AAL5 Transmit LFB and Functional API Implementation Agreement

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Revision 1.0

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1 Revision History

Revision	Date	Reason for Changes
1.0	08/16/2005	Rev 1.0 of the AAL5 Transmit LFB and Functional API Implementation Agreement. Source: npf2004.154.09.

2 Introduction

This contribution defines the AAL5 Transmit LFB and lists configurations that are required in the LFB.

2.1 Acronyms

- **AAL:** ATM Adaptation Layer
- **AAL5:** ATM Adaptation Layer – Type 5
- **API:** Application Programming Interface
- **ATM**: Asynchronous Transfer Mode
- **CLP:** Cell Loss Priority
- **FAPI:** Functional API
- **IA:** Implementation Agreement
- **ID:** Identifier
- **LFB:** Logical Functional Block
- **NNI:** Network Node Interface
- **PTI:** Payload Type Indicator
- **PVC:** Permanent Virtual Connection
- **SDU:** Service Data Unit
- **UNI:** User Network Interface
- **VC:** Virtual Connection
- **VCC:** Virtual Channel Connection
- **VCI:** Virtual Channel Identifier

2.2 Assumptions

The AAL5 Transmit LFB obtains its configurations from the ATM Configuration Manager Functional API implementation. The mechanism used to obtain this configuration is not in the scope of NPF.

2.3 Scope

This IA describes the configurations required by the AAL5 Transmit LFB handling VC links carrying AAL5 traffic. The IA also specifies the metadata generated and consumed by this LFB.

2.4 External Requirements and Dependencies

This document depends on the following documents:

- This document depends on the NPF Software API Conventions Implementation Agreement document [SWAPICON] for basic type definitions. (Refer section 5.1 of Software API Conventions IA Revision 2.0).
- This document depends on Software API Conventions Implementation agreement Revision 2.0 for the below type definitions
    - `NPF_error_t` – Refer section 5.2 of Software API Conventions IA Rev 2.0
    - `NPF_callbackHandle_t` - Refer section 5.2 of Software API Conventions IA Rev 2.0
    - `NPF_callbackType_t` - Refer section 5.2 of Software API Conventions IA Rev 2.0
    - `NPF_userContext_t` - Refer section 5.2 of Software API Conventions IA Rev 2.0
    - `NPF_errorReporting_t` - Refer section 5.2 of Software API Conventions IA Rev 2.0
- This document depends on Topology Manager Functional API Implementation Agreement Revision 1.0 for the below type definitions
    - `NPF_BlockId_t` – Refer section 3.1.1 of Topology Manager Functional API IA Rev 1.0

  - `NPF_FE_Handle_t` – Refer section 3.1.1 of Topology Manager Functional API IA Rev 1.0

- ATM Software API Architecture Framework Implementation Agreement Revision 1.0 defines the architectural framework for the ATM FAPIs.
- ATM Configuration Manager Functional API Implementation Agreement Revision 1.0 defines the functions to configure and manage ATM LFBs on a forwarding element.

3 AAL5 Transmit Description

The AAL5 Transmit LFB receives packets to be transferred on VC links from the previous LFB over the `CPCS_IF_DATA_IN` input. The AAL5 Transmit LFB transforms input packets into AAL5 frames, which it then segments into ATM SDUs to pass to the next LFB in the chain over the `ATM_SDU_OUT` output. The AAL5 Transmit LFB maintains the following counters for each VC link:

- Number of AAL5 frames transmitted
- Number of bytes transmitted on the VC link

The AAL5 Transmit LFB is modeled as shown in Figure 3.1

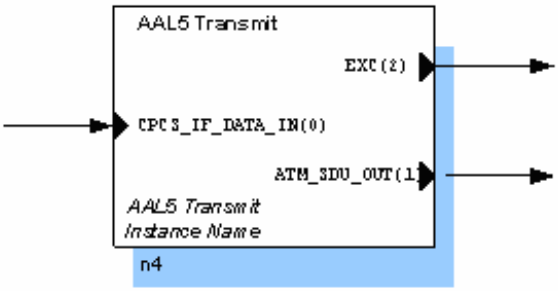

Figure 3.1: AAL5 Transmit LFB

The LFB may contain multiple instances of VC links that are identified by unique VC link IDs. Incoming packets are assigned to appropriate VC link instance according to metadata received with the input packet. Such instances are depicted in Figure 3.2 below. The maximum number of VC links that can be configured is an attribute of the AAL5 Transmit LFB and may be queried as such.

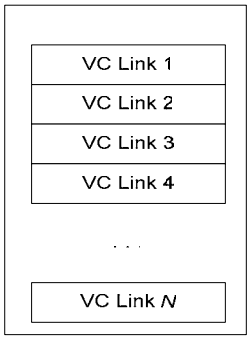

Figure 3.2: VC Link Instances

3.1 AAL5 Transmit Inputs

Table 3.1: AAL5 Transmit LFB Inputs

Symbolic Name	Input ID	Description
`CPCS_IF_DATA_IN`	0	This is the only input for the AAL5 Transmit LFB and is used to receive packet payloads to be transmitted on the AAL5 VC links.

3.1.1 Metadata Required

Table 3.2: Input Metadata for AAL5 Transmit LFB

Metadata tag	Access method	Description
`META_VCL_ID`	Read	Metadata identifying the VC link on which the packet is to be transmitted.
`META_CPCS_LP`	Read-and-consumed	CPCS Loss Priority to be used for determining the submitted loss priority for ATM SDUs.
`META_UUI`	Read-and-consumed	The UUI value to be signaled to the other end. This parameter is transparently transported by the CPCS between peer CPCS users.
`META_FRAME_LEN`	Read-and-consumed	The length of the packet to be transmitted.

3.2 AAL5 Transmit Outputs

Table 3.3: AAL5 Transmit LFB Outputs

Symbolic Name	Output ID	Description
`ATM_SDU_OUT`	1	This is the normal output for the AAL5 Transmit LFB. Packets to be transmitted on AAL5 VC links are segmented into ATM SDUs and sent on this output to the next LFB in the chain.
`EXC`	2	The packet requested for transmission is sent to this output when the packet needs to be discarded due to errors.

3.2.1.1 Metadata Produced

Table 3.4: Output Metadata for AAL5 Transmit LFB

Metadata tag	Access method	Description
`META_ATM_LP`	Write	Loss priority to be used for the ATM cell.
`META_ATM_PTI`	Write	The type of payload to be carried in the ATM cell requested for transmission.

3.3 Accepted Inputs

The AAL5 Transmit LFB can accept packets for transmission over UNI or NNI.

3.4 Packet Modifications

The AAL5 Transmit LFB segments the received packets into ATM SDUs after encapsulation of the packet in an AAL5 frame. The received packet is then discarded and the ATM SDUs formed are sent to the next LFB in the chain to send as payload in ATM cells.

3.5 Relationship with Other LFBs

The AAL5 Transmit LFB is placed in the processing chain before the ATM Traffic Manager LFB. The sequence of actions that configures AAL5 Transmit LFB and cooperating ATM Traffic Manager LFB instance, and cooperation between these two LFBs is schematically depicted in Figure 3.3.

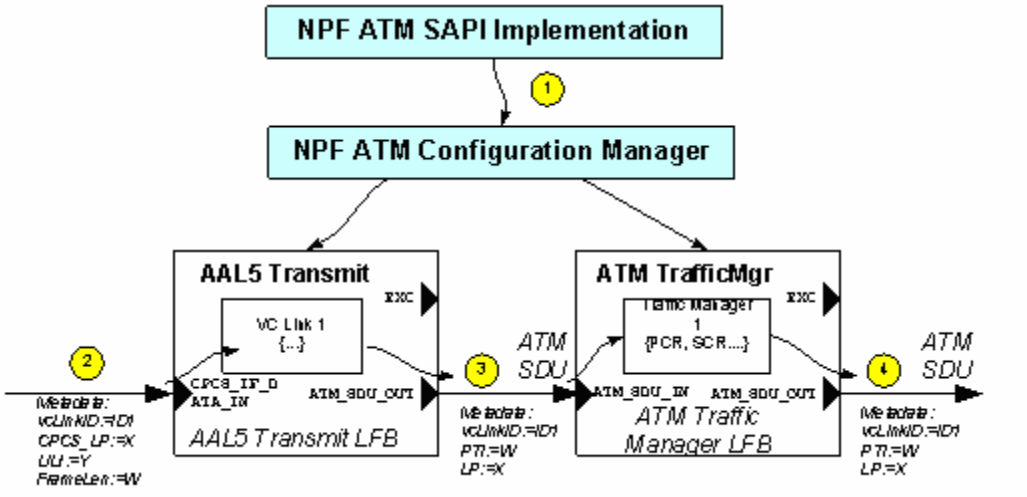

Figure 3.3: Cooperation between AAL5 Transmit and ATM Traffic Manager LFB

This figure shows part of example Forwarding Element that contains AAL5 Transmit LFB and ATM Traffic Manager LFBs. These two blocks are connected in chain and configured by the ATM configuration manager LFB. The sequence of actions that configure a VC link on the interface may be defined as follows (see corresponding numbers in circles in the figure):

1. The NPF ATM SAPI is invoked to create a VC link. The system software below the NPF ATM SAPI assigns a VC link ID ‘ID1’ to the VC link and invokes the ATM configuration manager FAPI to create the VC link. This causes a VC link instance to be created in the AAL5 Transmit LFB. An ATM Traffic Manager Instance is created in the ATM Traffic Manager LFB to manager the traffic sent on the VC link with VC link ID ‘ID1’.
2. The AAL5 Transmit LFB receives a packet from an LFB that uses AAL5 services to transmit packets. The AAL5 Transmit LFB performs the segmentation of the packet in to ATM SDUs.
3. The ATM SDU is forwarded to the ATM Traffic Manager LFB along with the PTI and LP over the `ATM_SDU_OUT` output of the AAL5 Transmit LFB. The ATM Traffic Manager LFB uses the VC link ID to determine the Traffic Manager instance associated with this VC link and performs the required traffic management actions like buffering, shaping, etc.
4. When the ATM Traffic Manager determines it is time to schedule transmission of an ATM cell on that VC link, the ATM SDU is forwarded to the next LFB in the chain for further processing.
5. The EXC output of the AAL5 Transmit LFB could be connected to an LFB that receives SDUs which could not be associated with any VC link or which need to be discarded due to errors.

The AAL5 Transmit LFB may be preceded in the topology by any LFB that can produce the information required by the AAL5 Transmit LFB at its input. Downstream (not necessarily next) of the AAL5 Transmit LFB, there should be LFBs that can utilize the information generated at output by AAL5 Transmit LFB. The exact design and connections between the AAL5 Transmit LFB and cooperating blocks is specific to the vendor that provides Forwarding Element design and FAPI implementation.

4 Data Types

4.1 Common LFB Data Types

4.1.1 LFB Type Code

It is possible to use the FAPI Topology Discovery APIs to discover an AAL5 Transmit LFB in a forwarding element using a block type value for the AAL5 Transmit LFB.

```
#define NPF_F_AAL5TRANSMIT_LFB_TYPE 34
```

4.1.2 AAL5 Transmit Configurations

4.1.2.1 ATM Virtual Channel Link Characteristics

The AAL5 Transmit LFB requires below configurations for each virtual channel link.

- ATM VC link ID
- Maximum outgoing CPCS PDU size
- AAL mode – messaging/streaming
- SSCS configured for this VC link – NULL, assured data transfer, non assured data transfer, frame relay

4.2 Data Structures for Completion Callbacks

4.2.1 AAL5 Transmit LFB Attributes query response

The attributes of an AAL5 Transmit LFB are the following:

```
typedef struct {
   NPF_uint32_t   maxVcls;              /* Maximum possible VC links  */
   NPF_uint32_t   curNumVcls;           /* Current number of VC links */
}  NPF_F_AAL5TransmitLFB_AttrQueryResponse_t;
```

The `maxVcls` field contains the maximum number of VC links supported in this AAL5 Transmit LFB. The `curNumVcls` field contains the number of VC links currently established in the AAL5 Transmit LFB.

4.2.2 Asynchronous Response

The Asynchronous Response data structure is used during callbacks in response to API invocations.

```
/*
* An asynchronous response contains an error or success code, and in
* some cases a function specific structure embedded in a union.
*/
typedef struct { /* Asynchronous Response Structure */
    NPF_F_AAL5TransmitErrorType_t error;  /* Error code for this response */
    union {
        /* NPF_F_AAL5TransmitLFB_AttributesQuery() */
        NPF_F_AAL5TransmitLFB_AttrQueryResponse_t      lfbAttrQueryResponse;
    } u;
} NPF_F_AAL5TransmitAsyncResponse_t;
```

4.2.3 Callback Type

This enumeration is used to indicate reason for invoking the callback function.

```
/*
* Completion Callback Types, to be found in the callback
* data structure, NPF_F_AAL5TransmitCallbackData_t.
*/
typedef enum NPF_F_AAL5TransmitCallbackType {
```

```
    NPF_F_AAL5TRANSMIT_ATTR_QUERY = 1,
} NPF_F_AAL5TransmitCallbackType_t;
```

4.2.3.1 Callback Data

An asynchronous response contains an error or success code and a function-specific structure embedded in a union in the `NPF_F_AAL5TransmitCallbackData_t` structure.

```
/*
* The callback function receives the following structure containing
* an asynchronous responses from a function call.
* For the completed request, the error code is specified in the
* NPF_F_AAL5TransmitAsyncResponse_t structure, along with any other
* information
*/
typedef struct {
    NPF_F_AAL5TransmitCallbackType_t type; /* Which function called?      */
    NPF_IN NPF_BlockId_t          blockId;  /*ID of LFB generating callback*/
    NPF_F_AAL5TransmitAsyncResponse_t resp;/* Response structures         */
} NPF_F_AAL5TransmitCallbackData_t;
```

The callback data that returned for different callback types is summarized in Table 4.1.

Table 4.1: Callback type to callback data mapping table

Callback Type	Callback Data
`NPF_F_AAL5TRANSMIT_ATTR_QUERY`	`NPF_F_AAL5TransmitLFB_AttrQueryResponse_t`

4.3 Data Structures for Event Notifications

4.3.1 Event Notification Types

None

4.3.2 Event Notification Structures

None

4.4 Error Codes

4.4.1 Common NPF Error Codes

The common error codes that are returned by AAL5 Transmit LFB are listed below:

- `NPF_NO_ERROR` - This value MUST be returned when a function was successfully invoked. This value is also used in completion callbacks where it MUST be the only value used to signify success.
- `NPF_E_UNKNOWN` - An unknown error occurred in the implementation such that there is no error code defined that is more appropriate or informative.
- `NPF_E_BAD_CALLBACK_HANDLE` - A function was invoked with a callback handle that did not correspond to a valid NPF callback handle as returned by a registration function, or a callback handle was registered with a registration function belonging to a different API than the function call where the handle was passed in.
- `NPF_E_BAD_CALLBACK_FUNCTION` - A callback registration was invoked with a function pointer parameter that was invalid.
- `NPF_E_CALLBACK_ALREADY_REGISTERED` - A callback or event registration was invoked with a pair composed of a function pointer and a user context that was previously used for an identical registration.

- `NPF_E_FUNCTION_NOT_SUPPORTED` - This error value MUST be returned when an optional function call is not implemented by an implementation. This error value MUST NOT be returned by any required function call. This error value MUST be returned as the function return value (i.e., synchronously).
- `NPF_E_RESOURCE_EXISTS` - A duplicate request to create a resource was detected. No new resource was created.
- `NPF_E_RESOURCE_NONEXISTENT` - A duplicate request to destroy or free a resource was detected. The resource was previously destroyed or never existed.

4.4.2 LFB Specific Error Codes

This section defines AAL5 Transmit configuration and management APIs error codes. These codes are used in callbacks to deliver results of the requested operations.

```
#define NPF_AAL5TRANSMIT_BASE_ERR (NPF_F_AAL5TRANSMIT_LFB_TYPE * 100)

/* Asynchronous error codes (returned in function callbacks) */
typedef NPF_uint32_t NPF_F_AAL5TransmitErrorType_t;
#define AAL5TRANSMIT_ERR(n) ((NPF_F_AAL5TransmitErrorType_t) \
                             (NPF_AAL5TRANSMIT_BASE_ERR+(n))

#define NPF_E_AAL5TRANSMIT_INVALID_AAL5TRANSMIT_BLOCK_ID AAL5TRANSMIT_ERR(0)
```

5 Functional API (FAPI)

5.1 Required Functions

None

5.2 Conditional Functions

The conditional API functions for registration and de-registration of the completion callback functions need to be implemented if any of the optional functions defined for this LFB are implemented.

5.2.1 Completion Callback Function

```
typedef void (*NPF_F_AAL5TransmitCallbackFunc_t) (
      NPF_IN NPF_userContext_t            userContext,
      NPF_IN NPF_correlator_t             correlator,
      NPF_IN NPF_F_AAL5TransmitCallbackData_t   data);
```

5.2.1.1 Description

This callback function is for the application to register an asynchronous response handling routine to the AAL5 Transmit API implementation. This callback function is intended to be implemented by the application, and be registered to the AAL5 Transmit API implementation through the `NPF_F_AAL5TransmitRegister` function.

5.2.1.2 Input Parameters

- `userContext` - The context item that was supplied by the application when the completion callback routine was registered.
- `correlator` - The correlator item that was supplied by the application when the AAL5 Transmit API function call was invoked.
- `data` - The response information related to the particular callback type.

5.2.1.3 Output Parameters

None

5.2.1.4 Return Values

None

5.2.2 Completion Callback Registration Function

```
NPF_error_t NPF_F_AAL5TransmitRegister(
      NPF_IN NPF_userContext_t                  userContext,
      NPF_IN NPF_F_AAL5TransmitCallbackFunc_t callbackFunc,
      NPF_OUT NPF_callbackHandle_t        *callbackHandle);
```

5.2.2.1 Description

This function is used by an application to register its completion callback function for receiving asynchronous responses related to AAL5 Transmit API function calls. Applications MAY register multiple callback functions using this function. The pair of `userContext` and `callbackFunc` identifies the callback function. For each individual pair, a unique `callbackHandle` will be assigned for future reference. Since the callback function is identified by both `userContext` and `callbackFunc`, duplicate registration of the same callback function with a different `userContext` is allowed. Also, the same `userContext` can be shared among different callback functions. Duplicate registration of the same `userContext` and `callbackFunc` pair has no effect, and will output a handle that is already assigned to the pair, and will return `NPF_E_ALREADY_REGISTERED`.

5.2.2.2 Input Parameters

- `userContext` – A context item for uniquely identifying the context of the application registering the completion callback function. The exact value will be provided back to the registered completion callback function as its first parameter when it is called. Applications can assign any value to the `userContext` and the value is completely opaque to the API implementation.
- `callbackFunc` – The pointer to the completion callback function to be registered.

5.2.2.3 Output Parameters

- `callbackHandle` - A unique identifier assigned for the registered `userContext` and `callbackFunc` pair. This handle will be used by the application to specify which callback function to be called when invoking asynchronous NPF AAL5 Transmit API functions. It will also be used when deregistering the `userContext` and `callbackFunc` pair.

5.2.2.4 Return Values

- `NPF_NO_ERROR` - The registration completed successfully.
- `NPF_E_BAD_CALLBACK_FUNCTION` – The `callbackFunc` is NULL, or otherwise invalid.
- `NPF_E_ALREADY_REGISTERED` – No new registration was made since the `userContext` and `callbackFunc` pair was already registered.

5.2.2.5 Notes

- This API function may be invoked by any application interested in receiving asynchronous responses for AAL5 Transmit API function calls.
- This function operates in a synchronous manner, providing a return value as listed above.

5.2.3 Completion Callback Deregistration Function

```
NPF_error_t NPF_F_AAL5TransmitDeregister(
      NPF_IN NPF_callbackHandle_t   callbackHandle);
```

5.2.3.1 Description

This function is used by an application to deregister a user context and callback function pair.

5.2.3.2 Input Parameters

- `callbackHandle` - The unique identifier returned to the application when the completion callback routine was registered.

5.2.3.3 Output Parameters

None

5.2.3.4 Return Values

- `NPF_NO_ERROR` - De-registration was completed successfully.
- `NPF_E_BAD_CALLBACK_HANDLE` – De-registration did not complete successfully due to problems with the callback handle provided.

5.2.3.5 Notes

- This API function MAY be invoked by any application no longer interested in receiving asynchronous responses for AAL5 Transmit API function calls.
- This function operates in a synchronous manner, providing a return value as listed above.
- There may be a timing window where outstanding callbacks continue to be delivered to the callback routine after de-registration function has been invoked. It is the implementation's responsibility to guarantee that the callback function is not called after the deregister function has returned.

5.3 Optional Functions

5.3.1 LFB Attributes Query Function

```
NPF_error_t NPF_F_AAL5TransmitLFB_AttributesQuery(
      NPF_IN NPF_callbackHandle_t   callbackHandle,
      NPF_IN NPF_correlator_t       correlator,
      NPF_IN NPF_errorReporting_t   errorReporting,
      NPF_IN NPF_FE_Handle_t        feHandle,
      NPF_IN NPF_BlockId_t          blockId);
```

5.3.1.1 Description

This function call is used to query ONLY one AAL5 Transmit LFB's attributes at a time. If the AAL5 Transmit LFB exists, the various attributes of this LFB are returned in the completion callback.

5.3.1.2 Input Parameters

- `callbackHandle` - The unique identifier provided to the application when the completion callback routine was registered.
- `correlator` - A unique application invocation context that will be supplied to the asynchronous completion callback routine.
- `errorReporting` - An indication of whether the application desires to receive an asynchronous completion callback for this API invocation.
- `feHandle` - The FE Handle returned by `NPF_F_topologyGetFEInfoList()` call.
- `blockId` – The unique identification of the AAL5 Transmit LFB.

5.3.1.3 Output Parameters

None

5.3.1.4 Return Values

- `NPF_NO_ERROR` - The operation is in progress.
- `NPF_E_UNKNOWN` - The LFB attributes was not queried due to invalid AAL5 Transmit block ID passed in input parameters.
- `NPF_E_BAD_CALLBACK_HANDLE` - The LFB attributes was not queried because the callback handle was invalid.
- `NPF_E_FUNCTION_NOT_SUPPORTED` - The function call is not supported.

5.3.1.5 Asynchronous Response

There may be multiple asynchronous callbacks to this request. Possible error codes are:

- `NPF_NO_ERROR` – Operation completed successfully.
- `NPF_E_AAL5TRANSMIT_INVALID_AAL5TRANSMIT_BLOCK_ID` – LFB ID is not an ID of LFB that has AAL5 Transmit functionality.

The `lfbAttrQueryResponse` field of the union in the `NPF_F_AAL5TransmitAsyncResponse_t` structure returned in callback contains response data. The error code is returned in the error field.

6 References

The following documents contain provisions, which through reference in this text constitute provisions of this specification. At the time of publication, the editions indicated were valid. All referenced documents are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

[FORCESREQ] "Requirement for separation of IP control and forwarding", H.Khosravi, T.Anderson et al, November, 2003 (RFC 3654).

[FAPITOPO] "Topology Manager Functional API", http://www.npforum.org/techinfo/topology_fapi_npf2002%20438%2023.pdf, Network Processing Forum.

[SWAPICON] "Software API Conventions Revision 2", http://www.npforum.org/techinfo/APIConventions2_IA.pdf, Network Processing Forum.

[ATMLFBARC] "ATM Software API Architecture Framework", http://www.npforum.org/techinfo/npf2004.088.12.pdf, Network Processing Forum.

[ATMMGR] "ATM Configuration Manager Functional API", http://www.npforum.org/techinfo/npf2004.165.31.pdf, Network Processing Forum.

Appendix A Header File Information

```
/*
 * This header file defines typedefs, constants and structures
 * for the NP Forum AAL5 Transmit Functional API
 */

#ifndef __NPF_F_AAL5_TX_H__
#define __NPF_F_AAL5_TX_H__

#ifdef __cplusplus
extern "C" {
#endif

/* It is possible to use the FAPI Topology Discovery
   APIs to discover an AAL5 Transmit LFB
   in a forwarding element.  */
#define NPF_F_AAL5TRANSMIT_LFB_TYPE 34

#define NPF_AAL5TRANSMIT_BASE_ERR (NPF_F_AAL5TRANSMIT_LFB_TYPE * 100)
/* Asynchronous error codes (returned in function callbacks) */
typedef NPF_uint32_t NPF_F_AAL5TransmitErrorType_t;
#define AAL5TRANSMIT_ERR(n) ((NPF_F_AAL5TransmitErrorType_t) \
                            (NPF_AAL5TRANSMIT_BASE_ERR+ (n))
#define NPF_E_AAL5TRANSMIT_INVALID_AAL5TRANSMIT_BLOCK_ID AAL5TRANSMIT_ERR (0)

/*************************************************************
 * Enumerations and types for AAL5 Tx attributes and         *
 * completion callback data types                            *
 *************************************************************/

/* The attributes of an AAL5 Transmit LFB */
typedef struct {
   NPF_uint32_t   maxVcls;             /* Maximum possible VC links  */
   NPF_uint32_t   curNumVcls;          /* Current number of VC links */
}  NPF_F_AAL5TransmitLFB_AttrQueryResponse_t;

/*
* An asynchronous response contains an error or success code, and in some
* cases a function specific structure embedded in a union.
*/
typedef struct { /* Asynchronous Response Structure */
    NPF_F_AAL5TransmitErrorType_t error;  /* Error code for this response */
    union {
        /* NPF_F_AAL5TransmitLFB_AttributesQuery() */
        NPF_F_AAL5TransmitLFB_AttrQueryResponse_t      lfbAttrQueryResponse;
    } u;
} NPF_F_AAL5TransmitAsyncResponse_t;

/*
* Completion Callback Types, to be found in the callback
* data structure, NPF_F_AAL5TransmitCallbackData_t.
*/
typedef enum NPF_F_AAL5TransmitCallbackType {
    NPF_F_AAL5TRANSMIT_ATTR_QUERY = 1,
} NPF_F_AAL5TransmitCallbackType_t;


/*
```

```
* The callback function receives the following structure containing
* an asynchronous responses from a function call.
* For the completed request, the error code is specified in the
* NPF_AAL5TransmitAsyncResponse_t structure, along with any other information
*/
typedef struct {
    NPF_F_AAL5TransmitCallbackType_t type; /* Which function was called?   */
    NPF_IN NPF_BlockId_t          blockId; /* ID of LFB generating callback*/
    NPF_F_AAL5TransmitAsyncResponse_t resp;/* response structures          */
} NPF_F_AAL5TransmitCallbackData_t;

/* Type for a callback function to be registered with AAL5 Tx */
typedef void (*NPF_F_AAL5TransmitCallbackFunc_t) (
      NPF_IN NPF_userContext_t userContext,
      NPF_IN NPF_correlator_t correlator,
      NPF_IN NPF_F_AAL5TransmitCallbackData_t data);


/* Completion Callback Registration Function */
NPF_error_t NPF_F_AAL5TransmitRegister (
      NPF_IN NPF_userContext_t userContext,
      NPF_IN NPF_F_AAL5TransmitCallbackFunc_t callbackFunc,
      NPF_OUT NPF_callbackHandle_t *callbackHandle);

/* Completion Callback Deregistration Function */
NPF_error_t NPF_F_AAL5TransmitDeregister (
      NPF_IN NPF_callbackHandle_t callbackHandle);

/* LFB Attributes Query Function */
NPF_error_t NPF_F_AAL5TransmitLFB_AttributesQuery (
      NPF_IN NPF_callbackHandle_t callbackHandle,
      NPF_IN NPF_correlator_t correlator,
      NPF_IN NPF_errorReporting_t errorReporting,
      NPF_IN NPF_FE_Handle_t feHandle,
      NPF_IN NPF_BlockId_t blockId);


#ifdef __cplusplus
}
#endif

#endif /* __NPF_F_AAL5_TX_H__ */
```

Appendix B Acknowledgements

Working Group Chair: Alex Conta

Task Group Chair: Per Wollbrand

The following individuals are acknowledged for their participation to ATM Task Group teleconferences, plenary meetings, mailing list, and/or for their NPF contributions used for the development of this Implementation Agreement. This list may not be all-inclusive since only names supplied by member companies for inclusion here will be listed. The NPF wishes to thank all active participants to this Implementation Agreement, whether listed here or not.

The list is in alphabetical order of last names:

Pål Dammvik, Ericsson
Patrik Herneld, Ericsson
Ajay Kamalvanshi, Nokia
Jaroslaw Kogut, Intel
Arthur Mackay, Freescale
Stephen Nadas, Ericsson
Michael Persson, Ericsson
John Renwick, Agere Systems
Vedvyas Shanbhogue (ed.), Intel
Keith Williamson, Motorola
Weislaw Wisniewski, Intel
Per Wollbrand, Ericsson

Appendix C List of companies belonging to NPF during approval process

Agere Systems
AMCC
Analog Devices
Cypress Semiconductor
Enigma Semiconductor
Ericsson
Flextronics
Freescale Semiconductor
HCL Technologies
Hifn
IDT
Infineon Technologies AG
Intel
IP Fabrics
IP Infusion
Motorola
Mercury Computer Systems
Nokia
NTT Electronics
PMC-Sierra
Sensory Networks
Sun Microsystems
Teja Technologies
TranSwitch
U4EA Group
Wintegra
Xelerated
Xilinx