ATM AAL5

Purpose:

- This module describes the use of the FCC when used in ATM AAL5 mode.

Objectives:

- This module will explain the different AAL types followed by a description of the ATM Adaptation Layer 5 and how the Frame is divided. After completing this module you will have an understanding of how the FCC transmits and receives an AAL5 cell.

Contents:

- Description of the AAL types and specifically, the AAL5 Frame and Cell followed by an in-depth look at how the FCC transmits and receives this protocol.

Learning Time:

- There are 11 pages and 6 reference pages which will take approximately 20 minutes.

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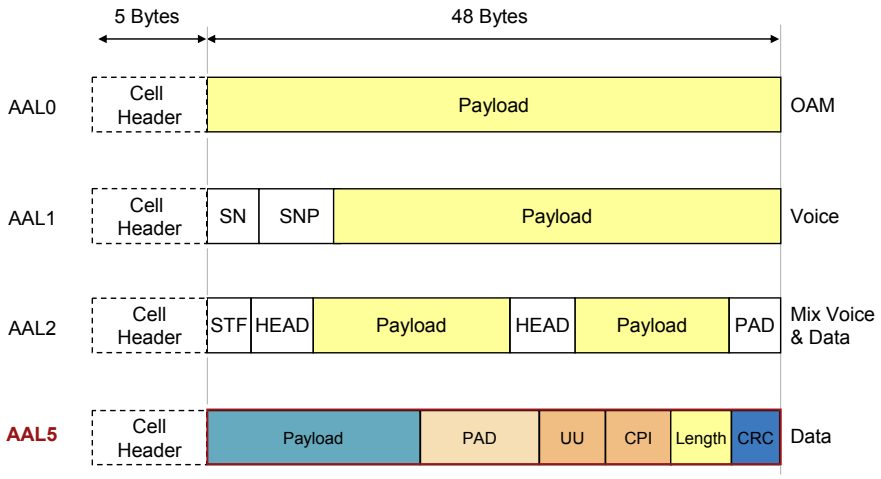
AAL Types



This section provides a brief description of the AAL5 protocol, which is represented by the bottom format shown here. This is simplified in that it only shows the last cell if the message covers multiple cells. For multi-cell messages, only the last has this format. The previous cells contain just the header and payload.

ATM Adaptation Layer 5

AAL5 provides the following options:

- Reliable service with guaranteed delivery with flow control
- No guaranteed delivery
- Unicast
- Multicast
- Message/stream mode

AAL5 provides the following options:

Reliable service with guaranteed delivery with flow control

No guaranteed delivery

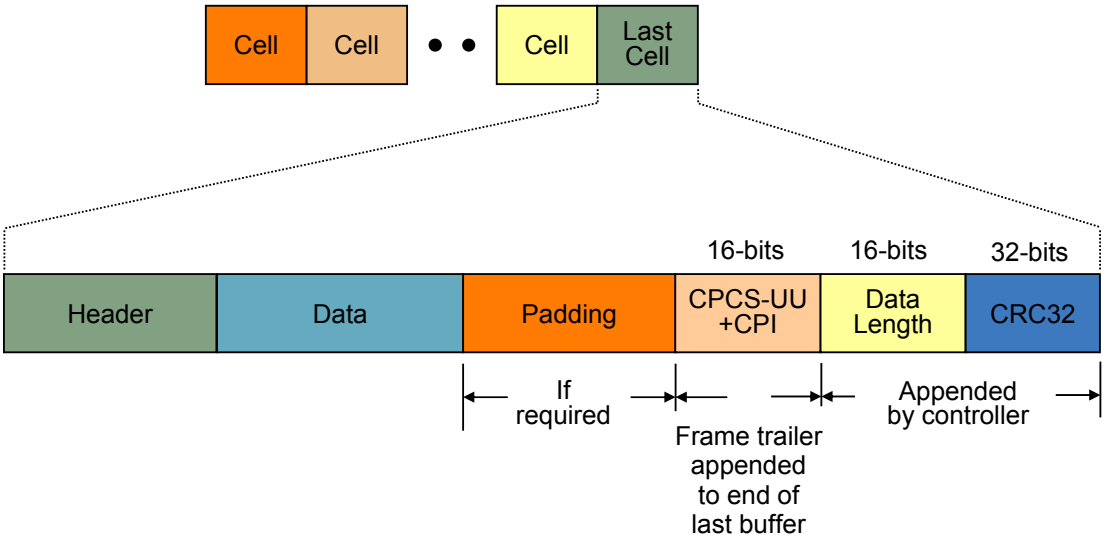
Unicast. Sending messages between single ends.

Multicast. Sending messages to multiple destinations, where there is no guaranteed delivery.

Message/stream mode. A possible drawback is that there is no distinction between data and control messages.

AAL5 Frame

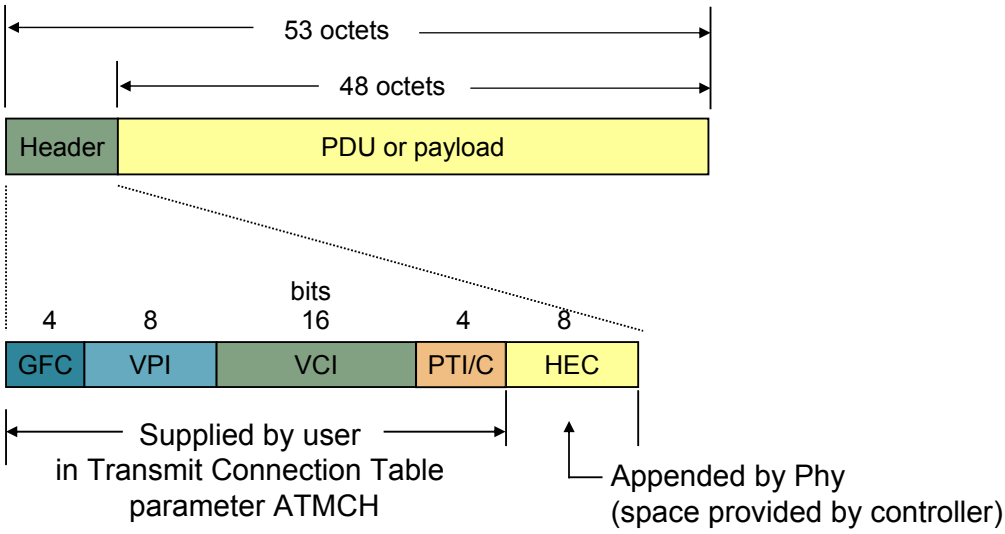
An AAL5 frame is one or more cells with an appended trailer in the last cell.



When a frame of data is to be transmitted, the first requirement is to add a trailer to it to identify it at the receiver and enable it to be re-assembled with other associated data. The data, including the trailer and other necessary information, is segmented into cells of equal size, which are transmitted over the network and re-assembled at the receiver. The frame could consist of anything up to 64 kilobytes of cells, depending on the size of the data.

AAL5 Cell

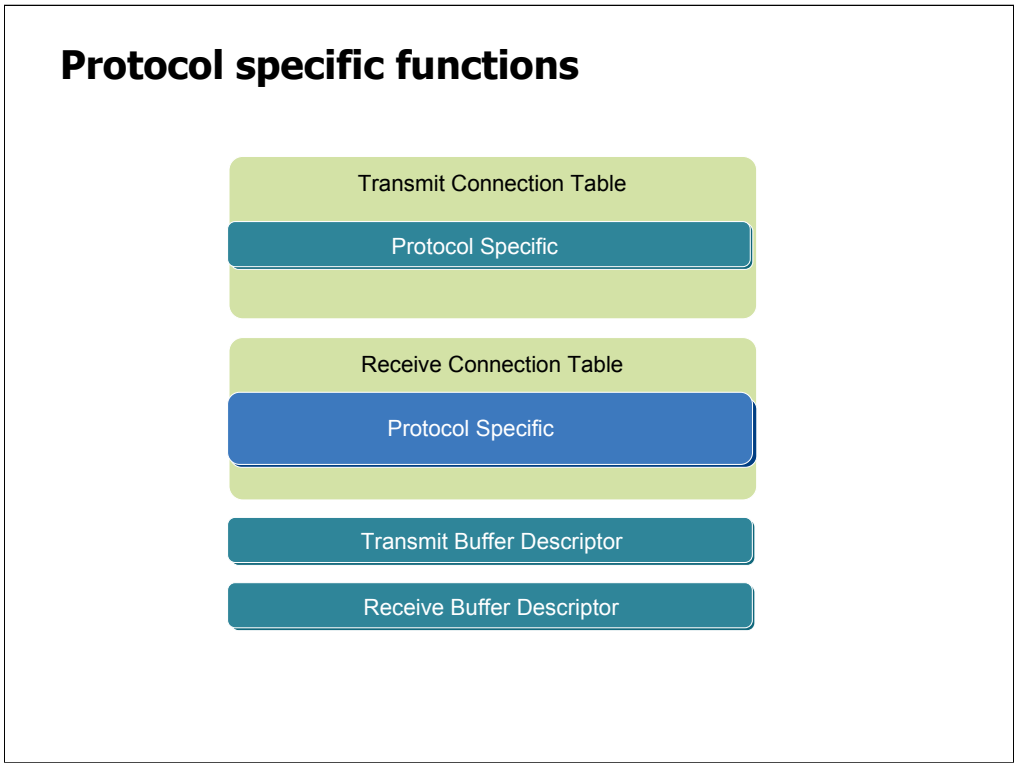
An AAL5 cell is a basic ATM cell consisting of a 48-octet AAL PDU (Protocol Data Unit) and a 5 octet cell header.



An AAL5 cell consists of 48 bytes of data, known as the Payload Data Unit, or payload, and a 5 byte header. The header provides addressing information, payload information, and header error control. The first four bits are known as generic flow control and were intended for user flow control, but are not generally used. Next is the Virtual Path Identifier, which could be analogous with the outer core of a multi-core cable in a fixed connection environment, and could define the major routing.

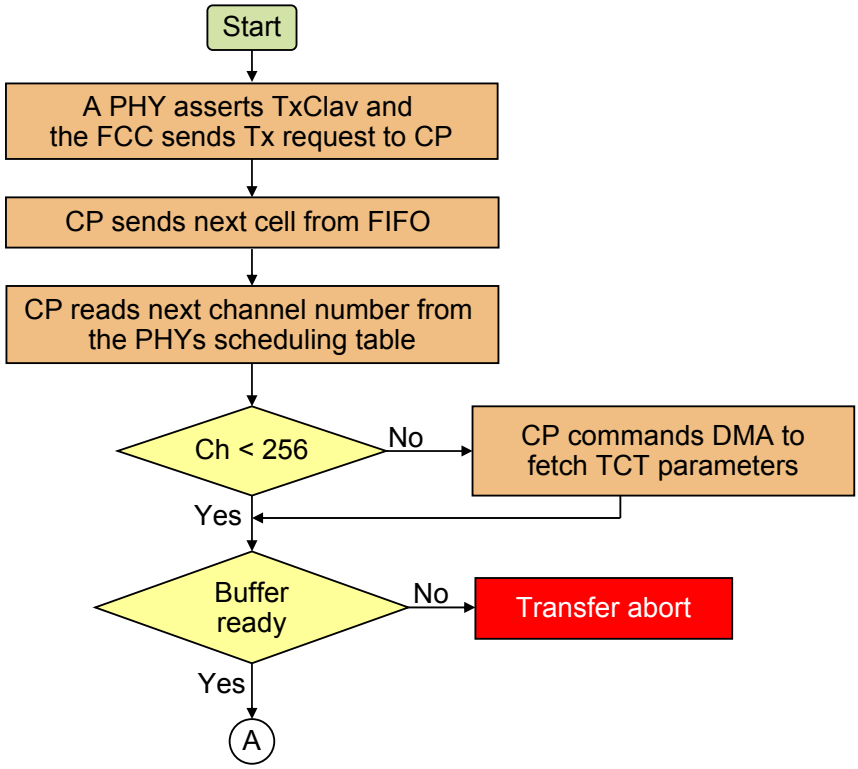
The Virtual Channel Identifier, using the above analogy, is similar to the single core in the multi-core cable, and provides the individual connection information for the data. The combination of VPI and VCI are used by the controller to define the onward routing or end receiver channel.

The final byte is for Header Error Control, to ensure the integrity of the header. This byte is supplied by the controller, but is loaded with the value by the PHY. The header is added to the payload of each cell by the controller before it is scheduled for transmission and subsequently removed from the cell at the receiver.



There are four functions which are protocol specific. Both the transmit and receive connection tables have protocol specific areas which relate to the AAL in use. The buffer descriptors also have some variations on the AAL in use. If you would like to look more closely at these, click on the item of interest.

How the FCC Transmits an AAL5 Cell (1 of 3)

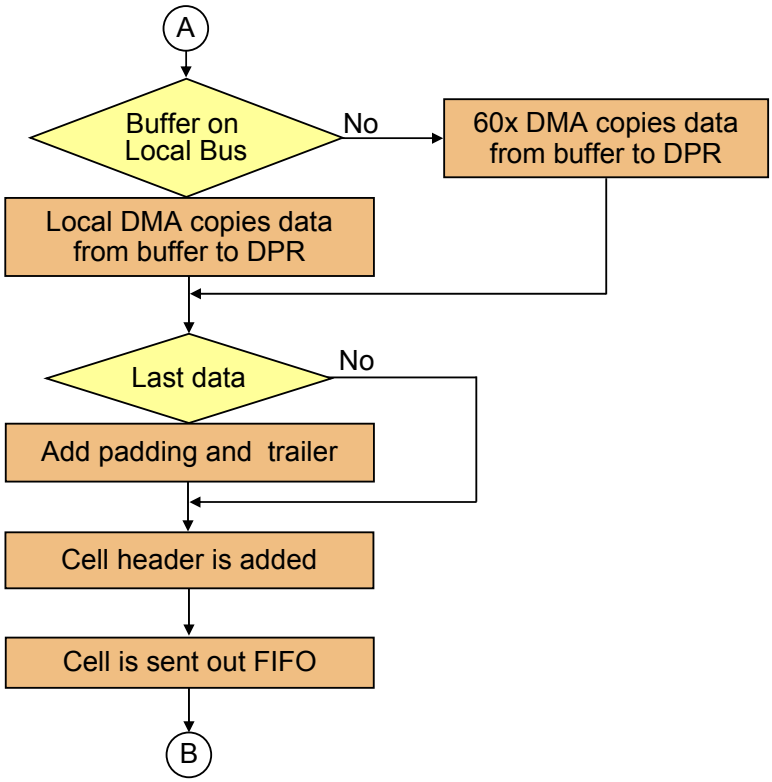


The next three pages provide a simplified flow chart of the process of transmitting an AAL5 cell. The process is initiated by the FCC, receiving a signal from the PHY that it has room for a cell to transmit. The transmit cell's available signal, results in a request to the comms processor.

The CP transfers a cell from the FIFO onto the utopia interface, with the appropriate signals, which results in space for another cell in the FIFO. The controller gets the next channel number from the scheduling table and accesses it's transmit connection table from either external memory or dual-port –ram depending on the channel number.

The connection table provides a pointer to the buffer descriptor defining the buffer containing the next cell payload, and indicates whether the buffer is ready. If it is not, then the transfer is aborted.

How the FCC Transmits an AAL5 Cell (2 of 3)

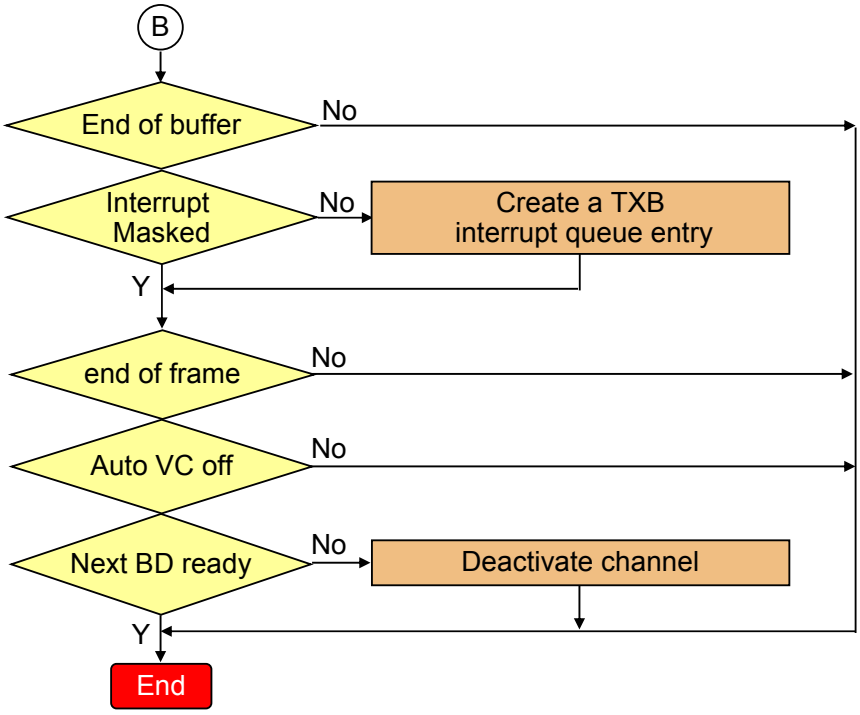


If the buffer is ready, then the connection table defines whether it is on the local or 60x bus and loads the data into the temporary buffer in dual-port-ram.

If it is the last data of the frame, then the controller fetches the next two bytes from the location following the last buffer, which contains the user provided frame trailer. The data length count and CRC result is obtained from the protocol specific portion of the connection table. All of this is appended to the end of the cell, and if this and the data is less than 48 bytes, then padding is added to bring it to a full cell count.

Regardless of whether this is the last cell or not, the cell header is obtained from the connection table and appended to the front of the payload and the complete cell transferred to the FIFO.

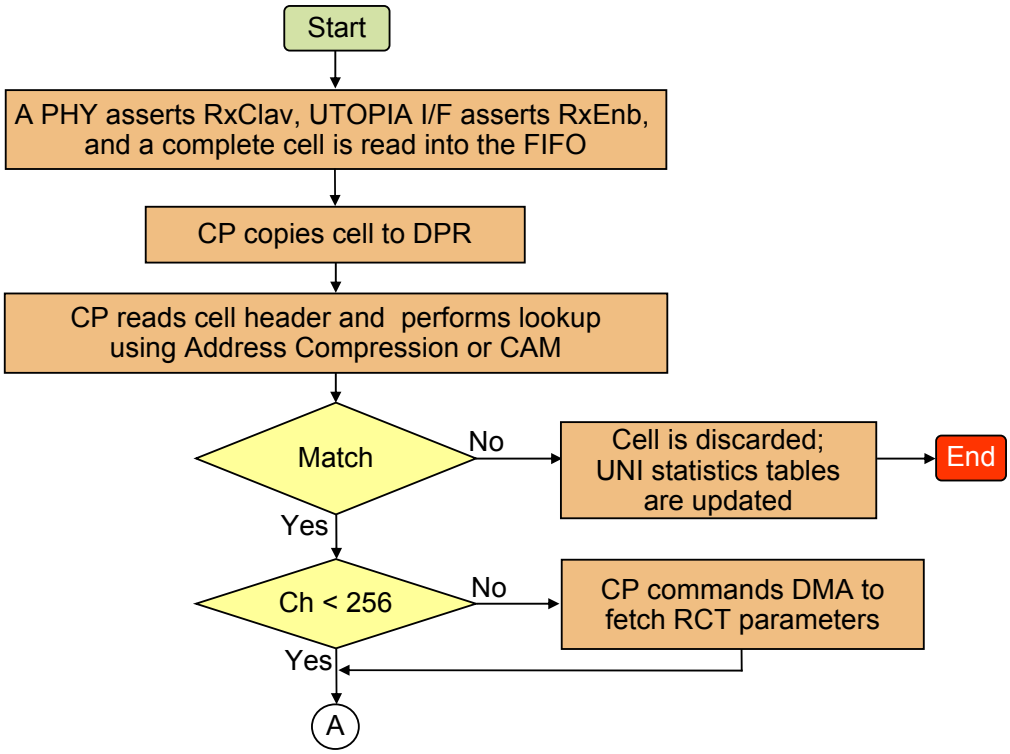
How the FCC Transmits an AAL5 Cell (3 of 3)



If this is not the end of the buffer then the process is complete, and another will be repeated when the next cell is scheduled. If it is the end of the buffer and the interrupt is not masked in the TCT, then a transmit buffer sent interrupt queue entry is generated. If it is not the end of the frame, then the process is complete, and another will be repeated when the next cell is scheduled.

If it is the end of the frame and auto VC off is enabled in the TCT, then the controller checks if the next buffer is ready. If it is not, then the channel is automatically de-activated by removing this channel number from the scheduling table. Otherwise the process is complete, and another will be repeated when the next cell is scheduled.

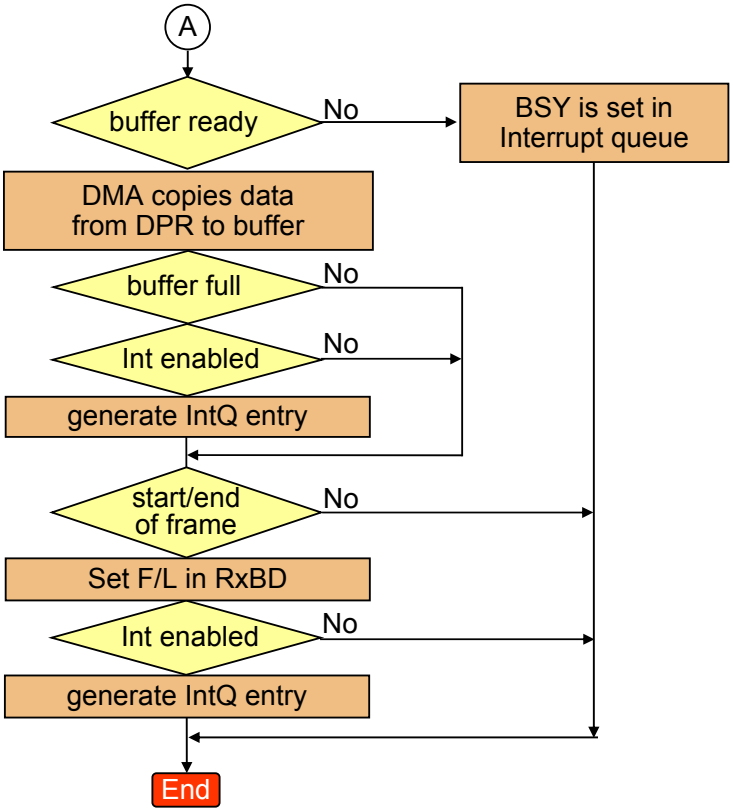
How the FCC Receives an AAL5 Cell (1 of 2)



The remaining slides provide a simplified flow for receiving an AAL5 cell. When the PHY asserts the receive cell available signal the UTOPIA replies with the receive enable signal to transfer the cell to the FIFO. The cell is then transferred to the temporary buffer in dual-port-ram where the controller examines the header.

Using either address compression or a content addressable memory, the controller obtains the channel number from the VPI and VCI and checks for a match of those address it is expecting to receive. If there is no match, then the cell is discarded, the user network information statistics are updated in dual-port-ram and the process ends. If there is a match, then the controller must access the receive connection table. If the channel number is greater than 255, then the connection table must be received from memory.

How the FCC Receives an AAL5 Cell (2 of 2)



Using the information in the connection table to access the buffer descriptor the controller checks for a buffer ready to transfer the cell to, and if there is not then the cell is discarded, an interrupt queue is generated for a busy error event, and the process ends waiting for the next cell available signal.

If a buffer is ready then the DMA controller transfers the cell payload to the buffer. If the buffer is filled and the mask is set in the RCT, then an interrupt queue entry is generated for a buffer full event. If this is the start or end of a frame then the appropriate bit is set in the buffer descriptor, and in the case of the end of frame, if the mask is set in the RCT, then an interrupt queue entry is generated for end of frame event. That completes the AAL5 module, which must be considered with the information in the general ATM module.