Benefits of SDH – Conclusions

A transport network using SDH provides much more powerful networking capabilities than existing asynchronous systems. The key benefits provided by SDH are the following.

Pointers, MUX/DEMUX

As a result of SDH transmission, the network clocks are referenced to a highly stable reference point; so the need to align the data streams using non-deterministic bit-stuffing is unnecessary. Therefore, a lower rate channel such as E1 is directly accessible, and intermediate demultiplexing is not needed to access the bitstreams.

For those situations in which synchronisation reference frequency and phase may vary, SDH uses pointers to allow the streams to “float” within the payload. Pointers are the key to synchronous timing; they allow a very flexible allocation and alignment of the payload within the transmission frame.

Reduced Back-to-Back Multiplexing

In the asynchronous PDH systems, care must be taken when routing circuits in order to avoid multiplexing and demultiplexing too many times since electronics (and their associated capital cost) are required every time an E1 signal is processed. With SDH, E1s can be multiplexed directly to the STM-N rate. Because of synchronisation, an entire optical signal doesn’t have to be demultiplexed – only the individual VC or STM signals that need to be accessed.

Optical Interconnect

A major SDH benefit is that it allows mid-span meet with multi-vendor compatibility. Today’s SDH standards contain definitions for fibre-to-fibre interfaces at the physical level. They determine the optical line rate, wavelength, power levels, pulse shapes, and coding. The current standards also fully define the frame structure, overhead, and payload mappings. Enhancements are being developed to define the messages in the overhead channels to provide increased OAM functionality.

SDH allows optical interconnection between network providers regardless of who makes the equipment. The network provider can purchase one vendor’s equipment and conveniently interface with other vendors’ SDH equipment at either operator locations or customer premises. Users may now obtain the STM-N equipment of their choice and meet with their network provider of choice at that STM-N level.

Multi-point Configurations

Most existing asynchronous transmission systems are only economic for point-to-point applications, whereas SDH can efficiently support a multi-point or cross-connected configuration.

The cross-connect allows many nodes or sites to communicate as a single network instead of as separate systems. Cross-connecting reduces requirements for back-to-back multiplexing and demultiplexing, and helps realize the benefits of traffic grooming.

Network providers no longer need to own and maintain customer-located equipment. A multi-point implementation permits STM-N interconnects and mid-span meets, allowing network providers and their customers to optimize their shared use of the SDH infrastructure.

Grooming

Grooming refers to either consolidating or segregating traffic to make more efficient use of the network facilities. Consolidation means combining traffic from different locations onto one facility, while segregation is the separation of traffic.

Grooming eliminates inefficient techniques such as back-hauling. It’s possible to groom traffic on asynchronous systems, however to do so requires expensive back-to-back configurations and manual or electronic cross-connects. By contrast, an SDH system can segregate traffic at either an STM-1 or VC level to send it to the appropriate nodes.

Grooming can also provide segregation of services. For example, at an interconnect point, an incoming SDH line may contain different types of traffic, such as switched voice, leased circuits for data, or video. An SDH network can conveniently segregate the switched and non-switched traffic.

Enhanced OAM

SDH allows integrated network OAM, in accordance with the philosophy of single-ended maintenance. In other words, one connection can reach all network elements within a given architecture; separate links are not required for each network element. Remote provisioning provides centralized maintenance and reduced travel for maintenance personnel – which translates to expense savings.

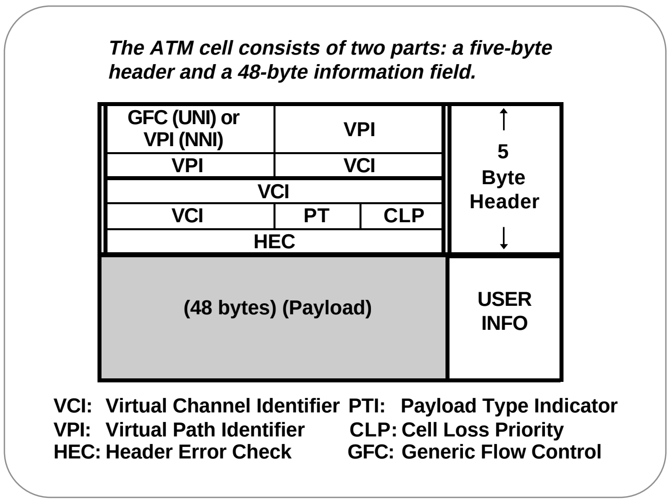
Note: *OAM is sometimes referred to as OAM&P.*

Enhanced Performance Monitoring

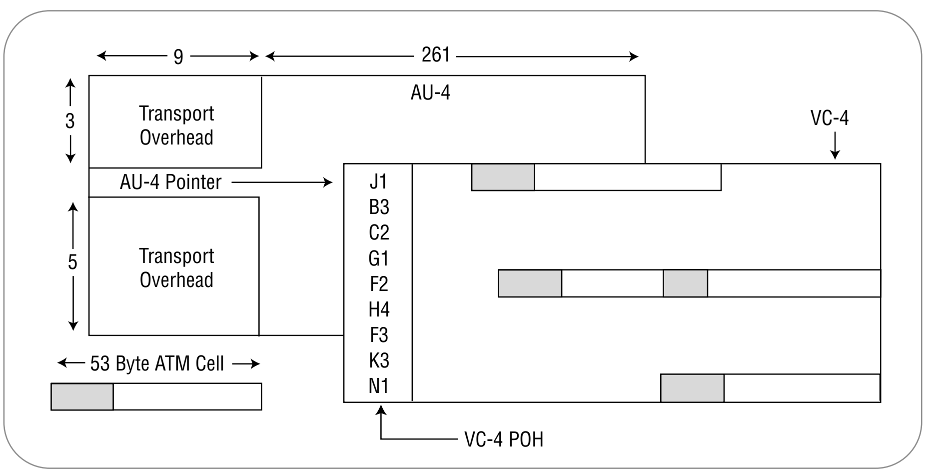
Substantial overhead information is provided in SDH to allow quicker troubleshooting and detection of failures before they degrade to serious levels.

Convergence, ATM, IP, Video, and SDH

Convergence is the trend toward delivery of voice, data, images, and video through diverse transmission and switching systems that supply high-speed transportation over any medium to any location. Tektronix is pursuing new opportunities to lead the market by providing test and measurement equipment to users who process or transport voice, data, image, and video signals over high-speed networks.



▶ ***Figure 29.*** *ATM cell structure.*



▶ ***Figure 30.*** *ATM SDH mapping.*

Some broadband services may use Asynchronous Transfer Mode (ATM) – a fast packet-switching technique using short, fixed-length packets called cells. Asynchronous Transfer Mode multiplexes a service into cells that may be combined and routed as necessary. Because of the capacity and flexibility that it offers, SDH is a logical transport mechanism for ATM. As local and wide area networks converge, Packet over SDH (PoS) technologies allow the transport of IP packets at SDH rates.

In principle, ATM is quite similar to other packet-switching techniques; however, the detail of ATM operation is somewhat different. Each ATM cell is made up of 53 octets, or bytes (see Figure 29). Of these, 48 octets make up the user-information field and five octets make up the header. The cell header identifies the “virtual path” to be used in routing the cell through the network. The virtual path defines the connections through which the cell is routed to reach its destination (see Figure 30).

A Packet-based network is bandwidth-flexible, which allows handling of a dynamically variable mixture of services at different bandwidths. Packet networks also easily accommodate traffic of variable speeds. An example of a service that realizes the benefits of a variable-rate interface is that of a video service, where video can be digitally coded and packetised within ATM or IP cells.

The rate at which cells can be transmitted through the network is dependent upon the physical layer of the network used for transport of the cells. The interface rate presented to the user may vary between a minimum and maximum rate, which ensures a much more efficient use of the bandwidth made available to the end user.