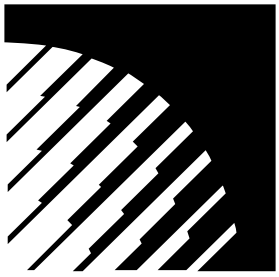

The ATM Forum
Technical Committee

PNNI Addendum for Generic Application Transport Version 1.0

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Acknowledgments

The Control and Signalling working group was chaired by Malcolm Wiles. Anurag S. Maunder was the editor for the *PNNI addendum for Generic Application Transport* specification. The minutes at related working group meetings were recorded by Gert Öster.
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Generic Application Transport

This addendum to PNNI v1.0 "Private Network-Network Interface Specification Version 1.0" [1] contains the description and specification of the Generic Application Transport (GAT) feature.

1 General Description

Generic Application Transport (GAT) is an optional extension to PNNI 1.0 which currently supports two functions:

1. It allows the transport of organization-specific information in an interoperable manner.
2. It provides a "container" to allow transparent transport of non-PNNI signalling protocol information through a PNNI network to support interworking. Examples of non-PNNI signalling protocols supported by GAT are ITU-T ISUP and FRF.10.1.

These functions are described below.

1.1 Organization-Specific Information Transport

The GAT information element allows the transport of organization-specific information through a PNNI network to support the non-standardized implementation of features. These can be network-specific features or vendor proprietary features. This is achieved by using the Application Type value of "Organization Specific" in the GAT information element.

1.2 Protocol Interworking Information Transport

As ATM networks are deployed, there is a growing interest in using these same networks to provide voice or other non-ATM services. Therefore, it is desirable to expand PNNI signalling to support the services of these other signalling protocols.

For example, some of the capabilities available in ISUP (both ANSI and ITU-T versions) that are missing in PNNI 1.0 are:

- Charge number for billing
- Support for echo control indication
- Generic number transport for supplementary services
- Originating Line Information to indicate a toll class of service

Similarly, capabilities available in FRF.10.1 that are missing in PNNI 1.0 are:

- Call Identification
- Clearing Network Identification
- Transit Network Identification
- Link Layer Core Parameters

The GAT IE is not limited to supporting only the capabilities listed above. The information necessary to support these features need not be processed or understood by nodes between the interworking functions,

but rather only at the interworking functions. Hence, the approach of defining new PNNI information elements to support each of these non-PNNI features is undesirable. Instead, the GAT information element is used to "tunnel" information transparently (information elements or parameters) from other protocols between interworking functions (IWFs) across a PNNI network. The architecture is as depicted in Figure 1-1 below:

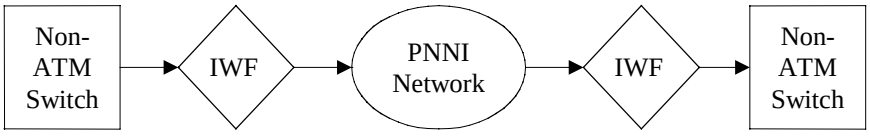

Figure 1-1: Interworking Architecture

2 Additions to PNNI Signalling Messages

2.1 ALERTING

Figure 6-3/PNNI 1.0 ALERTING Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-1 Additional ALERTING Message Content

2.2 CONNECT

Figure 6-5/PNNI 1.0 CONNECT Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-2 Additional CONNECT Message Content

2.3 NOTIFY

Figure 6-11/PNNI 1.0 NOTIFY Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6- 512

Note 1 - This information element may be present up to 5 times.

Figure 2-3 Additional NOTIFY Message Content

2.4 PROGRESS

Figure 6-14/PNNI 1.0 PROGRESS Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-4 Additional PROGRESS Message Content

2.5 RELEASE

Figure 6-6/PNNI 1.0 RELEASE Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-5 Additional RELEASE Message Content

2.6 RELEASE COMPLETE

Figure 6-7/PNNI 1.0 RELEASE COMPLETE Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-6 Additional RELEASE COMPLETE Message Content

2.7 SETUP

Figure 6-8/PNNI 1.0 SETUP Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-7 Additional SETUP Message Content

2.8 ADD PARTY

Figure 6-19/PNNI 1.0 ADD PARTY Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-8 Additional ADD PARTY Message Content

2.9 ADD PARTY REJECT

Figure 6-22/PNNI 1.0 ADD PARTY REJECT Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-9 Additional ADD PARTY REJECT Message Content

2.10 ADD PARTY ACKNOWLEDGE

Figure 6-20/PNNI 1.0 ADD PARTY ACKNOWLEDGE Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-10 Additional ADD PARTY ACKNOWLEDGE Message Content

2.11 PARTY ALERTING

Figure 6-21/PNNI 1.0 PARTY ALERTING Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-11 Additional PARTY ALERTING Message Content

2.12 DROP PARTY

Figure 6-23/PNNI 1.0 DROP PARTY Message Content is amended to include the following:

Information Element	Reference	Type	Length
Generic application transport	3.1	O(1)	6-512

Note 1 - This information element may be present up to 5 times.

Figure 2-12 Additional DROP PARTY Message Content

3 Information Element Coding

To provide the Generic Application Transport extension, the following information element is added to Table 6-5 in 6.4.5.1 of PNNI v1.0:

Bits	Information Element	Max Length	Max. no. of
8 7 6 5 4 3 2 1			Occurrences
1 1 1 0 0 1 0 1	Generic application transport	512	5

Table 3-1 Additional information element used in PNNI

3.1 Generic Application Transport

The purpose of the Generic application transport information element is to allow the carriage of organization-specific and interworking information through a PNNI network. Any node along the path of the call or connection may examine and process the contents of this information element.
The Generic application transport information element is coded as shown in Figure 3-1 and Table 3-2. The maximum length of this information element is 512 octets. The number of instances of this information element in a message is limited to five.

Bits 8	7	6	5	4	3	2	1	Octets	
Generic application transport information element identifier								1	
1	1	1	0	0	1	0	1		
1 Ext	Coding Standard		Information Element instruction field: Flag	Pass along	Information Element Action Indicator			2	
Length of Generic Application Transport contents								3	
Length of Generic Application Transport contents (continued)								4	
Application Type								5	
Application-specific information								6-512*	(Note 1)

Note 1 – The format of these octets depends on the Application Type, as defined in Table 1.

Figure 3-1 PNNI Generic Application Transport Information Element

Coding Standard (Octet 2)

Bits 7	6	Meaning
1	1	ATM Forum specific

Application Type (Octet 5)

Bits 8	7	6	5	4	3	2	1	Meaning
0	0	0	0	0	0	0	1	Organization specific
0	0	0	0	0	0	1	0	ITU-T ISUP (Q.763)
0	0	0	0	0	0	1	1	ANSI ISUP (T1.113)
0	0	0	0	0	1	0	0	Frame Relay Forum FRF.10.1
1	1	1	1	1	1	1	1	Reserved for an extension mechanism

All other values are reserved

Application -specific information coding (octets 6-512) when Application Type is Organization Specific:

Organization Unique Identifier (OUI)	6-8 (Note 1)
Organization specific information	9-512* (Note 2)

Note 1: Organization Unique Identifier (Octets 6-8)

These octets uniquely identify an organization. The value is assigned by IEEE. The most significant octet of the OUI appears in octet 6 and the least significant octet appears in octet 8. These octets must be present if the Application Type is organization-specific.

Note 2: Organization-specific information (octets 9-512.)

The format of this field is defined by the organization identified by the OUI.

Application-specific information coding (octets 6-512) when Application Type is ITU-T ISUP :
The format of this field is defined in section 4.3.

Application-specific information coding (octets 6-512) when Application Type is ANSI ISUP:
The format of this field is defined in section 4.3

Application -specific information coding (octets 6-512) when Application Type is Frame Relay Forum FRF.10.1 :
The format of this field is defined in
Network-to-Network FR/ATM SVC Service Interworking Implementation Agreement [4].

Table 3-2 Coding for Generic Application Transport Information Element

4 Procedures for Generic Application Transport

The procedures at a network node are described below. These procedures are in addition to the normal call/connection procedures defined in the PNNI specification.

4.1 Receiving a Message with One or More GAT Information Elements

When a message with one or more GAT information elements is received and the GAT information element is supported, the receiving entity shall examine and process the contents of each of the GAT information element instance(s) according to the following procedures:

i) If the Application Type is not recognized, or if the Application Type is organization specific but the node does not recognize the OUI, then the information element shall be treated as an unrecognized information element and not as an information element with unrecognized contents[1];

ii) If the Application Type is organization specific and the OUI is recognized then the information element shall be processed as defined by the organization identified by the OUI;

iii) If the Application Type is recognized and is not organization specific then:

- If the message has arrived at an IWF for the specified Application Type, the contents shall be processed according to the interworking specification for the specified Application Type (refer to Table 3-2).
- Otherwise, the information element shall be forwarded unchanged.

4.2 Sending a Message with One or More GAT Information Elements

When a message is sent from a node, if the GAT information element is allowed in the message, the node may insert one or more instances of the GAT information element into the message (up to the maximum number of instances). The GAT information elements shall be coded as shown in Figure 3-1 and Table 3-2, with the information element instruction indicator field set as described in section 5.

4.3 Procedures at an ISUP-PNNI border

At the ISUP-PNNI border, ISUP parameters may be included in corresponding PNNI messages (for example see Table 4-1). All other procedures for the processing of Generic application transport information elements also apply.

ISUP Message	PNNI Message
Initial Address	SETUP
Answer	CONNECT
Release	RELEASE
Release Complete	RELEASE COMPLETE

Table 4-1 Correspondence of ISUP and PNNI Messages

[1] The distinction between "being treated as an unrecognized information element" versus "being treated as an information element with content error" is important because the error handling procedure is different in these two cases. One important difference is that the pass along capability is not used in the case of "an information element with content error" but does apply to "an unrecognized information element".

ISUP parameters that cannot be directly mapped to one or more PNNI information elements by the interworking functions, such as those listed below, may be included in the Generic application transport information element with the Application Type set appropriately to the ISUP variant in use. Multiple ISUP parameters should be included in a single Generic application transport information element as described below. The encoding of the parameter(s) is as defined in the respective standard (e.g., ANSI ISUP [2], ITU-T ISUP [3]).

Within the Generic application transport information element, all ISUP parameters shall be coded with parameter name, parameter length and parameter value fields. Thus when a mandatory fixed length parameter is included, the parameter name and the length shall also be included (even though it is not required by ISUP since the message type defines the order and the length of mandatory parameters). The list of mandatory fixed parameters included in the Generic application transport information element is application dependent.

When a mandatory variable length parameter is included, the parameter name and the length shall also be included (even though the parameter name is not required by ISUP since the message type defines the order of mandatory parameters). The list of mandatory variable length parameters included in the Generic application transport information element is application dependent.

When an optional parameter is included, the parameter name and the length shall also be included.

The following list of ISUP parameters, which cannot be directly mapped to corresponding PNNI information elements, should be mapped into the Generic application transport information element:

- Charge number
- Echo control information
- Generic address
- Generic digits
- Generic name
- Originating Line Information

Any of the ISUP parameters listed above may be included in the Generic application transport information element. However, the GAT information element is not limited to supporting only the parameters listed above. Also, the list of parameters that is interpreted at a particular ISUP-PNNI border is application dependent.

4.4 Procedures at FR-PNNI Interworking Unit

The procedures for processing FRF.10.1 information elements at the FR/ATM Interworking Function (IWF) are described in "Network-to-Network FR/ATM SVC Service Interworking Implementation Agreement" [4].

5 Compatibility with Nodes Not Supporting Generic Application Transport

Generic Application Transport is an optional addendum to PNNI v1.0. This section describes how the GAT behaves in a network containing nodes that do not support the Generic Application Transport.
If support of the Generic application transport information element and its contents by all nodes along the path of the call/connection is optional, then the node creating the Generic application transport information element shall set the information element instruction flag field (bit 5 of octet 2) to "follow explicit instruction" and the pass along request field (bit 4 of octet 2) to "pass along request".

If support of the Generic application transport information element and its contents by all nodes along the path of the call/connection is mandatory for the correct functioning of the feature, then the information

element instruction field and action indicators shall be coded according to the requirements of the application.

6 Protocol Implementation Conformance Statement (PICS)

6.1 Introduction

To evaluate conformance of a particular implementation, it is necessary to have a statement of which capabilities and options that have been implemented. Such a statement is called a Protocol Implementation Conformance Statement (PICS).

6.1.1 Scope

Section 6.3 provides the PICS proforma for the Generic Application Transport, as specified in this document in compliance with the relevant requirements, and in accordance with the relevant guidelines, given in ISO/IEC 9646-2 [6]. In most cases, statements contained in notes in the specification, which were intended as information, are not included in the PICS.

6.1.2 Definitions

This following terms defined in ISO/IEC 9646-1[5] are used below:

- A Protocol Implementation Conformance Statement (PICS) is a statement made by the supplier of an implementation or system, stating which capabilities have been implemented for a given protocol.
- A PICS proforma is a document, in the form of a questionnaire, designed by the protocol specifier or conformance test suite specifier, which when completed for an implementation or system becomes the PICS.

6.1.3 Acronyms

GAT	Generic Application Tranport
IE	Information Element
IUT	Implementation under test
M	Mandatory requirements (these are to be observed in all cases)
O	Optional (may be selected to suit the implementation, provided that any requirements applicable to the options are observed)
O.n	Optional, but support is required for either at least one or only one of the options in the group labeled with the same numeral "n".
PICS	Protocol Implementation Conformance Statement

6.1.4 Conformance

The supplier of a protocol implementation which is claimed to conform to the ATM Forum Generic Application Transport is required to complete a copy of the PICS proforma provided in this document and is required to provide the information necessary to identify both the supplier and the implementation.

6.2 Identification of the Implementation

Implementation Under Test (IUT) Identification

IUT Name: _____

IUT Version: _____

_____

System Under Test (SUT) Identification

SUT Name: _____

Hardware Configuration: _____

_____

_____

Operating System: _____

Product Supplier

Name: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

Client

Name: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

PICS Contact Person

Name: _____

Address: _____

_____

Telephone Number: _____

Facsimile Number: _____

Email Address: _____

Additional Information: _____

PICS/System Conformance Statement

Provide the relationship of the PICS with the System Conformance Statement for the system:
_____
_____
_____

Identification of the protocol

This PICS proforma applies to the following:

- Generic Application Transport as defined in this document

6.3 PICS Proforma

6.3.1 Global statement of conformance

The implementation described in this PICS meets all of the mandatory requirements of the reference protocol.

[ ] YES
[ ] NO

Note: Answering "No" indicates non-conformance to the specified protocol. Non-supported mandatory capabilities are to be identified in the following tables, with an explanation by the implementor explaining why the implementation is non-conforming.

6.3.2 Instructions for Completing the PICS Proforma

The PICS Proforma is a fixed-format questionnaire. Answers to the questionnaire should be provided in the rightmost columns, either by simply indicating a restricted choice (such as Yes or No), or by entering a value or a set of range of values.

A supplier may also provide additional information, categorized as exceptional or supplementary information. These additional information should be provided as items labeled X.<i> for exceptional information, or S.<i> for supplemental information, respectively, for cross reference purposes, where <i> is any unambiguous identification for the item. The exception and supplementary information are not mandatory and the PICS is complete without such information. The presence of optional supplementary or exception information should not affect test execution, and will in no way affect interoperability verification. The column labeled ‘Reference’ gives a pointer to sections of the protocol specification for which the PICS Proforma is being written.

6.3.3 GAT - Roles

Item Number	Item Description_	Status	Reference	Support
GAT-MC1	Support the transport of GAT information element in the signalling messages?	M	2	Yes__No__
GAT-MC2	Support Generic application transport (GAT) information element with Application Type equal to organization specific?	O	2, 3	Yes__No__
GAT-MC3	Support Generic application transport (GAT) information element with Application Type equal to ITU-T ISUP?	O	2, 3	Yes__No__
GAT-MC4	Support Generic application transport (GAT) information element with Application Type equal to ANSI ISUP?	O	2, 3	Yes__No__
GAT-MC5	Support Generic application transport (GAT) information element with Application Type equal to Frame Relay Forum FRF.10.1?	O	2, 3	Yes__No__

6.3.4 GAT Encoding

Item Number	Item Description_	Status	Predicate	Reference	Support
GAT-E1	Is the IUT capable of including up to 5 GAT IEs in a - SETUP message? - CONNECT message? -RELEASE message? -RELEASE COMPLETE message? -ALERTING message? -NOTIFY message? -PROGRESS message? -ADD PARTY message? -ADD PARTY REJECT message? -ADD PARTY ACKNOWLEDGE message? - PARTY ALERTING message? -DROP PARTY message?	M		2	 Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__ Yes__No__
GAT-E2	If a node supports the origination of the GAT information element is the information element coded as shown in Figure 3-1 and Table 3-2?	M		3	Yes__No__

6.3.5 GAT Procedures

Item Number	Item Description_	Status	Predicate	Reference	Support
GAT-P1	Is the GAT information element treated as an unrecognized information element if the Application Type is not recognized?	M		4.1	Yes__No__
GAT-P2	Is the GAT IE treated as an unrecognized IE if the Application Type is "organization-specific" but the OUI is not recognized?	M		4.1	Yes__No__
GAT-P3	Does the IUT forward the GAT IE unchanged if it is not an IWF and the Application Type is recognized and is not organization specific?	M		4.1	Yes__No__

7 References

[1] ATM Forum, Private Network-Network Interface Specification Version 1.0, af-pnni-0055.000, March 1996.

[2] ANSI T1.113, "Signaling System No. 7 (SS7) - Integrated Services Digital Network User Part (ISUP)," American National Standards Institute, 1995.

[3] ITU-T Q.763, "Formats and Codes of the ISDN User Part of Signalling System No. 7," 3/93.

[4] Frame Relay Forum, "Network-to-Network FR/ATM SVC Service Interworking Implementation Agreement ", To be published

[5] ISO/IEC 9646-1:1994, Information technology - Open systems interconnection - Conformance testing methodology and framework - Part 1: General Concepts. (See also ITU Recommendation X.290(1995)).

[6] ISO/IEC 9646-2:1994, Information technology - Open systems interconnection - Conformance testing methodology and interconnection - Part 2: Abstract test suite specification. (See also ITU Recommendation X.291(1995)).