

TDM Switching in the Cisco AS5000 Gateways



Executive Summary

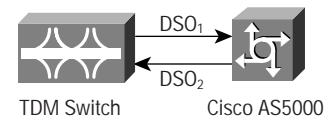
Time Division Multiplexing (TDM) switching enables the Cisco AS5000 Series Gateways to switch information directly between two DS0 circuits without change. The major benefits of TDM switching to service providers include the following:

- TDM switching can positively impact investment by lowering costs and increasing revenue for the service provider.
- TDM switching enables service providers to cap their investments in legacy technology, providing a way to use legacy services and new services simultaneously.
- Service providers can reduce their recurring Primary Rate Interface (PRI) costs by moving to Signaling System 7 (SS7) and generate new revenue from reselling PRIs generated from the SS7/Inter Machine Trunks (IMTs).
- TDM switching is an integral part of Cisco Any Service, Any Port (ASAP) architecture that the service providers can exploit to their advantage.

Overview

TDM switching enables the Cisco AS5000 Gateway to switch pulse code modulation (PCM) data directly between two DS0 circuits (DS01 and DS02) using the time-slot interchange (TSI) circuit, as depicted in Figure 1.

Figure 1 TDM Switching



Every dial, voice, and universal gateway in the Cisco AS5000 Series provides TDM switching capability. Any two DS0 channels in the gateway can be switched using the TDM switching capability of the gateway.

Upon receiving an incoming call, the Cisco Gateway (AS5000) analyzes the dialed digits and, if required, forwards the call outward to the destination.

TDM Switching Applications and Benefits

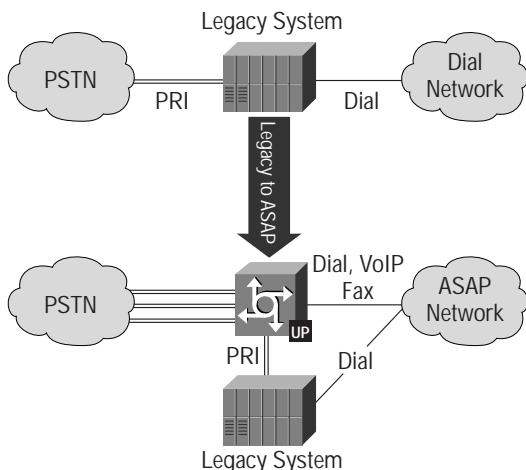
TDM switching can be used in various situations to reduce cost, increase revenue, and provide services that would not otherwise be possible. The major applications and benefits of TDM switching include:

- *Cap investments in legacy technology*—TDM switching can be used to protect the investments already made in the legacy technology/equipment while enabling the new investments in the technology for new services. The legacy systems can continue to be used transparently by using the PRI/channel-associated signaling (CAS).



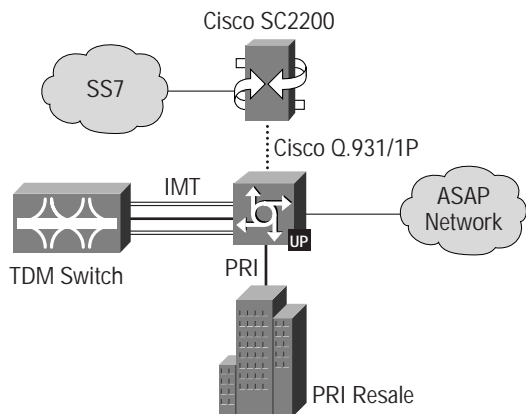
For example, the service providers can migrate to Cisco ASAP technology while continuing to use the legacy systems; the new investments can then be made in the new technology. The migration from the legacy systems to the new systems can be planned and managed on an as-needed basis, as shown in Figure 2.

Figure 2 Legacy to Cisco Any Service, Any Port Migration



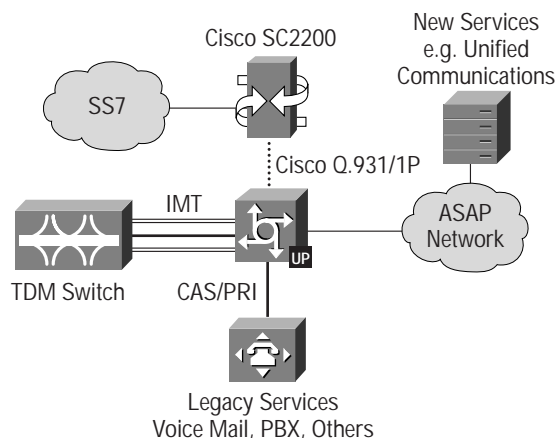
- **Resell PRI generated from IMTs**—PRI interfaces can be generated from Inter Machine Trunks (IMT/SS7) interfaces, which can then be sold to customers for new revenue, as shown in Figure 3. Cisco universal gateways are ideally suited for customers who require PRI grooming in conjunction with dial, voice over IP (VoIP), or fax services. The Cisco MGX™ 8260 Media Gateway fits well for large standalone PRI grooming applications.

Figure 3 PRI Resale



- **Lower interconnect costs with SS7**—IMT trunks are typically 40 to 70 percent cheaper than PRI trunks. Customers can migrate to SS7, directly connected to the Cisco gateway, and continue receiving benefits from their legacy systems.
- **Managed migration to new services**—Migration to new IP-based services providing new sources of revenue can be easily accomplished by gradually cutting over the customers to new services, starting with the new customers first, followed by the existing customers, as shown in Figure 4.

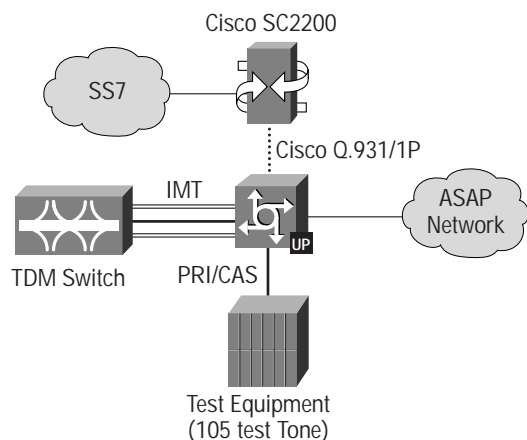
Figure 4 Managed Migration to New Services



- **Support for call redirection**—SS7 calls can be redirected back to the SS7 network based on dialed number. This feature may be used for local-number portability (LNP) service in Europe, provided ISDN User Part (ISUP)-to-ISUP transparency is not required.
- **TDM switching without a Digital Signal Processor (DSP)**—TDM switching in the Cisco Universal Gateway (Cisco AS5350, AS5400, and AS5850) between PRI and IMT trunks uses no DSPs and, therefore, lowers the cost of grooming services. This enables the service providers to pay as they grow for new services.
- **Use of external test equipment**—TDM switching can be used to connect to test tone-generating devices needed to meet service providers' provisioning or homologation requirements. Connecting to external test equipment by using TDM switching as depicted in Figure 5 can provide Type 105 test tones in the Cisco AS5000 Series Gateways.



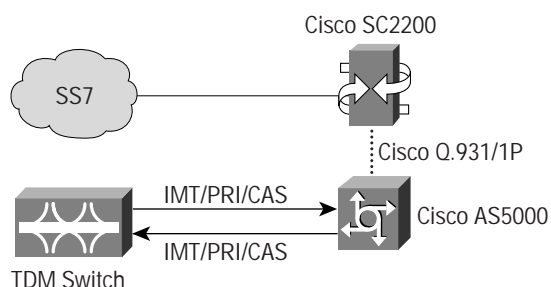
Figure 5 Use of External Test Equipment



TDM Switching Call Types

The Cisco AS5000 Series Gateways are capable of switching calls between SS7/IMT, PRI, and CAS trunks. Figure 6 depicts the various types of calls that can be involved in TDM switching.

Figure 6 TDM Switching Call Type



TDM Switching Interface Types

TDM switching is supported on T1/E1/DS3 interfaces. DS0 channels used in TDM-switched calls can come from the same T1/E1 interface or from different T1/E1 interfaces in the gateway.

DSP and DSP-Less TDM Switching

The TSI circuit located in either the trunk or the DSP card provides TDM switching in the Cisco AS5000 Series Gateways. When the connection between the two DS0 circuits involved in TDM switching is established, the TSI circuit is completely responsible for transmitting and receiving PCM data to/from the two DS0 circuits.

Because of the use of the TSI circuit to switch PCM data between the two DS0 circuits, any type of bearer data can be included in TDM switching.

The following section describes when a DSP is required for TDM switching in the Cisco AS5000 Series Gateways.

- Switching between SS7-PRI, PRI-PRI, or SS7-SS7
 - TDM switching in the universal gateway (Cisco AS5350, AS5400, and AS5850) does not use any DSP resource. The TSI circuit is available in the T1/E1/DS3 interface cards.
 - TDM switching in the Cisco AS5800 requires either a voice or a modem DSP card, which contains the TSI circuit. The DSP resource in the card is not used, however.
 - TDM switching in the Cisco AS5300 Voice Gateway requires a voice DSP card that contains the TSI circuit. The voice DSP resource is used to set up/tear down the TDM-switched connection, and is not used after the connection is established.
- Switching between SS7-CAS or PRI-CAS
 - When a CAS trunk is involved in TDM switching (all gateways), a DSP resource is needed/used to set up the connection. The DSP resource stays in the call path after the call is established to monitor the in-band signaling (A, B, C, and D bits), so that the call can drop normally.
- CAS-CAS
 - If two CAS calls are involved in the TDM switching session, then each leg of the call uses one DSP resource. DSP resources (two) stay in the call path after the call is established to monitor the in-band signaling (A, B, C, and D bits), so that the call can drop normally.
- Interactive voice response (IVR)
 - When an incoming call uses IVR functionality, a DSP resource is not released until the call is released.



Capacity

Any DS0 channel in the gateway can be used for TDM switching. The total number of switched calls in the system is a function of the number of channels supported by the gateway. A TDM-switched call uses two DS0 channels, one channel each for incoming or outgoing legs of the call. The number of simultaneous TDM-switched calls in a gateway varies from gateway to gateway. Please refer to Table 1 for more details.

Availability

The TDM switching feature is available now in the Cisco AS5350 Universal Gateway, AS5400 Universal Gateway, AS5800 Access Server, and Cisco AS5300 Voice Gateway. TDM switching in the Cisco AS5850 Universal Gateway will be available in Q3 CY '01.

Summary

TDM switching is an integral part of Cisco AS5000 Series Gateways in general and Cisco ASAP architecture in particular, a scenario that service providers can exploit to their advantage. The following summarizes the TDM switching service and the associated major benefits:

- Caps and protects legacy investments
- Results in new revenue from PRI offload
- Offers cost savings from migration to SS7
- Enables seamless migration to new services
- Available in all Cisco AS5000 Series Gateways and all trunk interfaces (T1/E1/DS3)
- Offers TDM switching between SS7, PRI, and CAS calls

Table 1 Cisco AS5000 Series Gateways TDM Switching Capacity

Gateways	Capacity	Comment
Cisco AS5350, AS5400, and AS5850 Universal Gateway	Full DS0 capacity	Subject to DSP requirements for CAS and IVR calls
Cisco AS5800/ Double Density Modem Module (DMM)	Full DS0 capacity	Subject to DSP requirements for CAS and IVR calls
Cisco AS5300/Voice Feature Card (VFC)	60 calls	When the TDM switching connection is established between two DS0 circuits, the DSP resource can be used for new calls that require TDM switching, subject to DSP requirements for CAS and IVR calls
Cisco AS5800/VFC	192 calls/fully populated card, 96 calls/half populated card, regardless of high complexity or medium complexity	After the TDM switching connection is established between two DS0 circuits, the DSP resource can be used for new calls that require TDM switching, subject to DSP requirements for CAS and IVR calls

Table 2 summarizes the types of switched TDM calls supported in the Cisco AS5000 Series Gateways. The table also indicates whether a DSP is used during the setup or during the entire duration of the switched call.

Table 2 Cisco AS5000 Series Gateways TDM Switching Summary

Gateway	Location of TSI Circuit	SS7 to SS7 ¹ , SS7 to PRI, and PRI to PRI			SS7 to CAS, PRI to CAS			CAS to CAS		
		Supported	Number of DSPs Used for Call Setup	Number of DSPs Used During TDM Switching	Supported	Number of DSPs Used for Call Setup	Number of DSPs Used During TDM Switching	Supported	Number of DSPs Used for Call Setup	Number of DSPs Used During TDM Switching
Cisco AS5350	Trunk Card	Y	0	0	Y	1	1	Y	2	2
Cisco AS5400	Trunk Card	Y	0	0	Y	1	1	Y	2	2
Cisco AS5850	Trunk Card	Y ²	0	0	Y ²	1	1	Y ²	2	2
Cisco AS5800/ DMM	DMM Card ³	Y	0 ⁴	0 ⁴	Y	1	1	Y	2	2
Cisco AS5800/ VFC	VFC Card ²	Y	2	0	Y	1	1	Y	2	2
Cisco AS5300/ VFC	VFC Card	Y	2	0	Y	1	1	Y	2	2

Notes:

1. SS7-SS7 with ISUP transparency will be available in Q4 '01.
2. This support will be available in Q3 CY '01.
3. The DMM card is used if both DMM and VFC cards are present in the system.
4. At least one DMM card is required in the system. The TSI logic is located in the DMM card.



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