

Fieldbus specification

Part 6. Fieldbus access sublayer (Services and protocol)

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Foreword

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This publication contains the following parts:

Part 1	System architecture	FF-94-800	Revision 1.0
Part 2	Network management	FF-94-801	Revision 1.0
Part 3	Data link layer services subset	FF-94-821	Revision 1.0
Part 4	Data link protocol specification	FF-94-822	Revision 1.0
Part 5	Fieldbus message specification	FF-94-870	Revision 1.0
Part 6	Fieldbus access sublayer (services and protocol)	FF-94-875	Revision 1.0

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According to the replies received the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

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Fieldbus Foundation

Fieldbus Specification

Fieldbus Access Sublayer (Services and Protocol)

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Foreword

This document describes the features and protocol of the Fieldbus Access Sublayer (FAS) of the Fieldbus Foundation Fieldbus Application Layer.

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Resolution List		
No.	Description of Resolution	Affected Sections

Comments to be Addressed in the Final Specifications

1. The Abort service should permit FMS to provide an FMS specified reason code that is supplied by the user when requesting an abort.

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1. Scope

The Fieldbus Foundation Fieldbus Access Sublayer (FAS) provides for interfaces to its service users and the Fieldbus Foundation Data Link Layer (DLL). This specification defines the FAS model, the FAS services, and its protocol.

This specification is intended to be read in conjunction with the Fieldbus Foundation Fieldbus Message Specification (FMS), Fieldbus Foundation Network Management Specification, and Fieldbus Foundation Data Link Layer Services and Protocol specifications.

2. Overview

Application Processes (APs) in a distributed communication system use a set of services and logical communication channels of the Application Layer to communicate with each other. In the Foundation Fieldbus environment, the FAS provides such communication channels called Application Relationships (ARs) between these APs. The FAS communicates with its communication partner by transferring FAS messages that are referred to as the FAS Protocol Data Units (FAS-PDUs).

This specification first describes the FAS architecture and the model with an overview of an AR. It then describes the FAS services provided for the FAS service users. Several AR types are then specified by their attributes. This specification also defines how the DLL services are used to transfer the FAS-PDUs. Protocol machines for different AR types are provided to describe operations and behaviour of the FAS in detail. Finally, the structure of the FAS-PDUs are defined.

3. Architecture

Figure 1 shows the relationship between the FAS and the other communication and application components of the Foundation Fieldbus architecture.

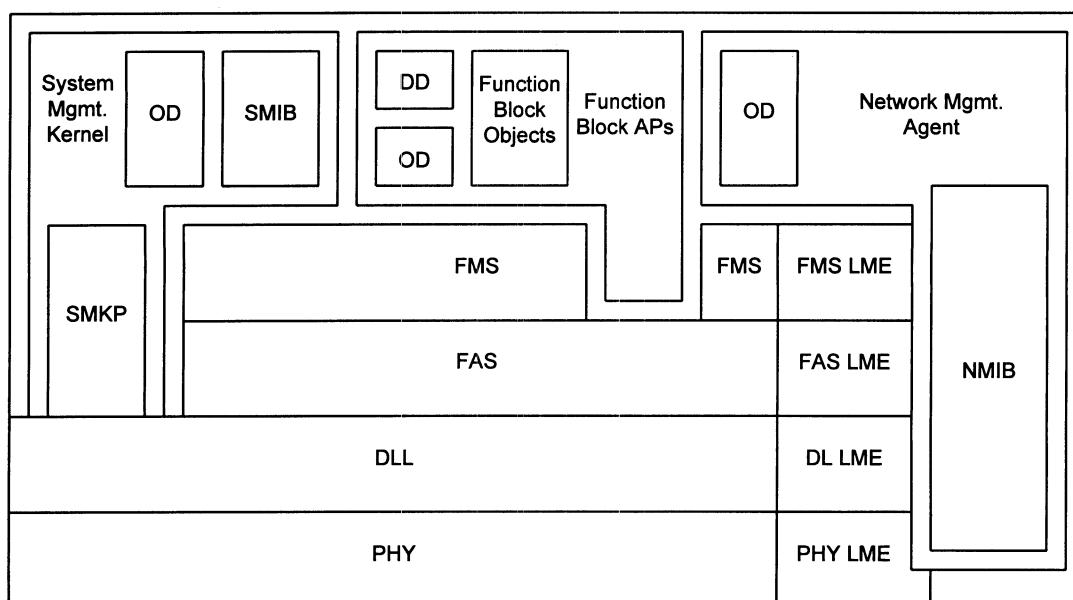


Figure 1 – General Fieldbus Foundation Architecture

3.1 FAS Interfaces

The FAS provides services to its service users, such as the FMS or APs, and uses the services of the DLL as shown in the figure above. In addition, for management purposes, a local interface to the FAS is provided by the FAS Layer Management Entity (FASLME).

3.2 Application Relationship

In a distributed system, Application Processes (APs) communicate with each other by exchanging application layer messages across well-defined application layer communication channels. These communication channels are modeled in the Fieldbus Application Layer as Application Relationships (ARs).

ARs are responsible for conveying messages between or among APs according to specific communication characteristics required by time-critical systems. When the FMS is the service user, the messages that are conveyed contain confirmed and unconfirmed service requests and confirmed service responses.

Each AR is established by connecting two or more Application Relationship End Points (AREPs). Characteristics of an AR are determined by the types of the AREPs involved in the AR. Each AR has only one AREP for each involved AP.

The characteristics of ARs are described in the remainder of Section 3. Different combinations of these characteristics lead to the definition of different classes of ARs in Section 4.

3.3 AREP Characteristics

3.3.1 AREP Context

To ensure communications compatibility among or between AREPs, each AREP definition contains a set of compatibility related characteristics. These characteristics shall be configured appropriately for each AREP for the AR to operate properly.

AREP definitions also contain a set of characteristics that describe the operation of the AR. These characteristics, when combined with those used to specify compatibility, define the context of the AREP. The AREP context is used by the FAS and the Network Management Entity to manage the operation of the AREP and the conveyance of FAS-PDUs. The characteristics which comprise the AREP context are described next.

3.3.2 AREP Roles

The role of an AREP describes how an AP interacts with other APs involved in the AR. Only AREPs with compatible roles can be related to form an AR. Each AREP role is defined by the characteristics of service requests and responses it is capable of conveying. The following AREP roles are defined: Client, Server, Peer, Publisher, Subscriber, Source, and Sink.

Client, Server, and Peer AREPs

Peer AREPs are those that can operate either as a Client or a Server AREP, or simultaneously as both. In the following descriptions, Client AREPs include Peer AREPs acting as Clients, and Server AREPs include Peer AREPs acting as Servers.

The following characteristics apply to Client and Server AREPs with regard to AR establishment and termination:

- A Client/Server AR is established over a peer-to-peer Data Link Connection (DLC).
- A Client AREP is able to send a request to establish an AR to a single Server AREP and to receive its response.
- A Client AREP may be configured to send such a request to either a prespecified Server AREP, or to any Server AREPs. The latter is designated as "Free" Client.
- A Server AREP can receive a request to establish an AR from a single Client AREP and to respond to it.
- A Server AREP may be configured to receive such a request from either a prespecified Client AREP, or from any Client AREPs. The latter is designated as "Free" Server.
- Either the Client or the Server AREP may request to terminate the AREP.

The following characteristics apply to Client and Server AREPs for conveying messages on an established AR:

- A Client AREP can send confirmed data transfer service requests and receive their responses.
- A Client AREP is not capable of receiving or responding to confirmed data transfer requests.
- A Client AREP is not capable of sending unconfirmed data transfer service requests.
- A Server AREP is capable of receiving confirmed data transfer service requests and returning their responses.
- A Server AREP is not capable of sending confirmed data transfer service requests or receiving their responses.
- A Server AREP is not capable of receiving unconfirmed data transfer service requests.

Publisher and Subscriber AREPs

The following characteristics apply to Publisher and Subscriber AREPs with regard to AR establishment and termination:

- A Publisher/Subscriber AR is established over a multi-peer DLC.
- A Publisher AREP does not send a request to Subscriber AREPs to establish an AR. However, a Publisher AREP requests its DLL entity to establish a multi-peer DLC for sending data. Subscribers are not known to the Publisher.
- A Subscriber AREP accepts a user request to establish an AR on a pre-specified DLCEP.
- A Subscriber AREPs does not receive a request from a Publisher AREP or send a request to a Publisher AREP to establish an AR. However, it requests its DLL entity to join the DLC that has been established by the Publisher to receive data from it.
- A Publisher AREP sends a request to Subscriber AREPs to terminate the AR.
- Subscriber AREPs receive the request from the Publisher AREP to terminate the AR.
- A Subscriber AREP does not send a request to the Publisher AREP to terminate the AR. However, it requests its DLL entity to stop participating in the DLC that has been used to receive data from the Publisher.

The following characteristics apply to Publisher and Subscriber AREPs for conveying messages on an established AR:

- A Publisher AREP can send unconfirmed data transfer service requests.
- A Publisher AREP is not capable of sending confirmed data transfer service requests.
- A Publisher AREP is not capable of receiving confirmed or unconfirmed data transfer service requests.
- A Subscriber AREP is capable of receiving only unconfirmed data transfer service requests.
- A Subscriber AREP is not permitted to send confirmed or unconfirmed data transfer service requests.

Source and Sink AREPs

The following characteristics apply to Source and Sink AREPs with regard to AR establishment and termination:

- A Source/Sink AR is established between two or more Data Link Layer Service Access Points (DLSAPs) and does not use a DLC.
- A Source AREP accepts a user request to establish an AR. However, it does not interact with its local DLL entity during AR establishment.

- A Sink AREP accepts a user request to establish an AR. However, it does not interact with its local DLL entity during AR establishment.
- A Source AREP accepts a user request to terminate the AR, but does not send a request to Sink AREPs to terminate the AR. It performs a local AREP termination only.
- A Sink AREP accepts a user request to terminate the AR, but does not send a request to the Source AREP to terminate the AR. It performs a local AREP termination only.

The following characteristics apply to Source and Sink AREPs for conveying messages on an established AR:

- A Source AREP can send unconfirmed data transfer service requests.
- A Source AREP is not capable of sending confirmed data transfer service requests.
- A Source AREP is not capable of receiving confirmed or unconfirmed data transfer requests.
- A Sink AREP is capable of receiving only unconfirmed data transfer service requests.
- A Sink AREP is not permitted to send confirmed or unconfirmed data transfer service requests.
- Flow control and lost FAS-PDU detection are done by the FAS user.

The following table summarizes the capabilities of each AREP role. A Peer AREP has the capabilities of Client and Server AREPs at the same time and is not included in the table.

AREP Role	Confirmed Service Requests	Confirmed Service Responses	Unconfirmed Service Requests
Client	Issue	Receive	No
Server	Receive	Issue	No
Publisher	No	No	Issue
Subscriber	No	No	Receive
Source	No	No	Issue
Sink	No	No	Receive

Table 1 – Characteristics of AREP Roles

3.3.3 AREP Cardinality

The cardinality of an AREP indicates the number of remote AREPs with which it simultaneously communicates. The table below summarizes the cardinality of AREPs by its role.

AREP Role	Permitted Cardinality	DLL Address Type	Meaning
Client	1	Individual DLCEP	A Client AREP shall be related to a single Server or Peer AREP in a single AR.
Server	1	Individual DLCEP	A Server AREP shall be related to a single Client or Peer AREP in a single AR.
Peer	1	Individual DLCEP	A Peer AREP shall be related to a single Client, Server, or Peer AREP in a single AR.
Publisher	>=0	Individual DLCEP	A Publisher AREP shall be related to zero or more Subscriber AREPs in a single AR.
Subscriber	1	Individual DLCEP	A Subscriber shall be related to a single Publisher AREP in a single AR.
Source	>=0	Individual DLSAP	A Source AREP shall be related to zero or more Sink AREPs in a single AR.
Sink	1	Individual or Group DLSAP	A Sink AREP shall be related to a single Source AREP in a single AR.

Table 2 – AREP Cardinality by AREP Type

3.3.4 AR Cardinality

The cardinality of an AR indicates the number of AREPs communicating with each other in the AR. The table below summarizes the cardinality of ARs.

AR Type	Permitted Cardinality	Meaning
Client / Server	1-to-1	1 Client, 1 Server
Publisher/ Subscriber	1-to-Many	1 Publisher, zero or more Subscribers
Source/Sink	1-to-Many	1 Source, zero or more Sinks

Table 3 – AR Cardinality by AR Type

3.3.5 Conveyance Path

A conveyance path of an AREP is a conceptual channel in an AR through which FAS-PDUs are transferred from one AREP to another. It is a one-way communication path between any two AREPs that send or receive FAS-PDUs.

AREPs that only send or receive FAS-PDUs are modeled with having one conveyance path, and those that do both are modeled with having two of them. An AR with a single conveyance path is called a uni-directional AR, and one with two conveyance paths is called a bi-directional AR.

3.3.6 Trigger Policy

Trigger policy of an AREP specifies when FAS-PDUs are transmitted by the local DLL. Two types of trigger policy are defined for the FAS.

The first type of trigger policy is referred to as user-triggered. User-triggered AREPs do not use the scheduling capability of the DLL. The DLL is configured so that FAS-PDUs are transmitted as soon as possible after they are received from the FAS. User-triggered AREPs do not support the timeliness aspects described later.

The second type of trigger policy is called network-scheduled. Network-scheduled AREPs use scheduling capability of the DLL. FAS-PDUs are transmitted to the network regardless of when they are received from the FAS user. The DLL is configured to transmit FAS-PDUs at a specified frequency. In addition, FAS-PDUs may be transmitted to the network sporadically when the local DLL is explicitly requested by the local or remote FAS users.

3.3.7 Conveyance Policy

Conveyance policy of an AREP indicates whether FAS-PDUs are transferred according to DL's buffer and queue models. These models describe the method of conveying FAS-PDUs from a sender to a receiver.

NOTE: Although this specification makes use of the buffer and queue models of the DLL, it does not specify whether additional buffers or queues are implemented in the FAS or not.

In the case of an AREP with buffered conveyance policy, updates to its buffer replace its contents with a new FAS-PDU. Thus, unconveyed or undelivered FAS-PDUs that have been replaced in the buffer are lost. Additionally, a buffer may be read multiple times without destroying the FAS-PDU contained in it. Also, the same FAS-PDU may be sent multiple times if the buffer is not updated by the FAS. When this occurs, the receiving DLL entity indicates to the FAS that the receiving buffer has been updated, but the update was a duplicate of the previous data. The FAS will make this information available to its user so that the user may detect "staleness" of the received data.

In the case of an AREP with queued conveyance policy, it conveys FAS-PDUs using a first-in first-out (FIFO) queue. A queue entry is not overwritten. New FAS-PDUs are appended to a queue until it becomes full. The DLL sends FAS-PDUs in the order they are put into the queue. Similar, but reversed actions take place at a receiving AREP. If a queue is full, a new FAS-PDU will not be placed into the queue.

3.3.8 Identification of AREPs

An AP distinguishes an AR by its local identifier.

The remote AREP is known to the local AREP only through configuration of the remote DLSAP-address for Source and Sink AREPs, or through configuration of the remote DLCEP-address for Client, Server, Peer, and Subscriber AREPs. Publisher AREPs do not know the identity of Subscriber AREPs.

The only exception to this rule is for AREPs that are configured to be "Free." For "Free" Client and Server AREPs, the remote address is not configured, but is dynamically determined when the AR is established. For "Free" Sink and Source AREPs, the remote address is provided by an FAS-PDU.

3.4 AR Establishment

Each AR is established by connecting two or more AREPs of the same type. How messages are conveyed on an AR is dependent on the types of the AREPs involved in the AR. AR establishment can occur in one of three ways:

First, ARs can be pre-established. Pre-established means that the AREP context is created when an AP is connected to the network. In this case, communications among the APs involved in the AR take place without first having to explicitly establish the AR. Any AR may be defined to be pre-established.

NOTE: When pre-established ARs are used, the state machines that deal with AR establishment and release do not apply. However, those that deal with data transfer still apply. A means to bring the state machines to the data transfer phase is a local matter.

Second, ARs can be pre-configured, but not established. Pre-configured means that the characteristics of the AR are known to each AREP, but that their contexts have not been synchronized for operation. In this case, the use of the FAS Associate service is required to activate the AR.

Third, ARs can require dynamic definition and establishment. In this case, AREP definitions have to be created for each of the AREPs involved in the AR. Network Management services may be used to remotely create AREP definitions. After creation, ARs can be established as though they were pre-configured.

Only Client/Server AR establishment results in the exchange of FAS-PDUs. During this exchange, DLCEP-addresses are used as the global identifiers for the Client/Server AREPs. These FAS-PDUs are transferred between node-local DLSAPs reserved for this purpose by the Foundation Fieldbus.

3.5 Underlying Communications Services

The FAS conveys FAS-PDUs using the capabilities of the DLL. This section briefly describes them for better understanding. Formal definitions of these characteristics are specified in the Fieldbus Foundation Data Link Layer specification.

3.5.1 Connectionless and Connection-Oriented Services

The DLL supports AREPs by providing connectionless and connection-oriented mode of services.

3.5.2 Buffer and Queue

The DLL provides services to configure and control its buffers and queues. These services are used by the Network Management to configure AREPs.

3.5.3 Cyclic and Acyclic Services

The DLL supports AREPs by providing cyclic or acyclic services. Cyclic services are used to support timeliness requirements of AREPs.

User triggered AREPs are always acyclic. Network triggered AREPs are either cyclic or acyclic. A Cyclic AREP implies that scheduling is done by a scheduling mechanism of the DLL .

3.5.4 Quality of Service

The DLL may provide more than one quality of service. When this occurs, the AREP shall be configured to use the quality of service appropriate for the FAS-PDUs it conveys. Quality of service parameters for AREPs are contained in the Data Link Mapping section of this specification.

3.5.5 Segmentation

The FAS does not segment user data it conveys. However, if the DLL provides segmentation, the maximum length of data conveyed by the FAS in a single FAS-PDU will increase accordingly.

3.5.6 Timeliness

The FAS supports the timeliness parameters provided by the DLL. It does not control any of the parameters; rather, it passes through these parameters from the DLL to its user.

4. FAS Model

The FAS model assumes that one or more ARs exist between APs. Each AR connects one or more APs based on its cardinality.

4.1 Application Relationship End Point Classes

AREP classes are defined with a combination of characteristics to form different types of ARs. For purposes of interoperability, this specification defines three AREP classes, from which a basic set of standardized ARs can be derived. These classes are:

- QUU: Queued User-triggered Unidirectional AREP Class
- QUB: Queued User-triggered Bidirectional AREP Class
- BNU: Buffered Network-Scheduled Unidirectional AREP Class

The following table summarizes AREP classes and supported characteristics described in the Architecture section:

	AREP Classes		
	QUU	QUB	BNU
Permitted Roles	Source, Sink	Client, Server, Peer	Publisher, Subscriber
Conveyance Paths	1	2	1
Conveyance Policy	Queued	Queued	Buffered
Transmission Policy	User Triggered	User Triggered	Network Scheduled

Table 4 – AREP Classes and Characteristics

4.1.1 QUU (Queued User-triggered Unidirectional) AREP Class

This AREP class provides an AR that supports on-demand queued distribution of unconfirmed services from one AP to zero or more APs, such as one with Source/Sink interactions.

A Source AREP accepts an unconfirmed service request, incorporates it into the appropriate FAS-PDU, and submits the FAS-PDU to the DLL. The DLL is configured to provide queued, connectionless data transfer services according to the attribute definitions of the AREP that are specified in the later section. All the FAS-PDUs from the Source AREP are sent with the same quality of service provided by the DLL. A Sink AREP receives the FAS-PDU from the DLL and delivers the unconfirmed service indication in the order it is received to the FAS user associated with this AREP.

4.1.2 QUB (Queued User-triggered Bidirectional) AREP Class

This AREP class provides an AR that supports an on-demand exchange of confirmed services between two APs.

A Client AREP accepts a confirmed service request, incorporates it into the appropriate FAS-PDU, and submits the FAS-PDU to the DLL. The DLL is configured to provide queued, connection-oriented data transfer services according to the attribute definitions of the AREP that are specified in the later section. The communication characteristics defined for the AREP determines how the DLL is configured. All the FAS-PDUs from the Client AREP are sent with the same quality of service provided by the DLL. A Server AREP receives the FAS-PDU from the DLL and delivers the confirmed service indication in the order received to the AP associated with this AREP.

The Server AREP accepts a confirmed service response from its user, incorporates it into the appropriate FAS-PDU, and submits the FAS-PDU to the DLL. The DLL provides queue-oriented, connection-oriented data transfer services according to the attribute definitions of the AREP that are specified in the later section. All the FAS-PDUs from the Server AREP are sent with the same quality of service provided by the DLL. The Client AREP receives the FAS-PDU that contains a confirmed service response from the DLL, delivers the confirmed service confirmation to the AP associated with this AREP, and completes the confirmed service.

4.1.3 BNU (Buffered Network-Scheduled Unidirectional) AREP Class

This AREP class provides an AR that supports scheduled, buffered distribution of unconfirmed services to zero or more APs, such as one with Publisher/Subscriber interactions.

A Publisher AREP accepts an unconfirmed service request, incorporates it into the appropriate FAS-PDU, and submits the FAS-PDU to the DLL. The DLL provides buffered, connection-oriented data transfer services according to the attribute definitions of the AREP that are specified in the later section. The communication characteristics defined for the AREP determines how the DLL is configured. All the FAS-PDUs from the Publisher AREP are sent with the same quality of service provided by the DLL. A Subscriber AREP receives the FAS-PDU from the DLL and delivers the unconfirmed service indication in the order it is received to the AP associated with this AREP.

If the Publisher AREP receives another unconfirmed service request before the FAS-PDU that contains the previous service request is transmitted, the previous FAS-PDU will be replaced with the new one, and the previous FAS-PDU will be lost. Similarly, if the Subscriber AREP receives another FAS-PDU before the previous one is read by its user, the previous one will be replaced by the new one and will be lost.

If the Publisher AREP does not receive a new unconfirmed service request before the DLL is triggered to transmit the buffer content, the same FAS-PDU will be retransmitted. If the Subscriber AREP receives the same FAS-PDUs successively, it notifies the user that duplicate FAS-PDUs have been received.

5. Operational Services

The FAS provides a set of services for its higher layer protocol. The Associate (ASC) and Abort (ABT) services control the establishment and release of ARs. The Data Transfer Confirmed (DTC) service provides a bi-directional exchange of higher layer services. It conveys confirmed higher layer services. The Data Transfer Unconfirmed (DTU) service provides a uni-directional data transfer and is used to convey unconfirmed higher layer services. The FAS-Compel (FCMP) service provides a means to generate “out of schedule” transmission from a scheduled buffer. The Get-Buffered-Message (GBM) service allows the FAS user to retrieve the contents of a buffer. Finally, the FAS-Status (FSTS) service reports several DLL events to the FAS user.

This section describes the FAS services, their parameters, and the service sequences at the interface between the FAS user and the FAS. The interface to the DLL is described later.

The following are the summary of FAS services at the interface to the FAS user:

- Associate (ASC) - establishment of an AR
- Abort (ABT) - release of an AR
- Data Transfer Confirmed (DTC) - data transfer confirmed by the user
- Data Transfer Unconfirmed (DTU) - unconfirmed data transfer
- FAS-Compel (FCMP) - a “send-buffer” request to the DLL
- Get-Buffered-Message (GBM) - retrieve an FAS-Service Data Unit (SDU) from the DLL
- FAS-Status (FSTS) - a reported event from the DLL

An FAS user which issues a service request to the FAS is called a “requester.” An FAS user which issues a service response to the FAS is called a “responder.” An FAS user which receives a service indication (for unconfirmed FAS user services) from the FAS is called the “receiver.”

5.1 Conventions

5.1.1 Parameters

The service primitives, used to represent service user/service provider interactions, convey parameters that indicate information available in the user/provider interaction.

This specification uses a tabular format to describe the component parameters of the FAS service primitives. Each table consists of up to five columns, containing the name of the service parameter, and one column each for the primitives used by the FAS service:

- the request primitive’s parameters,
- the indication primitive’s parameters,
- the response primitive’s parameters, and
- the confirm primitive’s parameters.

One parameter (or part of it) is listed in each row of each table. Under the appropriate service primitive columns, a code is used to specify the type of usage of the parameter on the primitive:

- “M” the parameter is mandatory for the primitive.
- “U” the parameter is a User option, and may or may not be provided depending on the dynamic usage of the FAS-user.
- “C” the parameter is conditional upon other parameters or upon the configuration of the AREP.
- “S” the parameter is a selection, and one of the parameters at the same indent level in the parameter column shall be selected.

If the above code is followed by “(=),” it indicates that the value of the parameter is equal to the parameter in the service primitive to its immediate left in the table.

5.1.2 General conventions

The service model, service primitives, and time-sequence diagrams used are entirely abstract descriptions; they do not represent a specification for implementation.

5.2 Associate (ASC)

The Associate (ASC) service is used to establish an AR and optionally transmit FAS user data.

Parameter Name	.request	.indication	.response	.confirm
Argument	M	M		
AREP Identifier	M	M		
Remote DLCEP Address	C			
Data	U	U(=)		
Result(+)			S	S
AREP Identifier			M	M
Data			U	U(=)
Result(-)			S	S
AREP Identifier			M	M
Data			U	U(=)

Table 5 – Associate (ASC)

5.2.1 Argument

The Argument contains the parameters of the ASC.request and ASC.indication primitives.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service.

Data

This optional parameter contains user data.

Remote DLCEP Address

This conditional parameter is present if the RemoteAddressConfigurationType attribute of the associated AREP is Free. If it is present, this parameter carries the remote DLCEP address.

If the RemoteAddressConfigurationType attribute is Linked, this parameter is not present.

5.2.2 Result(+)

This parameter indicates that the remote user agreed to establish the AR.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service.

Data

This optional parameter contains user data.

5.2.3 Result(-)

This parameter indicates that the remote user rejected the Associate request.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service.

Data

This optional parameter contains user data.

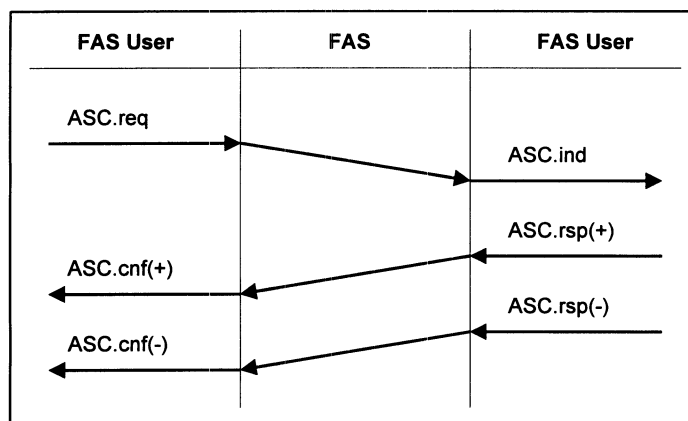


Figure 2 – Execution of the Associate (ASC – service at the FAS user- FAS interface for Client/Server ARs.

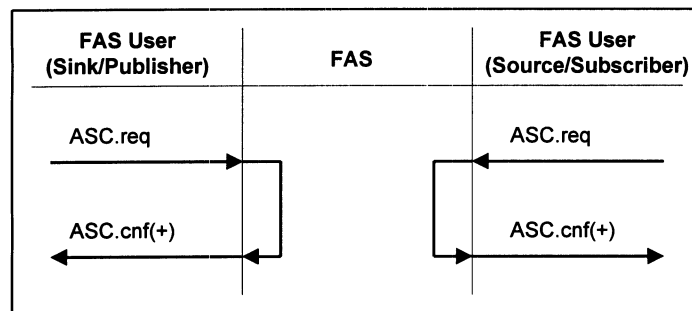


Figure 3 – Execution of the Associate (ASC – service at the FAS user- FAS interface for Sink/Source and Publisher/Subscriber ARs.

5.3 Data Transfer Confirmed (DTC)

The Data Transfer Confirmed service (DTC) is used to transmit confirmed FAS user service requests over an AR. An AR is a prerequisite for the execution of the DTC service.

Parameter Name	.request	.indication	.response	.confirm
Argument	M	M		
AREP Identifier	M	M		
Data	M	M(=)		
Result			M	M
AREP Identifier			M	M
Data			M	M(=)

Table 6 – Data Transfer Confirmed Service

5.3.1 Argument

The argument contains the parameters of the DTC.request and DTC.indication primitives.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service.

Data

This parameter contains a confirmed user request.

5.3.2 Result

This parameter indicates that the DTC service has been executed.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service.

Data

This parameter contains a confirmed user response.

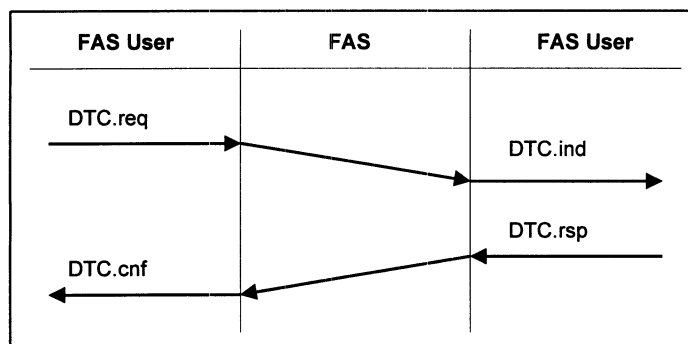


Figure 4 – Execution of the Data Transfer Confirmed (DTC – service at the FAS user- FAS interface

5.4 Data Transfer Unconfirmed (DTU)

The Data Transfer Unconfirmed service is used to transmit an unconfirmed FAS user service requests over a specified AR. An AR is a prerequisite for the execution of the DTU service.

Parameter Name	.request	.indication
Argument	M	M
AREP Identifier	M	M
Remote DLSAP Address	C	C
Duplicate FAS-SDU		C
Data	M	M(=)
Local Timeliness		C
Remote Timeliness		C

Table 7 – Data Transfer Unconfirmed Service

5.4.1 Argument

The argument contains the parameters of the DTU.request and DTU.indication primitives.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service.

Remote DLSAP Address

This conditional parameter is present if the ConfigurationType attribute of the associated AREP is Free. If it is present, this parameter carries the DLSAP address associated with the remote AREP. If the ConfigurationType attribute is Linked, this parameter is not present.

Duplicate FAS-SDU

This conditional parameter is present if the DuplicatePduDetectionSupported attribute is True. If it is present, it indicates whether or not the FAS-SDU is a duplicate of the FAS-SDU that has been received and delivered in a previous service indication.

This parameter takes a value of True if the same FAS-SDUs have been received successively. Otherwise, it takes a value of False.

Data

This parameter contains an unconfirmed service request.

Local Timeliness

This conditional parameter, if it is present and True, indicates that the FAS-SDU parameter has met the receiving timeliness criteria defined for the DLL. If its value is False, at least one of the timeliness criteria has not been met.

This parameter is present if the value of theSubscriberD1TimelinessClass attribute is other than None and is not present if it is None.

Remote Timeliness

This conditional parameter, if it is present and True, indicates that the FAS-SDU parameter has met the Publisher's and transmitting DL's timeliness criteria. If its value is False, at least one of the timeliness criteria has not been met.

This parameter is present if the value of thePublisherD1TimelinessClass attribute is other than None and is not present if it is None.

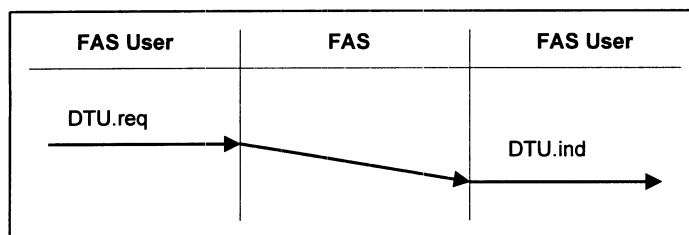


Figure 5 – Execution of the Data Transfer Unconfirmed (DTU – service at the FAS user- FAS interface

5.5 Abort (ABT)

The Abort service releases the specified AR. Execution of the DTC and DTU services after an Abort request has been issued is not permitted until the AR is re-established. This service may be requested by the FAS user or internally generated by the FAS.

Parameter Name	.request	.indication
Argument	M	M
AREP Identifier	M	M
Locally Generated		M
Identifier	M	M(=)
Reason Code	M	M(=)
Additional Detail	U	U(=)

Table 8 – Abort

5.5.1 Argument

The argument contains the parameters of the ABT.request and ABT.indication primitives.

AREP Identifier

This parameter contains sufficient information to locally identify the AR to be used to convey the service. This parameter may use a key attribute of the AREP.

Locally Generated

This parameter indicates whether the Abort service was initiated at the local or remote AREP.

Identifier

This parameter indicates where the reason for the connection abort was identified (user, FAS user, FAS or DLL).

NOTE: In cases when the ABT.request or ABT.indication is generated by the FAS, the Additional Detail parameter does not exist. If the ABT.indication is generated by the local FAS, the Identifier and Reason Code parameters are set locally.

Reason Code

This parameter specifies the reason for the AR abort.

Additional Detail

This optional parameter contains additional information about the connection release.

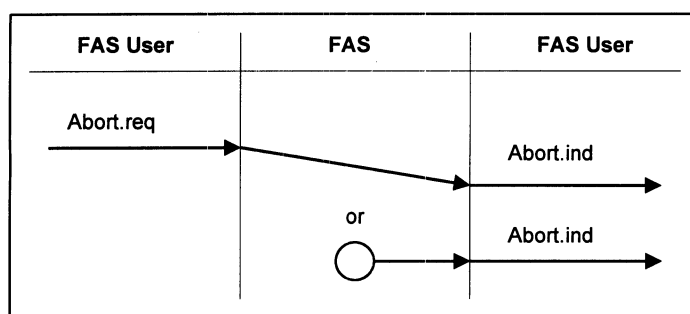


Figure 6 – Execution of the Abort service at the FAS user- FAS interface

5.6 FAS-Compel (FCMP)

The FAS-Compel service is a local confirmed service used by an FAS user to request the DLL to transmit the message which has been stored in the buffer. It is only used with the BNU AREP class. The structure of the component service primitives is shown below:

Parameter Name	.request	.confirm
Argument	M	
AREP Identifier	M	
Result		M
Status		M

Table 9 – FAS-Compel Service

5.6.1 Argument

The argument carries the parameters of the service request.

AREP Identifier

This parameter identifies the AREP to which the buffer that contains the message being delivered is attached.

5.6.2 Result

This parameter carries the service confirmation.

Status

This parameter indicates the result of the service request. The following three status codes provided by the DLL are defined:

success
 failure – inappropriate request
 failure – reason unspecified

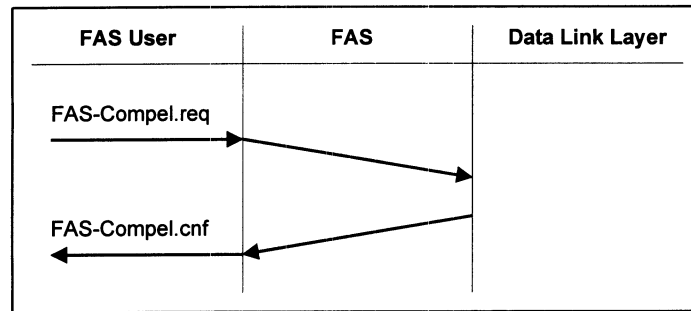


Figure 7 – Time Sequence Diagram for the FAS-Compel Service

5.7 Get-Buffered-Message (GBM)

The GetBuffered-Message service is a local confirmed service used by an FAS user to request the DLL to deliver the message which has been maintained in the buffer. It is used with the BNU AREP class only.

Parameter Name	.request	.confirm
Argument	M	
AREP Identifier	M	
Result(+)		S
AREP Identifier		M
Duplicate FAS-SDU		C
Data		M
Local Timeliness		C
Remote Timeliness		C
Result(-)		S

Table 10 – Get-Buffered-Message Service

Note: The maximum outstanding requests for the Get-Buffered-Message service is always one; i.e., the FAS users need to wait for the service confirmation before they issue another service request.

5.7.1 Argument

The argument carries the parameters of the service request.

AREP Identifier

This parameter identifies the AREP to which the buffer that contains the message is attached.

5.7.2 Result(+)

The Result(+) parameter indicates that the service request succeeded.

AREP Identifier

This parameter identifies the AREP to which the buffer that contains the message is attached.

Duplicate FAS-SDU

This conditional parameter is present if the DuplicatePduDetectionSupported attribute is True. If it is present, it indicates whether or not the FAS-SDU is a duplicate of the FAS-SDU that was received and delivered in a previous service indication.

This parameter takes a value of True if the same FAS-SDUs have been received successively. Otherwise, it takes a value of False.

Data

This parameter contains an unconfirmed user request.

Local Timeliness

This conditional parameter, if it is present and True, indicates that the FAS-SDU parameter has met the receiving timeliness criteria defined for the DLL. If its value is False, at least one of the timeliness criteria has not been met.

This parameter is present if the value of theSubscriberD1TimelinessClass attribute is other than None and is not present if it is None.

Remote Timeliness

This conditional parameter, if it is present and True, indicates that the FAS-SDU parameter has met the Publisher's and transmitting DL's timeliness criteria. If its value is False, at least one of the timeliness criteria has not been met.