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**DATA NETWORKS AND OPEN SYSTEM
COMMUNICATIONS**

**PUBLIC DATA NETWORKS –
SERVICES AND FACILITIES**

**MULTI-ASPECT PAD (MAP) FRAMEWORK
AND SERVICE DEFINITION**

ITU-T Recommendation X.8

(Previously "CCITT Recommendation")

FOREWORD

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The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation X.8 was prepared by ITU-T Study Group 7 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 1st July 1994.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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SUMMARY

This Recommendation provides the definition and framework for providing a Packet Assembly/Disassembly function (PAD) that supports multiple protocols, or “Aspects”, for access to a Packet Switched Public Data Network (PSPDN). The general framework for providing the multiple protocols is outlined, along with the basic requirements necessary within the PAD to enable the selection/modification of the protocol Aspects offered. This Recommendation on Multi-Aspect PAD (MAP), when implemented along with two or more PAD Aspects, will enable a user to access a PSPDN with one protocol, and to change to another protocol. MAP also brings the concept of simultaneous multiple sessions to the PAD as well. This is the framework specification for MAP. See also the various PAD Aspects for protocol and procedure alternatives supporting MAPs (e.g. Recommendations X.28, X.38, etc.).

MULTI-ASPECT PAD (MAP) FRAMEWORK AND SERVICE DEFINITION

(Geneva, 1994)

1 Scope

This Recommendation defines the basic framework and service Aspects of a Multi-Aspect Packet Assembly/Disassembly facility (MAP) in a Public Data Network. A MAP includes any Packet Assembly/Disassembly (PAD) Aspect defined by ITU-T, but is not limited to them. A MAP may also include non-ITU-T PAD Aspects, such as Binary Synchronous Communications PADs, SDLC PADs, T3POS PADs, generalized polling PAD (GPAD), et al. The Recommendation does not specify particular network access methods nor protocol Aspects.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of the Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of the Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of currently valid ITU-T Recommendations is regularly published.

- Recommendation X.25 (1993), *Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit.*
- Recommendation X.28 (1993), *DTE/DCE Interface for start-stop mode data terminal equipment accessing the Packet Assembly Disassembly Facility (PAD) in a public data network situated in the same country.*
- Recommendation X.29 (1993), *Procedures for the exchange of control information and user data between a Packet Assembly Disassembly (PAD) facility and a packet mode DTE or another PAD.*
- Recommendation X.38 (1992), *G3 facsimile equipment/DCE interface for G3 facsimile equipment accessing the Facsimile Packet Assembly/Disassembly Facility (FPAD) in a public data network situated in the same country.*
- Recommendation X.39 (1992), *Procedures for the exchange of control information and user data between a Facsimile Packet Assembly/Disassembly Facility (FPAD) and a packet mode Data Terminal Equipment (DTE) or another FPAD.*
- Recommendation X.340 (1993), *General arrangements for interworking between a Packet Switched Public Data Network (PSPDN) and the international telex network.*

3 Definitions

For the purposes of this Recommendation, the following definitions apply:

access information path: The communication link established between a DTE and a MAP.

access interface: An interface to the MAP with both physical (e.g. speed, parity) and logical (e.g. default PAD Aspects) characteristics.

multi-aspect packet assembly/disassembly facility: A facility that provides an access to a Public Data Network for a DTE which does not operate in the Packet Mode, where several PAD instances are supported.

multi-session: A term that is used to specify where two or more PAD Aspects are used simultaneously by a single DTE accessing a MAP.

PAD aspect: A term that represents the logical function of a PAD operating with a specific protocol used by the DTE connected to a MAP.

PAD instance: A term that represents a PAD Aspect when the PAD Aspect is invoked by a DTE accessing a MAP.

4 Abbreviations

For the purpose of this Recommendation the following abbreviations are used:

AIP	Access Information Path
DCE	Data-terminating Circuit Equipment
DTE	Data-Terminating Equipment
MAP	Multi-Aspect Packet Assembly/Disassembly Facility
PAD	Packet Assembly/Disassembly Facility
PSPDN	Packet Switched Public Data Network

5 Overview of MAPs

The concept of a Multi-Aspect PAD (MAP) is an additional capability in PAD implementations. A MAP consists of a DCE supporting two or more ITU-T defined or non-ITU-T defined PAD Aspects. Each PAD Aspect running is referred to as an individual PAD instance. These PAD instances may be different PAD Aspect types. The multiple PAD Aspects are supported in a single device with a single access interface (see Figure 1). In addition a MAP may also be supported in a single device with multiple access interfaces (see Figure 2).

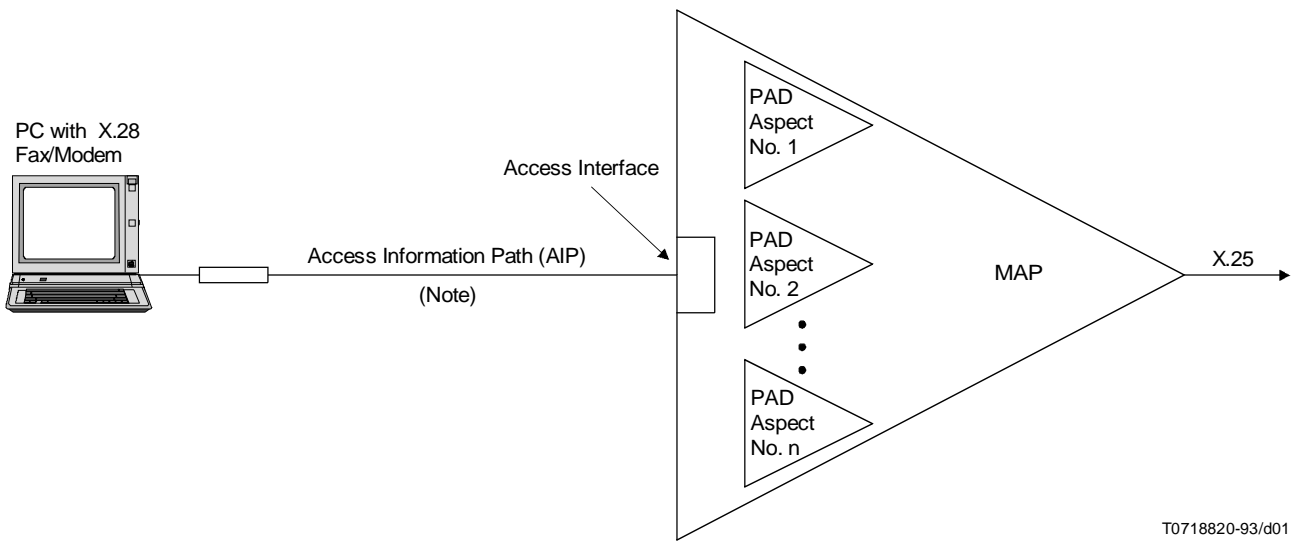
When multiple PAD Aspects are dynamically available to a DTE on a single access interface and a user is able to switch PAD operation from one PAD Aspect to another, there are at least two benefits. First, PSPDN users are provided with the ability to quickly and conveniently switch between different PAD Aspects, which may provide access to different applications or interface profiles. Second, multiple PAD Aspects decrease the PSPDN administration's equipment and operations costs when the same access interface is used to access different PAD Aspects.

5.1 PAD Aspect Support

Any and all PAD Aspects offered by the ITU-T may be supported. Current ITU-T PAD Aspects that may be used with MAPs are listed in Table 1 along with their referenced Recommendations. In addition, this framework in support of MAPs is also intended to be used with non-ITU-T Aspects.

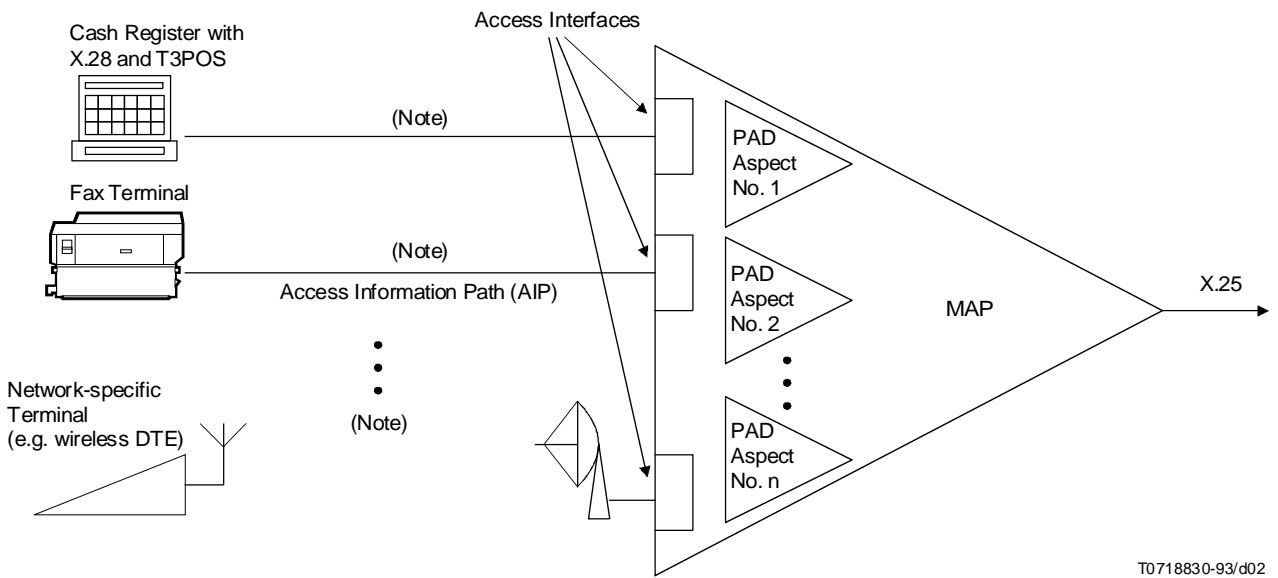
5.2 PAD Aspect Default

All MAP access interfaces shall be assigned a default PAD Aspect. The access interface shall be assigned a default PAD Aspect to be applicable on the interface at subscription time by agreement with the Administration. If the access information path is disconnected, the DCE interface shall operate in its default mode when a new access information path is established.



NOTE – No interference shall be taken as to the mechanism for establishment of the access information path.

FIGURE 1/X.8
Functional illustration of a MAP with single access interface



NOTE – No inference shall be taken as to the mechanism for establishment of the access information path.

FIGURE 2/X.8
Functional illustration of a MAP with multiple access interfaces

TABLE 1/X.8

Multi-Aspect PAD Codes

PAD Aspect Selections	Referenced ITU-T/CCITT Recommendation(s)	X.28 PAD Codes (Note 1)
Facsimile PAD	X.38/X.39	4/6(F), 5/0(P), 4/1(A), 4/4(D)
Start-stop (or character) PAD	X.28/X.29	4/3(C), 5/0(P), 4/1(A), 4/4(D)
Telex	X.340	5/4(T), 5/0(P), 4/1(A), 4/4(D)
Non-ITU-T network specific	–	4/13(N), 5/3(S) (Note 2)
NOTES 1 PAD codes defined provide a unique IA5 listing of PAD aspects that can be referenced by individual PAD Recommendations for access and control. 2 The IA5 Code 4/13(N) 5/3(S) followed by a network specific code(s) applies to those PAD aspects that are not defined in ITU-T Recommendations. 3 Additional columns of Aspect-specific PAD codes will be added as PAD Aspects are defined in the ITU-T.		

6 Common Capabilities

All DCEs supporting the MAP functionality shall include a common set of capabilities to ensure a minimum level of uniformity. The following methods for controlling the PAD Aspect shall be provided: a MAP Status Inquiry, and a *Modify MAP command* signal with return. The formats of the specific *MAP command* and *MAP service* signal are defined in their referenced Recommendations.

6.1 MAP Status Inquiry

A DTE shall be able to inquire about the status of the PAD Aspect currently active, the PAD Aspects available on the interface, and the PAD Aspect set as the default.

6.2 Modify MAP with Return

A MAP shall allow a DTE to modify or temporarily change from one PAD Aspect to another using the *Modify MAP* command signal.

The *Modify MAP command* signal procedures may be used both before a virtual call is set up and while a virtual call is in progress. The procedures for the selection of a different PAD instance are defined in the referenced Recommendations. When the DCE is set to operate in a particular PAD Aspect, it shall remain in that mode of operation unless otherwise instructed or if the access information path is disconnected.

The *Modify MAP command* signal is entered to cause the PAD to change Aspects. The *Modify MAP command* signal shall support a duration parameter that indicates when the PAD will revert to the default Aspect. A minimum of three different values for the duration parameter shall be provided. See Table 2 for these values.

If no duration parameter value is entered, the duration is for one complete call sequence (i.e. call request through clear indication). The additional duration parameter values shall be offered are independent of the status of the virtual call: an access information path duration indication wherein the PAD reverts to the default Aspect when the access information path is cleared; and an idle time duration indication wherein the PAD reverts to the default Aspect after the specified number of seconds. These two additional duration parameter values are considered to be optional.

TABLE 2/X.8

Modify aspect duration parameter values

Duration Parameter Values	Resulting Action
Virtual Call	The PAD shall revert to the default Aspect upon clearing of the virtual call.
Idle Timer (a numeric value)	The PAD shall revert to the default Aspect upon “n” seconds of idle time (i.e. no activity) on the PAD, independent of the VC status.
Access Information Path	The PAD shall revert to the default Aspect upon the closing of the AIP.

All PAD Parameter settings and values set previous to the *Modify MAP command* signal in the default Aspect remain as set. No changes to any values take place due to the new Aspect. Upon entering the new Aspect, the Aspect will obtain all necessary operational parameter values (e.g. speed, character code set, parity) from the previous Aspect. Should said values be inapplicable or unavailable to the new Aspect, default values, as specified in the reference Recommendations shall be used.

Upon receipt of the *Modify MAP command* signal, the PAD shall confirm the command by sending a *Confirm Modify MAP service* signal and then transition to the specified PAD Aspect.

All PAD Aspects upon entry shall issue an *Aspect Entry MAP service* signal to indicate successful transition to the new PAD instance.

7 Additional MAP capabilities

Additional MAP capabilities may be offered by some Administrations when supporting the MAP functionality. The following capabilities further enhance the benefits and flexibility of the MAP offering:

- Change MAP;
- Multi-session (New Instance support); and
- Remote MAP Control.

7.1 Change MAP capability

A MAP may provide an on-line method for users of dedicated access interfaces to change/specify the default PAD Aspect. This *Change MAP* capability is provided to enable users of dedicated MAP access interfaces to control which PAD Aspect is always invoked when the access information path (AIP) is established. This capability to change the default PAD Aspect provides a simple form of customer configuration management. Through a default PAD Aspect will be configured at subscription time, this capability allows users of dedicated access interfaces to re-configure the default PAD Aspect after subscription time.

The *Change MAP command* signal is entered to cause the PAD to change the default Aspect of operation. The *Change MAP command* signal shall support a parameter that indicates the specific PAD Aspect that is to be used. Once having confirmed the event (see below concerning *Change MAP Verification* sequence), the PAD will immediately disconnect the AIP and then change to the new default PAD Aspect. Subsequent establishment of the AIP will then be presented with this PAD Aspect.

PADs supporting the *Change MAP* capability shall provide a *Change MAP Verification* sequence. The sequence shall provide a request indication-response-confirm sequence to ensure the *Change MAP* function is desired (vice the *Modify MAP command* as outlined above in 6.2). Upon receipt of a valid *Change MAP* command signal, the PAD shall seek to confirm the requested change by transmitting a *Verify Change MAP service* signal to the DTE. The *Verify Change MAP service* signal shall include the name of the new specified PAD aspect and an indication of the specific access port being

changed. The DTE must respond with the *Confirm Change MAP command* signal. Upon receipt of a valid *Confirm Change MAP command* signal, the PAD will transmit the appropriate *Confirm Change MAP service* signal, disconnect the AIP and change the default PAD Aspect for that interface.

The *Change MAP* procedure may only be used when a virtual call is not in progress.

NOTE – The *Change MAP* procedure is defined herein to be used on dedicated access interfaces only. Applications of the *Change MAP* procedure to public ports is for further study.

7.2 Multi-Session

With the introduction of the support of multiple Aspects within a single PAD, the ability to run multiple simultaneous Aspects can be provided. Each Aspect that is running (i.e. an Aspect Instance) supports one virtual call. The Multi-session procedures enable the MAP user to open up additional Aspects, or instances, without closing the previous instance, without any additional AIPs. Further, Multi-session procedures allow the MAP user to dynamically switch between the open instances, back and forth, at any time. This results in a traditionally single-session user being able to run multiple parallel sessions. The Multi-session capability shall be controlled with the following procedures: New Instance Establishment Switch Instance and Close Instance.

7.2.1 New Instance Establishment

A MAP shall allow a DTE to start, or open, a new instance of a PAD Aspect without closing the current instance. The *New Instance MAP command* signal shall enable this function.

The *New Instance MAP command* signal procedures may be used both before a virtual call is set up and while a virtual call is in progress. The procedures for the selection of a different PAD instance are defined in the referenced Recommendations.

The *New Instance MAP command* signal is entered to cause the PAD to open a new instance of the PAD aspect while maintaining the existing instance and any associated VCs. The *New Instance MAP command* signal causes a new instance of the same PAD aspect to be opened. All PAD Parameter settings and values set previous to the *Modify MAP command* signal in the default Aspect remain as set. The new instance PAD aspect opens with the same parameter values as those in the originating Aspect.

Once entering the new instance, the DTE operates in total conformance with the capabilities and functionality provided by that instance. The DTE may change parameter values, in accordance with the referenced Recommendations, within each instance; independent of one another. The DTE may change operational characteristics of each instance, independent of one another. The DTE may even change aspect types (with the *Modify MAP command* signal; if supported) independent of one another.

Upon receipt of the *New Instance MAP command* signal, the PAD shall confirm the command by sending a *Confirm New Instance MAP service* signal and then open and transition to the specified PAD Aspect.

All PAD Aspects upon entry shall issue an *Aspect Entry MAP service* signal to indicate successful transition to the new PAD instance.

7.2.2 Switch Instance

In order to switch between PAD instances, (as opened with the *New Instance MAP command* signal defined above) the *Switch MAP command* signal is provided.

The *Switch MAP command* signal procedures may be used at any time after a *New Instance MAP command* signal has been issued, and before a *Close Instance MAP command* signal has been issued. The procedures for using the *Switch MAP command* signal to move between instances are found in the referenced Recommendations.

Should the instances being switched between be of different type Aspects (such as due to the use of the *Modify MAP command* signal), the procedure for switching out of an instance shall be governed by the Aspect's referenced Recommendation.

7.2.3 Close Instance

A MAP shall enable a DTE to stop or close, an instance of a PAD Aspect without closing any other instance, nor the AIP. The *Close Instance MAP command* signal shall provide this function.

The *Close Instance MAP command* signal procedures may be used both before a virtual call is set up and while a virtual call is in progress. The procedures for handling any open or pending VC when a *Close Instance MAP command* signal is issued shall be identical to those procedures outlined in the referenced Recommendations concerning disconnect by the DTE of the AIP.

The *Close Instance MAP command* signal is issued to cause the PAD to close the instance of the PAD aspect (and any associated VC) in which the command was issued, and transition back to a parent aspect. If no other aspect remains open, the MAP shall treat the *Close Instance MAP command* signal as a disconnect of the AIP by the DTE in accordance with the referenced Recommendation.

7.3 Remote MAP Control

With the ability to switch PAD Aspects during a virtual call, the ability to remotely switch the PAD Aspect operating at the remote DTE is also envisioned. The Remote MAP Control shall include the following procedures: Remote Inquiry, Remote Modify MAP and Remote Synchronize.

7.3.1 Remote Inquiry

A DTE shall be able to inquire about the status of the remote PAD Aspect currently active, the PAD Aspects available on the interface, and the PAD Aspect set as the default during a virtual call.

7.3.2 Remote Modify MAP

A MAP shall allow a DTE to modify or temporarily change the remote PAD Aspect to another using the *Remote Modify MAP command* signal.

The *Remote Modify MAP command* signal procedures may be used only while a virtual call is in progress. The procedures for the selection of a different PAD instance are defined in the referenced Recommendations. When the remote DCE is set to operate in a particular PAD Aspect, it shall remain in that mode of operation unless otherwise instructed or until the virtual call is broken down.

The *Remote Modify MAP command* signal is entered to cause the PAD to change Aspects. The *Remote Modify MAP command* signal shall support the same variables as the local *Modify MAP command* signal. See 6.2 for details.

7.3.3 Remote Synchronize

A MAP shall provide a *Remote Synchronize MAP command* signal that automates the control of the remote PAD aspect. The *Remote Synchronize MAP command* signal is valid only when a virtual call is in progress.

When a DTE enters the *Remote Synchronize MAP command* the local PAD will provide synchronization functionality in the following manner:

After entering the *Remote Synchronize MAP command* signal;

- when the local DTE enters a *MAP Status Inquiry command* signal (as defined in 6.1 above), the local PAD considers a *Remote MAP Status Inquiry command* signal (as defined in 7.3.1 above) as having also been issued; and
- when the local DTE enters a *Modify MAP command* signal (as defined in 6.2 above), the local PAD considers a *Remote Modify MAP command* signal (as defined in 7.3.2 above) as having also been issued with the same parameters.

The synchronization functionality by the local PAD shall terminate when the virtual call is cleared.

Appendix I

An example of the use of a MAP

(This appendix does not form an integral part of this Recommendation)

MAP Applications – CPAD and FPAD protocol Aspects when accessed by a personal computer supporting both capabilities.

Application – A MAP which provides CPAD and FPAD Aspects may be used in the following manner where a personal computer equipped with a modem and a fax modem accesses a host computer to transmit facsimile images. The environment shown in Figure I.1 is applied in this example.

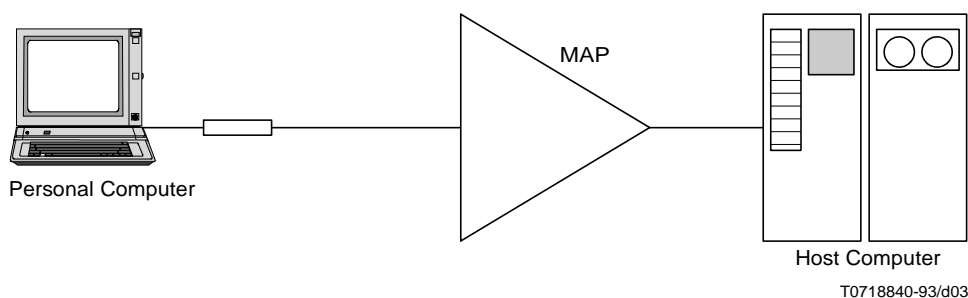


FIGURE I.1/X.8

Example of an environment where a MAP is used

In this example, the following procedures are followed:

A personal computer wishes to send a fax via the FPAD functionality. However, the personal computer is unable to utilize touch tone signalization as required under Recommendation X.38. As such, the personal computer, being able to generate IA5 characters, wishes to access a MAP with the CPAD and FPAD functionality.

The personal computer accesses a MAP on an access interface which has CPAD as its default Aspect. It engages in a dialogue with the CPAD MAP to establish its NUI and destination (i.e. through request for VC establishment). After the personal computer initiates a call to a host computer, the personal computer will initiate a Modify MAP command signal to change the PAD Aspect to FPAD for transmission of the facsimile image. When the Aspect is successfully changed to FPAD, the personal computer starts communicating the facsimile image in accordance with the procedures outlined in Recommendation X.38.

The sequence of commands and responses used in this example is shown below in Figure I.2.

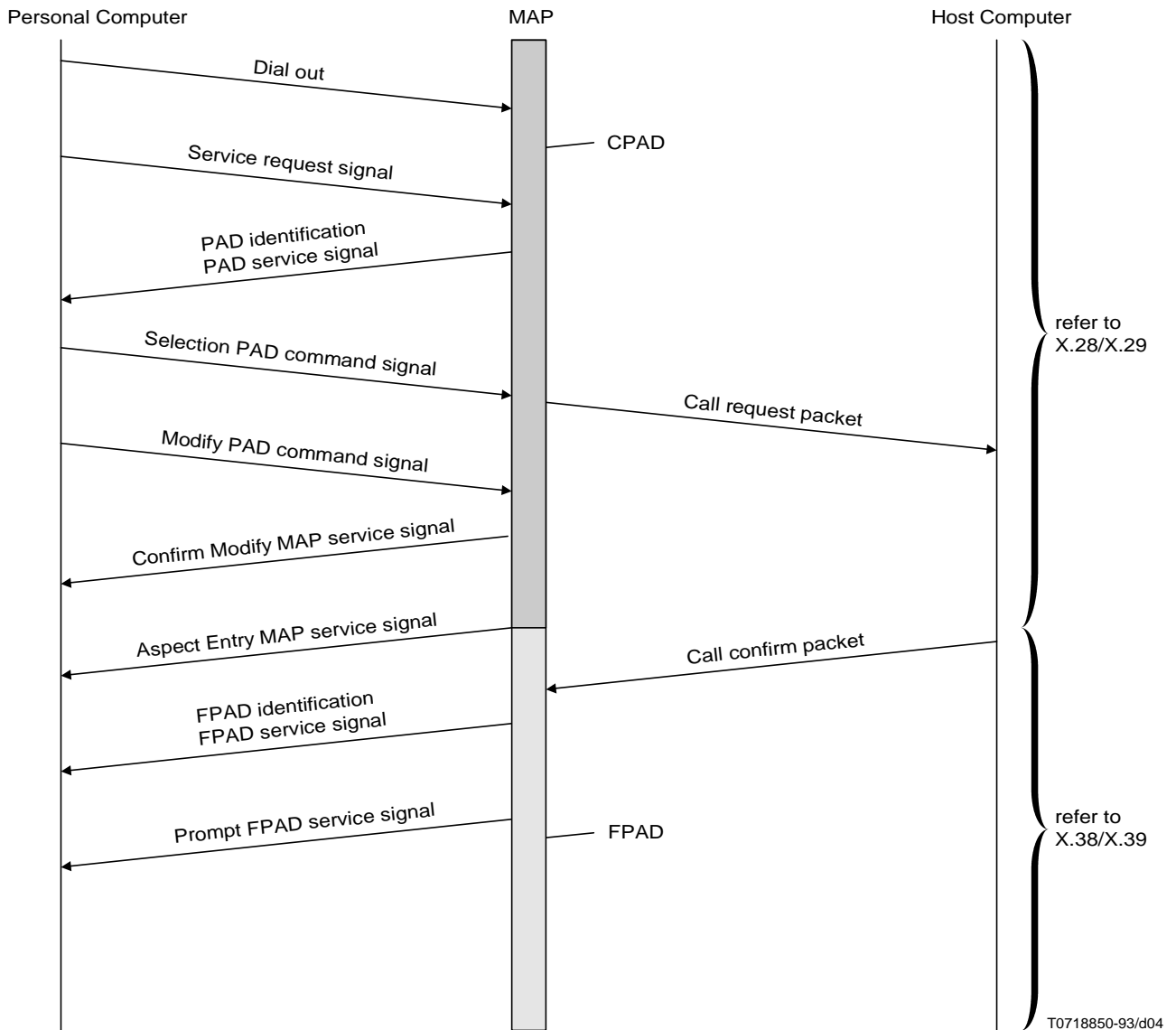


FIGURE I.2/X.8
Example of a sequence of commands and responses