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SERIES I: INTEGRATED SERVICES DIGITAL NETWORK

Overall network aspects and functions – Protocol layer
requirements

B-ISDN ATM layer specification

ITU-T Recommendation I.361

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION I.361

B-ISDN ATM LAYER SPECIFICATION

Summary

This Recommendation specifies ATM header bit assignments including ATM cell structure and the associated coding for both NNI and UNI, defines service primitives to be exchanged with upper and lower layers and with the ATM management entity, and specifies ATM protocol procedures for GFC.

Source

ITU-T Recommendation I.361 was revised by ITU-T Study Group 13 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 26th of February 1999.

FOREWORD

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Recommendation I.361**B-ISDN ATM LAYER SPECIFICATION***(revised in 1999)***1 Introduction**

This Recommendation specifically addresses:

- a) the cell structure and the ATM cell coding;
- b) the ATM protocol procedures.

2 Cell structure coding

Two different coding schemes have been adopted: the UNI format and the NNI format. They are described in 2.2 and 2.3.

2.1 Cell structure

The cell consists of a five-octet header and a 48-octet information field as shown in Figure 1.

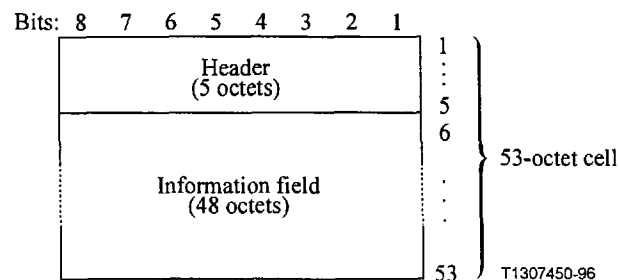


Figure 1/I.361 – Cell structure at the UNI/NNI

NOTE – The header will be sent first followed by the information field.

When a field within the header is contained within a single octet, the lowest bit number of the field represents the lowest order value.

When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases; the lowest bit number associated with the field represents the lowest order value.

This leads to the following conventions:

- bits within an octet are sent in decreasing order, starting with bit 8;
- octets are sent in increasing order, starting with octet 1;
- for all fields, the first bit sent is the Most Significant Bit (MSB).

2.2 Cell header format and encoding at UNI

The structure of the header is shown in Figure 2. The fields contained in the header and their encoding are described in the following subclauses.

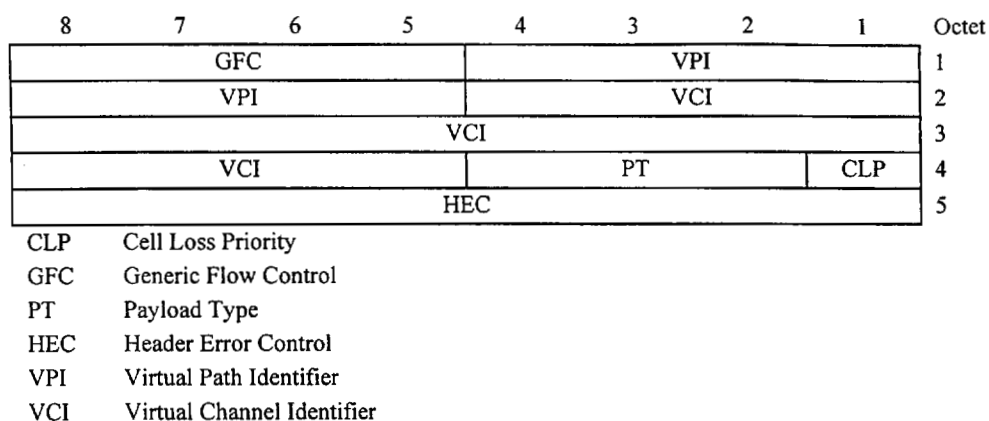


Figure 2/I.361 – Header structure at UNI

2.2.1 Pre-assigned values of the physical cell header

Physical cells are reserved for use by the Physical layer. These cells are not passed from the Physical layer to the ATM layer.

Pre-assigned values of the cell header (to differentiate cells for the use of the ATM layer from cells for the use of the Physical layer) are given in Table 1. In the case of Physical cells, the bit in the location of the CLP indication is not used for the CLP mechanism as specified in 3.4.2.3.2/I.150. All other values which are described in Tables 2 and 4 are for the use of the ATM layer.

Table 1/I.361 – Pre-assigned Physical cell header values (excluding the HEC field)

	Octet 1	Octet 2	Octet 3	Octet 4
Idle cell identification	00000000	00000000	00000000	00000001
Reserved for use of the Physical layer (Note)	PPPP0000	00000000	00000000	0000PPP1
P Indicates the bit is available for use by the Physical layer. Values assigned to these bits have no meaning with respect to the fields occupying the corresponding bit positions at the ATM layer. NOTE – Specific pre-assigned physical layer cell header values are given in Recommendation I.432-series and in other Recommendations related to Physical layer (see Appendix I).				

2.2.2 Generic Flow Control (GFC) field

The GFC field contains 4 bits.

The following provides an overview of the GFC functions for the valid codings of the GFC field (see 4.1.1).

Uncontrolled equipment will always set the GFC field to 0000. Coding of this field by controlling and controlled equipment is given in 4.1.1. The controlled equipment default mode provides for a single queue for controlled ATM connections and allows uncontrolled ATM connections. The two-queue model provides for two queues for controlled ATM connections and allows uncontrolled ATM connections. At any given instant of time, controlled equipment which may not have any controlled ATM connections active will continue to respond to the HALT command.

In the direction from the controlling equipment to the controlled equipment, the GFC field is defined as follows: (When the GFC function is not used, the value of this field is 0000.)

- The first bit indicates HALT (bit set to 1)/NO_HALT(0).

The HALT command stops the transmission towards the network of assigned ATM layer cells, including cells on uncontrolled ATM connections.

In the case of controlled ATM connections, the credit counter(s) is(are) not modified by the HALT command.

- The second bit indicates:
 - in the default mode (1-queue model) mode, SET(1)/NULL(0) for the controlled ATM connections;
 - in the 2-queue model, SET/NULL for the connections of Group A.

The SET/NULL command applies only to controlled ATM connections. It sets the credit counter to its GO_VALUE.

- The third bit is set to 0 in the default mode. In the 2-queue model, it indicates SET/NULL for the connections of Group B.
- The fourth bit is set to 0 at the S_B and T_B reference point. In the multiaccess UNI, it indicates the GFC signal of the ATM layer cell controls the emission from the B-TE* identified by its specific VPI value.

In the direction from controlled equipment to controlling equipment, the GFC field is defined as follows:

- The first bit is unused and set to 0.
- In the default mode, the second bit indicates to the controlling equipment if the cell belongs to the uncontrolled ATM connections (0), or to the controlled ATM connections (1). In the 2-queue model, it indicates if the cell belongs to the controlled ATM connections of Group A (1) or not (0).
- In the default mode, the third bit is unused and set to 0. In the 2-queue model, it indicates if the cell belongs to the controlled ATM connections of Group B (1) or not (0).
- The fourth bit indicates if the equipment is controlled (1) or uncontrolled (0).

2.2.3 Routing field (VPI/VCI)

Twenty-four bits are available for routing: 8 bits for Virtual Path Identifier (VPI) and 16 bits for Virtual Channel Identifier (VCI). Pre-assigned combinations of VPI and VCI values are shown in Table 2. Other pre-assigned values of VPI and VCI are for further study. The VCI value of zero is not available for user virtual channel identification.

The number of bits of the VPI and VCI fields used for routing are established by negotiation between the user and the network as described in 3.1.2.3/I.150. The bits within the VPI and VCI fields used for routing are allocated using the following rules:

- The allocated bits of the VPI field will be contiguous.
- The allocated bits of the VPI field will be the least significant bits of the VPI field (beginning at bit 5 of octet 2).
- The allocated bits of the VCI field will be contiguous.
- The allocated bits of the VCI field will be the least significant bits of the VCI field (beginning at bit 5 of octet 4).

Table 2/I.361 – Combinations of pre-assigned VPI, VCI, PTI and CLP values at UNI

Use	VPI	VCI (Note 8)	PTI	CLP
Unassigned cell	0	0	Any value	0
Invalid	Any VPI value other than 0	0	Any value	B
Unassigned cell (Note 13)				0
Meta-signalling (See Recommendation I.311)	Any VPI value (Note 1)	1 (Note 5)	0AA	C
General broadcast signalling (See Recommendation I.311)	Any VPI value (Note 1)	2 (Note 5)	0AA	C
Point-to-point signalling (See Recommendation I.311)	Any VPI value (Note 1)	5 (Note 5)	0AA	C
Segment OAM F4 flow cell (See Recommendation I.610)	Any VPI value	3 (Note 4)	0A0 (Note 11)	A
End-to-end OAM F4 flow cell (See Recommendation I.610)	Any VPI value	4 (Note 4)	0A0 (Note 11)	A
VP resource management cell (See Recommendation I.371)	Any VPI value	6	110 (Note 9)	A
Reserved for future VP functions (Note 6)	Any VPI value	7 (Note 10)	0AA (Note 11)	A
Reserved for future functions (Note 7)	Any VPI value	Any VCI value in the range 8 to 15 (Note 10)	0AA	A
Reserved for private network use (Note 12)	Any VPI value	Any VCI value in the range 16 to 21	0AA	A
Reserved for future functions (Note 7)	Any VPI value	Any VCI value in the range 22 to 31 (Note 10)	0AA	A
Segment OAM F5 flow cell (See Recommendation I.610)	Any VPI value	Any VCI value other than 0, 3, 4, 6 or 7	100	A
End-to-end OAM F5 flow cell (See Recommendation I.610)	Any VPI value	Any VCI value other than 0, 3, 4, 6 or 7	101	A
VC Resource management cell (See Recommendation I.371)	Any VPI value	Any VCI value other than 0, 3, 4, 6 or 7	110	A
Reserved for future VC functions	Any VPI value	Any VCI value other than 0, 3, 4, 6 or 7	111	A

The GFC field is available for use with all of these combinations.

A Indicates that the bit may be 0 or 1 and is available for use by the appropriate ATM layer function.

B Indicates the bit is a "don't care" bit.

C Indicates the originating entity shall set the CLP bit to 0. The value may be changed by the network.

Table 2/I.361 – Combinations of pre-assigned VPI, VCI, PTI and CLP values at UNI (concluded)

- NOTE 1 – For VPI value equal to 0, the specific VCI value specified is reserved for user signalling with the local exchange. For VPI values other than 0, the specified VCI value is reserved for signalling with other signalling entities (e.g. other users or remote networks).
- NOTE 2 – Intentionally left blank.
- NOTE 3 – Intentionally left blank.
- NOTE 4 – According to Recommendation I.610, transparency is not guaranteed for the OAM F4 flows in a user-to-user VP.
- NOTE 5 – The VCI values are pre-assigned in every VPC at the UNI. The usage of these values depends on the actual signalling configurations. (See Recommendation I.311.)
- NOTE 6 – This VCI value is reserved to provide function for VPs.
- NOTE 7 – These VCI values are reserved for future standardization for specific functions.
- NOTE 8 – According to Recommendation I.610, cells with VCI values 1, 2, 5, 16 through 31, and greater than 31 are monitored by the VP OAM function. Cells with other VCI values are not monitored by the VP OAM function. (See also Recommendation I.150.)
- NOTE 9 – This specifies the allowed coding of the PTI field on transmission. This VCI value shall only be used for the stated functions regardless of the coding of the PTI field. It is an implementation option on how to process errored cells received with VCI = 6 and PTI not equal to 110. In particular, such cells may be processed as VP RM cells.
- NOTE 10 – Transparency of the payload for these VCI values is not guaranteed, i.e. cells with these VCI values may be extracted or inserted at midpoints of a VP. The specific situations under this extraction/insertion may occur are for further study. In the absence of this further study, the payload for these VCI values shall be transparently transported in a VP.
- NOTE 11 – This specifies the allowed coding of the PTI field on transmission. These VCI values shall only be used for the stated functions regardless of the coding of the PTI field. On reception, the PTI field is not used for the purpose of identifying the cell type. For example, a cell with VCI = 4 will be treated as an end-to-end F4 OAM cell regardless of the coding of the PTI field.
- NOTE 12 – ITU will neither maintain nor assign this group of VCIs.
- NOTE 13 – For the point-to-point UNI, it is an invalid cell. If received on a point-to-point UNI, the cell will be treated as an unassigned cell (i.e. discarded). For the multiaccess UNI using GFC protocol, it is an unassigned cell. In the multiaccess UNI GFC protocol, identification of the end terminal is done by VPI values. When there is no user cell, unassigned cells are sent to the right terminal using VPI field as a terminal address.

In addition, unallocated bits, i.e. bits not utilized by the user or the network, within the 24-bit routing field will be set to zero.

See 3.1.3/I.150 and 3.1.4/I.150 for VPI/VCI assignment information.

2.2.4 Payload Type (PT) field

Three bits are available for PT identification. The following table describes the payload type identifier (PTI) coding.

PTI coding

bits

4 3 2

0 0 0	User data cell, congestion not experienced. ATM user-to-ATM-user indication = 0
0 0 1	User data cell, congestion not experienced. ATM-user-to-ATM-user indication = 1
0 1 0	User data cell, congestion experienced. ATM-user-to-ATM-user indication = 0
0 1 1	User data cell, congestion experienced. ATM-user-to-ATM-user indication = 1
1 0 0	OAM F5 segment associated cell
1 0 1	OAM F5 end-to-end associated cell
1 1 0	Resource management cell
1 1 1	Reserved for future VC functions

Any congested network element, upon receiving a user data cell, may modify the PTI as follows. Cells received with PTI = 000 or PTI = 010 are transmitted with PTI = 010. Cells received with PTI = 001 or PTI = 011 are transmitted with PTI = 011. Non-congested network elements should not change the PTI. See Recommendation I.371.

The use of PTI = 110 is reserved for resource management use. See Recommendation I.371.

The use of PTI = 100 is discussed in Recommendation I.610.

The use of PTI = 101 is discussed in Recommendation I.610.

When the PTI value is set to 111 in a cell, the function of the ATM layer will be found in a field of the payload of that cell. The length of this field is for further study. The allocation of the extended values are under the control of ITU-T. The coding of the remaining part of the payload should be done by the group which has proposed the functions in consultation with ITU-T.

2.2.5 Cell Loss Priority (CLP) field

Depending on network conditions and for some ATM transfer capabilities (see Recommendation I.371), cells where the CLP is set (CLP value is 1) are subject to discard prior to cells where the CLP is not set (CLP value is 0). (See Recommendation I.371 for further details about the use of the CLP bit.)

2.2.6 Header Error Control (HEC) field

The HEC field consists of 8 bits. Use of this field is described in 4.3/I.432.

2.3 Cell header format and encoding at NNI

The structure of the header is shown in Figure 3. The fields contained in the header and their encoding are described in the following subclauses.

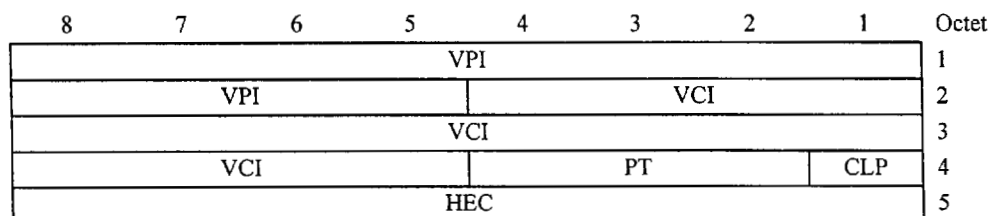


Figure 3/I.361 – Header structure at NNI