ATM Connections on Demand

Introduction

Control

Call and Connection

Though they may remain active for an arbitrary amount of time, on-demand sessions may not be immediately released. All GoS needed for the session in the event of a network failure, congestion, or disconnection procedure. With connection setup, the user must first establish an ATM connection, with both connection setup procedures for operation (ATM Forum). This section describes the ATM Forum has reached a consensus on how connection setup procedures are organized around the

Table 10-1: Capabilities of ATM Demand Connections

Non-support of multi-connection operations

Not allowed to run-to-end capability parameters

Connection registration procedure

Verifier for addressing formats

Preferred or alternate carriers

Definition of an out-of-band signaling channel

Definition of VPI/VCI types

Non-interception of GoS between users

Support for class A, C, and X transport services

Multiple connection procedures for call setup, request, answer, clear, and out-of-band signaling

Single connection calls

Symmetry or asymmetry bandwidth requirements

Point-to-point and point-to-multipoint connections

Connection on demand (reserved)

These ATN services, focused on PDC implementation, with user-settable at any time, are described in a later section. This chapter examines the ATM call and connection control operations.
**Initial Domain Identifier (IDI):** Specifies the addressing domain

- **46 = E.164 format**
- **47 = IOD ATM format**
- **39 = DCC ATM format**

**Authority Domain Identifier (ADI):** Contains a one-byte field to identify the domain-specific part (DSP) for ATM. The DSP field is coded as:

1. The DSP field contains the address of the NSAP that identifies the type of service, the domain, and the area.
2. The DSP field is used to identify the service specified for the NSAP address.
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Figure 10-2

The reverse direction

Note: Similar activities can occur in

- Request
- Get
- Post
- Accept
- Give addresses, address format, etc.

Response

Prefix

Prefix for addresses

Next for addresses

initialization procedures

User

UIN

The OSI/ATM Address Formats

(a) Format for E.164 Addresses

(b) Format for DCC and 1CD Addresses

The American National Standards Institute (ANSI), which identifies an internetwork, and also defines the format and structure of the addresses, is responsible for the allocation of addresses in certain fields in the DCC. (AA) is an organization recognized by the ISO that is responsible for the other aspects of the remainder of the DCC. The administrative authority of the network authority for ATM, the conference, determines the value and format of the addresses and is published by the British Standards Institute of (3) 3166: (c) the international code designator (ICD), which identifies an internetwork.

Figure 10-1
Table 10-2 ATM Connection Control Messages

<table>
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<tr>
<th>Function</th>
<th>Message</th>
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<td>CONNECT Acknowledge</td>
</tr>
<tr>
<td>CALL RESUME</td>
<td>CONNECT Acknowledge</td>
</tr>
<tr>
<td>CALL PROCEEDING</td>
<td>CONNECT Acknowledge</td>
</tr>
<tr>
<td>CALL ABORT</td>
<td>CONNECT Acknowledge</td>
</tr>
<tr>
<td>CALL RELEASE</td>
<td>CONNECT Acknowledge</td>
</tr>
</tbody>
</table>

When the user side is registered, the ATM layer provides the necessary interfaces to support the function of the user side. The user side sends an AAL2 message to the ATM layer to indicate that it wishes to register on the ATM side. The ATM layer then sends an AAL2 message to the user side to indicate that it has registered. This process is repeated until the user side is registered.

The user side can send and receive data to and from the network using the AAL2 protocol. The protocol provides a interface to the user side for data transfer. The user side can also send and receive data to and from the network using the AAL2 protocol.

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Each connection is controlled by states, for example, a user enters into a "call present" state when a call establishment request has been received but the user has not yet responded to the request. Various states are possible, such as "idle", "transient", and "error". Table 3 summarizes these states, and Table 4 outlines the general operations that are performed in each state.

To illustrate, the user enters the "call present" state after the call establishment request has been received. The user's network then initiates a connection setup, and the NATT UIM interface provides the sequence and completion of a state transition. For the connection, the NATT UIM interface provides the sequence and completion of a state transition.

Figure 10-4 illustrates the steps involved in setting up a connection. The user initiates a call by sending a "connect" message to the network. The network responds with a "call proceed" message, and the user is informed of the progress. The call proceeds through a series of states, including "call established" and "call completed".

Information elements that are transferred in the messages for the connection are illustrated in Figure 10-3. The messages in the boxes in Figure 10-4 depict the main fields for the connection. The user's network is responsible for the message across the network. Other parameters are not included because they are not needed to clear the state. The effect of this message across the network. Other parameters are not included because they are not needed to clear the state.
The timer T903 can also be stopped if either a CONNECT message or a SETUP message is received. If both are received, the CONNECT message is acknowledged, and the SETUP message is discarded. If only the SETUP message is received, the CONNECT message is acknowledged.

A virtual channel is considered to be disconnected when it is no longer a part of the connection. A virtual channel is considered to be reconnected when it becomes a part of the connection again.

Before discussing and providing some examples of connection control examples, please refer to Figure 10-5, which shows the timers involved for the establishment of a connection. These timers are involved in the process and perform the following functions:

- **Setup**
  - ADP PARTY ACKNOWLEDGE ADP RELEASE received
  - DROP PARTY sent
  - ADP PARTY ACKNOWLEDGE or RELEASE received
  - STATUS ENQUIRY sent
  - INITIAL CLEANING or call reference received
  - ADP PARTY ACKNOWLEDGE received
  - CALL PROCEEDING sent
  - SIGNAL received
  - CALL PROCEEDING received
  - RELEASE COMPLETE or RELEASE received
  - SETUP sent

- **Timer**
  - Normal
  - Setup

<table>
<thead>
<tr>
<th>Stop</th>
<th>Normal</th>
<th>Setup</th>
<th>Class For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer</td>
<td>Number</td>
<td></td>
<td></td>
</tr>
</tbody>
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</table>

Sample connection control examples:

- Connect PARTY RELEASE or RELEASE received
  - PARTY ACKNOWLEDGE or ADP RELEASE received
  - DROP PARTY sent
  - ADP PARTY ACKNOWLEDGE or RELEASE received
  - STATUS ENQUIRY sent
  - INITIAL CLEANING or call reference received
  - ADP PARTY ACKNOWLEDGE received
  - CALL PROCEEDING sent
  - SIGNAL received
  - CALL PROCEEDING received
  - RELEASE COMPLETE or RELEASE received
  - SETUP sent

- Not supported in this implementation agreement.

Table 10-3: Timers in the Network Side
The connection setup procedure:

- **Stop 1310**
- **Connect**
- **Setup**
- **Call Proc**
- **SETUP**
- **Call Proc ACK**
- **CONNECT**
- **CONNECT ACKNOWLEDGMENT**

**Figure 10-5**

Connection Release:

- **Stop 1310**
- **Connect**
- **Setup**
- **Call Proc**
- **SETUP**
- **Call Proc ACK**
- **CONNECT**
- **CONNECT ACKNOWLEDGMENT**

The connection is released by the procedure when the call is dropped or the network decides to release the call.

Notes:
- This procedure is triggered by the network's decision to release the connection.
- It is used to inform the other party about the release.
- The CONNECT ACKNOWLEDGMENT message is sent to confirm the receipt of the CONNECT message from the other party.
- This ensures that both parties are aware of the call's termination.
procedures to support these types of applications. This capability is in
Because of the importance and wide use of telephone conference

Add Party

errors on a link basis.
message, this timer is turned off to be aware that a status enquiry only op-
message. Upon receipt of the STATUS INQUIRY message, if the
point connection, as indicated in Fig 10-6. The timer starts when the
the user to determine the state of the connection, such as the call state, the
The status Inquiry procedure is invoked by either the network or

Status Inquiry

are to be restricted.

channel is to be restricted or all channels controlled by this layer 2 entity

Restart Procedure

message. Labelled restart indicator determines if an indicated virtual
An timer expires, the call reference as well as the virtual channel,
null: a party does not exist; therefore an endpoint reference

The scenario shown in this figure is similar to the one described in Figure 1. However, in this case, the remote node has requested a SETUP message, which has been sent by the originating node. The destination node has then sent a SETUP message in response, indicating that it is ready to establish the connection. The originating node then sends another SETUP message, followed by an ADD PARTY ACK message, indicating that the connection has been established.

The diagram shows the flow of messages and the state transitions involved in setting up a bidirectional connection with multiple parties. The network layer is shown in the center, with the user and the originating node at the top. The diagram includes state transition labels and message exchange paths.

In the context of the IGAPv2 guidelines, this scenario illustrates how to establish a connection between two nodes and add multiple parties to the conversation. The steps include:

1. The originating node sends a SETUP message to the destination node.
2. The destination node responds with a SETUP message.
3. The originating node sends another SETUP message, followed by an ADD PARTY ACK message.
4. The destination node sends a STATUS message to confirm the connection.

These steps ensure the successful establishment of a connection with multiple parties, as described in Figure 2.
The ATM SVC supports both point-to-point connections and point-to-multipoint connections. The point-to-multipoint messages allow one ATM link (the trunk link) to send information to any remaining nodes on the same VC. Multiple VCIs can be supported in a single ATM SVC.

Messages for Adding and Dropping Parties

The messages used for the global call reference are listed in Table 10-6. An example of the information elements that are need in these messages is shown below.

### Messages for Call Control

Examples of the messages and the information elements that are needed in the messages. A single message shows coding examples that may be present in the messages. A key is provided within Table 10-5 to identify the information elements that are needed by the network or user.

### Functions of Q.2931 Messages and Information Elements

The messages used for the global call reference are listed in Table 10-6. An example of the information elements that are need in these messages is shown below.
## Descriptions of the Information Elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Message</td>
<td>Information present in the messages. The control are shown in Table 10-7, as well as the information element. The messages used with ATM point-to-multipoint call and connection. Drop a party from an existing point-to-multipoint connection. Drop a party message (again, as the name implies) are used to reflect that the add party was successful. The add party returns knowledge that the add party request was successful. The connection, these nodes are called leaf nodes and receive copies of all the information sent by the root node. The leaf party messages (as their name implies) are used to reflect that the connection. These nodes are called leaf nodes and receive copies of all the information sent by the root node.</td>
</tr>
</tbody>
</table>
In Table 10-5, AVTN messages are listed. These values are placed in several of the 3, 4, 5, 6 columns.

<table>
<thead>
<tr>
<th>Message</th>
<th>Protocol Discriminator</th>
<th>Message Type</th>
<th>Message Length</th>
<th>Message Code</th>
<th>Cell Reference</th>
<th>AVTN Parameters</th>
<th>VPL Parameters</th>
<th>Call Reference</th>
<th>Call Party Number</th>
<th>Call and Calling Party Subaddress</th>
<th>Broadband Low Power Information</th>
<th>Broadband High Power Information</th>
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</table>

Table 10-8: Functions of the Information Service Elements
Examplary of the bearer parameters are an indication that braking

user node.

no effect on the ATM network, and are passed transparently to the end-

The parameters here serve to provide a link for the OSI

connection at a B-ISDN bearer service (the lower three layers of OSI)

information elements include a wide variety of service-related

Broadband bearer capability and higher layer information.

the connection into the network party called and calling party sub-

point (NSAP).

16.4, type, and an OSI address known as the network access

network address - The purpose of the sub-address to provide a link for the OSI

The best identifier is the network party called and calling party sub-

point (NSAP).

ATM user traffic descriptor: The parameters in the Traffic descriptor:

- Error correction method for AAL I
- Mode for AAL 2 (message mode or streaming mode)
- Clock recovery type for AAL 1
- CRP type (64 Kbps, DS1, E1 x 64 Kbps, etc.)
- Maximum SDL size for AAL 3/4
- Etc.

Subtype of traffic (channel identifies, high-speed audio, video,

7 type of traffic (1, 2, 3, 4, 5, or user-defined)

ATM AL parameters:

The parameters in the AAL information element.

To carry the difference between the party number and the party

ATM AL parameters.

The parameters in the AAL information element.

of the connection identifier is not an identifier as such, but is

the connection identifier contains the VP and VC values.

that exist in other types of networks.

This approach avoids avoid collisions (simultaneous use of the same value).

by the VP/VCI values can be used in many number-dialing access by the VP and VC values.

Within the connection identifier contains the VP and VC values.

For a network, the VP/VCI values are used as network and eX.25 call reference values. These may on the same network

Table: 10-8 Functions of the Information Service Element (cont'd)

- Reseeding rate
- Reseeding factor (e.g., 100)
- Bounding state
- Indentify each endpoint (and party identifier)
- Endpoint reference
Protocol error, unsolicited
Inconsistency message length
Recover on timer expiration
Peer refusal not compatible with call state
Invalid information element contents
Information element nonexistent or not implemented
Invalid information element 3 not missing
AVP parameters cannot be supported
Too many pending call party requests
Invalid transmit network selection
Invalid endpoint reference
Incompatible destination
Invalid endpoint does not exist
Invalid local reference value
Unsupported combination of traffic parameters
Peer capability not implemented
Service option not available
Peer capability not presentable
Peer capability not authorized
Calling party descriptor not available
Quality of service unavailable
No VPI/VCI available
Access information discarded
Transport failure
Network out of order
Not requested VPI/VCI not available
Message in operation
Stuck ENQUIRY
Table 10-9 Cause Values (continued)

Part 7 [ATM99a],

In this information element, Table 10-9 lists the cause values currently published.

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<tbody>
<tr>
<td>Invalid number format (address complete)</td>
<td>0x0000</td>
<td>Destination out of order</td>
</tr>
<tr>
<td>Layer refuses all calls with calling party identification restriction (CIR)</td>
<td>0x0001</td>
<td>Circuit refused</td>
</tr>
<tr>
<td>Call refused</td>
<td>0x0002</td>
<td>Call busy</td>
</tr>
<tr>
<td>Layer busy</td>
<td>0x0003</td>
<td>VPI/VCI unacceptable</td>
</tr>
<tr>
<td>No route to destination</td>
<td>0x0004</td>
<td>No route to specified transport network</td>
</tr>
<tr>
<td>No route to specified transport network</td>
<td>0x0005</td>
<td>No route to specified transport network</td>
</tr>
</tbody>
</table>

The above networks, with ATM, act as the backbone transport network for other networks, with ATM, the backbone transport network. Certain ATM operations, however, are not implemented in these networks. Chapter 11, Interworking with ATM Networks, shows how these operations are implemented in the ATM layer. Examples of functions of given messages and information elements
Chapter 10-11: Transmission Control and Connection Control

Example of a 0.2391 Message

<table>
<thead>
<tr>
<th>Bit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Length of cell reference value</td>
</tr>
<tr>
<td>4</td>
<td>Call reference value (continued)</td>
</tr>
<tr>
<td>5</td>
<td>Message type</td>
</tr>
<tr>
<td>6</td>
<td>Message length</td>
</tr>
<tr>
<td>7</td>
<td>Message type (continued)</td>
</tr>
<tr>
<td>8</td>
<td>Variable length information elements</td>
</tr>
</tbody>
</table>

In order to understand the encoding structure of the ATM message, the following is a list of the 0.2391 standard.

**Coding Conventions**

- The message type defines the message's type, which is used to identify the message type. The field 'length' is encoded for all 0.2391 type messages except for the header, which includes the header field. The length field includes the length of the message, including the header.
- The message length specifies the length of the message, including the header.
- The message type defines the message by specifying the length of the message, including the header.
- The variable length information elements define the length of the message, including the header.

**Examples Of 0.2391 Messages**

Choose the Interconnection Control (ICC) for the session. This allows the user to

**Transport Network Selection**

This selection defines many roles for coding messages.
The multipler parameter is used to define a parameter indicating the range from 2 to 2^6-1. The clock recovery type parameter indicates the number of clock bits. In the following table, the multipler parameter is given with a value of 2^4 clock bits.

<table>
<thead>
<tr>
<th>Multiplier Value</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00000001</td>
</tr>
<tr>
<td>1</td>
<td>00101000</td>
</tr>
<tr>
<td>2</td>
<td>01001000</td>
</tr>
<tr>
<td>3</td>
<td>01101000</td>
</tr>
<tr>
<td>4</td>
<td>10001000</td>
</tr>
<tr>
<td>5</td>
<td>10101000</td>
</tr>
<tr>
<td>6</td>
<td>11001000</td>
</tr>
<tr>
<td>7</td>
<td>11101000</td>
</tr>
<tr>
<td>8</td>
<td>00010000</td>
</tr>
<tr>
<td>9</td>
<td>00110000</td>
</tr>
<tr>
<td>10</td>
<td>01010000</td>
</tr>
<tr>
<td>11</td>
<td>01110000</td>
</tr>
<tr>
<td>12</td>
<td>10010000</td>
</tr>
<tr>
<td>13</td>
<td>10110000</td>
</tr>
<tr>
<td>14</td>
<td>11010000</td>
</tr>
<tr>
<td>15</td>
<td>11110000</td>
</tr>
</tbody>
</table>

Parameter for an AAL 2 connection.

<table>
<thead>
<tr>
<th>Parameters for an AAL 2 connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.1</td>
</tr>
<tr>
<td>Partially filled cells method</td>
</tr>
<tr>
<td>1 0 0 0 1 0 1 1 1</td>
</tr>
<tr>
<td>Partially filled cell indicator</td>
</tr>
<tr>
<td>Structured data transfer blocksize</td>
</tr>
<tr>
<td>1 0 0 0 1 0 1 0 1</td>
</tr>
<tr>
<td>Structured data transfer blocksize indicator</td>
</tr>
<tr>
<td>Error correction method</td>
</tr>
<tr>
<td>1 0 0 0 1 0 1 0 1</td>
</tr>
<tr>
<td>Error correction method indicator</td>
</tr>
<tr>
<td>Source clock frequency recovery method</td>
</tr>
<tr>
<td>1 0 0 0 1 0 0 0 0</td>
</tr>
<tr>
<td>Source clock frequency recovery method indicator</td>
</tr>
</tbody>
</table>

Further content depending upon AAL 2 type:

<table>
<thead>
<tr>
<th>AAL 2 Type</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00001000</td>
</tr>
<tr>
<td>1</td>
<td>00011000</td>
</tr>
<tr>
<td>2</td>
<td>00101000</td>
</tr>
<tr>
<td>3</td>
<td>00111000</td>
</tr>
<tr>
<td>4</td>
<td>01001000</td>
</tr>
<tr>
<td>5</td>
<td>01011000</td>
</tr>
<tr>
<td>6</td>
<td>01101000</td>
</tr>
<tr>
<td>7</td>
<td>01111000</td>
</tr>
<tr>
<td>8</td>
<td>10001000</td>
</tr>
</tbody>
</table>

Examples of Quality Messages:

<table>
<thead>
<tr>
<th>Quality Messages</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00000000</td>
</tr>
<tr>
<td>1</td>
<td>00010000</td>
</tr>
<tr>
<td>2</td>
<td>00100000</td>
</tr>
<tr>
<td>3</td>
<td>00110000</td>
</tr>
<tr>
<td>4</td>
<td>01000000</td>
</tr>
<tr>
<td>5</td>
<td>01010000</td>
</tr>
<tr>
<td>6</td>
<td>01100000</td>
</tr>
<tr>
<td>7</td>
<td>01110000</td>
</tr>
<tr>
<td>8</td>
<td>10000000</td>
</tr>
</tbody>
</table>

CBR Field:

<table>
<thead>
<tr>
<th>CBR Field</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00000000</td>
</tr>
<tr>
<td>1</td>
<td>00010000</td>
</tr>
<tr>
<td>2</td>
<td>00100000</td>
</tr>
<tr>
<td>3</td>
<td>00110000</td>
</tr>
<tr>
<td>4</td>
<td>01000000</td>
</tr>
<tr>
<td>5</td>
<td>01010000</td>
</tr>
<tr>
<td>6</td>
<td>01100000</td>
</tr>
<tr>
<td>7</td>
<td>01110000</td>
</tr>
<tr>
<td>8</td>
<td>10000000</td>
</tr>
</tbody>
</table>

Variable length of AAL 2 parameters (continued):

<table>
<thead>
<tr>
<th>Variable length of AAL 2 parameters</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00000000</td>
</tr>
<tr>
<td>1</td>
<td>00010000</td>
</tr>
<tr>
<td>2</td>
<td>00100000</td>
</tr>
<tr>
<td>3</td>
<td>00110000</td>
</tr>
<tr>
<td>4</td>
<td>01000000</td>
</tr>
<tr>
<td>5</td>
<td>01010000</td>
</tr>
<tr>
<td>6</td>
<td>01100000</td>
</tr>
<tr>
<td>7</td>
<td>01110000</td>
</tr>
<tr>
<td>8</td>
<td>10000000</td>
</tr>
</tbody>
</table>
with internetworking operations.

These examples have given the reader an idea of the syntax and for

\section*{User Traffic Descriptors}

and (4) SSCS type (such as assured operations, a frame relay SSCS, etc).

\section*{Parameters for an ALL 6 connection.}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{table}
\caption{Parameters for an ALL 3/4 connection.}
\end{figure}

\section*{AL 3/4 and AL 5.}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{table2}
\caption{Parameters for an ALL 3/4 connection.}
\end{figure}
SUMMARY