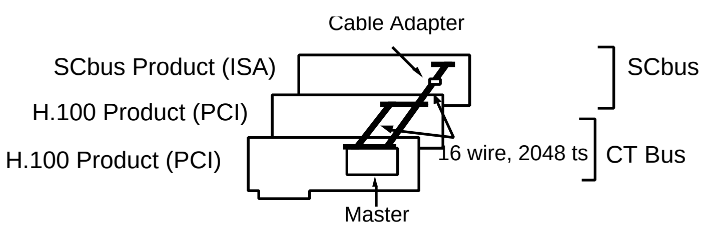
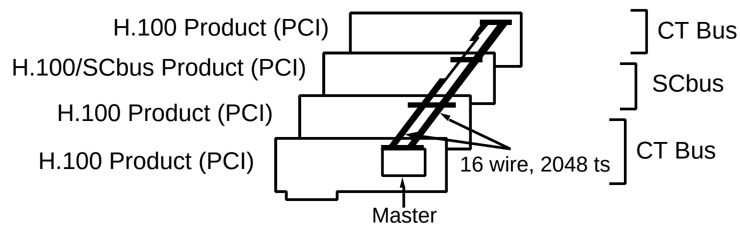


Figure 9 shows the last scenario in migration: combining the H.100/SCbus products with fully compliant H.100 products. The SCbus PCI card attaches to the H.100 product directly, without the need for a cable adapter, because both types of products use the same H.100 CT Bus connector. There is no change to the application code or to system performance because both buses use the same switching model and are fully compatible. Both types of boards are capable of running at 8 MHz, providing access to all of the 4096 ports available with the H.100 compliant products. In contrast, mixed systems using MVIP-90 and H.100 CT Bus devices sacrifice up to 1536 time slots because up to half of the CT Bus must run at 2 MHz to support interoperability with the MVIP-90 devices.

Figure 9: Combining PCI SCbus and H.100 Devices



Going Forward

If you are currently using SCbus hardware, there is no need to put design decisions on hold until H.100 CT Bus products populate the market. The SCbus offers the highest densities and broadest range of technology and platform support in the market today, with over 100 products available from more than 30 suppliers. These products will be interoperable with fully compliant H.100 CT Bus products when they become available. No code changes are needed to take advantage of new resources. If you want to incorporate additional CT Bus features, it is as simple as using a new function call that implements that feature. The overall design does not change because the switching model remains the same. In addition, mixed ISA SCbus and H.100 CT Bus systems will run with the least difference in bus speed, capacity, and physical connectivity when compared to other mixed bus systems. For example, developers using mixed MVIP-90 (512 time slots, 2 MHz) and H.100 CT Bus systems, may be initially constrained in system capacity.

Dialogic’s mission is to *enable customers to achieve success* by providing the best software and hardware platforms for computer telephony worldwide. Vision, technical innovation, participation in industry forums, adoption of new standards that improve telephony server design, and strict attention to migration issues are all essential to this mission. As such, Dialogic has played a pivotal role in the evolution of the telephony bus and development open standards, including the contributions of original SCSA work to the ECTF as the foundation of the H.100, S.100, S.200, and S.300 specifications. This foresight, dedication, and experience gives those invested in SCbus products the most seamless path to the CT Bus systems of the future.

Dialogic's continued success as the leading innovator in voice and fax signal computing technology, DSP control, CTI integration, and media management is fueled by an annual 17% investment in research and development, as well as active participation in key industry forums. Among these forums, Dialogic is a founding member of the following open standards organizations:

- Enterprise Computer Telephony Forum (ECTF)
- Intelligent Network Forum (INF)
- Voice over IP (VoIP) Forum

Dialogic also holds active membership in the following open standards organizations:

- American National Standards Institute (ANSI)
- VME Industry Trade Association (VITA)
- European Computer Manufacturers Association (ECMA), Telecommunications working group (TC32-TG11)
- PCI Industrial Computer Manufacturers Group (PICMG)
- Interactive Multimedia telecommunications Consortium (IMTC)
- Internet Engineering Task Force (IETF)

To find out more about SCSA and the new CT Bus, look for the following documents on the web:

- SCSA Architectural Blueprint
- SCSA Architectural Overview
- ECTF H.100 Spec (order form)
- ANSI/VITA SCbus Specification (ordering information)
- H.100 FAQs
- ECTF Press Release
- Dialogic H.100 Press Release

H.100 Support

One More Reason to Choose Dialogic

- Dialogic fully supports H.100. Existing Dialogic PCI network interface boards (T-1, E-1, and analog) are being immediately modified for H.100. All future PCI products will be H.100 compliant.
- Preserve your existing hardware investment. Existing SCbus ISA hardware can be easily connected to and interoperate with H.100/SCbus and H.100 CT Bus PCI hardware, using a simple cable adapter.
- Preserve your existing software investment. No application changes are needed when switching from Dialogic SCbus hardware to H.100 CT Bus hardware.
- Take advantage of the Dialogic Edge. The new Dialogic DM3 products combine complete H.100 compliance with the industry's most advanced resource architecture, making it the best choice for creating your most visionary computer telephony systems.

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