

Overview of Asynchronous Transfer Mode (ATM) and MPC860SAR

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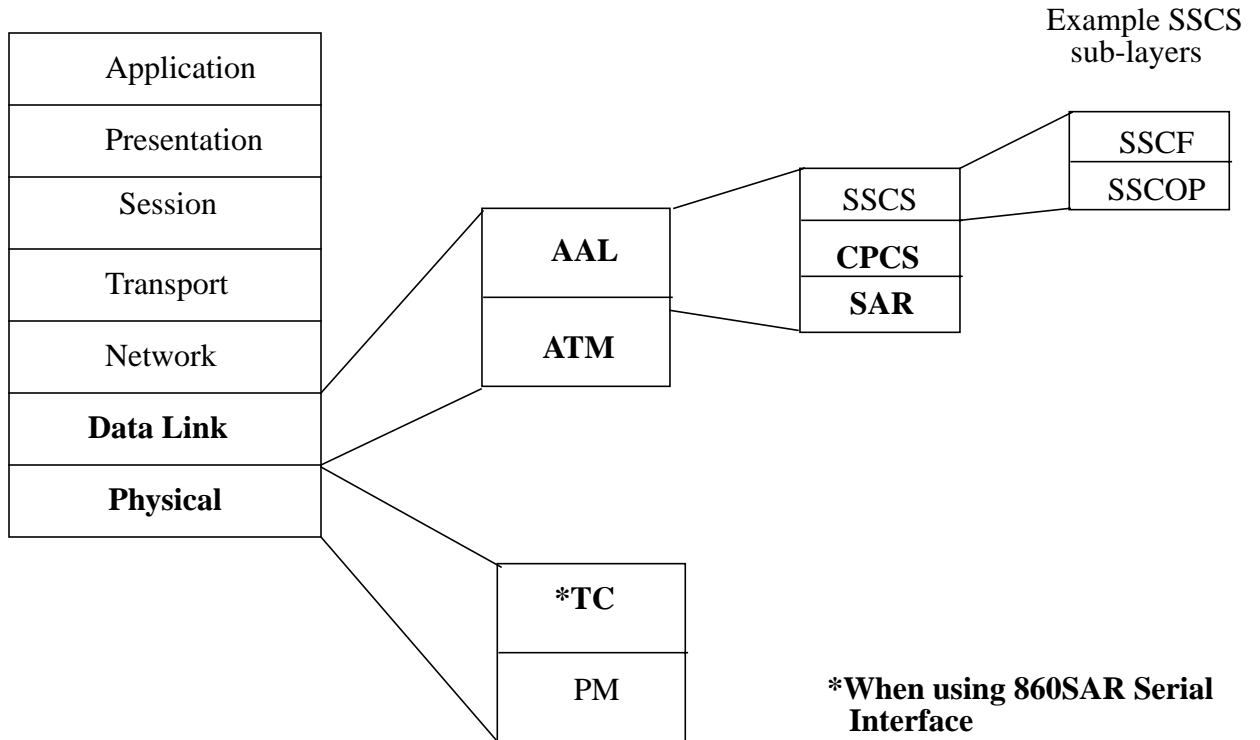
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What is ATM?

- o Protocol that applies primarily to layer 2 of the OSI protocol stack:



BOLD Text = Functionality performed by 860SAR

**Common Part
Convergence Sublayer
(CPCS)**

Service Specific
Convergence Sublayer
(SSCS)

Figure 1

Why was ATM developed?

- o ATM was developed to better utilize the bandwidth in circuit switched networks (Synchronous Transfer Mode).

Time Slots



Transmission over any channel/time slot is fixed for duration of call/connection. At times, time slot will not be utilized (no data to send).

- o With ATM, data is only sent when needed and unused bandwidth can be used by other applications (a.k.a. statistical multiplexing).
- o The fact that transmission is not tied to a particular time slot is what makes this technology “Asynchronous.”

Standards body:

ITU-T - International Telecommunications Union - Telecommunications

ANSI - American National Standards Institute

Industry Forums:

ATM Forum

o **A few things you probably already know:**

- ATM traffic is conveyed in 53 byte packets/cells.

5 bytes = Header (e.g. address information)

48 bytes = Payload (i.e. the data you are sending)

- ATM allows for traffic with different characteristics:

Data, Voice, Video.

Header - 5 bytes

GFC 4 - bits	VPI 8 - bits	VCI 16 - bits	PTI 3 - bits	CLP 1 - bit	HEC 8 - bits	Payload - 48 bytes
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Generic Flow Control - Intended to support multiplexing. However, its use is not standardized. It is eliminated in switch-to-switch links and is used instead to extend the number of VPIs supported.

Virtual Path Identifier - identifies the path that cell will take.

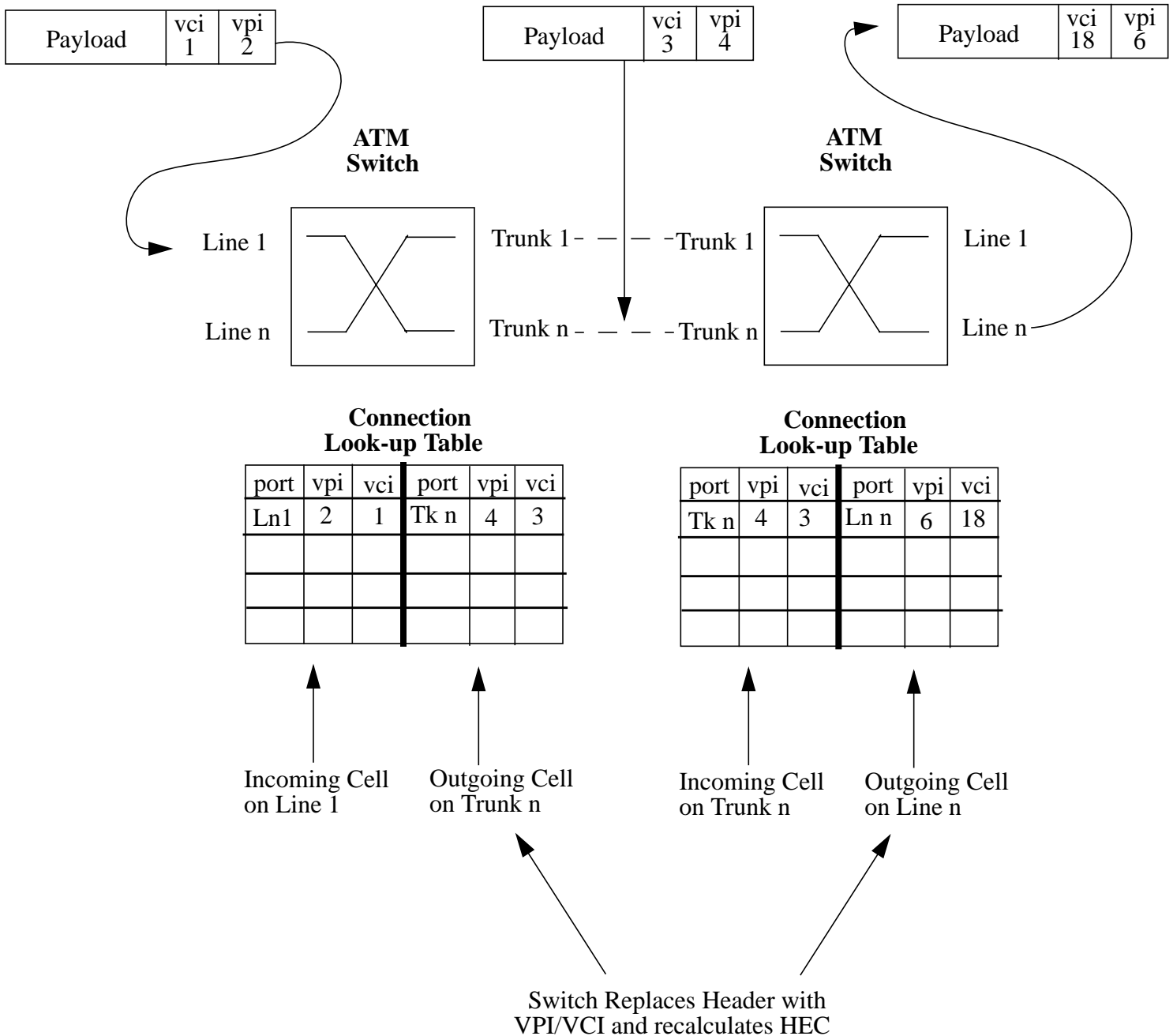
Virtual Channel Identifier - identifies the channel within the path that cell will take.

Payload Type Identifier - identifies payload type (e.g. data, traffic control). Note, when carrying data, a 1 in the least significant bit indicates the last cell (in a sequence of cells).

Cell Loss Priority - when set to 1, indicates that this cell can be discarded if congestion exists.

Header Error Control - this is a checksum over the cell header.

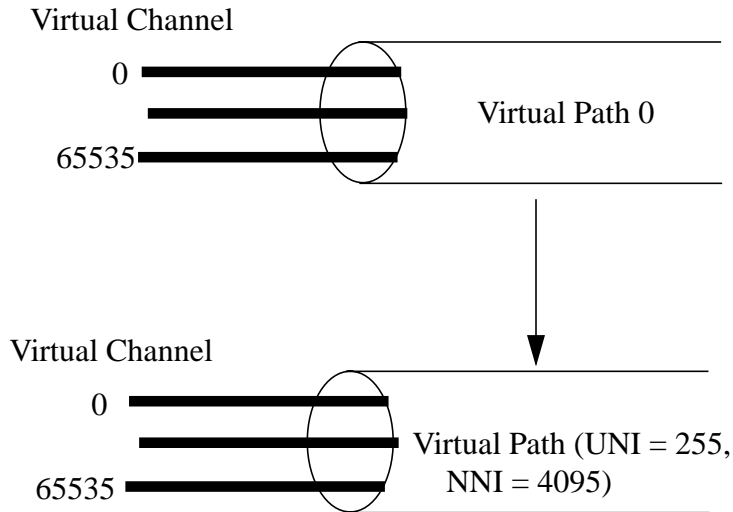
ATM is a connection oriented protocol. This means that a connection must be established before a user can transmit anything. A connection is identified by its VPI/VCI. The connection can either be a Permanent Virtual Connection or a Switched Virtual Connection.



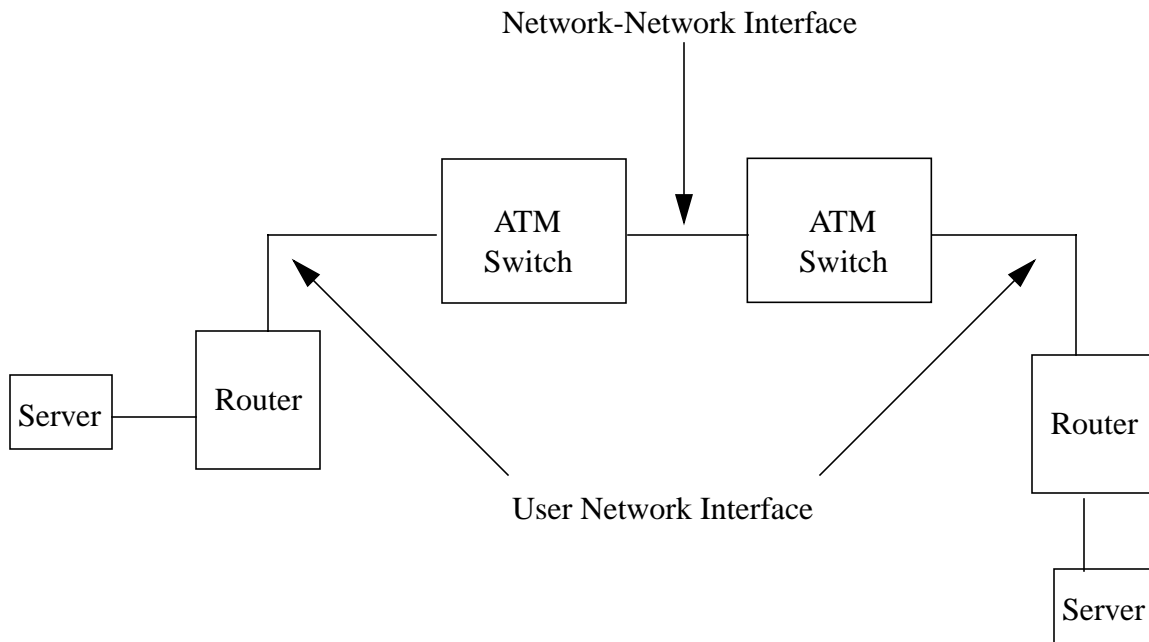
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o How is traffic routed?

Traffic is routed, multiplexed and demultiplexed based on the Virtual Path Identifier and Virtual Channel Identifier found in the header.



Possible number of entries in lookup table: 4096 x 65536



What does the ATM Adaptation Layer (AAL) do?

The ATM Adaptation Layer is responsible for breaking up data into packets (i.e. segmentation) and putting data back together from packets (i.e. reassembly). AAL is further divided into a Convergence Sublayer (CS) and a Segmentation And Reassembly (SAR) sublayers. Depending on the AAL implemented, overhead is added to the data in the form of CS control information (CS Protocol Data Unit).

There are different flavors of AALs that support different traffic requirements:

AAL1 - supports constant bit rate (CBR) traffic, such as real time video, DS1/DS3 circuit emulation.

AAL2 - you may see references to this in older documents as a protocol in the works to support Variable Bit Rate (VBR) traffic (packetized audio/video). It was never standardized for VBR, it now targets voice-trunking.

AAL3/4 - supports VBR traffic such as Frame Relay, X.25., SMDS. Uses 4 bytes of the 48 byte payload for overhead info. Being replaced by AAL5.

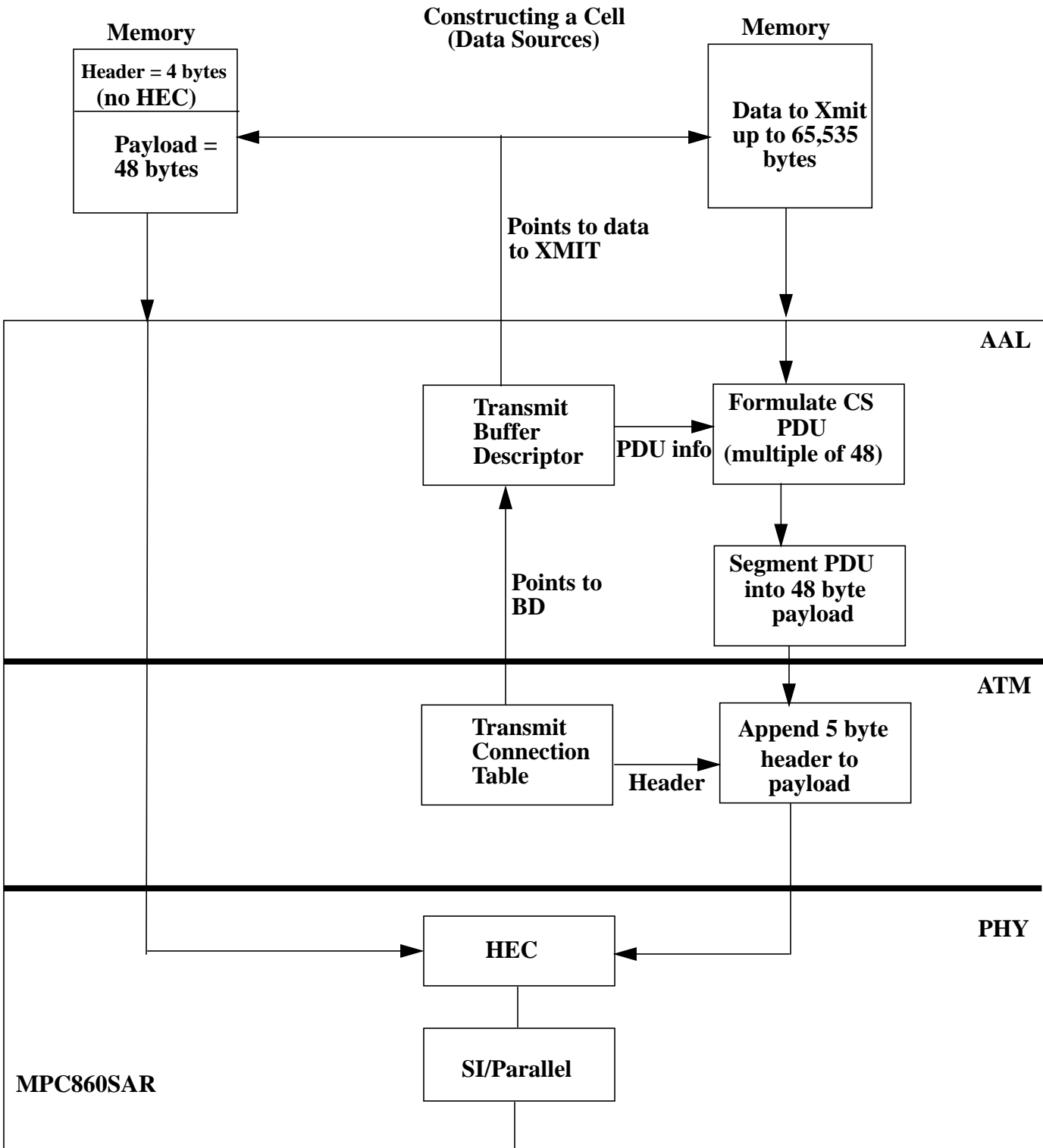
AAL5 - “leaner” version of AAL3/4 (removes some error recovery and retransmission capabilities). Supports Frame Relay, X.25, IP (LAN Traffic).

AAL0 - this, in essence, nullifies the AAL. The data to be transmitted “fits” in a cell (i.e. it is 48 bytes). So, the AAL layer does not have to break it up to transmit. For example, AAL0 can be used to convey Operations, Administration, and Maintenance (OAM) information.

o What AALs does the 860SAR directly support?

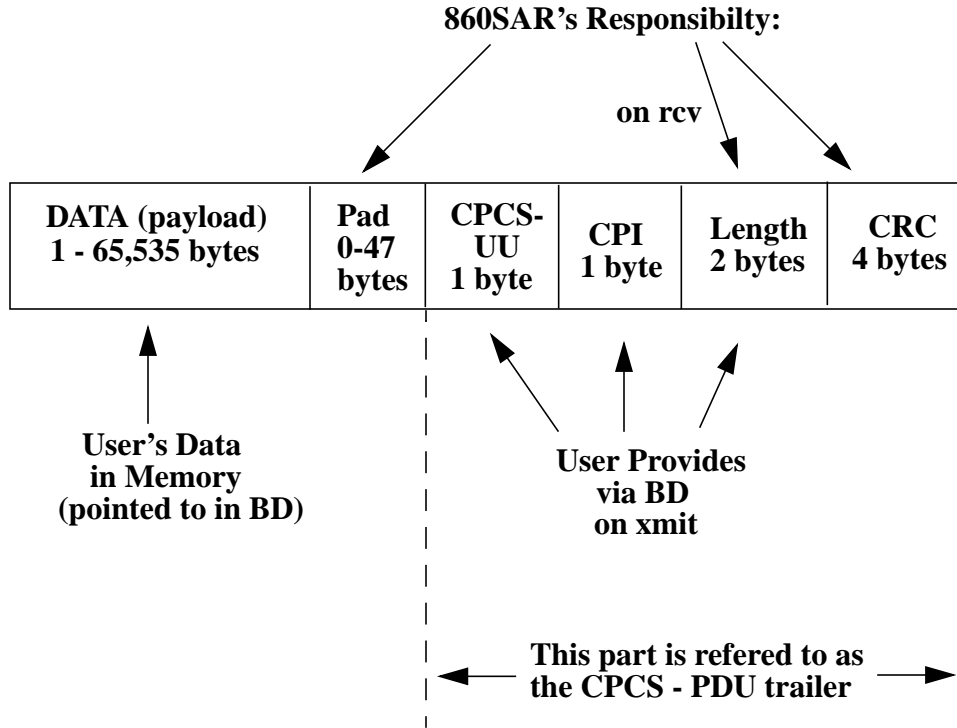
AAL0

AAL5



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o What does the AAL5 CS-PDU look like (aka CPCS-PDU)?



Pad - pad may be needed if the PDU is not a multiple of 48 bytes.

UU - User-to-User data

CPI - Common Part Indicator, current use is simply to align trailer to 64 bit boundary.

Length - number of bytes in payload.

CRC - Cyclic Redundancy Check (CRC-32), same as 802.3 CRC.

o What is the convergence sub-layer (CS)?

The CS is responsible for adding padding, CRC checking, and appending the trailer (refer to CS-PDU).

o What is SAR?

The Segmentation And Reassembly (SAR) sublayer is responsible for breaking up the CS-PDU into 48 byte parts that are passed to ATM layer. When receiving, the SAR reassembles 48 bytes of payload into a CS-PDU. Note that non-payload (e.g. CPI, length) data resides in the Buffer Descriptors (BDs).

o What is the Service Specific Convergence Sub-layer (SSCS)?

As the name implies, this sub-layer is responsible for service specific functions. An example of a specific service is Signaling. Signaling uses AAL5, and the service specific sub-layers are referred as Signaling AAL (SAAL). Some of the SAAL responsibilities are:

- o Interface to signaling protocol (Q.2931)
- o Error detection and reporting
- o Maintain data sequence integrity

Figure 1 depicts the protocols that make up the SAAL:

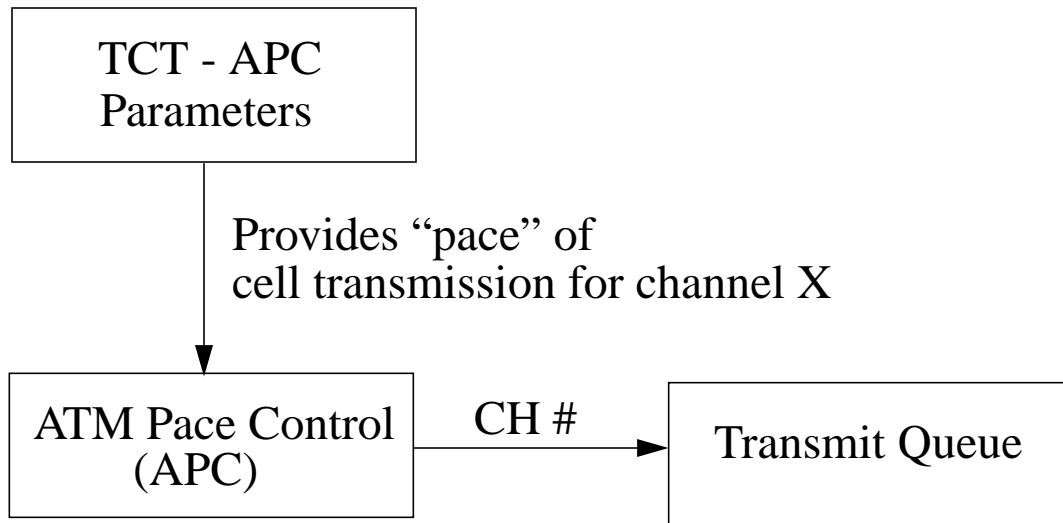
- o Service Specific Coordination Function (SSCF)
- o Service Specific Connection-Oriented Protocol (SSCOP)
- o SSCF+SSCOP is referred as Signaling AAL (SAAL).

NOTE: There will be signaling and OAM packages introduced 1Q 98 that work with the 860SAR.

Signaling information is conveyed via VPI 0 and VCI 5. Other information, such as OAM (e.g. loopback orders, provisioning, PM) are conveyed via other fixed VPI/VCI's.

o What types of service can the 860SAR provide?

As you may recall from the earlier definition of AAL5, it supports VBR (variable bit rate). However, the 860SAR ***DIRECTLY** supports Constant Bit Rate (CBR) and Unspecified Rate (UBR).



*ABR and VBR require additional software support to modify APC.

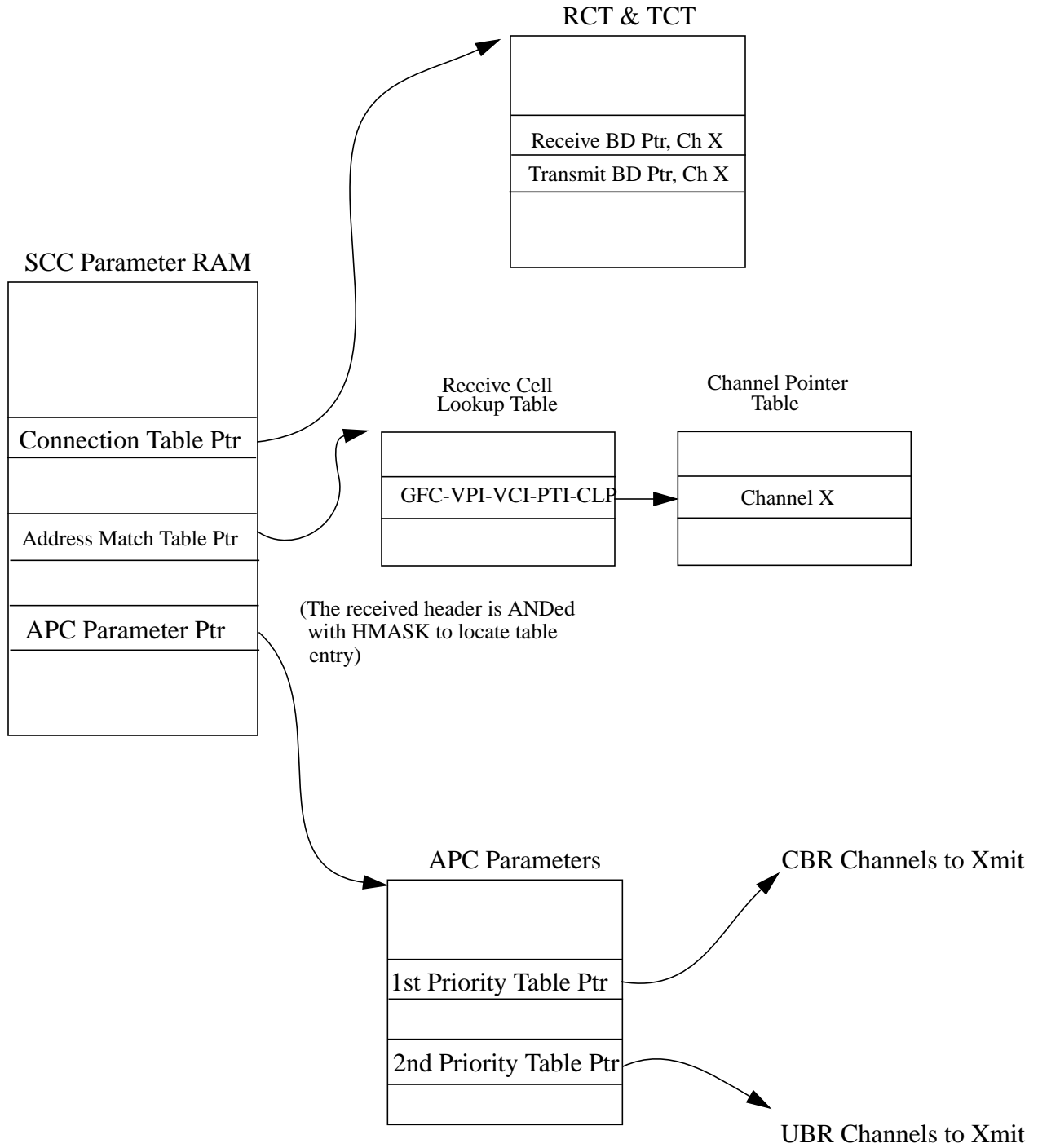
CBR - Constant Bit Rate, intended for applications that require low delay variation, e.g. voice and video. Allocated bandwidth.

UBR - Unspecified Bit Rate, best effort type of service, where applications can tolerate variations in delay.

VBR - Variable Bit Rate, has two categories real time and non-real time. Intended for “bursty” traffic.

ABR - Available Bit Rate, intended for applications that can alter their transfer rate based on network bandwidth availability. The sender gets a message from the network indicating if it can increase the rate or if it should decrease the rate (known as a Resource Management (RM) cells).

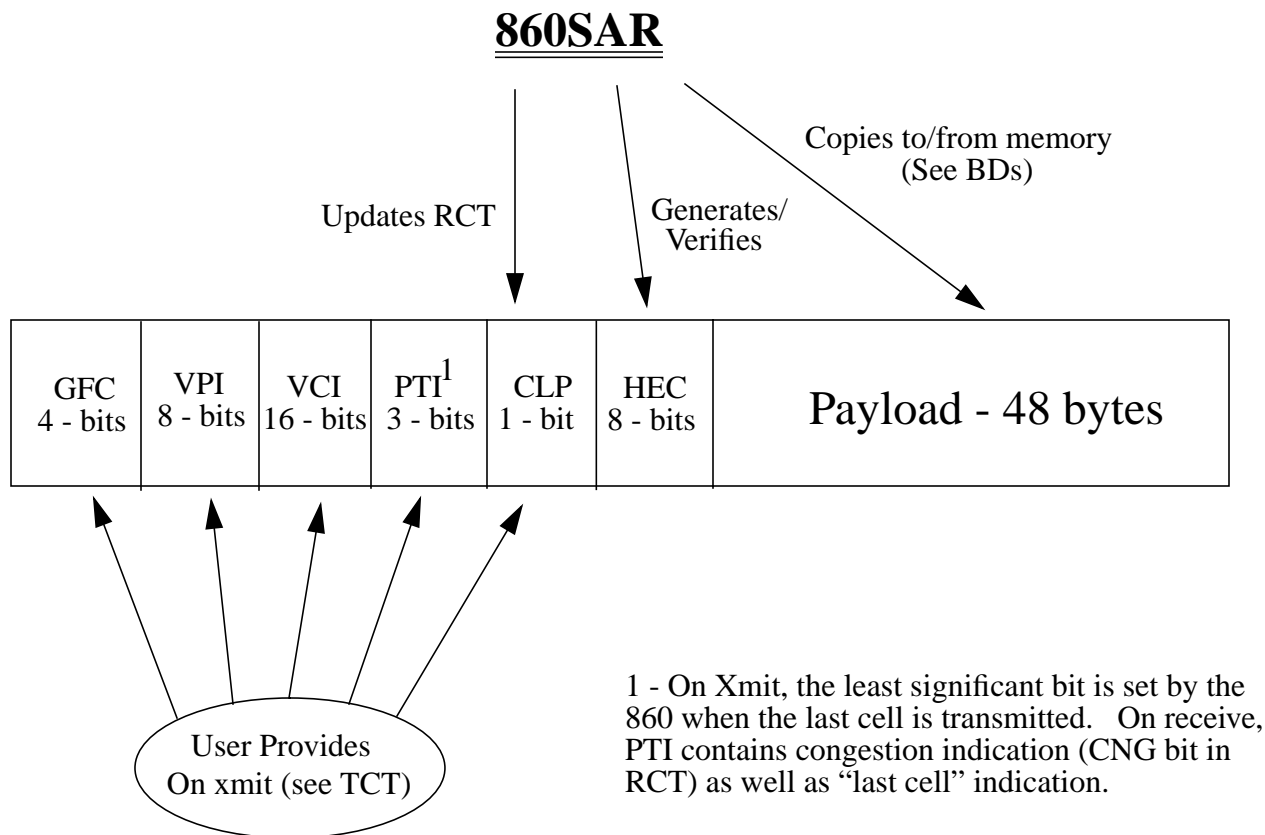
Some Useful Pointers



What does the ATM Layer do?

Some of the ATM layer responsibilities:

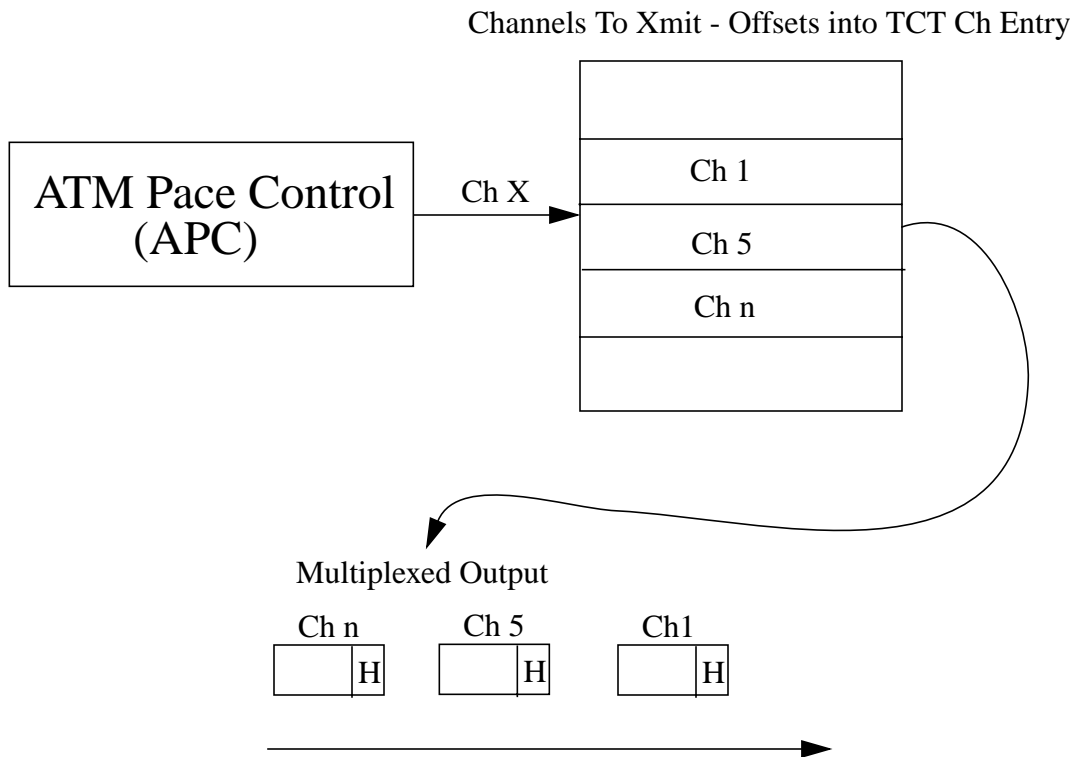
- o Appending/Removing the cell header.
- o *Multiplexing/Demultiplexing based on VPI/VCI.
- o Interpreting Cell Payload Type Identifier



*A switch routes cells using VPI/VCI via a lookup table. An entire VP can be switched.

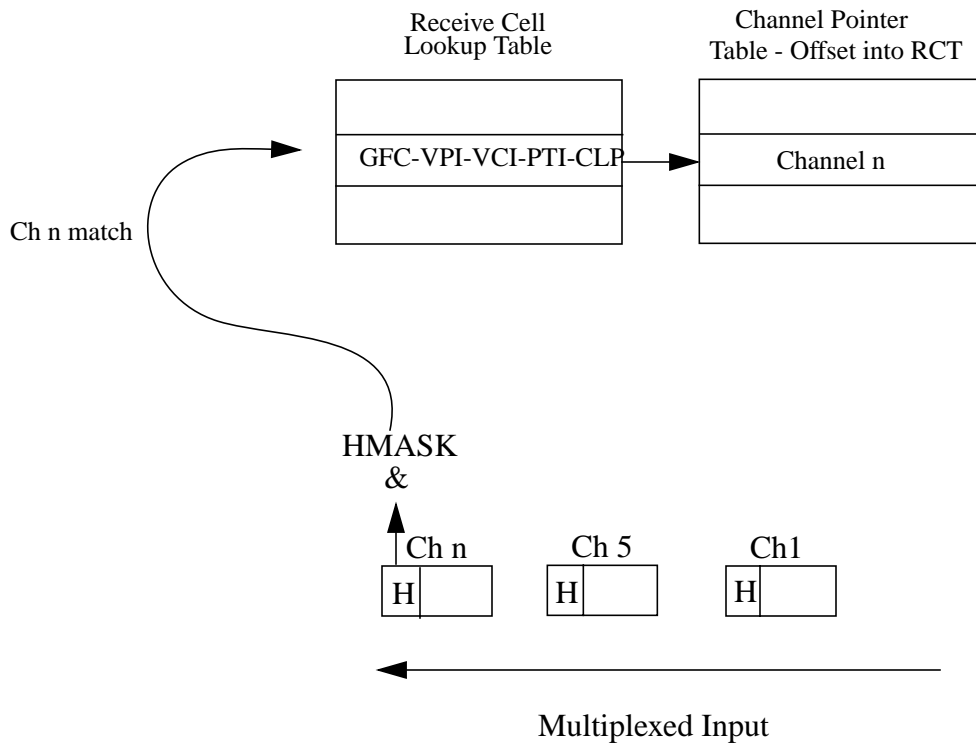
Multiplexing?

The APC algorithm, based on the pace parameters found in the TCT, will place the ch# in the Transmit Queue for those channels that are scheduled to transmit.



Demultiplexing?

When a cell is received, the header is ANDed with the mask (e.g. HMASK). The result is used to find a matching entry in the “Received Cell” look up table and the corresponding channel number.



o The physical layer.

The physical layer is divided into two sub-layers: Transmission Convergence (TC) and Physical Medium (PM).

o What does TC do?

- Converts bit stream into cells, or cells into bit stream depending on direction.
- Generates and verifies HEC
- Performs cell delineation (serial mode)
- Cell rate decoupling - sends idle cells when there is nothing to transmit. This allows the physical interface to retain synchronization.
- Discards idle cells received.

o What does PM do?

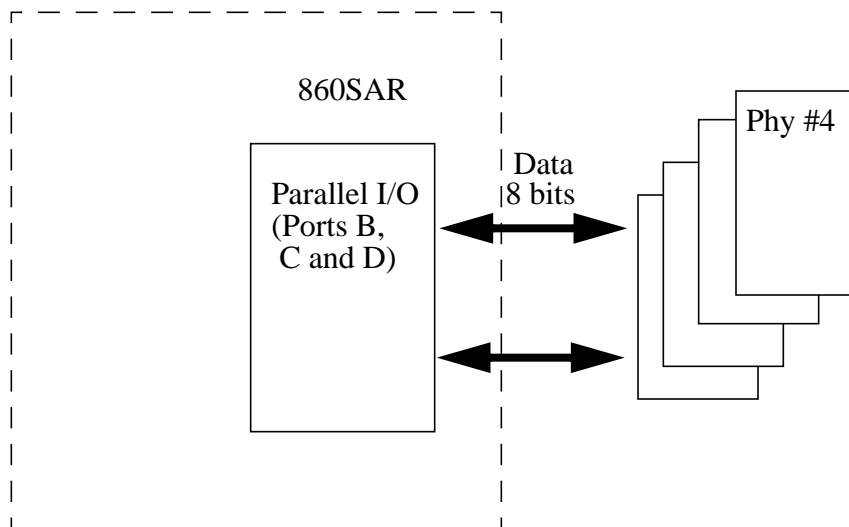
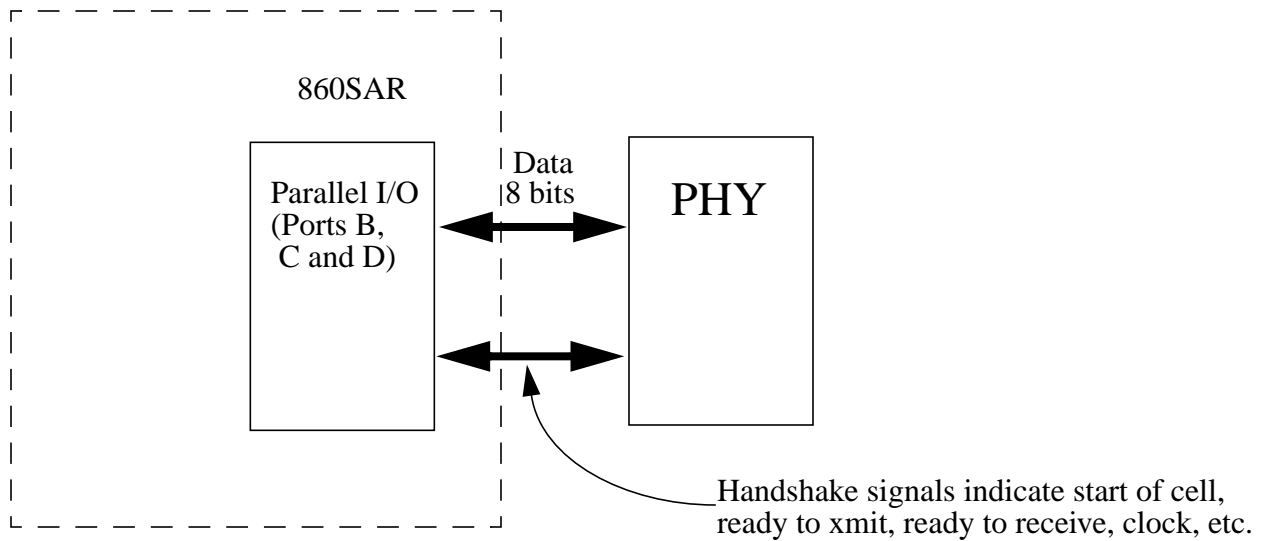
This is the interface to the transmission medium (e.g. coax, twisted pair, fiber) that clocks the bits.

Some of the physical layer standards that exist to support ATM:

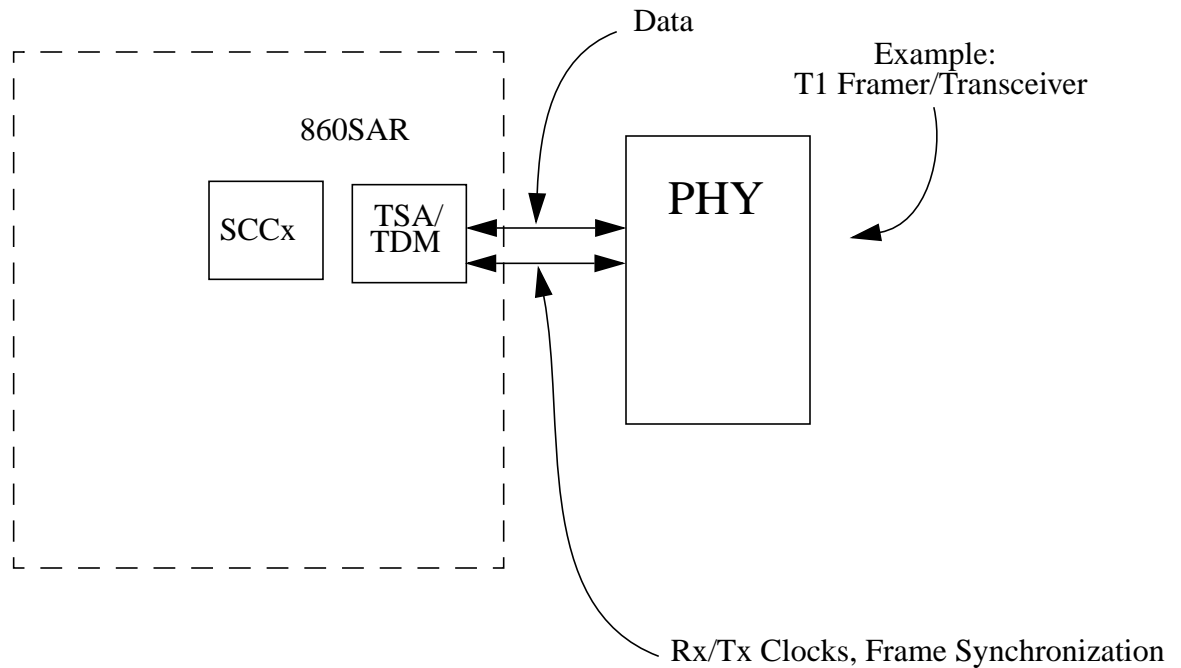
- DS1 - 1.544 Mb/s (a.k.a. T1)
- E1 - 2.048 Mb/s
- STS-1 - 51.84 Mb/s
- STS-3 - 155.52 Mb/s
- STS-4 - 622.08 Mb/s

The MPC860SAR supports serial and parallel interfaces

- o Universal Test & Operations Physical Interface for ATM (UTOPIA) - defines a parallel interface between physical layer and the ATM layer.



- o The 860SAR supports a serial bit stream via the Serial Interface (e.g. SCC using TSA).



The MPC860SAR supports aggregate Tx/Rx rates of 60 Mb/s for the UTOPIA interface and 20 Mb/s for the serial interface.