**Coprocessor ATM Reassembler
User Manual 2.5.5r1**

Leading Network Intelligence

Typographical Conventions Used in this Document

- Command-line examples suitable for entering at command prompts are displayed in `mono-space courier font`.

    Results generated by example command-lines are also displayed in `mono-space courier font`.

Protection Against Harmful Interference

When present on equipment this manual pertains to, the statement "This device complies with part 15 of the FCC rules" specifies the equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the Federal Communications Commission [FCC] Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Extra Components and Materials

The product that this manual pertains to may include extra components and materials that are not essential to its basic operation, but are necessary to ensure compliance to the product standards required by the United States Federal Communications Commission, and the European EMC Directive. Modification or removal of these components and/or materials, is liable to cause non compliance to these standards, and in doing so invalidate the user's right to operate this equipment in a Class A industrial environment.

Table of Contents

USE THIS SPACE FOR NOTES

1.0 PREFACE

1.1 User Manual Purpose

Description　　The purpose of this User Manual is to identify and describe:

- An overview of the ATM Reassembler
- Endace Record Format
- Configuring DAG card and coprocessor
- Operating DAG coprocessor ATM Reassembler
- Statistics, counters and events reporting

Figure　　Figure 1-1 shows the Coprocessor ATM Reassembler.

Figure 1-1. Coprocessor ATM Reassembler.

1.2 ATM Reassembler Current Performance Factors

Description　　Several features outlined in the product specification are not implemented in the current ATM Reassembler release.

In this section　　This section covers the following topics of information.

- Features not Available
- Current Performance
- Customer Support

1.2.1 Features not Available

Description　　The principal features not included are:

- VC/VP Filtering
- Activity time-out
- Instantaneous access to state tables

These features may be added and the revised software/firmware made available for access to them.

1.2.2 Current Performance Levels

Description The current ATM Reassembler released by Endace cannot achieve full performance levels. Full performance is defined as being a fully utilised link containing representative traffic patterns. For the DAG 3.8S card, up to two such links are supported.

The figures in the following tables are performance examples, actual numbers may vary with the local network used.

Full performance Table 1-1 outlines the ATM Reassembler full performance.

Card	Number	Link Rate	Cells/Second
DAG 3.8S	Single	OC3c	380K
	Dual	OC3c	760K
	Single	OC12c	1.3M
	Dual	OC12c	2.6M
DAG 4.3S	Single	OC48c	5.54M

Table 1-1. ATM Reassembler Full Performance Outline.

1.2.2 Current Performance Levels, continued

Actual performance Table 1-2 outlines the ATM Reassembler actual performance.

Card	Number	Link Rate	Cells/Second	Utilisation
DAG 3.8S	Single	OC3c	380K	100%
	Dual	OC3c	760K	100%
	Single	OC12c	1.3M	100%
	Dual	OC12c	2.4M	80%
DAG 4.3S	Single	OC48c	2.3M	42%

Table 1-2. ATM Reassembler Actual Performance Outline.

1.3 Customer Support

Description Contact support@endace.com with comments or feedback about the present and/or proposed feature sets, or if functional problems are encountered that are not described in this document.

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USE THIS SPACE FOR NOTES

2.0 ATM REASSEMBLER OVERVIEW

Introduction   The theory of the Coprocessor Reassembler is explained in the cell level processing and ATM reassembly process.

Figure`   Figure 1-1 shows the Endace DAG ATM Reassembler basic datapath.
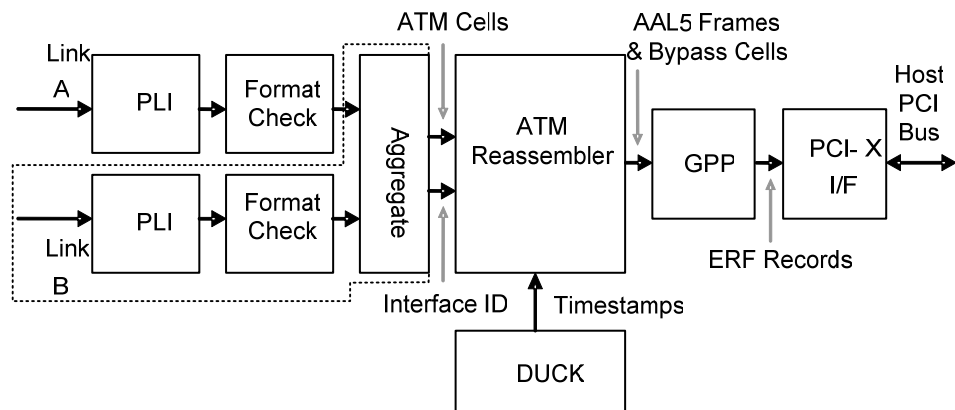
Figure 1-1. Endace DAG ATM Reassembled Basic Datapath.

DAG Cards   For the DAG 4.3S card a single PLI feeds cells for reassembly at OC48c rate. For the DAG 3.8S card two PLI's feed cells for reassembly, both at either OC3c or OC12c rate. The identical VCI/VPI values on each link will be distinguished and reassembled separately.

In this chapter   This chapter covers the following sections of information.

- ATM Reassembler Traffic Components
- Extensible Record Format Field Functions

2.1 ATM Reassembler Traffic Components

Description   The ATM Reassembler target performance specifications are:

- DAG 3.8S: Complete reassembly of two, fully utilized, OC12c network links carrying a "representative" distribution of AAL5 encapsulated ATM cell traffic on as many as 65535 VC/VPs simultaneously.

- DAG 4.3S: Complete reassembly of a single, fully utilized, OC48c network links carrying a "representative" distribution of AAL5 encapsulated ATM cell traffic on as many as 65535 VC/VPs simultaneously.

In this chapter   This chapter covers the following sections of information.

- Traffic Components
- Performance Issues

4

2.1.1 Traffic Components

Description   Four traffic components are combined to form the representative test-traffic pattern used to establish the ATM Reassembler performance. Each component as a proportion of the total number of ATM cells and AAL5 frames that form the combined result.

Traffic components   The following table describes the traffic components.

Cell Proportion	Frame Proportion	Traffic Type
1.00%	14.30%	Cells constituting frames having a length normally distributed about 40 bytes with a standard deviation of 5 bytes.
10.00%	14.30%	Cells constituting packets having a length normally distributed about 576 bytes with a standard deviation of 10 bytes.
60.00%	57.10%	Cells constituting packets having a length randomly distributed between 40 and 1500 bytes.
28.00%	14.30%	Cells constituting packets having a length normally distributed about 1500 bytes with a standard deviation of 20 bytes.
1.00%	-	Cells marked as Operation and/or Management [OAM].

Continued on next page

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2.1.1 Traffic Components, continued

Traffic components,continued

Figure   Figure 1-1 shows typical distribution of AAL5 frame-sizes in units of
                    ATM cell units.
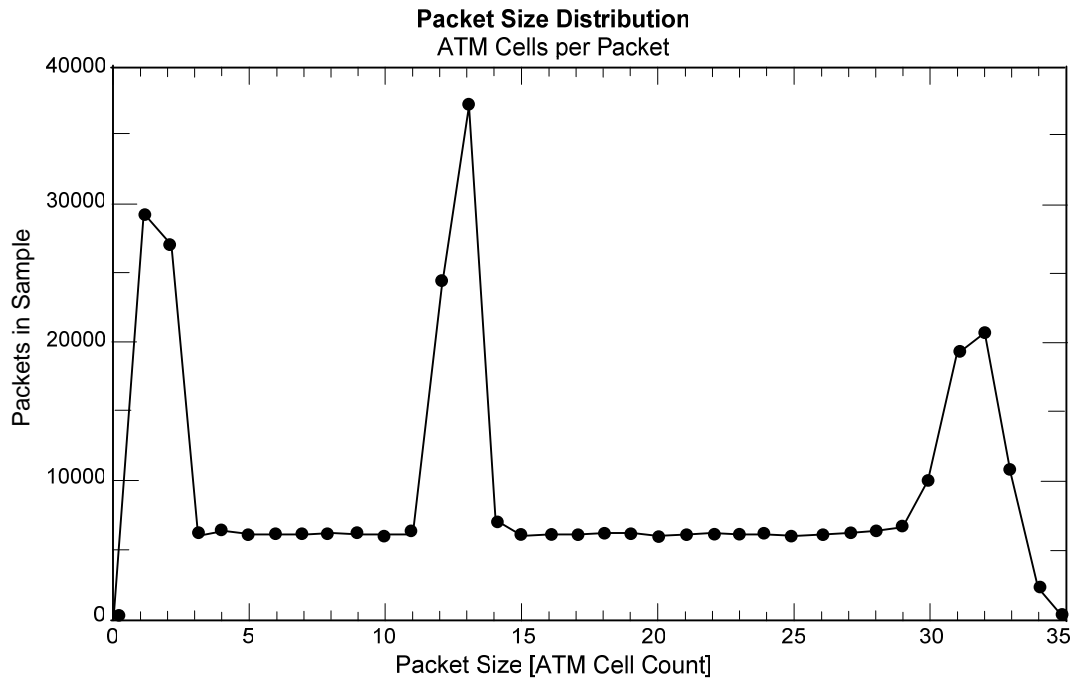
Figure 1-1. Typical Distribution of AAL5 Frame-sizes in ATM Cell Units.

2.1.2 Cell Level Processing

Description   The cell level processing involves Asynchronous Transfer Mode [ATM]
                    cells arriving at the Physical Layer Interface [PLI], which are then parsed
                    for correctness in formatting, have additional data annotated, and enter the
                    ATM Reassembler. They can be treated in either UNI or NNI mode.

ATM cells   ATM cells arriving at PLI are immediately tested for header checksum
                    errors. Cells with uncorrectable errors are dropped. Cells with correctable
                    header errors are corrected.

                    After header error detection and correction, all cells have their HEC byte
                    removed. Error-free and corrected cells are then tested for proper
                    formatting; for example, cells are exactly 52 bytes long. Cells with
                    formatting errors are dropped.

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2.1.2 Cell Level Processing, continued

ATM reassembler	The ATM Reassembler may be configured to handle operational, administration, and maintenance [OAM] cells in either one of two ways:

- OAM cells may be dropped immediately or,
- OAM cells can bypass the reassembly process for direct inclusion in output record stream.

PLI record counters	Counters for each PLI record the number of cells dropped due to:

- Uncorrectable header errors
- Cells with correctable header errors
- Total number of cells received
- Number of OAM cells received

A Boolean flag records that cells were dropped due to formatting errors.

Accessing the PLI record and other counters is described in Chapter 6.0 Statistics, Counters and Events Reporting.

Cell annotation	On arrival, cells are annotated with two additional pieces of information:

- A timestamp
- An interface identifier that records the port on which a cell arrived.

Annotated cells are presented to the ATM Reassembler for processing.

The DAG Timestamping Whitepaper provides more information about timestamps.

NNI and UNI modes	The reassembler can be set to NNI and UNI modes, with NNI being the default.

The uppermost nibble of the ATM cell header, the GFC field, is ignored in UNI mode for the purpose of VP/VC look-ups in the internal state table.

Configuring the reassembler for UNI/NNI operation is described in Section 5.5 Network Node Interface or User-Network Interface Operations Selection.

2.2 ATM Reassembly Process

Introduction   The reconstruction of an AAL5 frame consists of two phases, cell accumulation and frame draining.

Up to 65,535 buffers are available in which cells are accumulated in order to reconstruct complete AAL5 frames.

Once a complete frame is assembled, the buffer is drained into the Generic Packet Processor [GPP] for formatting into an extensible record format [ERF].

The extensible format and GPP configuration options are described in Chapter 3.0 Endace Extensible Record Format.

In this section   This section covers the following topics of information.

- Cell Accumulation
- Frame Draining

2.2.1 Cell Accumulation

Description   The cell accumulation process involves annotation with timestamp and interface fields, and storage in reassembly buffers. This process may be perturbed by:

- Oversize frames
- Search space becoming full
- An event requiring a cell to be discarded according to the cell discard protocol

Process   The following describes the cell accumulation process.

Process	Description
Timestamp.	Only the timestamp accompanying the first cell of each AAL5 frame is stored. When the reassembled AAL5 frame is drained and formatted into an ERF record, this is the timestamp used.
Added interface field.	Dual-channel DAG cards, such as DAG 3.8S, separate interfaces for purpose of list search. This ensures cells with identical VCI/VPI values that originated on different physical links are distinguished.

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2.2.1 Cell Accumulation, continued

Process,continued

Process	Description
Reassembly buffers.	The number of reassembly buffers may be reduced in order to achieve larger individual buffers. Buffer size is selected when the reassembler is initialized and cannot be altered while reassembly is in progress. The ATM Reassembler with different buffer-size parameters is described in Section 4.3 *Reassembly Buffer Size Selection*. Table 1-1 describes the relationship between the number of reassembly buffers and buffer size. <table><tr><th>No Reassembly Buffers</th><th>Max AAL5 Payload Size</th><th>No. ATM Cells in frame that can be stored in Buffer</th></tr><tr><td>65,535</td><td>1,528</td><td>32</td></tr><tr><td>32,767</td><td>3,064</td><td>64</td></tr><tr><td>16,383</td><td>6,136</td><td>128</td></tr><tr><td>8,191</td><td>12,280</td><td>256</td></tr><tr><td>4,095</td><td>24,568</td><td>512</td></tr><tr><td>2,047</td><td>49,144</td><td>1024</td></tr></table> Table 1-1. Reassembly Buffers and Buffer Size Relationships.

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2.2.1 Cell Accumulation, continued

Process,continued

Process	Description
Oversized frames.	When an AAL5 frame consists of more cells than the chosen buffer-size can accommodate, the buffer overflows. When the buffer is completely full the last cell in the buffer is repeatedly overwritten. This ensures that when the reassembled frame is drained, the last cell in the buffer is the final cell of the AAL5 frame. For example, the final 8 bytes of the reassembled frame always carry the AAL5 trailer. The RX Error flag is set under these conditions because the AAL5 CRC fails due to missing cells. The process is described in Chapter 3.0 Endace Extensible Record Format. A counter records the number of truncated frames, as described in Chapter 6.0 Statistics, Counters and Events Reporting.

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2.2 ATM Reassembly Process, continued

Process, continued

Process	Description
Full search space.	If the list of active VCs contains 65,535 entries, the search space is full and new VCI/VPI values cannot be recorded. Therefore, cell accumulation cannot be initiated for cells on new VC/VPs. Cells received while this condition persists are dropped. Normal operation resume when space becomes available. The continuing reassembly of partially completed frames is not affected by this condition. Cells dropped due to this mechanism would otherwise have been treated as the first cells on new VC/VPs. As these are dropped cells, the next cell to arrive on an unlisted VC/VP will appear to have been the first cell of a new AAL5 frame. The reassembled frame will be missing one or more of its first cells resulting in RX Error flag assertion due to failure of the AAL5 CRC. The process is further explained in Chapter 3.0 Endace Extensible Record Format. A count of the number of cells dropped due to insufficient space on the list of active VC list is available.

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2.2.1 Cell Accumulation, continued

Process, continued

Process	Description
Cell discard protocol	The cell accumulation process consumes internal resources, including: entries on the list of active VCs, reassembly buffers in local-memory, and local-memory write bandwidth. If insufficient resources are available to process an incoming cell, the cell is dropped. If a dropped cell would have been added to a partially reassembled AAL5 frame, the incomplete frame along with any future cells with the same VCI/VPI, are also discarded. The early discard condition persists until arrival of a cell on the same VC/VP whose PTI field indicates it as the AAL5 frame final cell. The early discard condition is reset and the next cell to arrive on that VC/VP initiates a new cell accumulation process. Events causing early discard condition include: • No empty buffers available in local-memory • Local-memory write queue full. Counters record the number times these events occur.

2.2.2 Frame Draining

Description   Once a buffer contains a complete AAL5 frame, a command to drain the buffer is issued to the memory controller.

AAL5 CRC frame test   An AAL5 CRC calculation is applied to the frame as it is read from local memory and the result is compared with the AAL5 checksum field carried in the final cell of the frame.

A checksum mismatch results in the ERF Record RX Error flag being set for this frame. There are several reasons why the CRC test may fail:

- Cell payload might have been corrupted by the network
- Cells belonging to the frame might have been dropped either by the:
  - Network
  - ATM reassembler, due to:
    - Insufficient internal resources to process a cell
    - Reassembly buffer overflow

Final cell payload   The final cell payload of an AAL5 frame consists of up to 2 sections, being the:

- Final part of AAL5 payload, packet data for example
- AAL5 trailer

If the encapsulated packet is an even multiple of 48 bytes then the frame final cell may contain only the AAL5 trailer.

Trailer fields   The three fields within the trailer are:

- Padding
- AAL5 length
- AAL5 checksum

Depending on the size of the encapsulated packet, padding may be omitted.

USE THIS SPACE FOR NOTES

3.0 ENDACE EXTENSIBLE RECORD FORMAT

Description   The Endace Extensible Record Format [ERF] is relative to the ATM Reassembler and the specific ERF record fields.

In this chapter   This chapter covers the following sections of information.

- Extensible Record-type Format
- Extensible Record Format Field Functions

3.1 Extensible Record-type Format

Description   Reassembled AAL5 frames are presented to the GPP for formatting into ERF Records. ERF record type 0x04 is used to indicate reassembled AAL5 frames.

Table   Table 3-1 shows the reassembled AAL5 ERF record-type format.
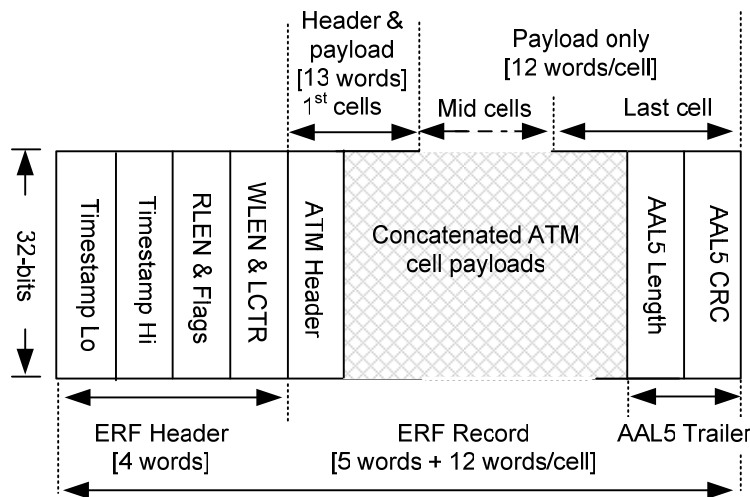
Table 3-1. Reassembled AAL5 ERF Record-type Format.

Reassembler configuration   The reassembler may be configured to present OAM cells directly to the GPP, bypassing the reassembly process. For these frames, the ATM Cell ERF record-type (0x03) is used instead. The record stream generated by the ATM Reassembler may therefore include a mixture of ATM Cell and Reassembled AAL5 ERF record-types.

Continued on next page

3.1 Extensible Record-type Format, continued

Reassembler configuration (continued)

Table Table 3-2 shows the ATM Cell ERF record-type format.
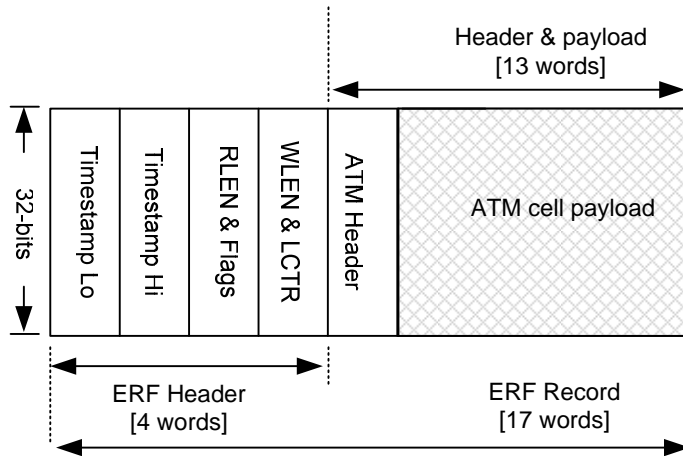
Table 3-2. ATM Cell ERF Record-type Format.

Capture parameter

The snap-length [slen] capture parameter may be used to set a preferred upper limit on record size, truncating any records that would otherwise exceed this limit. Records smaller than the snap-length will be unaffected.

The fixed-length [novarlen] capture parameter may be used to pad records that are shorter than the snap-length up to a fixed size. All records will be of uniform size in this mode, the snap-length plus 16 bytes.

The capture parameters apply to both Reassembled AAL5 and ATM Cell ERF records. For Reassembled AAL5 records, any truncation causes loss of the AAL5 trailer.

For more information on capture configuration parameters, see the relevant User Guide.

ERF records fields construction

The ERF records fields include:

- High and low time stamp
- Record length and flags
- Wire length and loss counter
- ATM header
- AAL5 trailer, including:
    - o Length field
    - o Reserved field
    - o CRC

Continued on next page

3.1 Extensible Record-type Format, continued

Table   Table 3-3 shows a detailed view of the ERF record fields.

Timestamp Lo	31	Timestamp Low	0
Timestamp Hi	31	Timestamp High	0

RLEN & Flags: 31 Type 24 | 23 Flags 16 | 15 Record Length 0

WLEN & LCTR: 31 Loss Counter 16 | 15 Wire Length 0

ATM Header*: 31 VCI/VPI 4 | 3 Flg 0

AAL5 Length*: 31 Reserved - Zero 16 | 15 AAL5 Length 0

AAL5 CRC*: 31 AAL5 CRC 0

Flags: 7 6 5 4 3 2 1 0 — Reserved | DS | RX | TR | Var | Interface

* Fields are presented in network byte ordering

Table 3-3. Detailed View of ERF Record Fields.

3.2 Extensible Record Format Field Functions

Description   The extensible record format field functions are for the timestamp, record length, wire length and loss counter. The functions also include indication of ERF record type, flagging, and recording the ATM header cell headers.

Field/function   The following table describes the ERF record fields.

Field	Function
Timestamp High/Low.	For ERF record-type = ATM Cell: timestamp allocated to the ATM cell. For ERF record-type = Reassembled AAL5: timestamp allocated to first cell of the AAL5 frame. The timestamps of all other cells belonging to the frame are discarded.
Record length.	Describes ERF record length in bytes. ERF records are always word (4 bytes) aligned.
Wire length.	Describes lengths in bytes of ATM cells or Reassembled AAL5 frame, before any truncation by GPP and excluding ERF header.

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3.2 Extensible Record Format Field Functions, continued

Field/function (continued)

Field	Function
Loss counter.	A number count of ATM Cells or Reassembled AAL5 frames dropped prior to receiving this ERF record due to insufficient data transfers to host computer. The loss counter values apply separately to each of ATM cells and AAL5 frames.
Type.	Indicates ERF record type: • 0x03 indicates ATM Cell • 0x04 indicates Reassembled AAL5

Flags.	RX Error:
	    Indicates AAL5 Checksum failure. Always zero for ATM Cells.
	
	DS Error :
	    Unused. Always Zero.
	
	TR Truncate:
	    Unused. Always Zero.
	
	VAR Variable/Fixed length :
	    Indicates whether record stream contains variable '1' or fixed-length '0' records. Variable length records are not uniform in size, but the Record Length field can be used to parse the record stream.
	
	Interface:
	    This two-bit field indicates the port on which the ATM cell or AAL5 frame originated. The loss counter values apply to each interface separately

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3.2 Extensible Record Format Field Functions, continued

Field/function (continued)

Field	Function
ATM header.	For ERF record-type = ATM Cell: The cell header. For ERF record-type = Reassembled AAL5: The cell header of the first AAL5 frame cell. The headers of all other cells belonging to the frame are discarded as they are identical to the first, barring the PTI and CLP fields.
AAL5 length.	Describes encapsulated packet length in bytes. An AAL5 length value of zero indicates the frame was aborted by the transmitter and should be discarded. For ERF record-type = Reassembled AAL5 only.
AAL5 trailer: reserved.	The CPCS-PDU trailer contains two reserved fields that should always be zero and are ignored by the reassembler. For ERF record-type = Reassembled AAL5 only.
AAL5 CRC.	A 32-bit checksum against which the entire reassembled frame may be validated. The reassembler always performs this test internally before presenting frames to GPP for ERF formatting. Frames failing the test result in RX Error flag being set. For ERF record-type = Reassembled AAL5 only.

4.0 CONFIGURE DAG CARD AND COPROCESSOR

Description   The DAG card, with coprocessor attached, is installed in the host system with the device drivers loaded and standard capture applications operating successfully.

The DAG card is checked to ensure that correct statistics are reported about the monitored link, and it is capable of capturing data using standard firmware, such as non ATM Reassembler.

Relevant User Guides have instructions on DAG card configuration, and performing basic capture functions.

In configuring the DAG card and coprocessor for use with the ATM Reassembler application a single DAG card is assumed to be present in the system.

If more than one DAG card is present then the `-d /dev/dag[n]` option is added to all command-lines to specify the target device.

The list of recognized DAG cards can be obtained from the operating system with command: `daginf -d /dev/dag[n]` for $0 \le n \le 3$

Procedure   Follow these steps to configure the DAG card and coprocessor.

Step 1.   Load DAG card

Load the ATM Reassembler firmware into the DAG card. For DAG 4.3S OC48:

```
dagrom -ryvp < dag/xilinx/dag43pcix-aal5.bit
```

For DAG 3.8S OC3/12:

```
dagrom -ryvp < dag/xilinx/dag38pcix-aal5.bit
```

Step 2.   Load coprocessor

Load ATM Reassembler firmware into coprocessor:

For DAG 4.3S OC48:

```
dagld -x dag/xilinx/dag43cp-aal5.bit
```

For DAG 3.8S OC3/12:

```
dagld -x dag/xilinx/dag38pp-erf.bit:dag/xilinx/dag38cp-
aal5.bit
```

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4.0 CONFIGURE DAG CARD AND COPROCESSOR, continued

Procedure (continued)

> **Step 3.**   **Configure DAG Card**
>
> Configure DAG card appropriately for attached network link.
>
> Check relevant User Guide for more information on performing this step.
>
> For DAG 4.3S OC48:
>
> ```
> dagfour default laser fcl atm slen=2048 varlen
> ```
>
> For DAG 3.8S OC3/12:
>
> ```
> dagthree oc12c fcl atm slen=2048 varlen
> ```
>
> **Step 4.**   **Start Reassembler**
>
> Initialize and start ATM Reassembler, for both the DAG 3.8S OC3/12 and the DAG4.3S OC48:
>
> ```
> dagsar default
> ```
>
> **Step 5.**   **Start Packet Capture Application**
>
> Initialize and start packet capture application.
>
> For example, for both DAG3.8S OC3/12 and DAG4.3S OC48:
>
> ```
> dagsnap –v –o [output_filename]
> ```

5.0 OPERATING DAG COPROCESSOR ATM REASSEMBLER

Introduction   Operating the DAG coprocessor ATM reassembler involves the main tool that interacts with the ATM reassembler, the reassembler state and buffer size selection. There is Operation, Administration, and Maintenance [OAM] cell bypass or discard selection. The process includes activity timeout threshold selection, and network node interface or user network interface operations selection.

In this chapter   This chapter covers the following sections of information.

- ATM Reassembler Interaction Tool
- Reassembler Operating States
- Reassembly Buffer Size Selection
- Operations, Administration, Maintenance Cell Bypass or Discard Selection
- Network Node Interface or User-Network Interface Operations Selection

5.1 ATM Reassembler Interaction Tool

Description   The ATM Reassembler main interaction tool is `dagsar`. A command-line usage summary is:

```
# dagsar -h
Usage: dagsar [-hvsabeup] [-d /dev/dagN] [-c N,M,O,...,U] [-i
interval]

 -h          this page (use -hh to get a list of steerable
             counters
 -v          increase verbosity (more verbose -vv or -vvv ...)
 -s          show statistics counters
 -a          only show statistics for port A
 -b          only show statistics for port B (dual-channel only)
 -e          show extended statistics counters
 -u          show utilisation statistics (as percentages)
 -p          show (DDR) performance statistics counters
 -c N,..     load Steerable Counters (up to 8, depending on
             Firmware). Argument to 'c' is a comma-seperated list
             of numbers
 -d dag      use device dag
 -i int      repeat statistics with interval int seconds
 default     Reset SAR
 reset       Reset SAR
 uni         Set UNI mode
 nni         Set NNI mode
 enablesar   Start SAR
 disablesar  Pause SAR
 long=N      Maximum length packet to reassemble is N
```

Continued on next page

5.1 ATM Reassembler Interaction Tool, continued

–d /dev/dag0 option

In all the following command-line examples, the `–d /dev/dag0` option is implied. This option applies the command to specified device, `dag0`.

Reassembler status summary

A summary of the reassembler status can be obtained using the `dagsar` command with no options.

```
# dagsar
SAR     enablesar SAM Ready CAM Ready AQDQ Ready NNI
buffers number=32767 long=3064 bytes each
atmchkA (no errors)
atmchkB (no errors)
Events
  Err   (none)
```

The `SAR` line reports the reassembler current state, and the reassembler initialisation status for the SAM, CAM, and AQDQ main functional components.

If any of the SAM, CAM, or AQDQ report `busy`, the reassembler is still in its initialisation state.

The reassembler state is described in Chapter 4.0, Section 4.2 Reassembler Operating States.

Reassembly buffer-size choice

The `buffers` line indicates the user's choice of reassembly buffer-size and the corresponding number of buffers available.

Cell formatting errors

The `atmchk` line(s) reports the type of cell formatting errors detected by the reassembler.

The two-channel DAG3.8S, `atmchkA` refers to events on physical link A and `atmchkB` refers to events on physical link B. The single-channel DAG 4.3S only reports to `atmchkA`.

Significant events report

The remainder of the report describes significant events that have occurred during the reassembler operation. Reported events include mainly internal errors and are included for debugging purposes.

Error log clear command

The error log reported by `atmchk` and `events` is cleared whenever `dagsar` command is used with either the `–s` option or with no options.

5.2 Reassembler Operating States

Description   The ATM Reassembler has four operating states:

- Initialise
- Paused
- Run
- Pausing

While the reassembler is in a paused or initialise state, certain counters continue counting. For example, the count of cells arriving.

Given the reassembler being in the initialise state, cells arriving increment the count of cells dropped due to reassembler being in that state.

Given the reassembler being in the paused state, cells arriving increment the count of cells dropped due to the reassembler being in that state.

All counters reset to zero when the reassembler enters the initialise state.

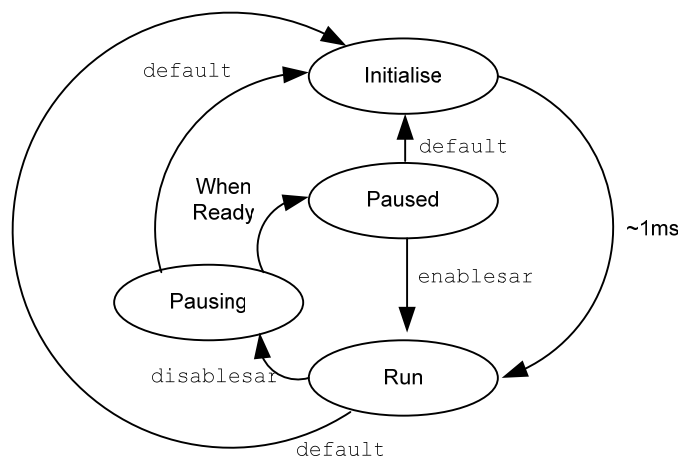**Figure**   Figure 5-1 shows the Reassembler operational states.

Figure 5-1. Reassembler Operational States.

In this section   This section covers the following topics of information.

- Set Reassembler to Run State
- Stop Reassembly Process

5.2.1 Set Reassembler to Run State

Description   On power-up, or immediately after issuing `dagreset`, or `dagrom –p` or `dagld -x` commands, the reassembler state is undefined.

The reassembler can be set to the initialise state at any time by issuing the `dagsar default` command.

Approximately 1 ms after entering initialise state, the reassembler automatically clears its memory and moves to run state. In the run state, the reassembler begins reassembling incoming ATM cells, and ERF records are generated by the DAG card.

5.2.2 Stop Reassembly Process

Description   The reassembly process can stopped in one of three ways:

- Stopping capture application
- Issuing `dagsar default` command
- Issuing `dagsar disablesar` command.

Stopping capture application   By stopping the capture application the reassembly process actually continues. Given this method, the GPP drops reassembled frames and OAM cells due to insufficient data transfers to the host computer.

Any partially reassembled AAL5 frames are ultimately completed but discarded by the GPP. Reassembly statistics continue to reflect the reassembler instantaneous state.

Issuing `dagsar default` command   The `dagsar default` command can be issued at any time during a capture. Given this method, the reassembler moves directly to the initialise state where it clears its memory, and then moves to the run state where it begins to reassemble network traffic.

Any partially reassembled AAL5 frames are immediately discarded and statistics about the reassembly session are lost.

Reassembly resumes once initialisation is complete.

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5.2.2 Stop Reassembly Process, continued

Issuing `dagsar disablesar` command

The reassembly process can be stopped by issuing the `dagsar disablesar` command. Given this method, the reassembler moves to the pausing state where only partially reassembled AAL5 frames are completed, or discarded due to activity time-out.

Immediately upon issuing the command, the reassembler ceases to accept incoming cells other than those with VCI/VPI fields that match partially reassembled frames. By this method, partially reassembled frames are completed and presented to the GPP.

It can take up to 100 seconds for a problematic frame to exceed its activity time-out threshold. Given that reassembly does not cease immediately, reassembled AAL5 frames and OAM cells can continue to arrive for a short time after the command is issued.

Once the final partially reassembled frame is completed, reassembly stops altogether and the reassembler moves to the paused state. Statistics about the reassembly session are then static and may be observed at any time. Reassembly can be resumed immediately upon issuing a `dagsar enablesar` command.

5.3 Reassembly Buffer Size Selection

Description

Different values for buffer size can be selected at any time. However the effect of changing buffer size is similar to issuing a `dagsar default` command.

Given a buffer size change, reassembly ceases immediately. The reassembler moves to initialising state while reassembly memory is cleared before moving to the run state.

The command-line for specifying the desired buffer size is:

```
dagsar long=nnnn
```

Any value less than 65,536 may be substituted for *nnnn* since `dagsar` will use the next larger legal value.

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5.3 Reassembly Buffer Size Selection, continued

Long and snap-length parameter relationships

Consideration needs to be given to the relationship between the ATM Reassembler's `long` parameter and the Endace packet capture applications' snap-length (`slen`) parameter.

The `slen` parameter is used by the GPP to truncate captured packets to the desired size. The `long` parameter determines the space allocated in memory for each reassembly buffer.

The `long` parameter is to be set by users to exceed the largest size packet expected on the network.

If the `long` parameter is set to less than the largest size packet the AAL5 CRC will fail for all packets that exceed the buffer size causing the RX Error flag to be set in the resulting ERF record.

If a small value of `slen` is to be used, such as to capture only the packet header, a lower value may be considered for `long` to take advantage of the increased number of reassembly buffers. This may result in ERF records with RX Error flag set.

It serves no purpose to set the `slen` parameter to a value greater than that of `long` because packets can never exceed `long` bytes.

5.4 Operations, Administration, Maintenance Cell Bypass or Discard Selection

Description

OAM cells may be dropped from the link or formatted into ERF records for presentation to the host. Equally, reassembled frames may also be dropped or presented.

There are specific command lines for each of the DAG 4.3S and DAG 3.8 cards.

DAG 4.3S card command line

The command-line for specifying DAG 4.3S card to specify each of these is:

`dagfour enablea`	Enables presentation of reassembled frames.
`dagfour disablea`	Drop reassembled frames, disable presentation.
`dagfour enableb`	Enable presentation of OAM cells.
`dagfour disableb`	Drop OAM cells, disable presentation.

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5.4 Operations, Administration, Maintenance Cell Bypass or Discard Selection, continued

DAG 3.8 card command line The command-line for specifying DAG 3.8 card to specify each of these is:

Command	Description
`dagthree enablea`	Enables presentation of reassembled frames.
`dagthree disablea`	Drop reassembled frames, disable presentation.
`dagthree enableb`	Enable presentation of OAM cells.
`dagthree disableb`	Drop OAM cells, disable presentation.

On a DAG 3.8, these controls affect both physical and links simultaneously.

5.5 Network Node Interface or User-Network Interface Operations Selection

Description The ATM Reassembler can be configured to operate in either NNI or UNI networks.

In NNI mode, the entire 28-bit VCI/VPI field from the ATM cell header is used to distinguish cell's VC/VP.

In UNI mode, the 4-bit GFC field is ignored and only the 24-bit VCI/VPI field is used.

The command-line for specifying the desired configuration is:

```
dagsar uni
dagsar nni
```

The commands reset the ATM reassembler instantly, with an effect equivalent to `dagsar default` command.

USE THIS SPACE FOR NOTES

6.0 STATISTICS, COUNTERS AND EVENTS REPORTING

Description   Many types of statistics are available from the ATM Reassembler.

Most statistics take count of the number of times a particular event has occurred since the previous request for statistics.

Other statistics take the form of Boolean flags that record if a particular event has occurred since the previous request for statistics.

The act of requesting statistics clears statistics counters and Boolean flags.

In this chapter   This chapter covers the following sections of information.

- Statistics Request Command
- Statistics Labels `dagsar` Command Options

6.1 Statistics Request Command

The commands that request statistics, and thereby clear statistic counters, are:

```
dagsar, dagsar -s
```

The presentation of statistics can be automated on a periodic basis using the `-i [n]` option resulting in a per-second, per-minute, or per-hour view. The `dagsar -si 1` command, for example, repeats the `dagsar -s` command at an interval of 1 second.

If no interval is specified a default value of 1 second is used. If the `-i [n]` option is used then it must be the last option on the command line.

Basic operational statistics are reported using the `dagsar -s` command.

```
# dagsar -s

   A:   TotCell   Lcell   OAMcell   Frame   CRCFail   B:   Totcell   Lcell   Frame   CRCFail
   A:         0       0         0       0         0   B:         0       0       0         0
```

Two-channel DAG3.8S OC3/12 card   For the two-channel DAG3.8S OC3/12 card, statistics are preceded with `A:` or `B:` to indicate the port to which statistics apply.

Statistics for only one port may be printed by including the `-a` or `-b` options on the `dagsar` command line.

6.2 Statistics Labels `dagsar` Command Options

Description   There are many types of statistics reported by the various forms of the
`dagsar` command options. The reports include error events, standard
statistics, and extended statistics.

In this section   This section covers the following topics of information.

- Reassembler Error Event Reporting
- Standard Statistics Reporting
- Extended Statistics Reporting
- Extended Statistics with Increased Verbosity
- Standard Statistics with Usage Information

6.2.1 Reassembler Error Event Reporting

Description   The reassembler error event reporting is based on the dagsar Boolean label
functions described in the following table.

dagsar Boolean Label	Function
`cam full`	Indicates a cell with an unlisted VCI/VPI arrived when there was no room to add it to the active VC list.

`aqdq busy`
`cam busy`
`sam busy`
	Indicates a cell arrived during the ATM reassembler's initialisation phase. The cell was dropped and no other consequences arise from this event.

`req ffull`
`dq ffull`
`dq overflow`
`aq overflow`
`dq underrun`
`sam overwrote vld`
`sh busy err`
`shr cam err`
`shr logerr`
	Any of these events indicate loss of internal consistency.
	
	If such an event is recorded, the ATM Reassembler produces irrelevant data.
	
	Report such events to support@endace.com with as much information as possible about the circumstances.

`idle_err`	Framer reported a link-error between cells.

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6.2.1 Reassembler Error Event Reporting, continued

Description,continued

dagsar Boolean Label	Function
`cell_err`	Framer reported a link-error during a cell. Cell is discarded.
`cell_len`	Framer generated a "cell" that was too long or too short. Cell is discarded. Ensure DAG card link configuration is appropriate for the monitored network link.
`cell_sop`	While a cell was being received from the framer, the framer indicated that a new cell commenced. Data prior to start of new cell is discarded and new cell is considered valid. Ensure DAG card link configuration is appropriate for monitored network link.
`dump_sop`	While an invalid cell was being discarded the framer indicated that a new cell commenced. Data prior to start of new cell is discarded and new cell is considered valid. Ensure DAG card link configuration is appropriate for monitored network link.
`dump_eop`	The framer has indicated the end of an invalid cell.

6.2.2 Standard Statistics Reporting

Description   The dagsar command-line option for standard statistics reporting is:

        -s

dagsar Boolean Label	Function
TotCells	The total number of cells received by the reassembler; excludes cells dropped due to formatting or header checksum errors.
LCells	The number of cells received by the reassembler whose PTI field indicates they are the final cell of an AAL5 frame.
OAMCell	The number of cells received by the reassembler whose PTI field indicates that they are OAM cells.
Frame	The number of reassembled AAL5 frames output by the reassembler to the GPP for formatting into ERF records.
CRCFail	The number of reassembled AAL5 frames output by reassembler to GPP with AAL5 CRC test failures.

6.2.3 Extended Statistics Reporting

Description   The dagsar command-line option for extended statistics reporting is:

    -es

dagsar Boolean Label	Function
FifoFull	The number of times a cell was discarded because internal memory-write bandwidth was insufficient to process the cell. This count includes number of cells partially reassembled prior to the event, plus any cells received on same VC/VP after the event until last cell of discarded frame has been received.
DiscA DiscB Disc	The number of times a cell was discarded because no empty reassembly buffers were available in which to start reassembling a new AAL5 frame.
DiscAged	The number of cells discarded as a consequence of an activity time-out event.
DiscFifo	The total number of cells discarded as a consequence of a FifoFull event. This count includes number of cells partially reassembled prior to the event, plus any cells received on the same VC/VP after the event until last cell of the discarded frame has been received.
DFCells	The number of cells output by the reassembler to the GPP in the form of reassembled AAL5 frames. This count includes cells dropped as a result of a reassembly buffer overflow.

6.2.4 Extended Statistics with Increased Verbosity

Description

The `dagsar` command-line option for extended statistics with increased verbosity reporting is:

    `-evs`

dagsar Boolean Label	Function
Bypass	The number of OAM cells that bypassed the reassembly process and were presented to GPP directly.
Discard	Number of OAM cells discarded.

6.2.5 Standard Statistics with Usage Information

Description

The `dagsar` command-line option for standard statistics with resource utilisation information reporting, including `-s` statistics, is:

    `-eus`

dagsar Boolean Label	Function
%cam	Percentage of the 65,535 entries on the available VC list that are presently in use.
%AQ	Percentage of the total number of empty reassembly buffers available for immediate use.
%DQ	Percentage of the total number of reassembly buffers containing complete AAL5 frames and require draining.
%Cells_IM	Percentage of 128MB coprocessor memory used to store partially or completely reassembled AAL5 frames.