TTC標準
Standard

JJ-22.08

Technical Specification
Path replacement additional network feature
Information Interface between Private SIP Networks

Version 1.1

June 9, 2016

THE TELECOMMUNICATION TECHNOLOGY COMMITTEE

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<Reference>

1. Introduction

The Enterprise Network Interface Sub-Working Group of the Enterprise Network Working Group has been standardizing IP protocols intended for inter-PBX (Private Branch eXchange) private networks (circuit-switched networks) and Qsig (Signaling information flows at the Qreference point). Now, taking recent trends of the market and international recommendations into consideration, it is necessary to study implementation of VoIP (Voice over Internet Protocol) technology based on SIP (Session Initiation Protocol) in operating agencies. This standard specification is stated, focusing on how the new technologies mentioned above are lately handled and how carriers are handling them.

This standard, which is referring to JS-22535 (QSIG tunneling), is for making Qsig-based inter-office services also available in the SIP (Session Initiation Protocol) network.
This standard is especially dedicated for the Path Replacement additional network feature (ANF-PR).

2. Revision History

Version	Date of establishment	Description
1	February 24, 2010	Established.
1.1	June 9, 2016	Revision (Correction of Figure 2.4.11)

3. Other

(1) Referenced recommendations, standards, etc.

JS-13874: Private Integrated Services Network (Path Replacement additional network feature)
- Specifications for inter-PBX signaling protocol -

JS-11572: Private Integrated Services Network (circuit-mode bearer services)
- Layer 3 Specifications for inter-PBX signaling protocol -

JS-11582: Private Integrated Services Network (Generic Functional Protocol for the support of supplementary services)
- Specifications for inter-PBX signaling protocol -

JS-22535: Technical Specification on “QSIG” tunneling by Session Initiation Protocol (SIP) in corporate telephonic network (CN)

TTC standard: JJ-22.00 The Guideline for the Architecture of the Technical Specifications for Private SIP in TTC

TTC standard: JJ-22.01 Technical Specifications on Inter-connection Interface between Private SIP Networks

TTC standard: JJ-22.02 Inter-work Specifications between Private SIP Network and private ISDN Network

4. Responsible working group

Version 1: Enterprise Network Working Group

Version 1.1: Enterprise Network Working Group

1. Outline of this standard

This specification is for standardization of the Path Replacement addition network feature used in conformity with the JS-22535 (QSIG tunneling) in networks connected through an IP network (SIP).

1.1 Purpose

This standard is intended to state definitions of inter-office services used in networks connected through an IP network (SIP) in order to plot interwork affinity and expandability of inter-office services.

1.2 Summary

This standard states the conditions for tunneling with SIP (Session Initiation Protocol), based on JS-13874 (private integrated services network [Path Replacement additional network feature] - specifications for inter-PBX signaling protocol).

2. Description of the standard

2.1 Definition of the standard

This standard stipulates the Path Replacement additional network feature employing inter-office service tunneling by Session Initiation Protocol (SIP) in corporate telephonic communication network (CN).

SIP is an application layer protocol to start, end, and change a multimedia session. SIP is usually handled with IP transmission (RFC791, RFC2460). Telephonic calls are regarded as a type of multimedia session in which audio is exchanged. SIP is defined by RFC3261.

QSIG is a signal protocol between private integrated service network exchanges (PINX) on the private integrated service network (PISN). PISN provides circuit-switched basic services and supplementary services for users. QSIG is stipulated in the domestic standards JS-11572 (basic service call control) and JS-11582 (Generic Functional Protocol for support of supplementary services), and the Path Replacement additional network feature are stipulated in the domestic standard JS-13874 (private integrated services network [Path Replacement additional network feature] - specifications for inter-PBX signaling protocol) and standards of respective supplementary services.

Note: QSIG is named after signaling at Q reference points. The Q reference point is the boundary between two PINXs.

In some cases, CN is composed by both PISN and IP network employing QSIG and SIP respectively. Calls and signals which independent from calls are sent out by the user connected to the PISN and received by the user connected to the IP network, or vice versa. In both cases, the gateway provides the interworking between QSIG and SIP at the boundary of the PISN and the IP network. The basic call interworking at the gateway is stated in ISO/IEC17343. In another case calls and signals, which are sent out by the user connected to the PISN, transit the IP network employing SIP and received by the user connected to another PISN (or another site in the same PISN).

2.2 Scope

QSIG tunneling with SIP on a public IP network is out of the scope of this standard.

This stipulation is also applicable to interworking units that function as a gateway between PISN employing QSIG and private IP network employing SIP and also provide QSIG tunneling of SIP requests/responses.

2.3 Tunneling

This document describes user-terminated calls and signals independent from calls that are originated from users connecting with a PISN employing QSIG, routed through an IP network employing SIP, and terminated by a user connecting with another PISN (or another site in the same PISN). As shown in Figure 2.3, on the boundaries between the PISNs employing QSIG and the IP network employing SIP, gateways are placed for the connections.

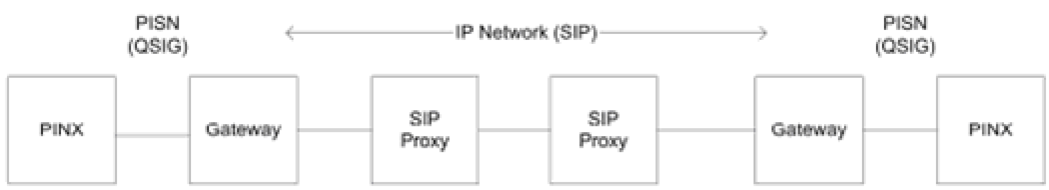


Figure 2.3 Call from QSIG to QSIG via SIP

The gateways interwork together as stated by ISO/IEC 17343. This provides basic call functions. In ISO/IEC 17343, like JS-11572, only interworking to QSIG basic calls is specified. It does not include any QSIG functions (supplementary services and additional network features) stipulated by other standards and vendor-specific specifications.

This leads to loss of functions in calls and signals independent from calls in the direction from QSIG to SIP or SIP to QSIG. Even in a case similar to that shown in Figure 2.3, it leads to loss of functions, too. This assumes that if the two gateways are different types only the functions common to both the gateways are available end-to-end.

As a solution to prevent loss of QSIG functions end-to-end, QSIG messages passed through the IP network are tunneled under SIP messages. Either of the two gateways starts a SIP dialog to the other gateway. By using SIP messages in the dialog, QSIG messages are tunneled. If necessary, a session is established by using SDP of RFC 3264 to transmit user information (e.g., audio) between the QSIG gateways. The two gateways function as a QSIG Transit PINX and they transite QSIG messages with little modification.

In conventional PISNs employing QSIG, associated PINXs are connected with an inter-PINX link, and it consists of one (QSIG message transmission) signal channel, and more than one user information channel for audio, modem information, or data transmission. The tunneling technique makes the IP network provide the inter-PINX link between gateways functioning as a Transit PINX. The QSIG-dedicated SIP-provided tunnel functions as a signal channel, and the media stream functions as a user information channel.

In addition to that, in case an SIP sequence failure is encountered in the QSIG-SIP interworking, it is necessary to make consideration so that no call remains on both QSIG and SIP. For example, if a timeout occurs on the SIP side, no processing is to be performed at timer-monitored parts on the end point (QSIG) side, but some processing is to be performed at other locations with an implementation-based procedure. (For example, a timeout in the middle of a sequence intended for release of a call makes it to be released and a timeout in the middle of a sequence intended for connection of a call makes it to ignore the timeout.)

As a supplementary matter, the primary response (callproc) in tunneling is to be handled as an option.

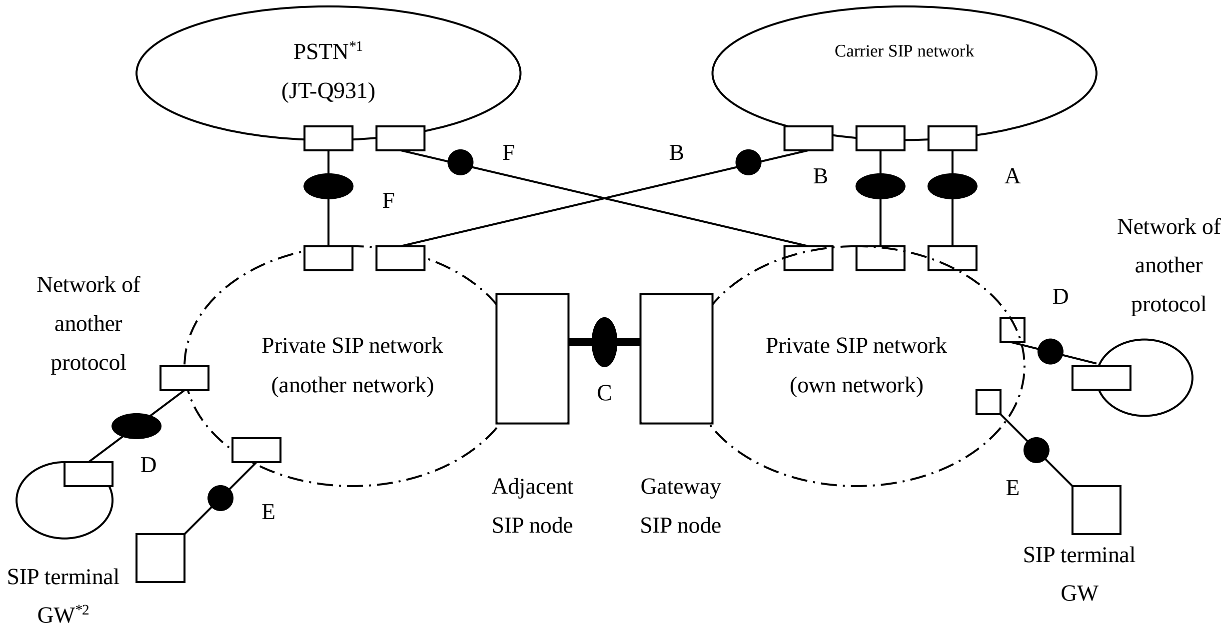
2.4 Connection configuration

2.4.1 Basic connection configuration

This standard describes the conditions for connection interfaces to managed private SIP networks that are applicable to Interfaces C and E specified in the private SIP network interconnection model shown in Figure 2.4.1.1. In this standard, a private SIP network that has an interface that can observe the provisions for this interface is called a “managed private SIP network”.

It is assumed in the remainder of this standard that the term private SIP network refers to a “managed private SIP network”.

When the service stipulated in this standard is used for connections between nodes in a private SIP network (local network), the connections can be peer-to-peer connections. This standard, however, does not apply to the peer-to-peer connections between nodes in the own private SIP network and those in another private SIP network via Interface C.



*1: PSTN…Public Switched Telephone Networks
*2: GW…GateWay

Figure 2.4.1.1 Private SIP network interconnection model

2.4.2 Procedures (normal sequences)

The following abbreviatuions are used:

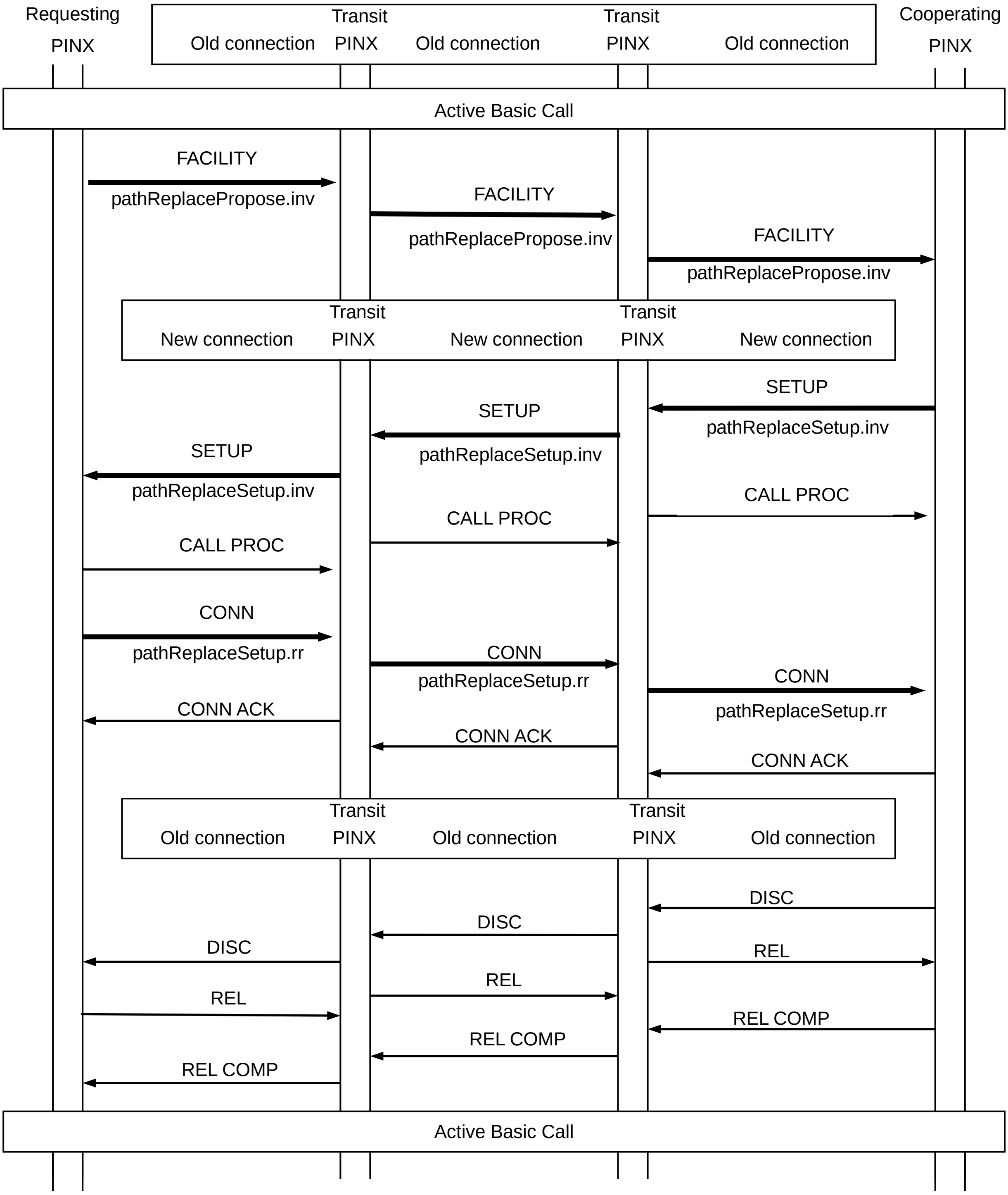
CALL PROC	CALL PROCEEDING
CONN	CONNECT
CONN ACK	CONNECT ACKNOWLEDGE
DISC	DISCONNECT
REL	RELEASE
REL COMP	RELEASE COMPLETE

This standard states the conditions for use of interfaces (sequences) stipulated by JS-13874 with SIP messages.

2.4.2.1 Example of message sequence for the normal procedure of ANF-PR

Attached Figure 2.4.2.1 shows an example of the message sequence for the normal procedure of ANF-PR. Each of old and new connections passes through two transit PINXs.

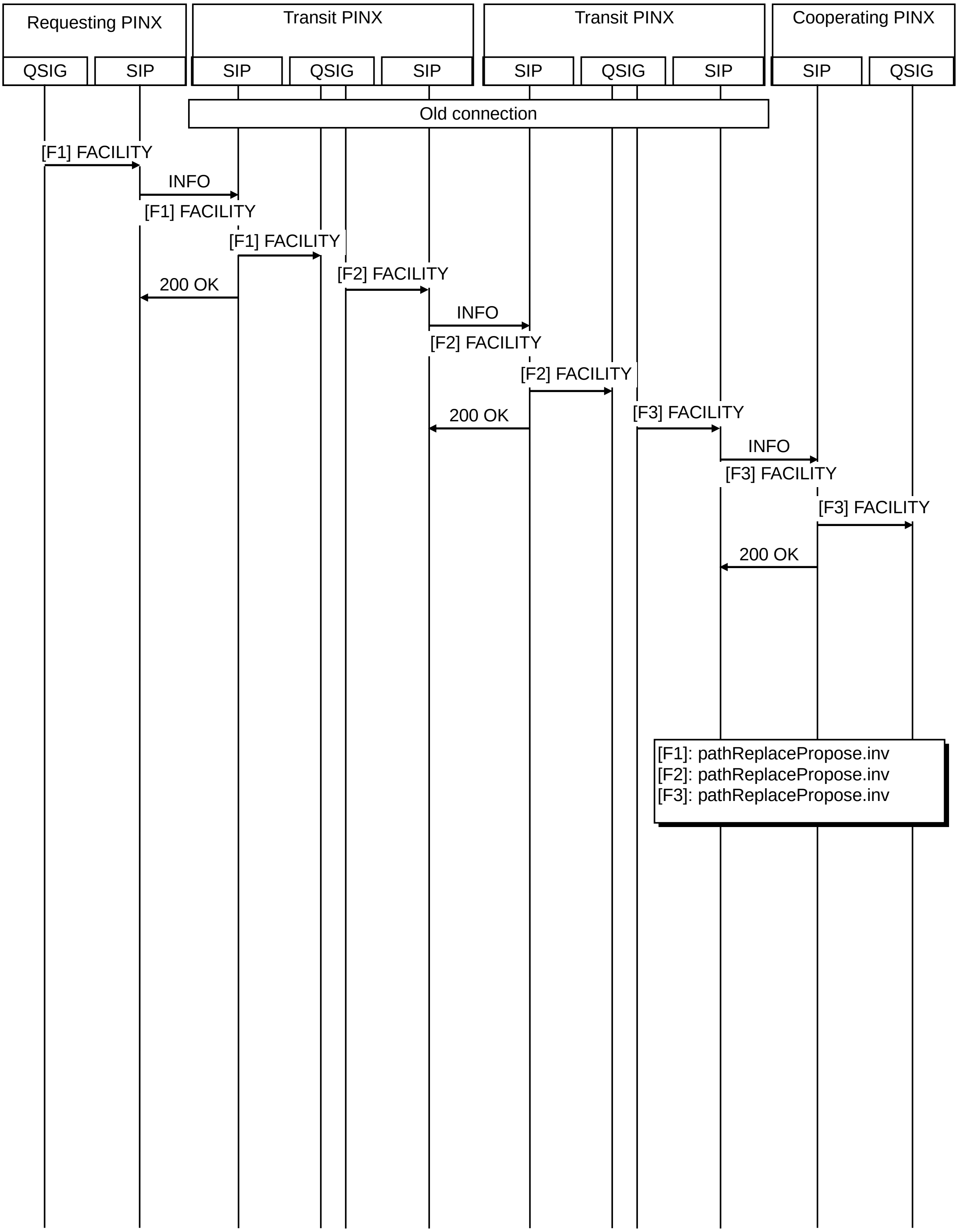
Note that the sequence example below is a quote from those defined in JS-13874.



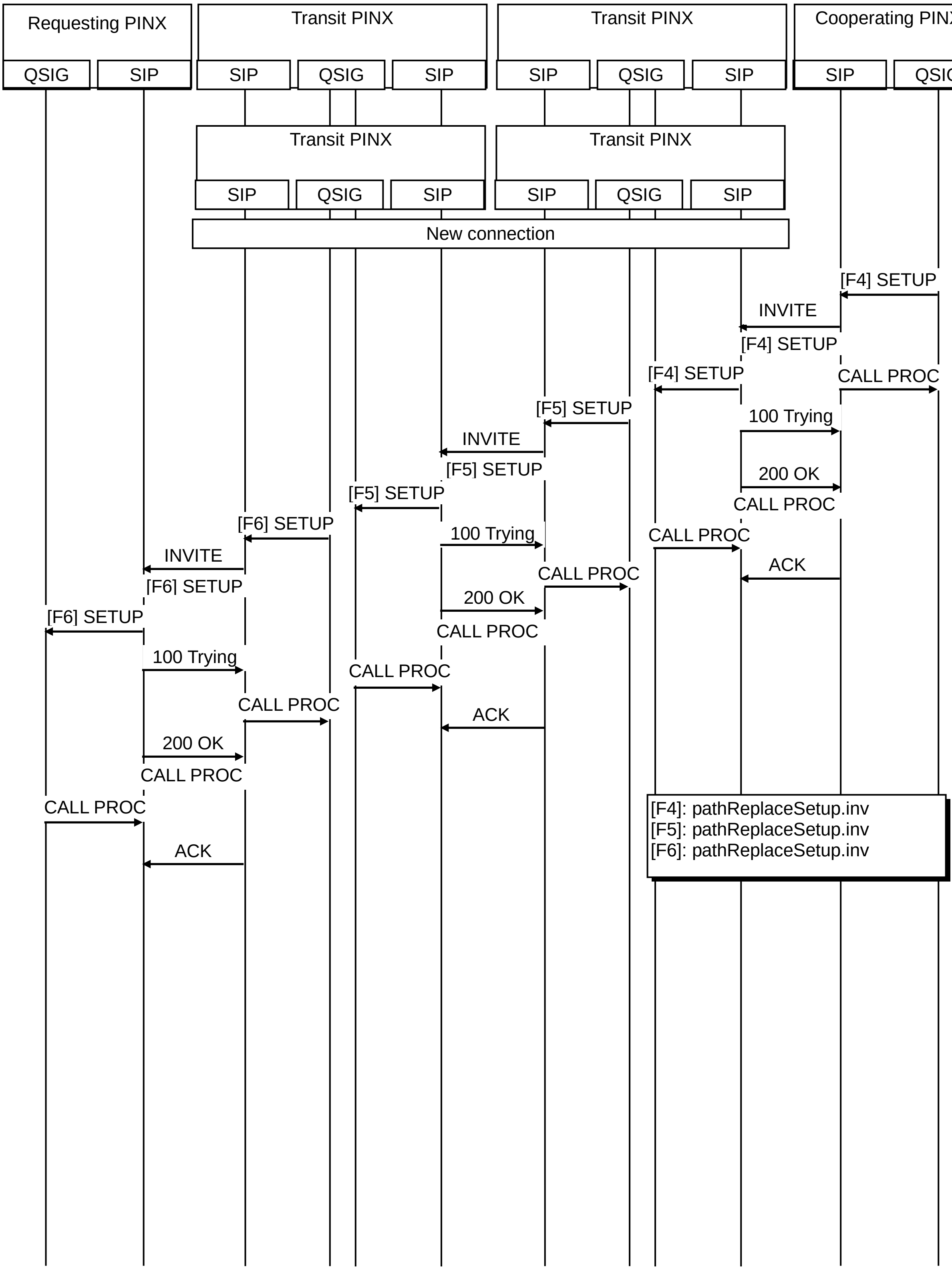
Attached Figure 2.4.2.1 Message sequence for the normal procedure of ANF-PR

2.4.2.1-1 Example of message sequence for the normal procedure of ANF-PR (in SIP tunneling)

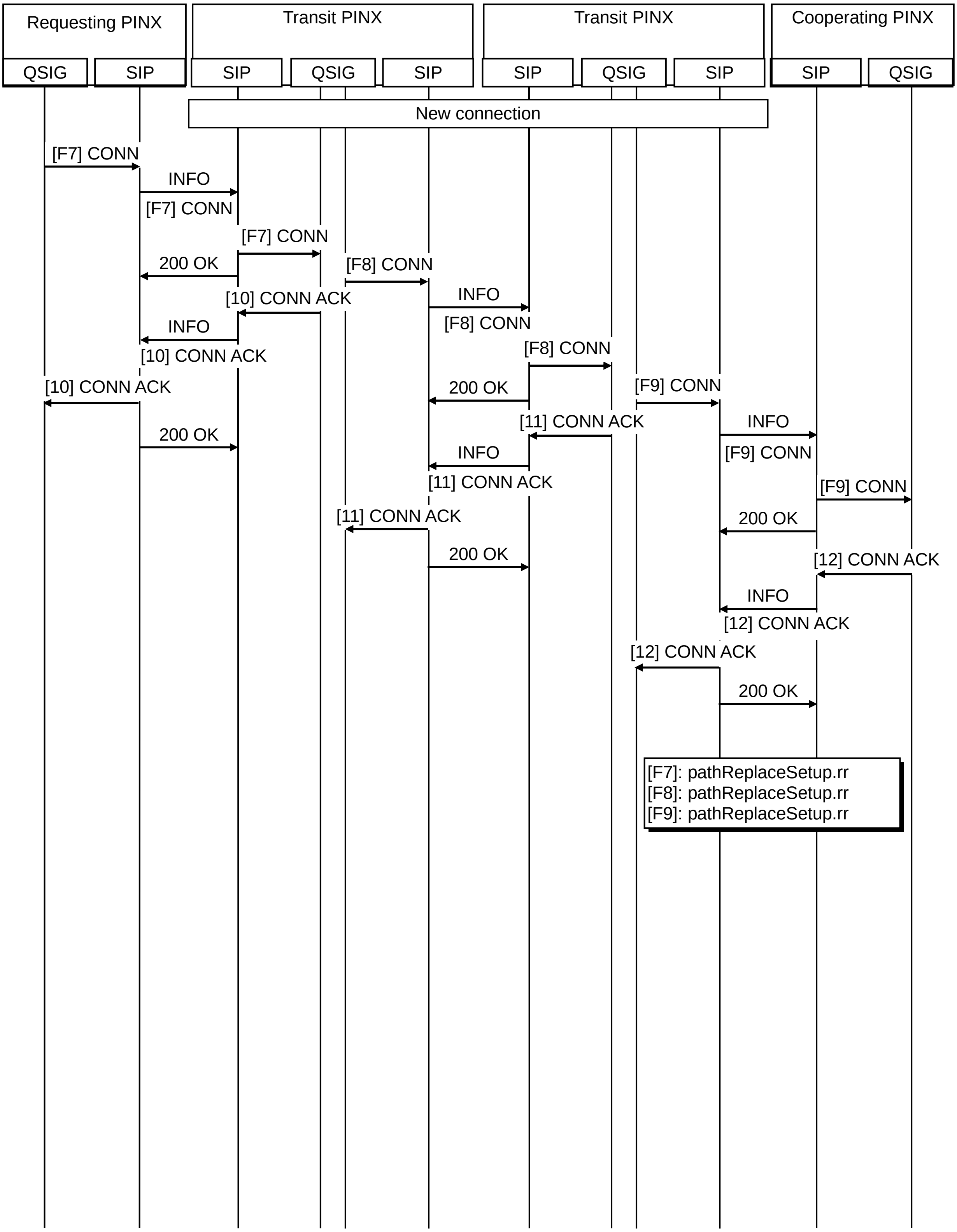
Attached Figure 2.4.2.1-1 shows an example of the message sequence for the normal procedure of ANF-PR. Each of old and new connections passes through two transit PINXs.



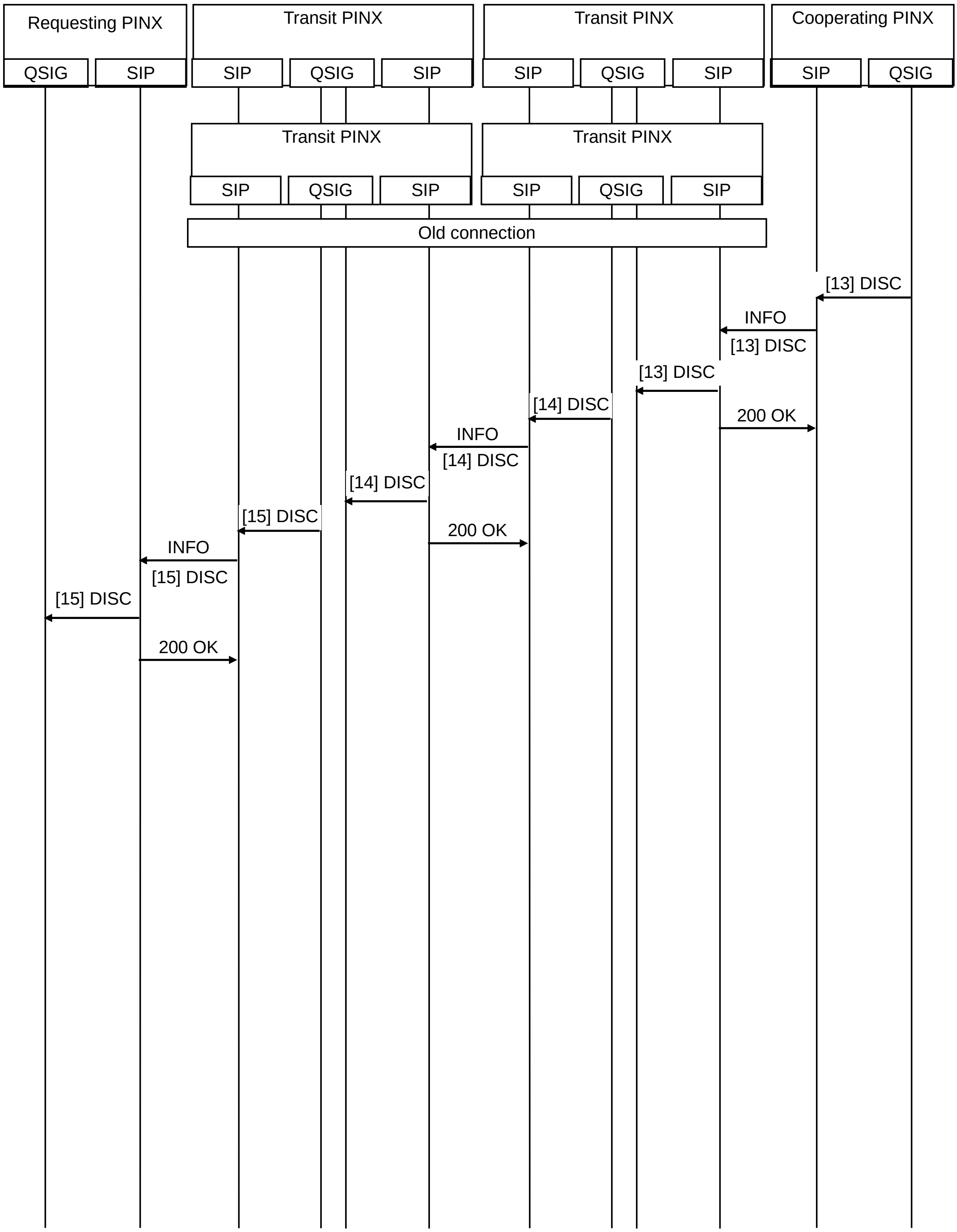
Attached Figure 2.4.2.1-1 (1/5) Message sequence for the normal procedure of ANF-PR (in SIP tunneling)



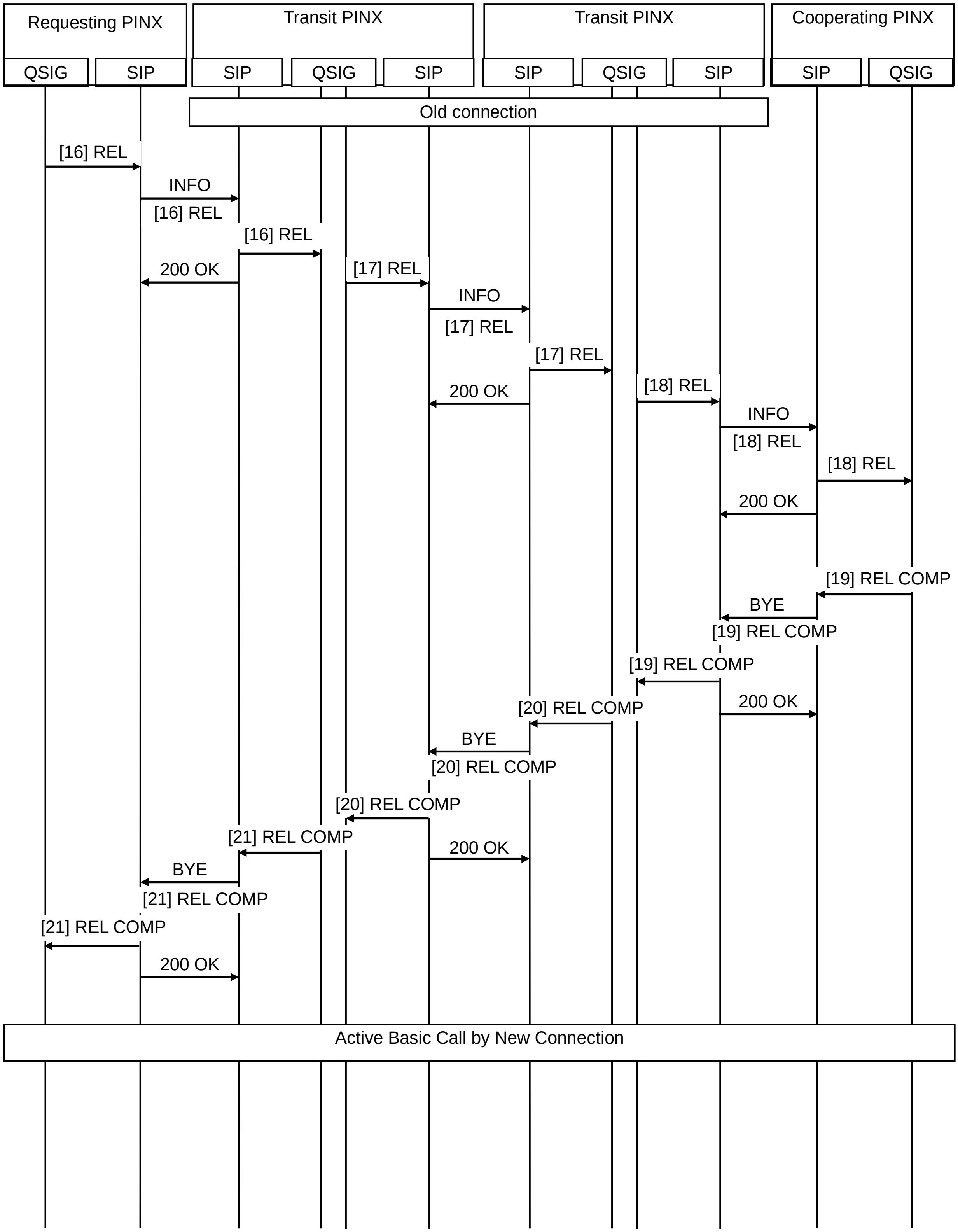
Attached Figure 2.4.2.1-1 (2/5) Message sequence for the normal procedure of ANF-PR (in SIP tunneling)



Attached Figure 2.4.2.1-1 (3/5)　Message sequence for the normal procedure of ANF-PR (in SIP tunneling)



Attached Figure 2.4.2.1-1 (4/5) Message sequence for the normal procedure of ANF-PR (in SIP tunneling)

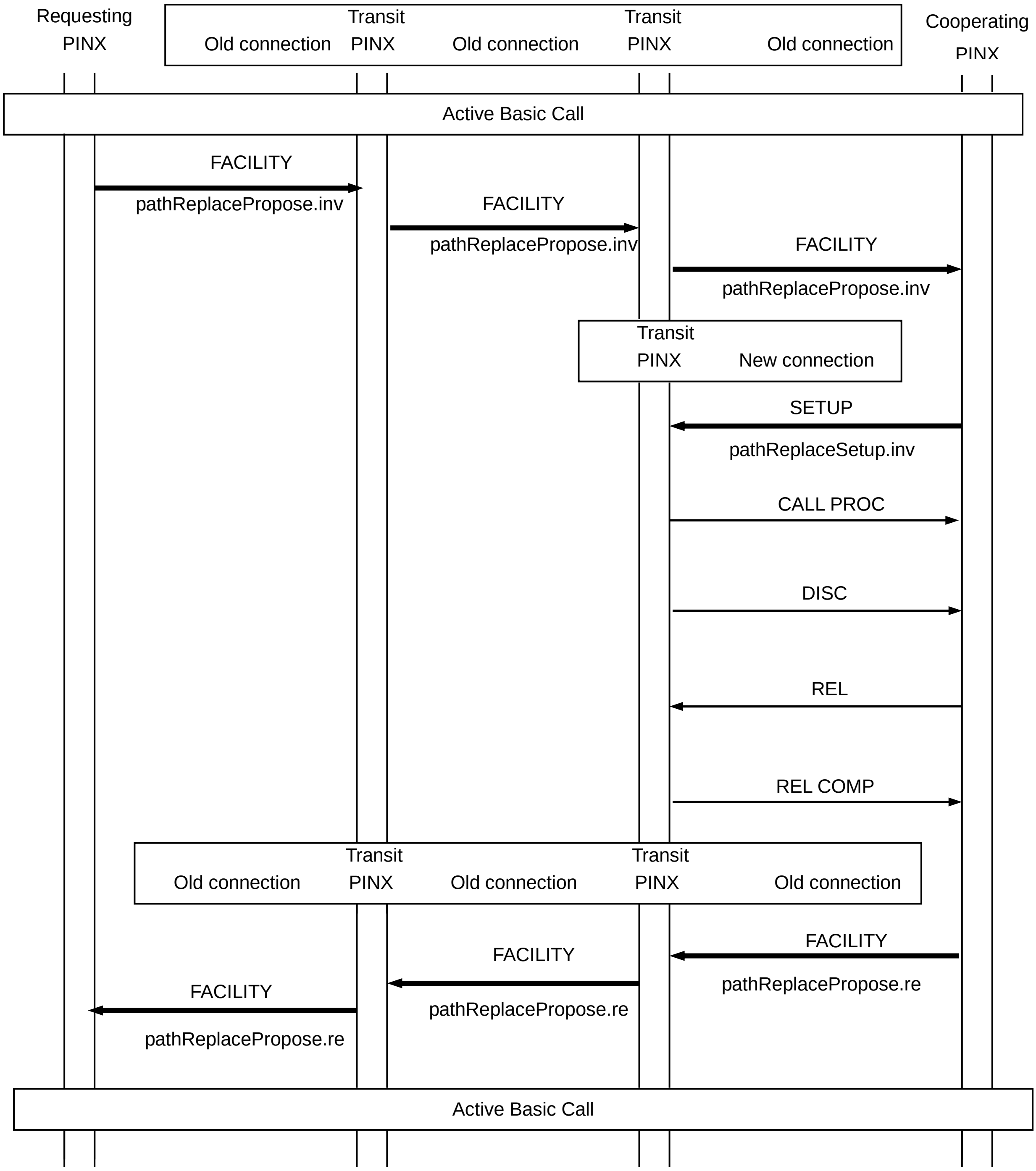


Attached Figure 2.4.2.1-1 (5/5) Message sequence for the normal procedure of ANF-PR (in SIP tunneling)

2.4.2.2 Example of message sequence in the case where congestion occurs at a transit PINX

Attached Figure 2.4.2.2 shows an example of ANF-PR operation in the case where connection cannot be kept established because of congestion at the transit PINX for the new connection. The ANF-PR operation fails.

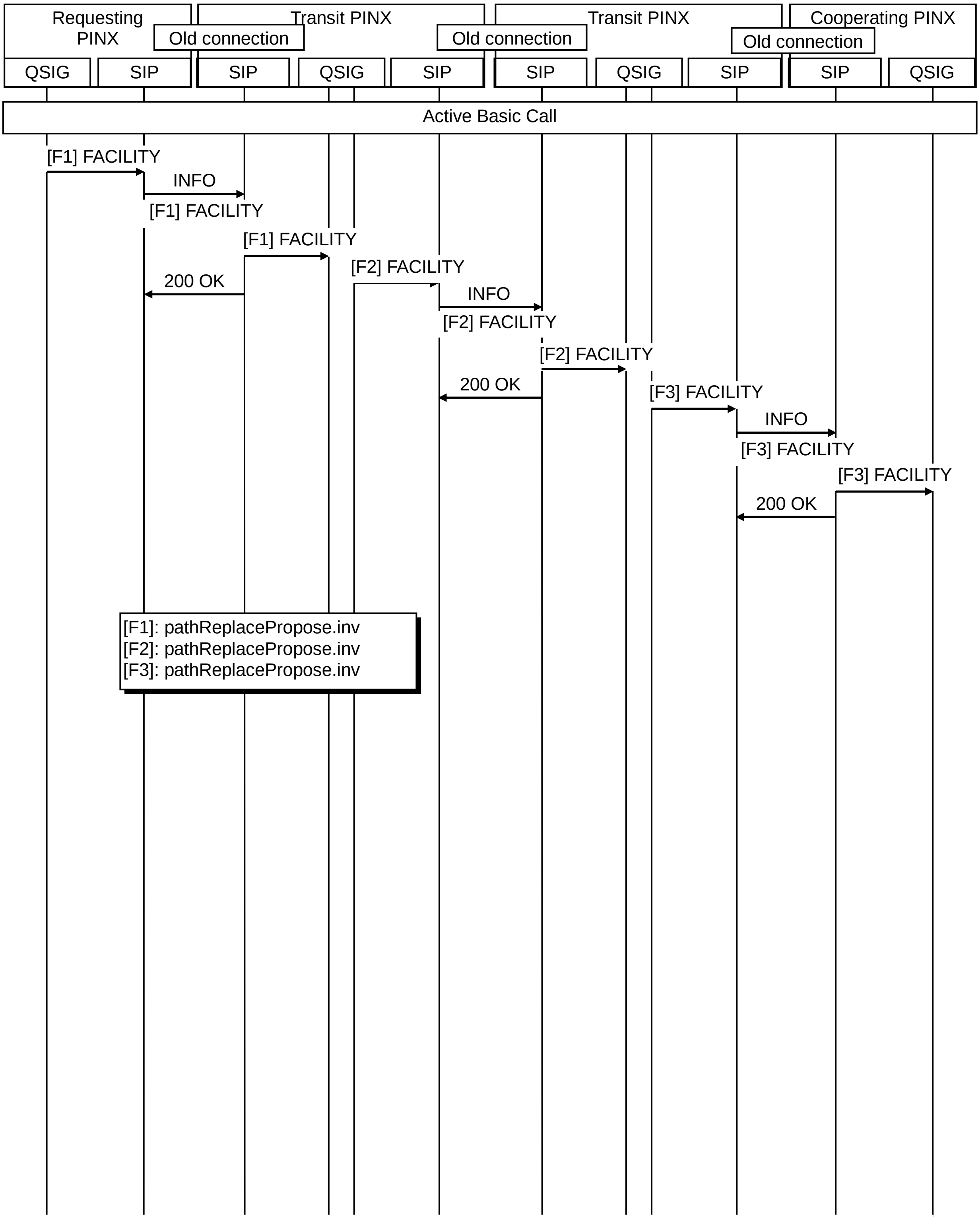
Note that the sequence example below is a quote from those defined in JS-13874.



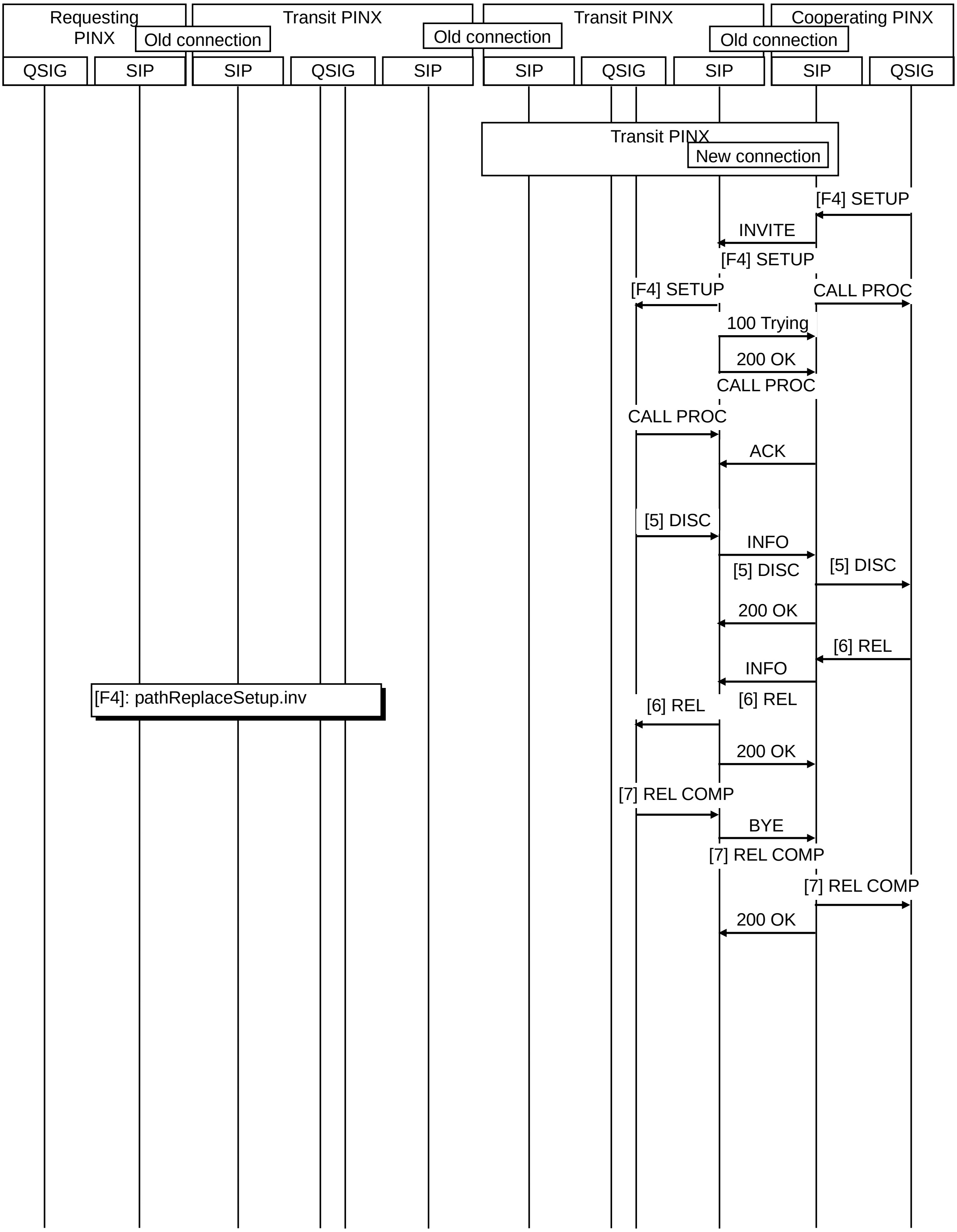
Attached Figure 2.4.2.2 Message sequence for ANF-PR in the case where congestion occurs

2.4.2.2-1 Example of message sequence in the case where congestion occurs at a transit PINX (in SIP tunneling)

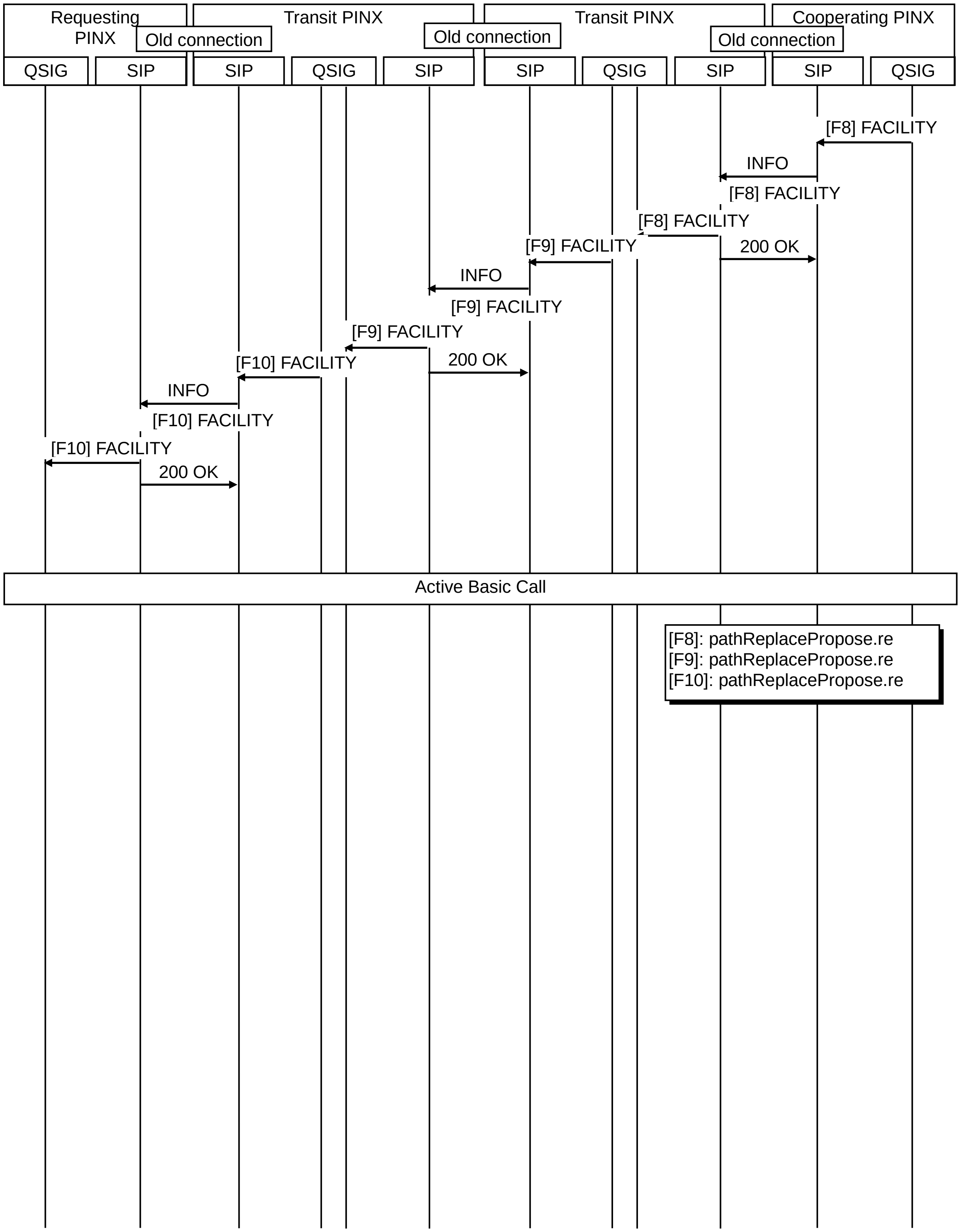
Attached Figure 2.4.2.2-1 shows an example of ANF-PR operation in the case where connection cannot be kept established because of congestion at the transit PINX for the new connection. The ANF-PR operation fails.



Attached Figure 2.4.2.2-1 (1/3) Message sequence for ANF-PR operation in the case where congestion occurs (in SIP tunneling)



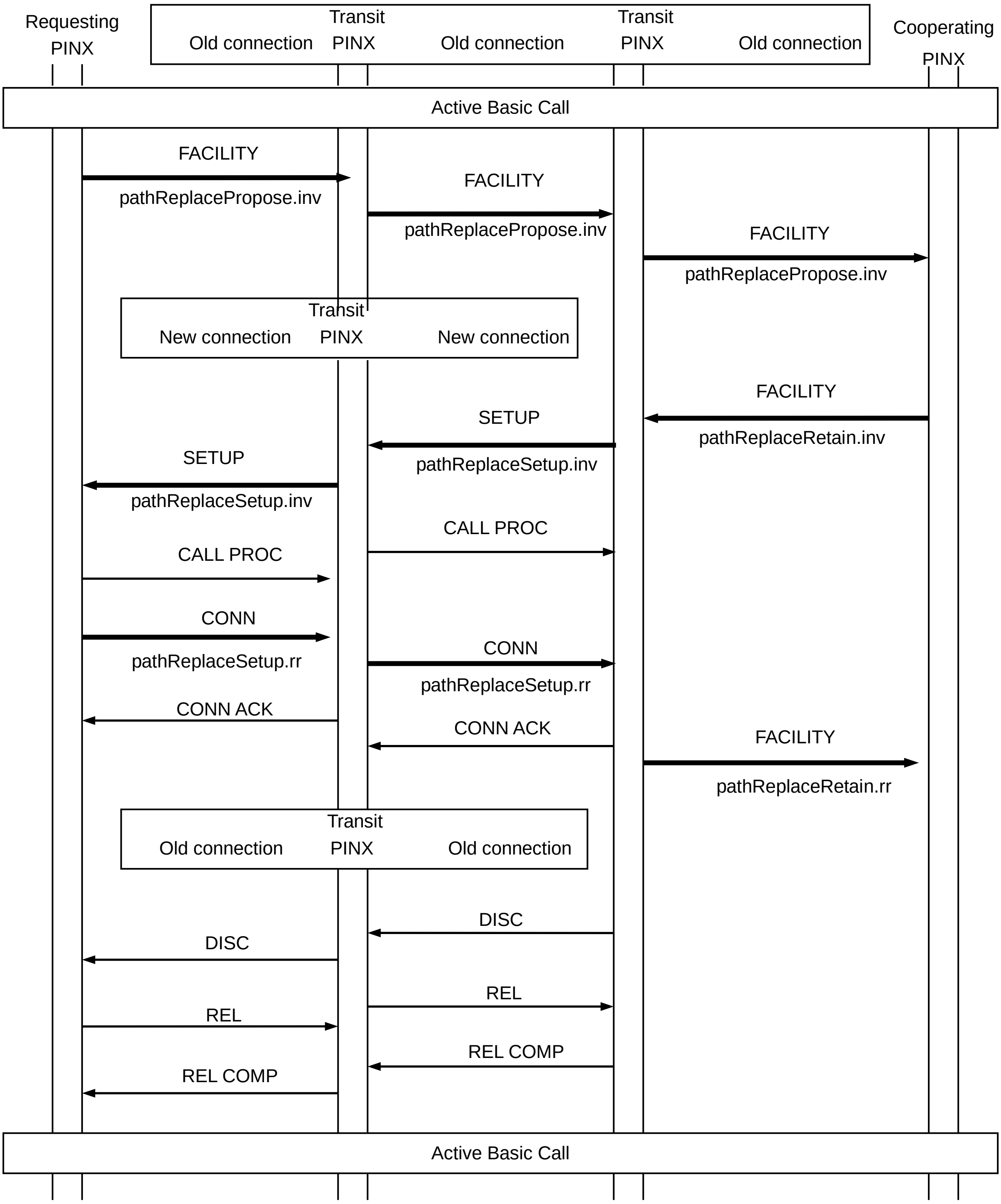
Attached Figure 2.4.2.2-1 (2/3)　Message sequence for ANF-PR operation in the case where congestion occurs (in SIP tunneling)



Attached Figure 2.4.2.2-1 (3/3) Message sequence for ANF-PR operation in the case where congestion occurs (in SIP tunneling)

2.4.2.3 Example of message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained

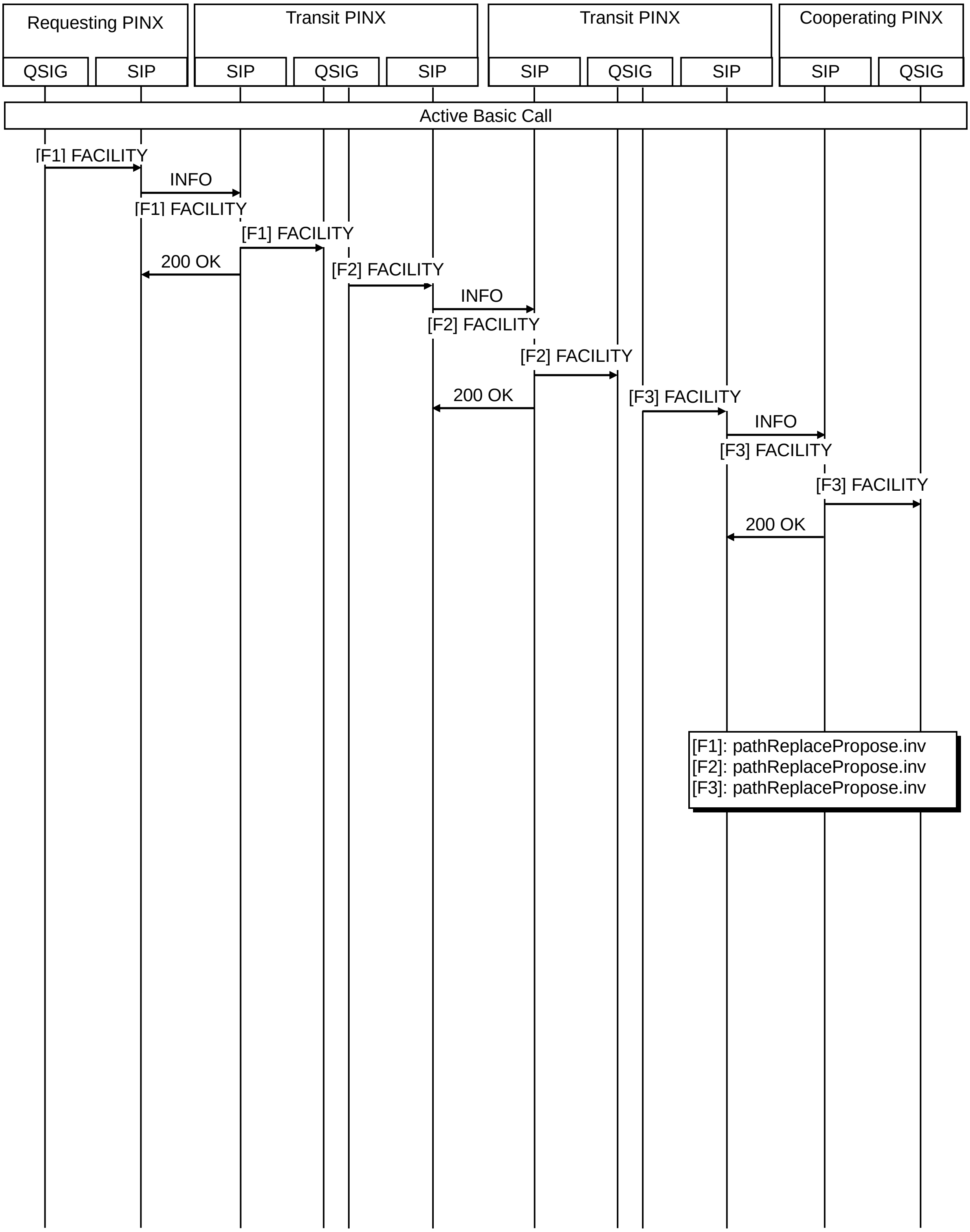
Attached Figure 2.4.2.3 shows an example of the message sequence for the normal procedure of ANF-PR in the case where the old connection is retained until the first transit PINX. Each of old and new connections passes through one transit PINX.
Note that the sequence example below is a quote from those defined in JS-13874.



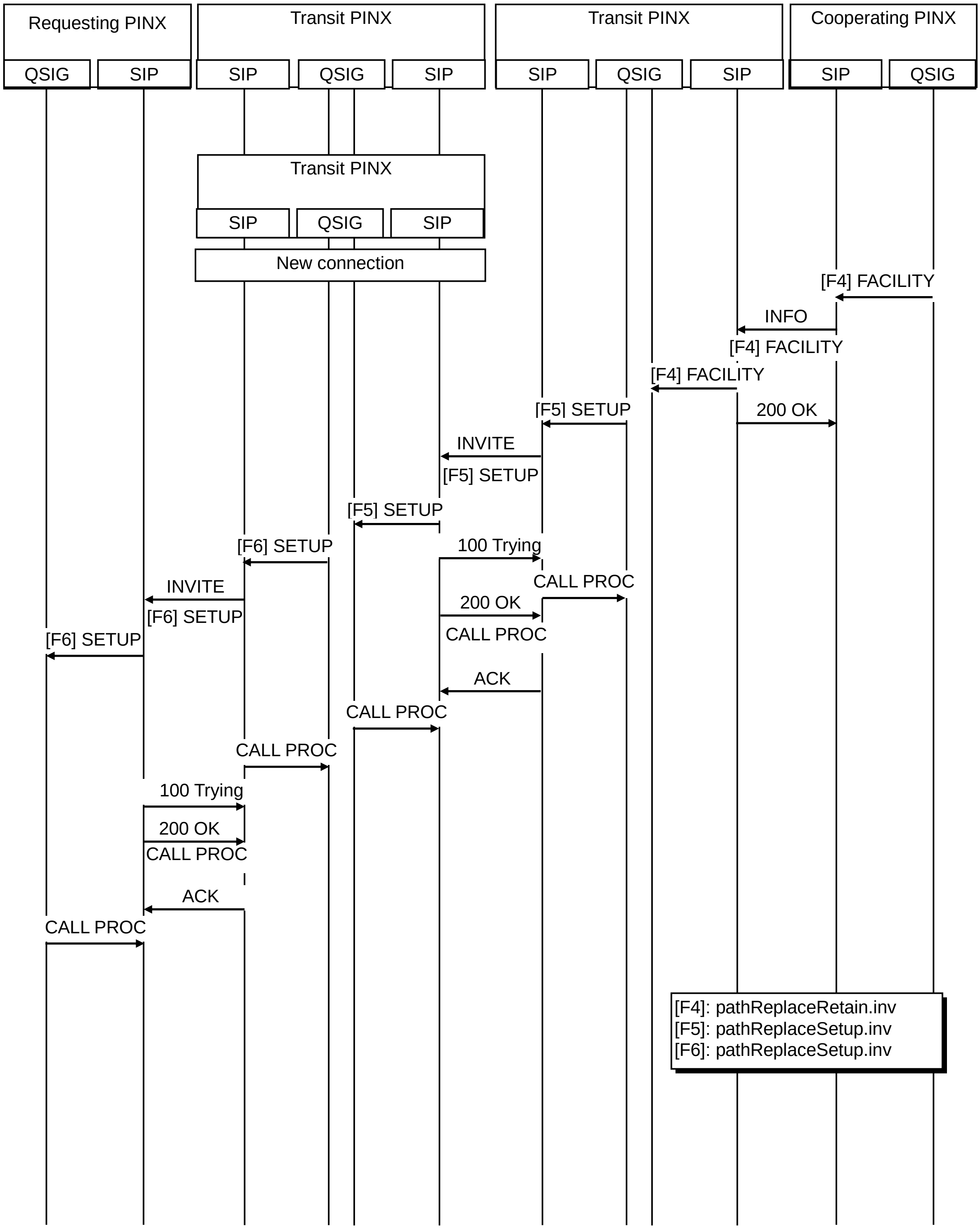
Attached Figure 2.4.2.3 Message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained

2.4.2.3-1　Example of message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained (in SIP tunneling)

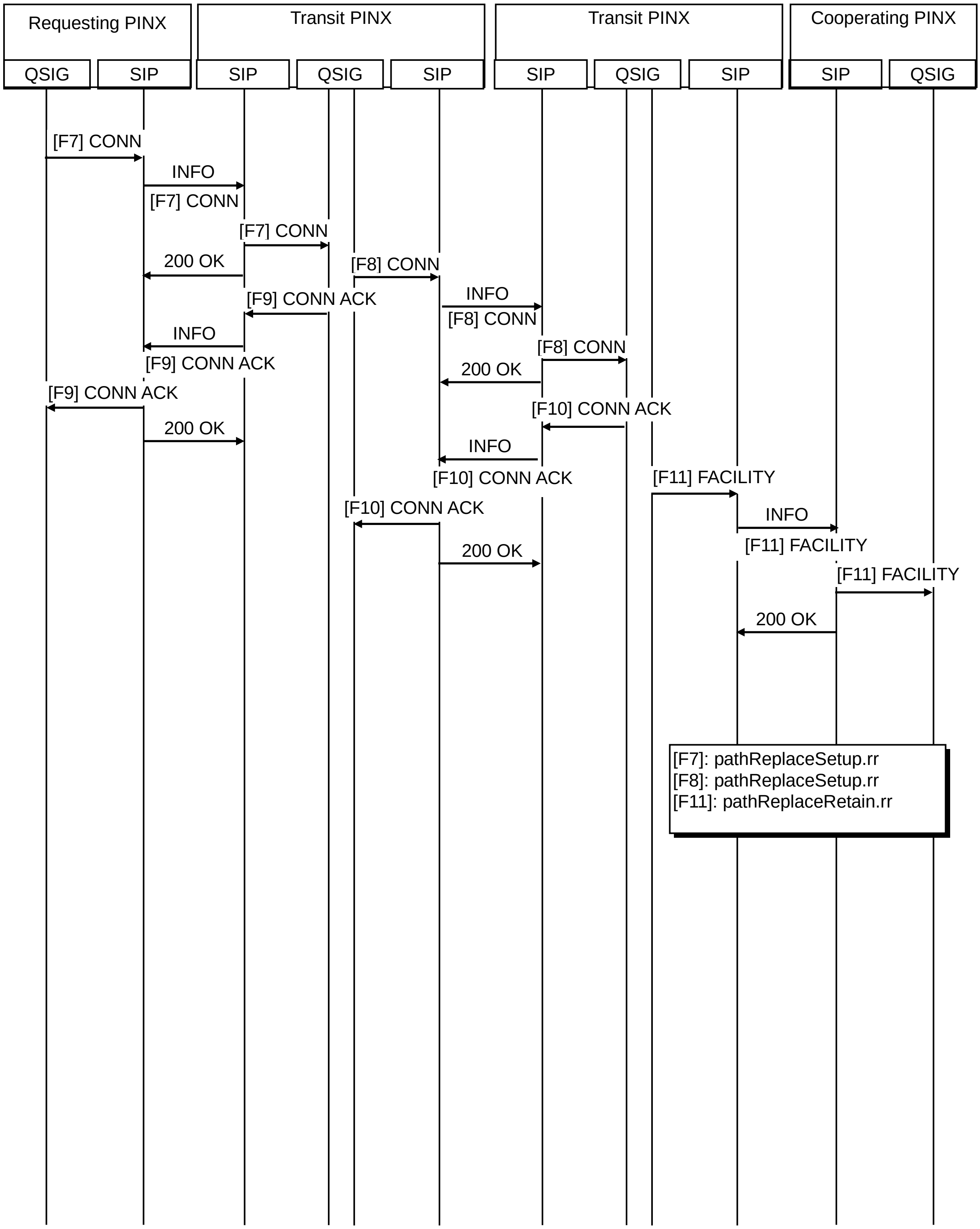
Attached Figure 2.4.2.3-1 shows an example of the message sequence for the normal procedure of ANF-PR in the case where the old connection is retained until the first transit PINX.　Each of old and new connections passes through one transit PINX.



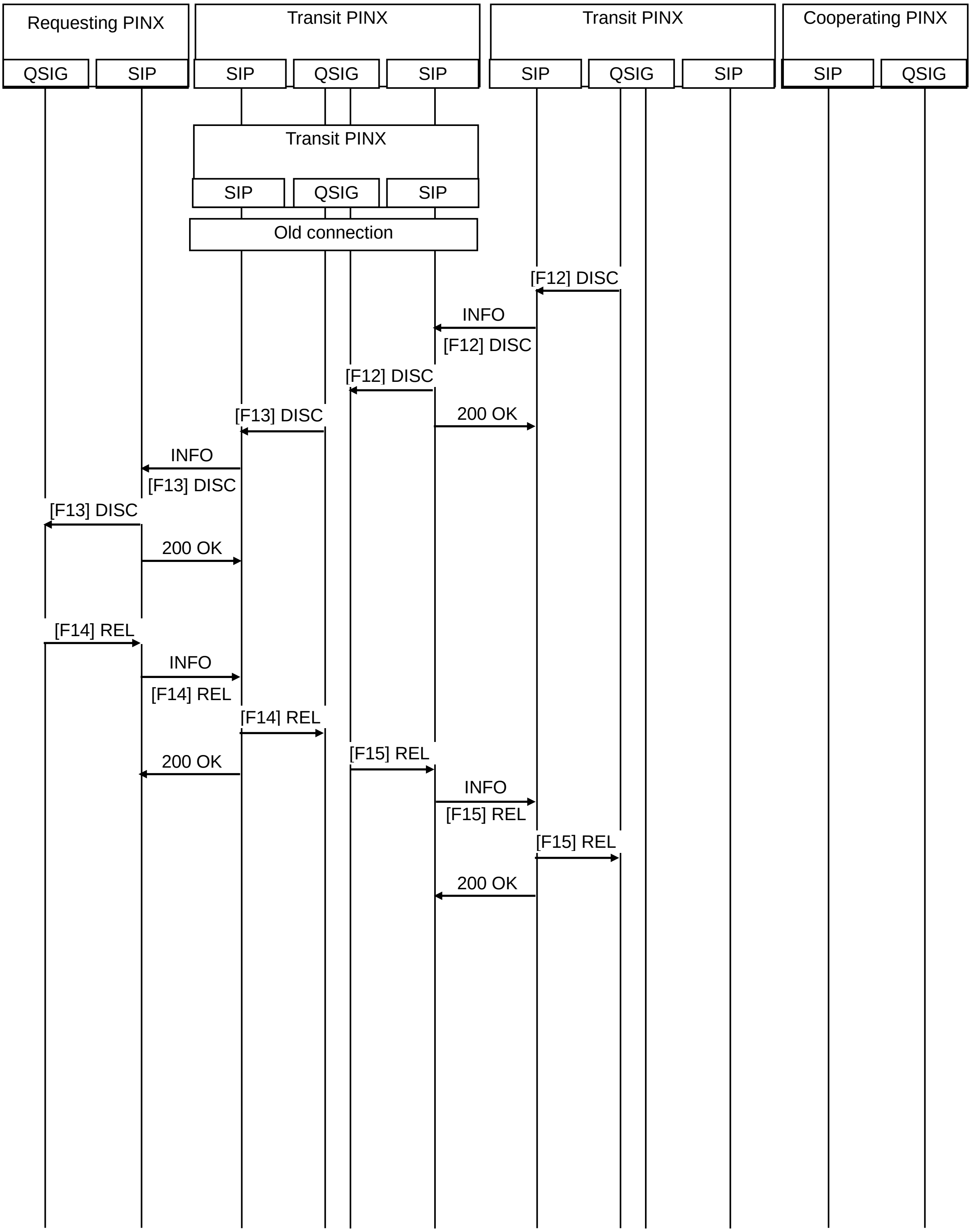
Attached Figure 2.4.2.3-1 (1/5)　Message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained (in SIP tunneling)



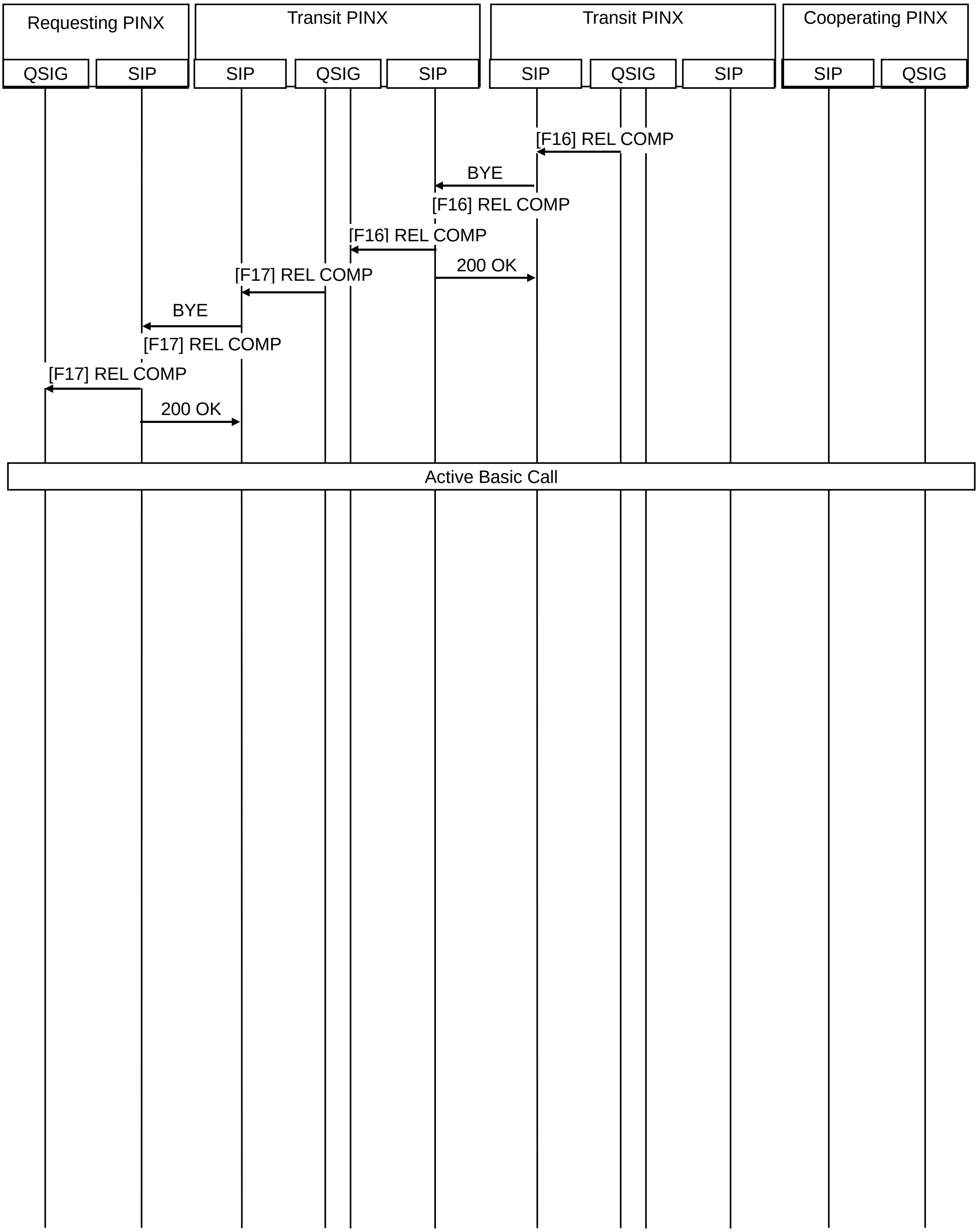
Attached Figure 2.4.2.3-1 (2/5) Message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained (in SIP tunneling)



Attached Figure 2.4.2.3-1 (3/5) Message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained (in SIP tunneling)



Attached Figure 2.4.2.3-1 (4/5) Message sequence for the normal procedure of ANF-PR operation in the case where the old connection is partly retained (in SIP tunneling)



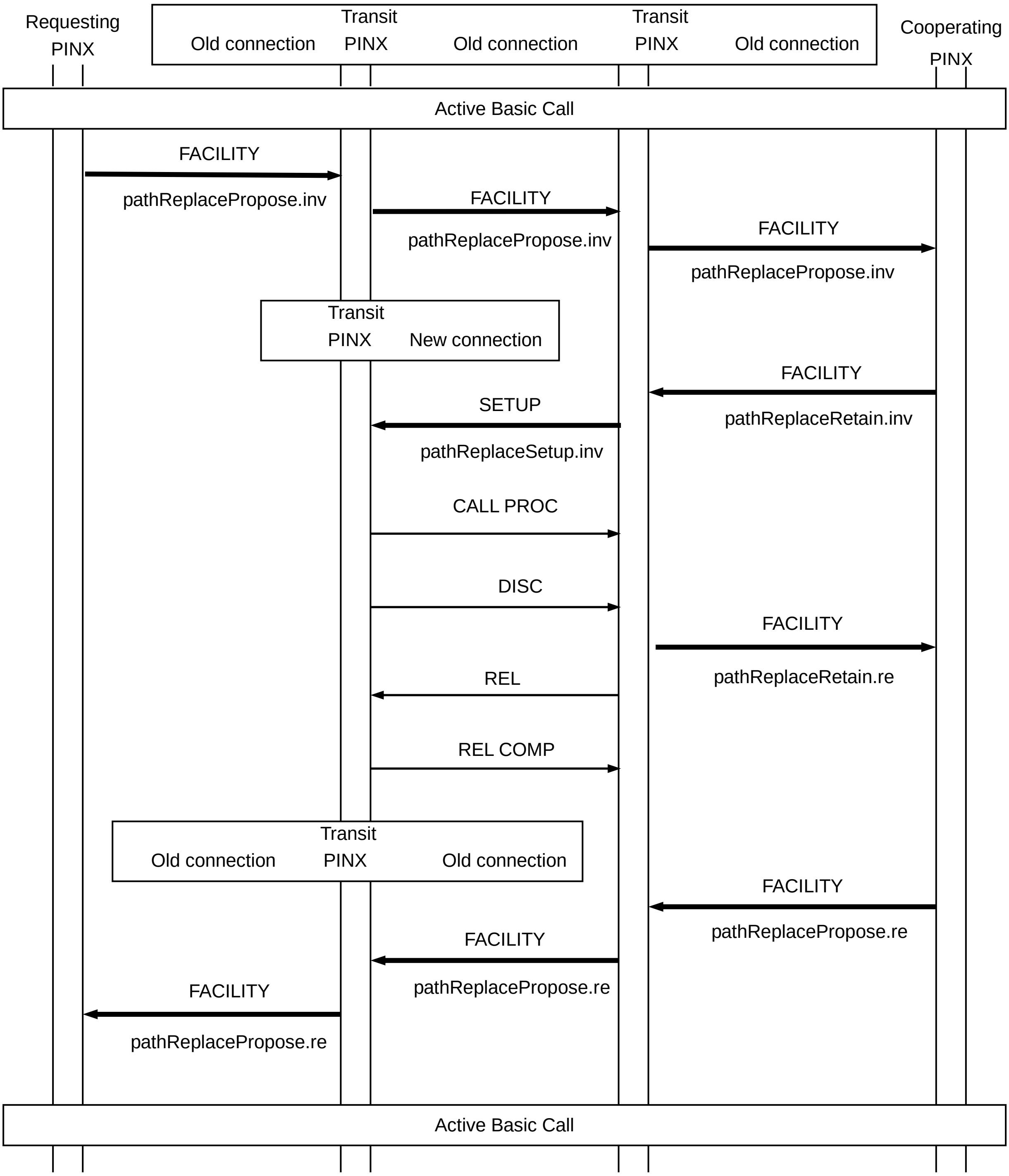
Attached Figure 2.4.2.3-1 (5/5) Message sequence for the normal procedure of ANF-PR in the case where the old connection is partly retained (in SIP tunneling)

2.4.2.4 Example message sequence in case of congestion encountered at PINX after retaining part of the old connection

Attached Figure 2.4.2.4 shows an example of operation of ANF-PR with elements of the old connection is retained as far as the first Transit PINX (branch PINX) and failed in the establishment of the new connection at the second Transit PINX because of congestion or for other reasons.

ANF-PR fails because the Ccooperating PINX does not retry operation of ANF-Pusing a new connection at all.

Note that the sequence example below is a quote from those defined in JS-13874.

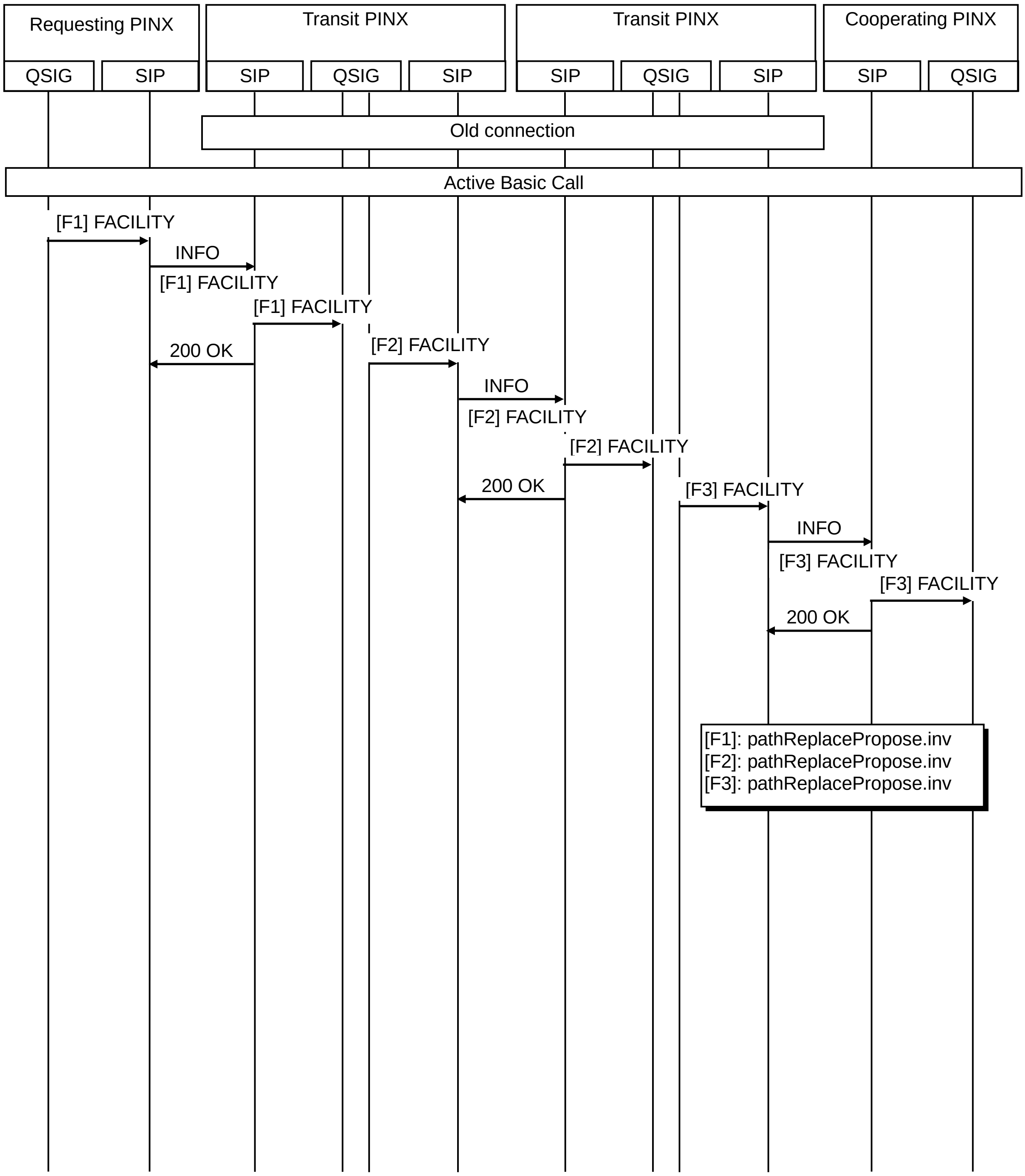


Attached Figure 2.4.2.4 Message sequence for congestion case, retaining part of the old connection

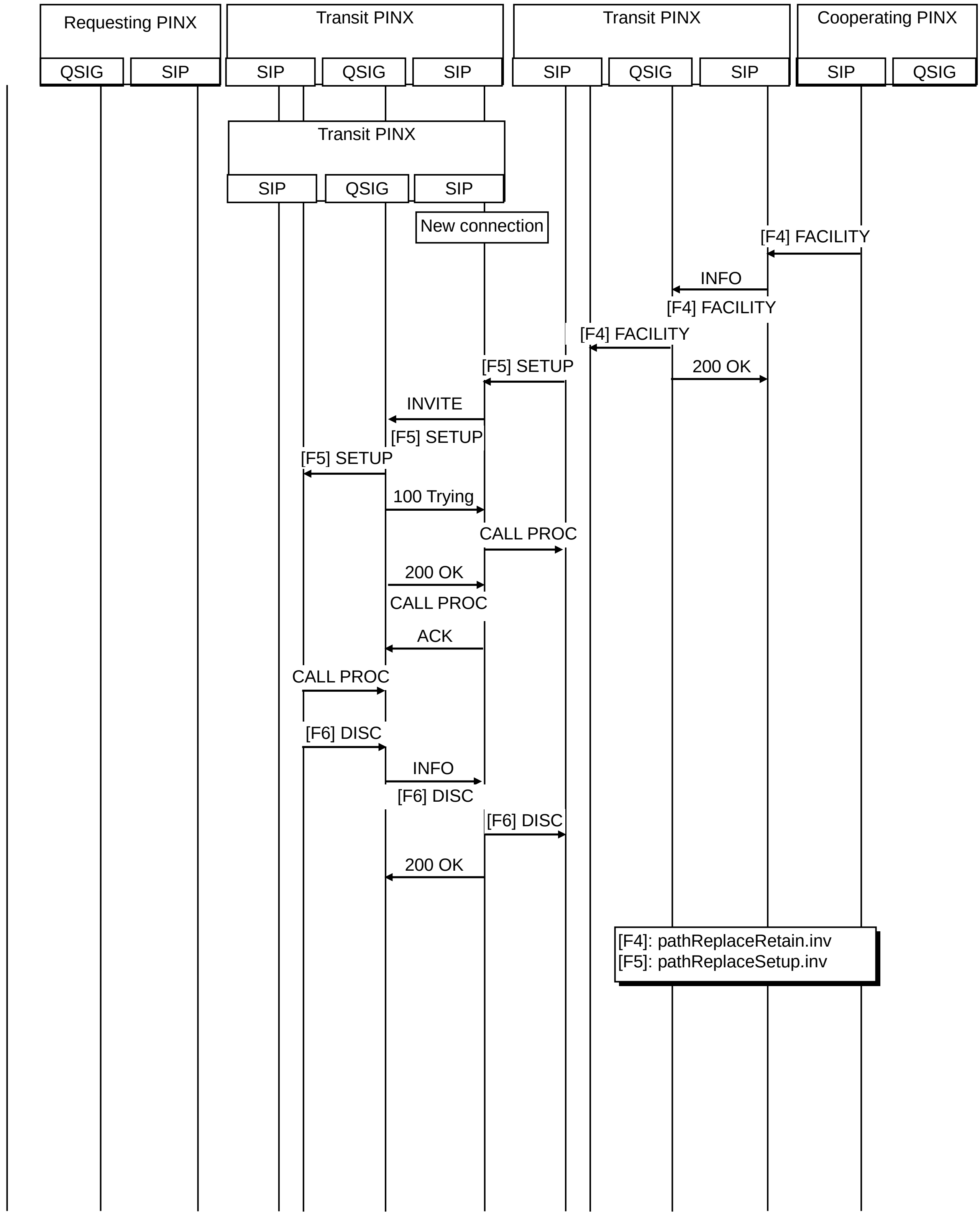
2.4.2.4-1 Example message sequence in case of congestion encountered at PINX after retaining part of the old connection (in SIP tunneling)

Attached Figure 2.4.2.4-1 shows an example of operation of ANF-PR with elements of the old connection retained as far as the first Transit PINX (branch PINX) and failed in the establishment of the new connection at the second Transit PINX because of congestion or for other reasons.

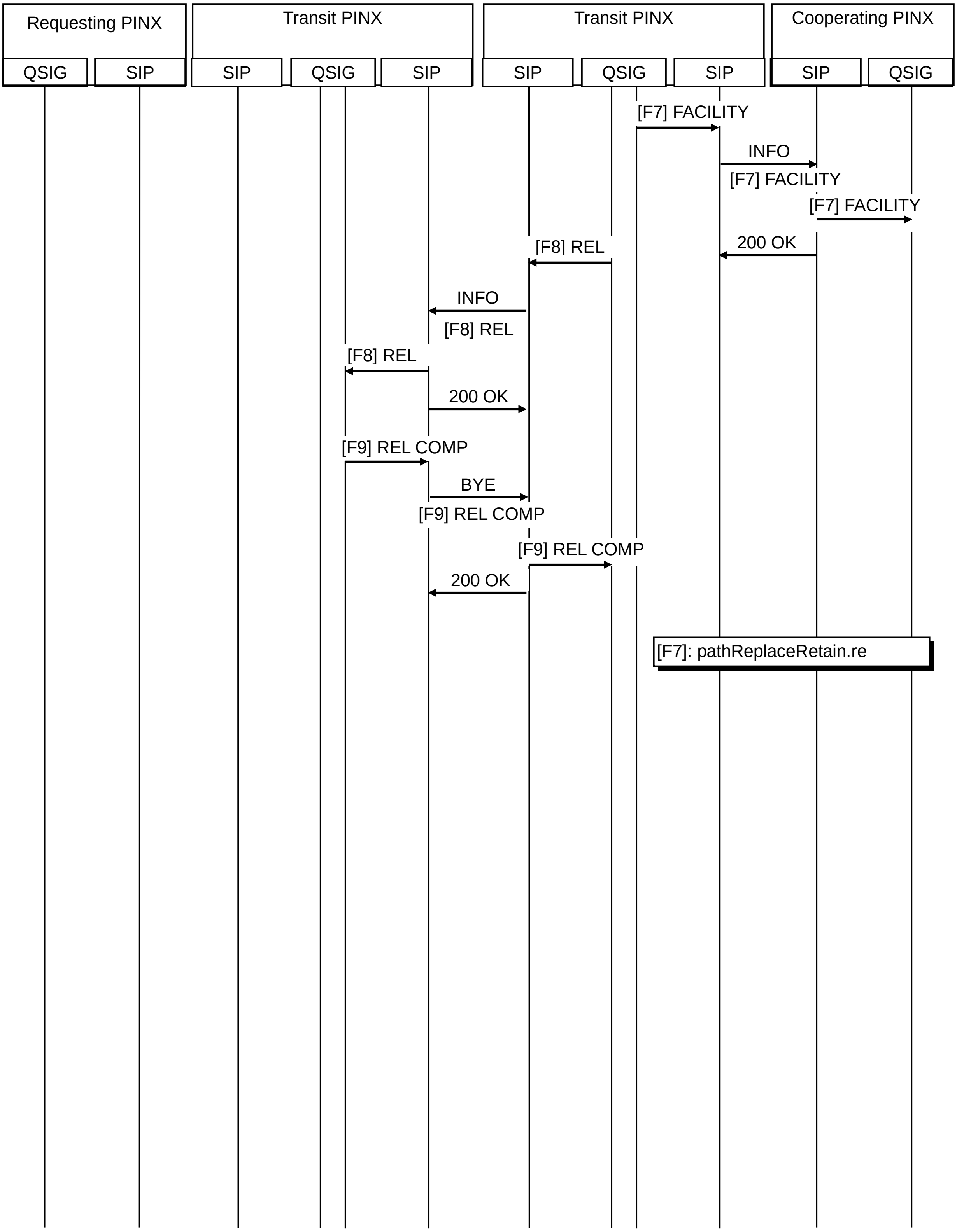
ANF-PR fails because the Cooperating PINX does not retry operation of ANF-PR using a new connection at all.



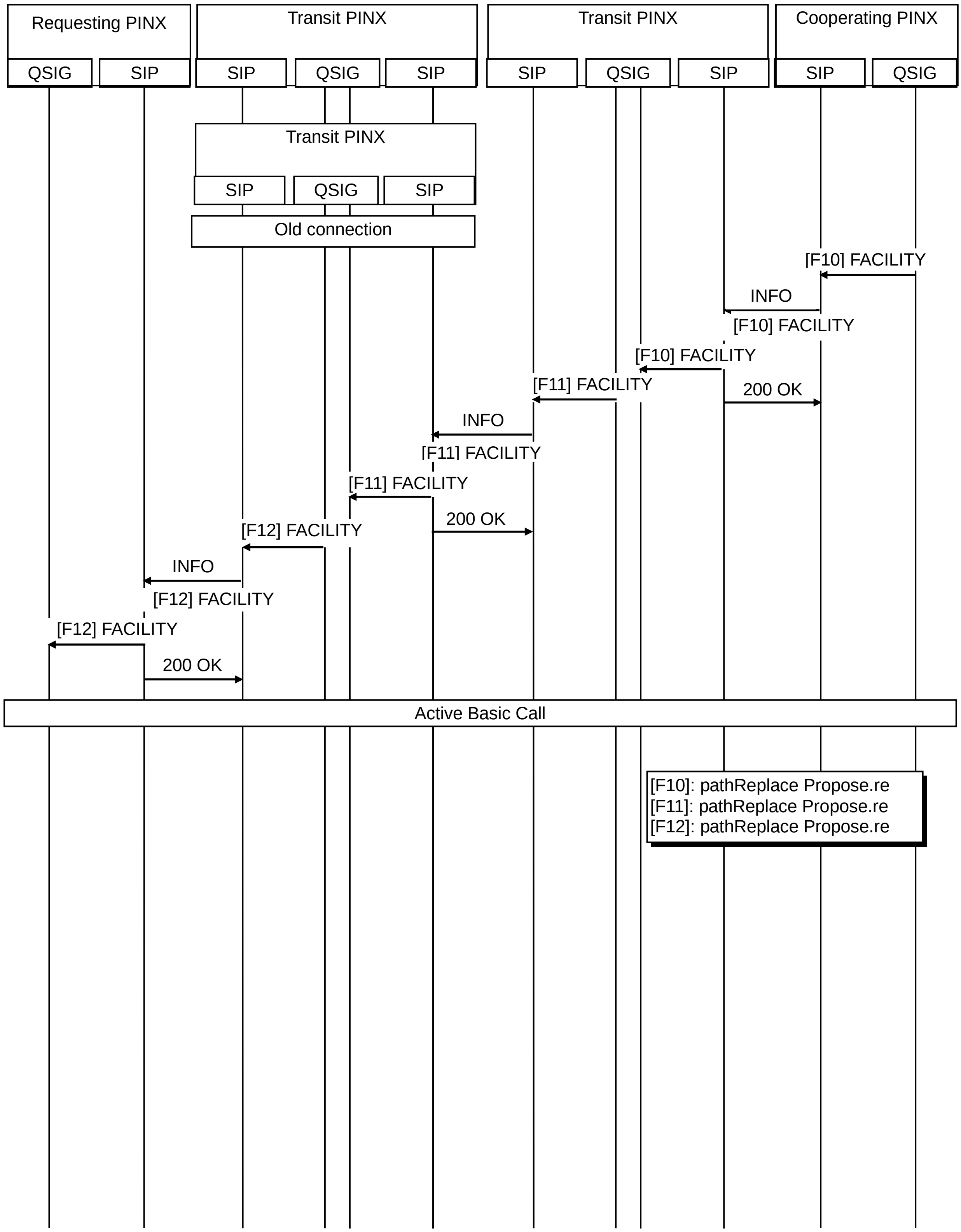
Attached Figure 2.4.2.4-1 (1/4) Message sequence for congestion case, retaining part of the old connection (in SIP tunneling)



Attached Figure 2.4.2.4-1 (2/4) Message sequence for congestion case, retaining part of the old connection (in SIP tunneling)



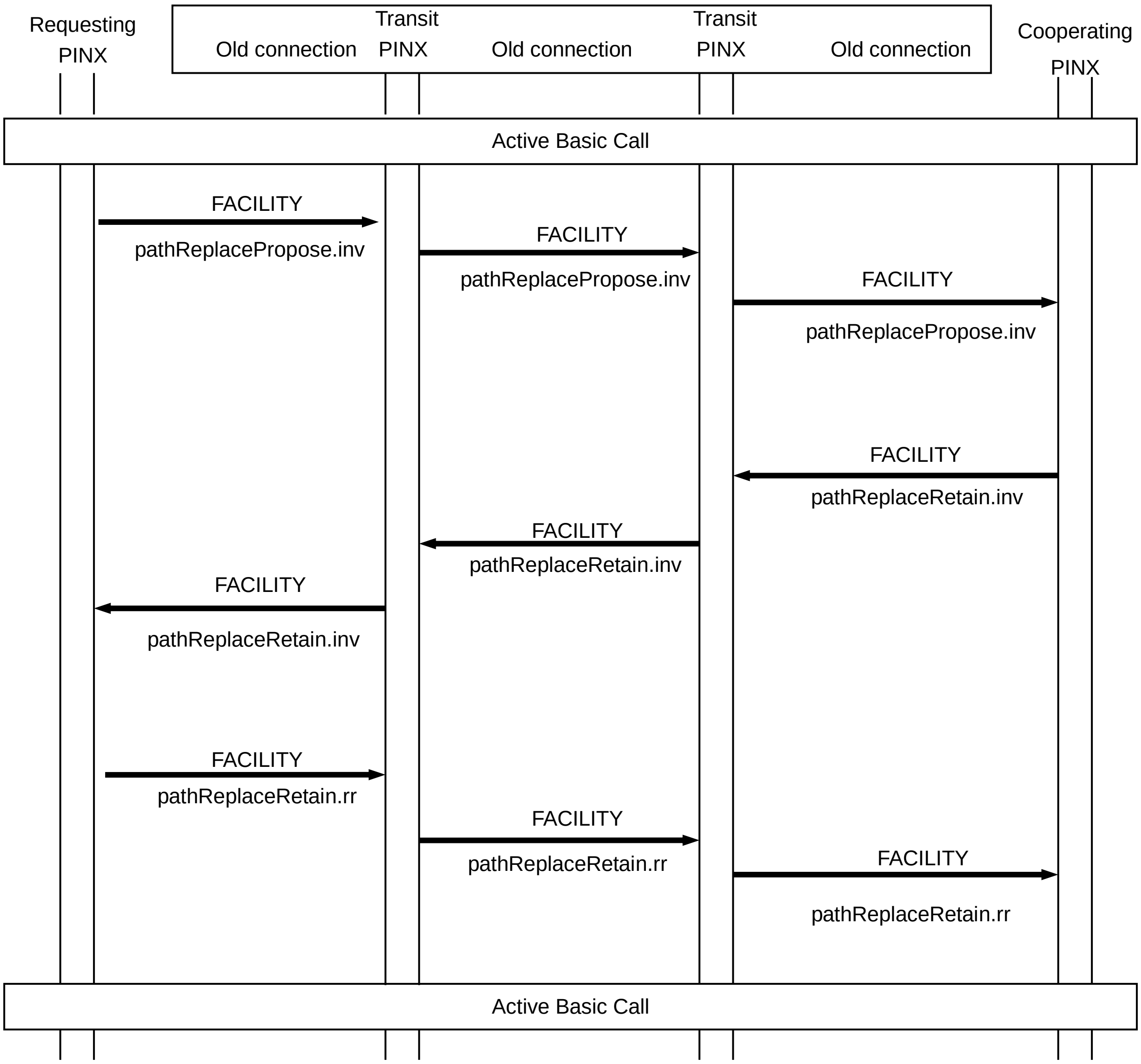
Attached Figure 2.4.2.4-1 (3/4) Message sequence for congestion case, retaining part of the old connection (in SIP tunneling)



Attached Figure 2.4.2.4-1 (4/4)　Message sequence for congestion case, retaining part of the old connection (in SIP tunneling)

2.4.2.5 Example message sequence for the normal operation, retaining all of the old connection

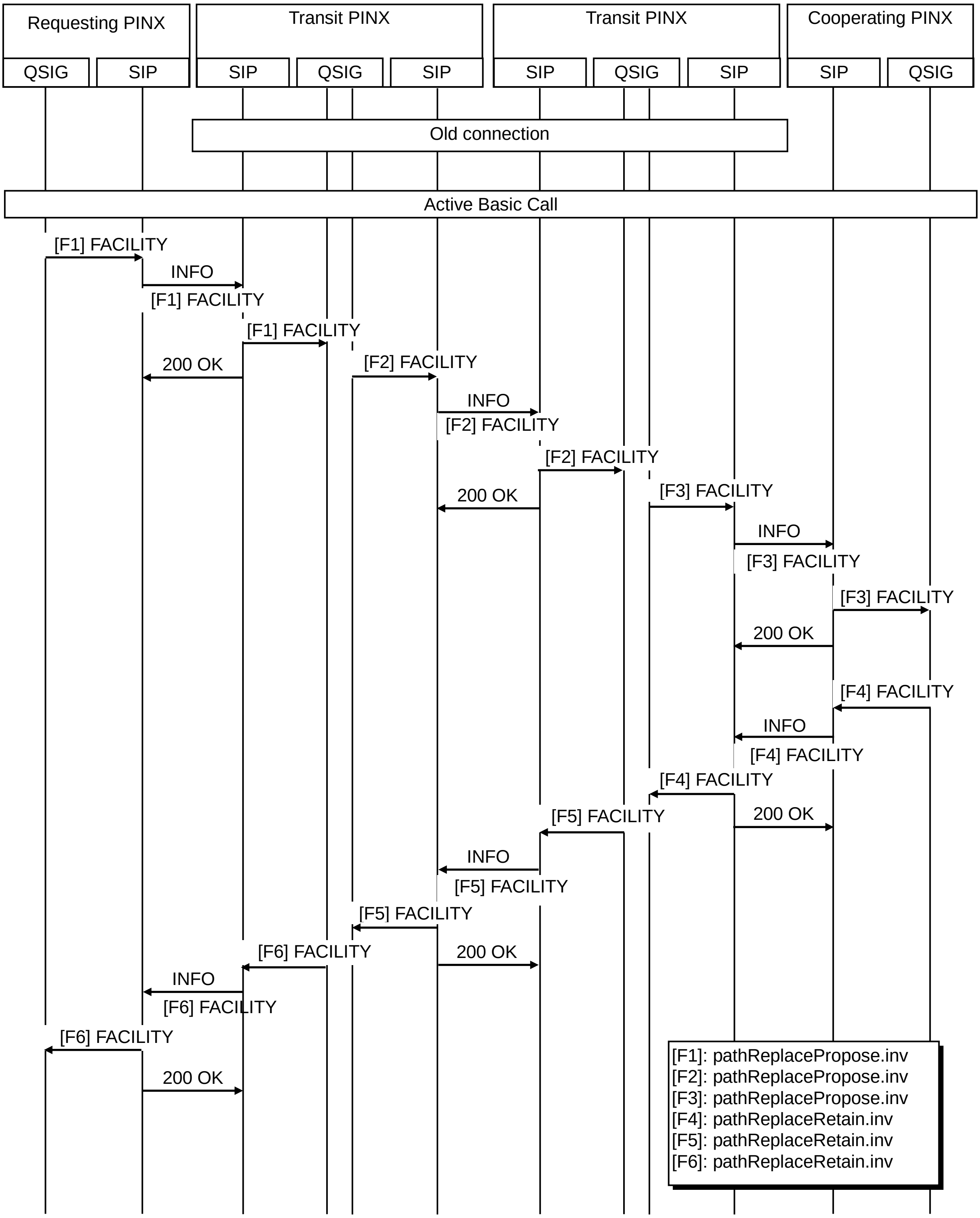
Attached Figure 2.4.2.5 shows an example of normal operation of ANF-PR with all of the old connection
Note that the sequence example below is a quote from those defined in JS-13874.



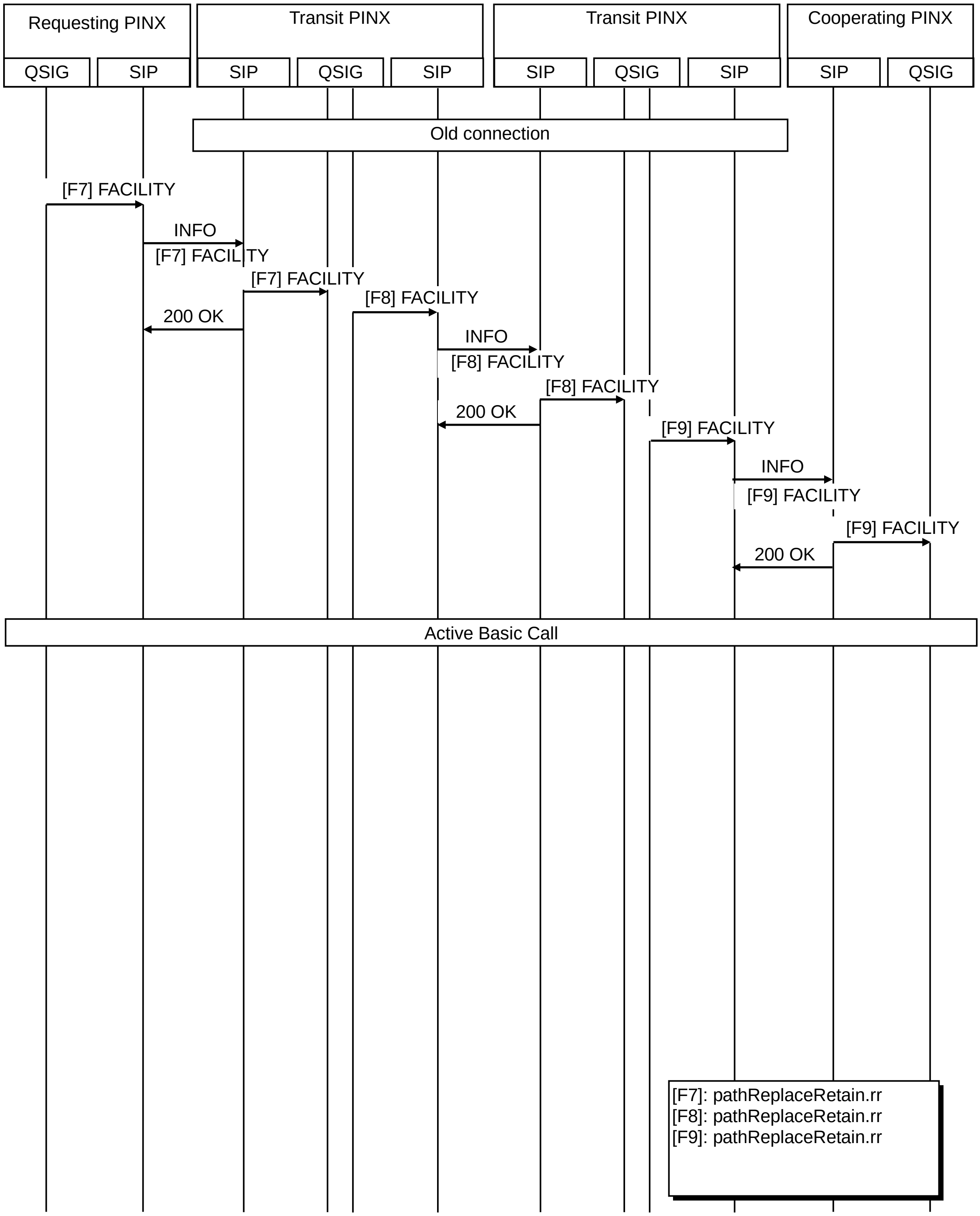
Attached Figure 2.4.2.5 Message sequence for normal operation of ANF-PR retaining all of the old connection

2.4.2.5-1 Example message sequence for the normal operation, retaining all of the old connection (in SIP tunneling)

Attached Figure 2.4.2.5-1 shows an example of the normal operation of ANF-PR with all of the old connection.



Attached Figure 2.4.2.5-1 (1/2) Message sequence for normal operation of ANF-PR, retaining all of the old connection–(in SIP tunneling)

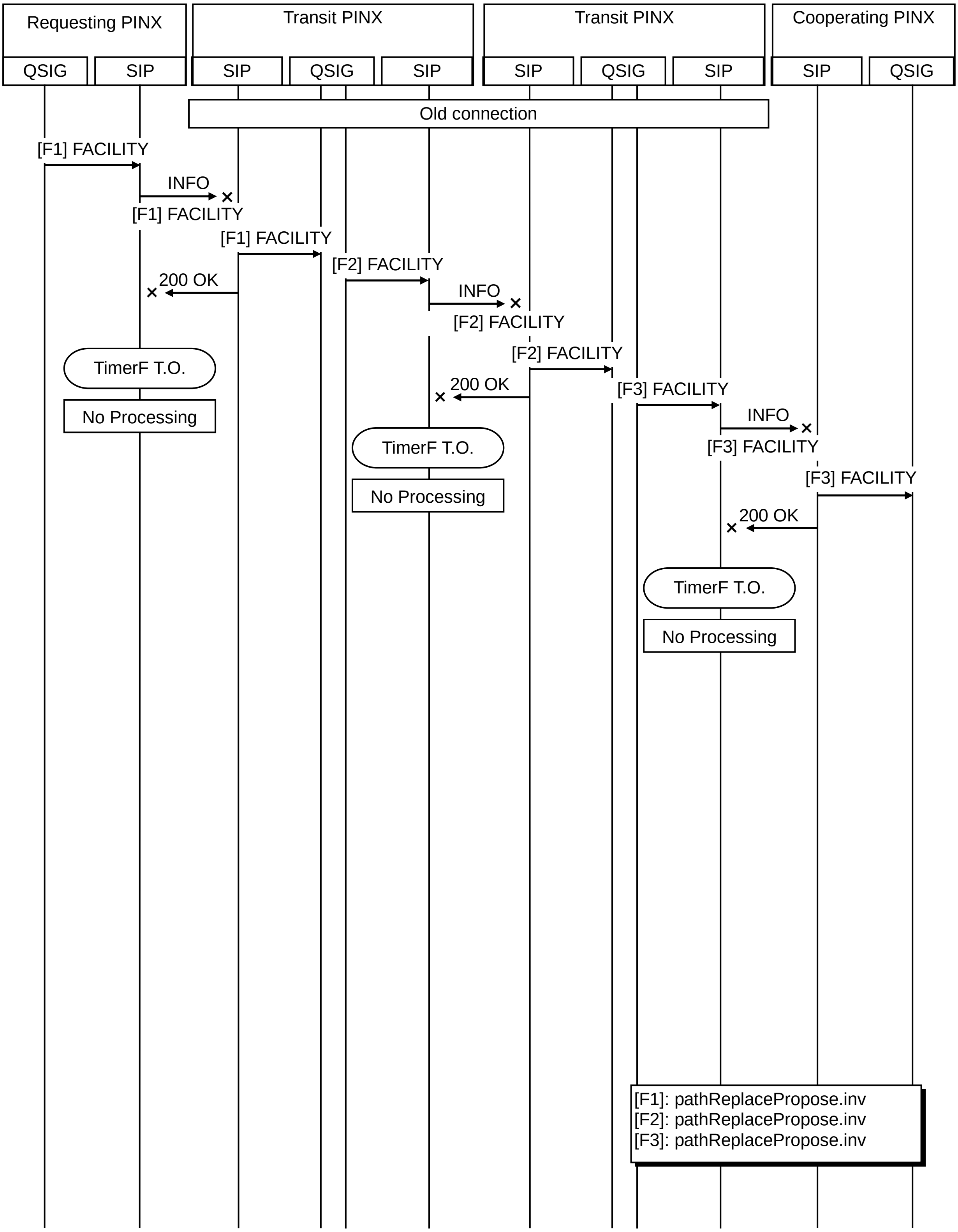


Attached Figure 2.4.2.5-1 (2/2) Message sequence for normal operation of ANF-PR, retaining all of the old connection–(in SIP tunneling)

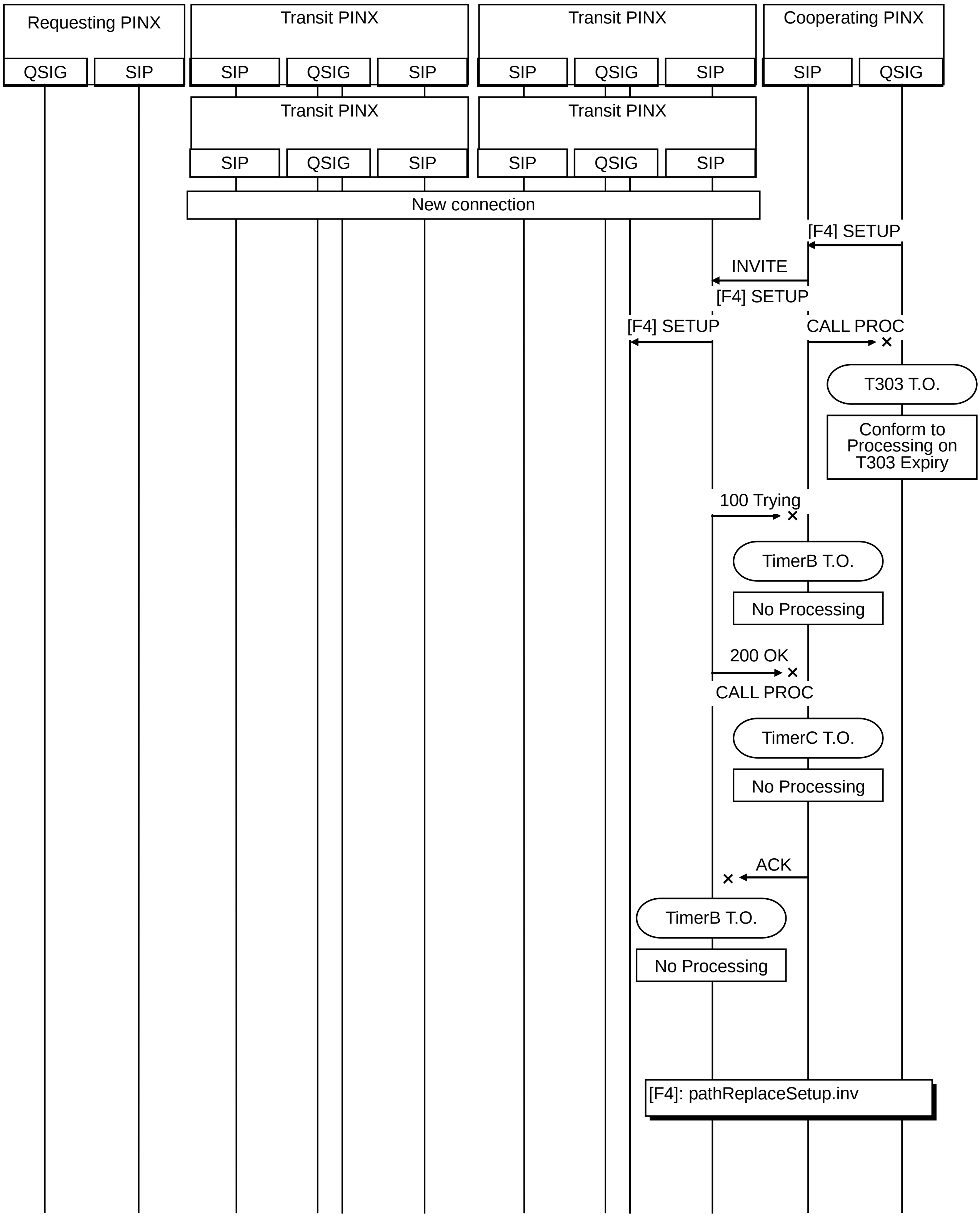
2.4.3 Procedures (quasi-normal sequences)

2.4.3.1 Example of message sequence for the quasi-normal procedure of ANF-PR

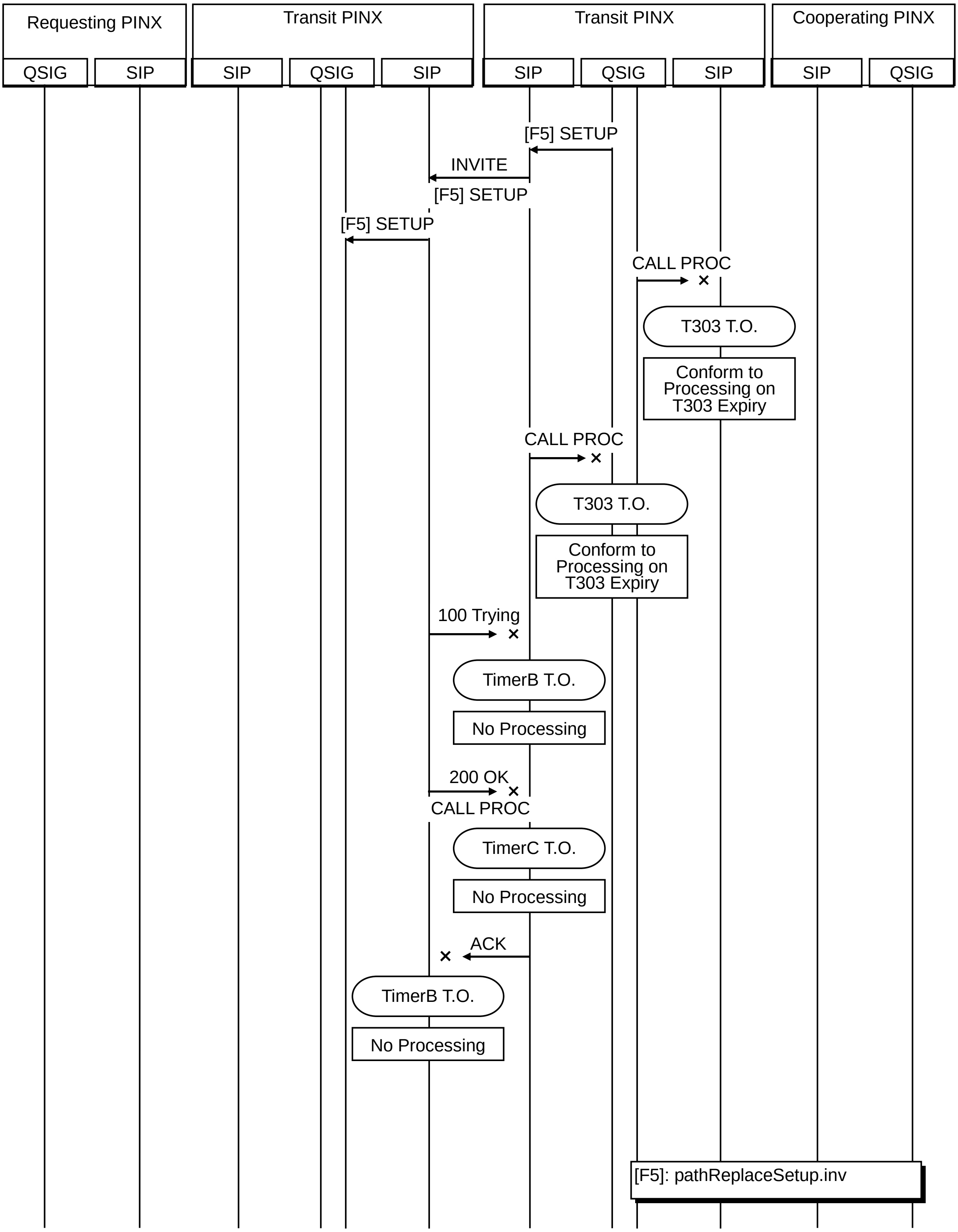
Attached Figure 2.4.3.1 shows an example of the message sequence for the quasi-normal procedure of ANF-PR. Each of old and new connections passes through two transit PINXs.



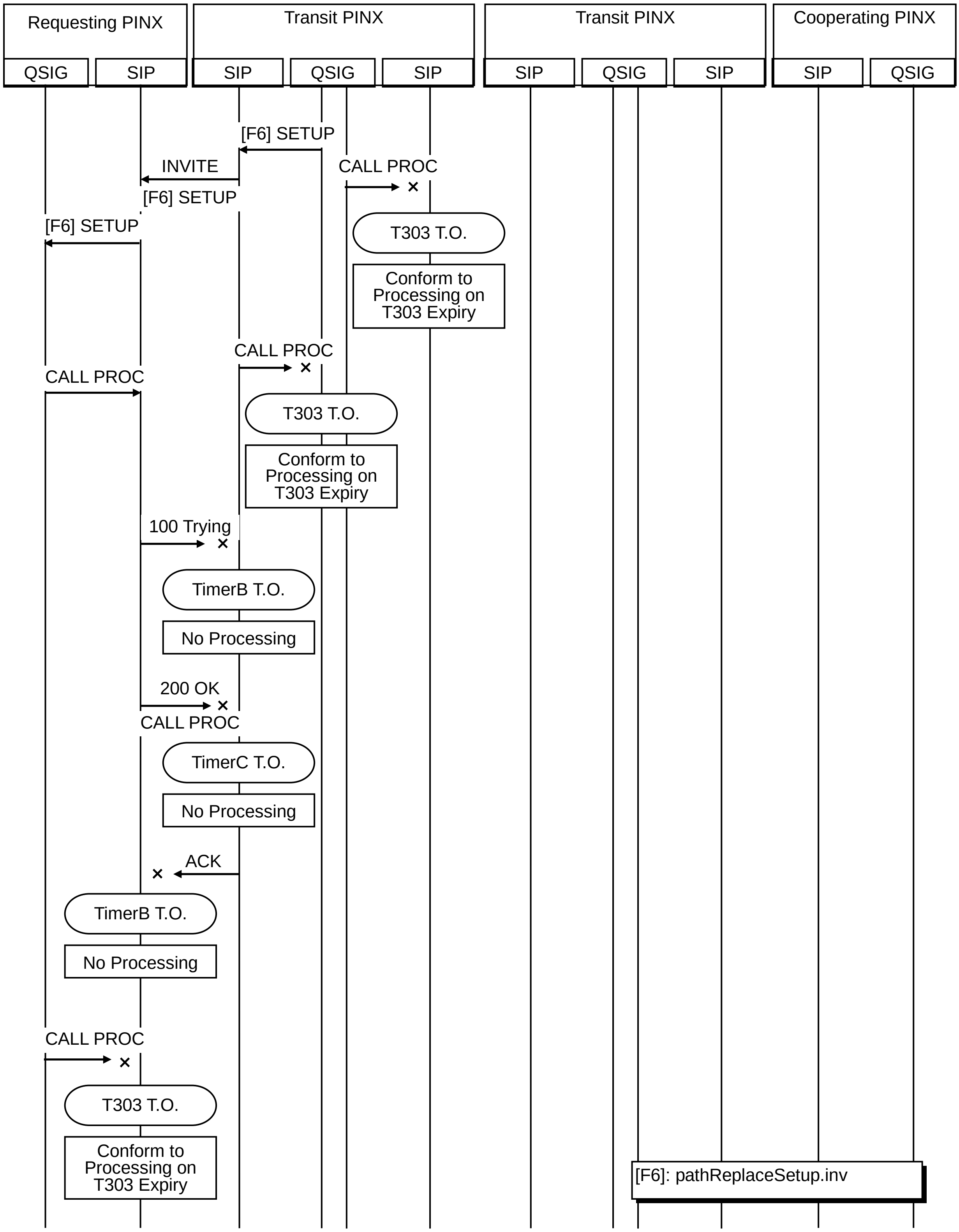
Attached Figure 2.4.3.1 (1/8) Message sequence for the quasi-normal procedure of ANF-PR



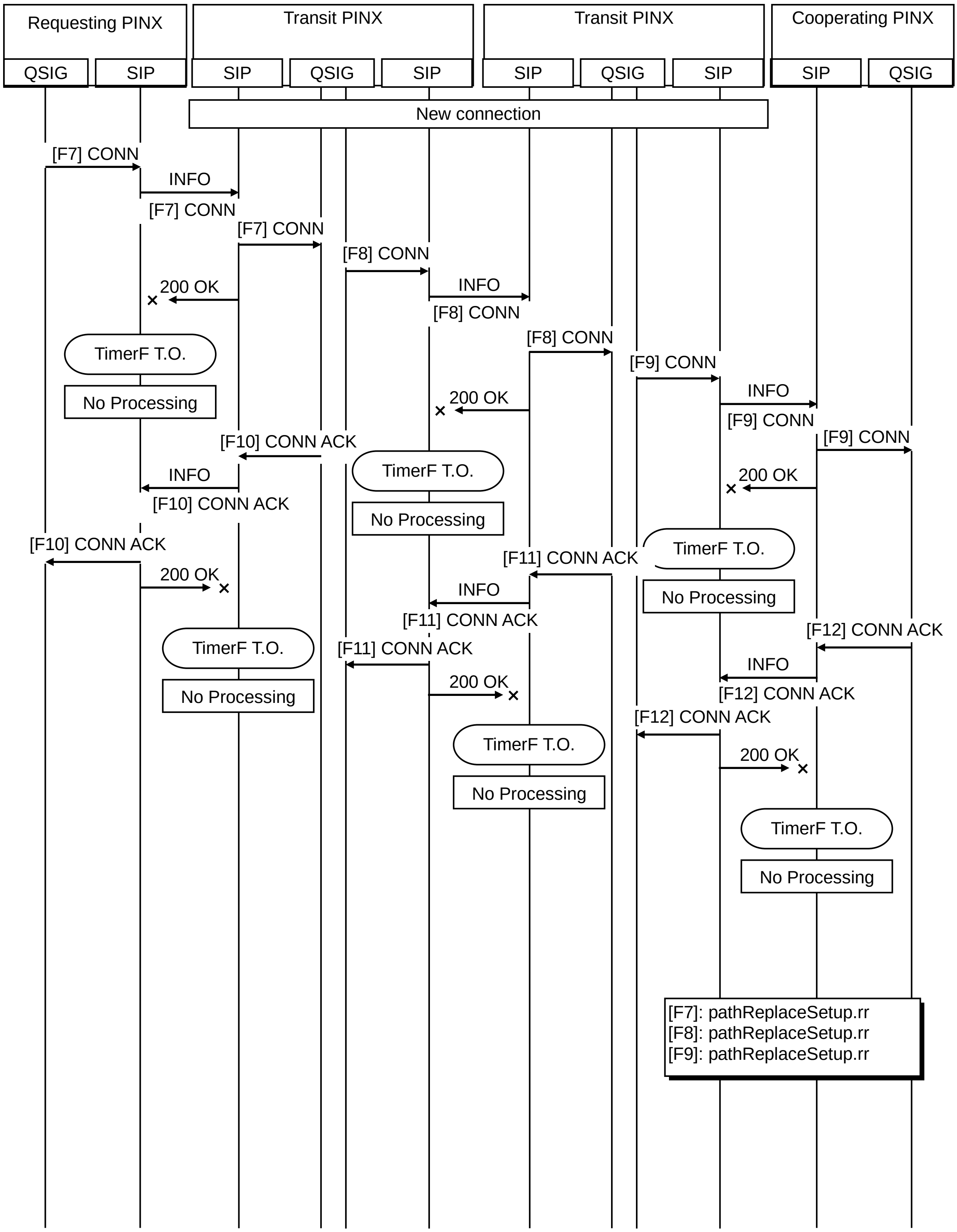
Attached Figure 2.4.3.1 (2/8) Message sequence for the quasi-normal procedure of ANF-PR



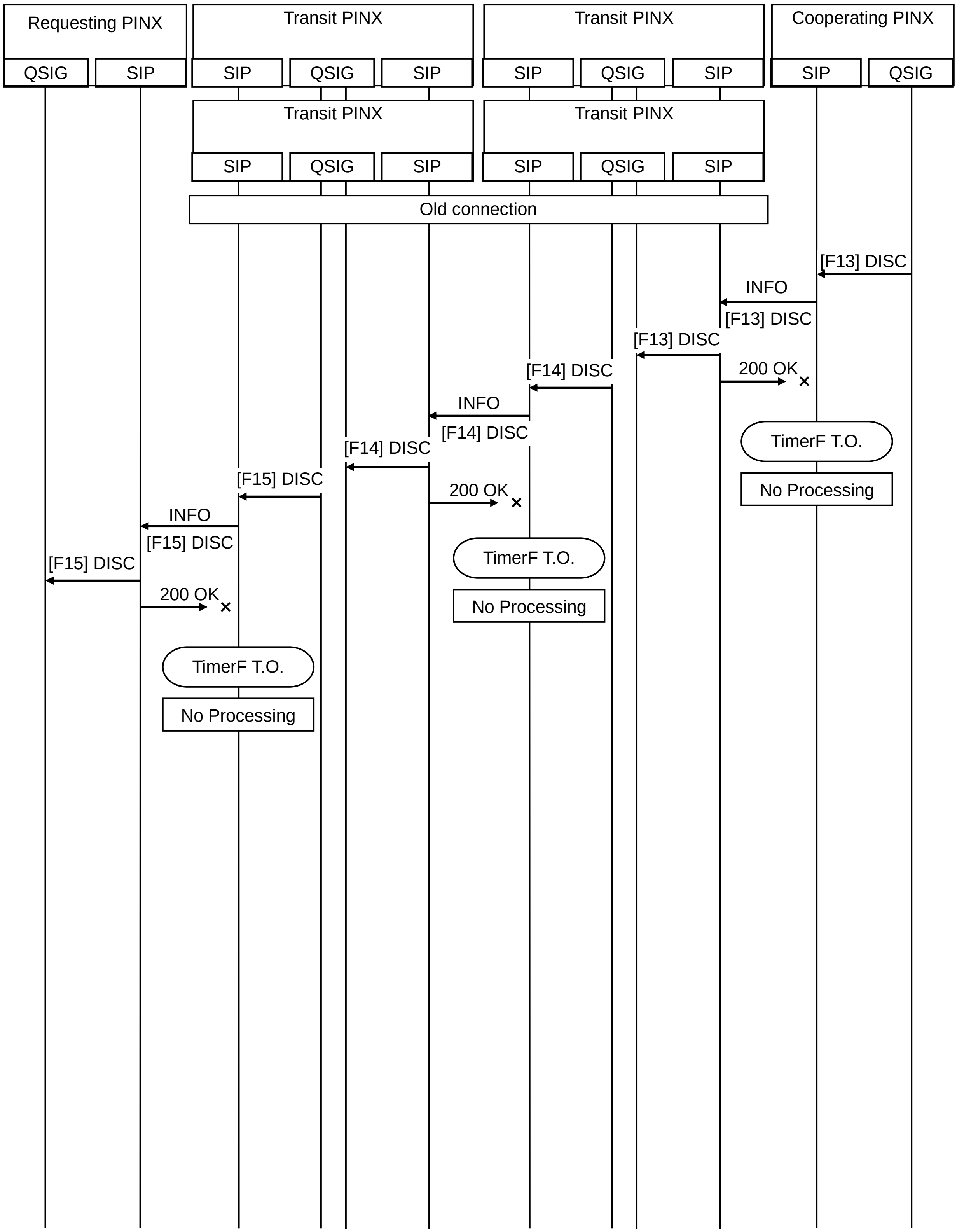
Attached Figure 2.4.3.1 (3/8)　Message sequence for the quasi-normal procedure of ANF-PR



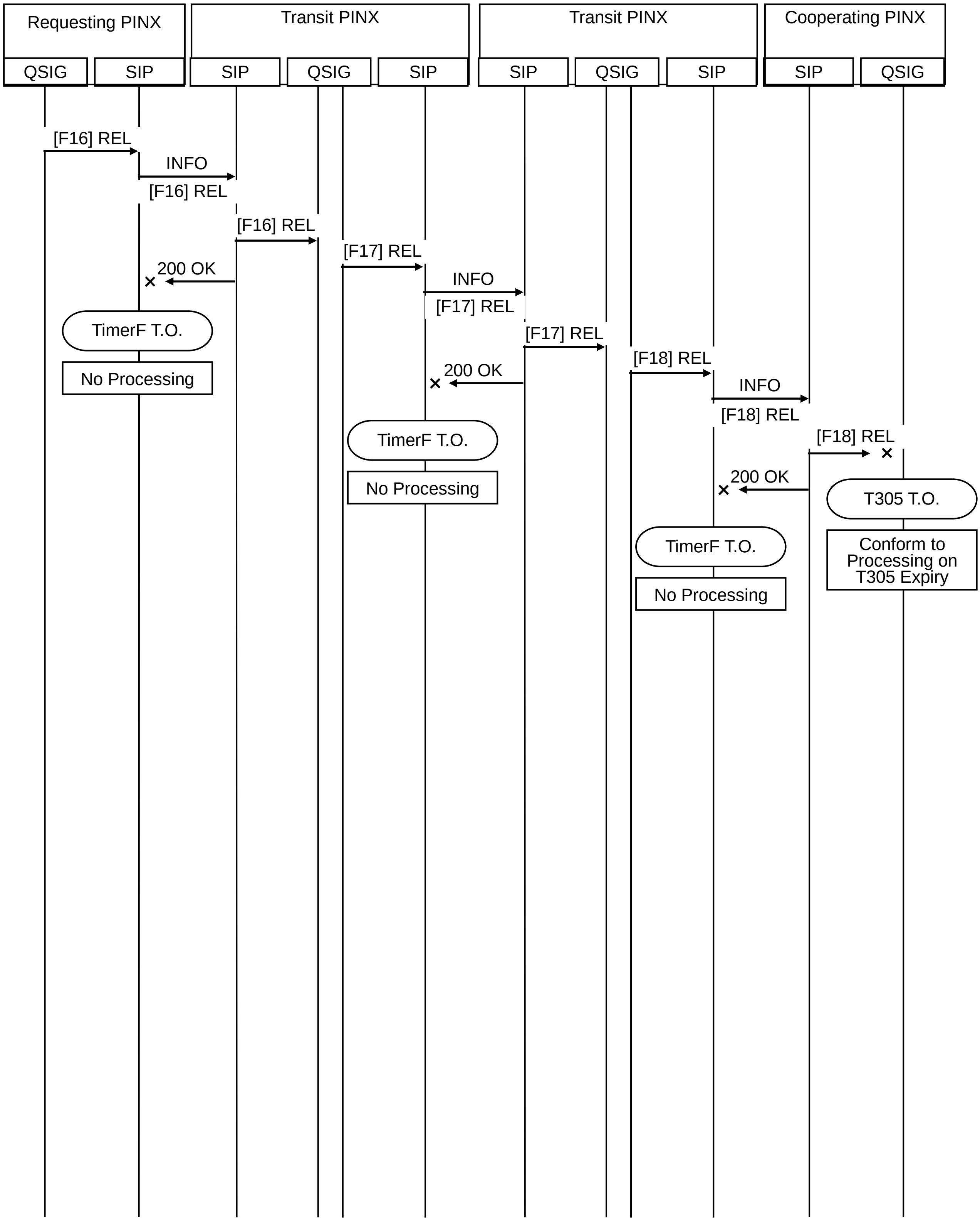
Attached Figure 2.4.3.1 (4/8) Message sequence for the quasi-normal procedure of ANF-PR



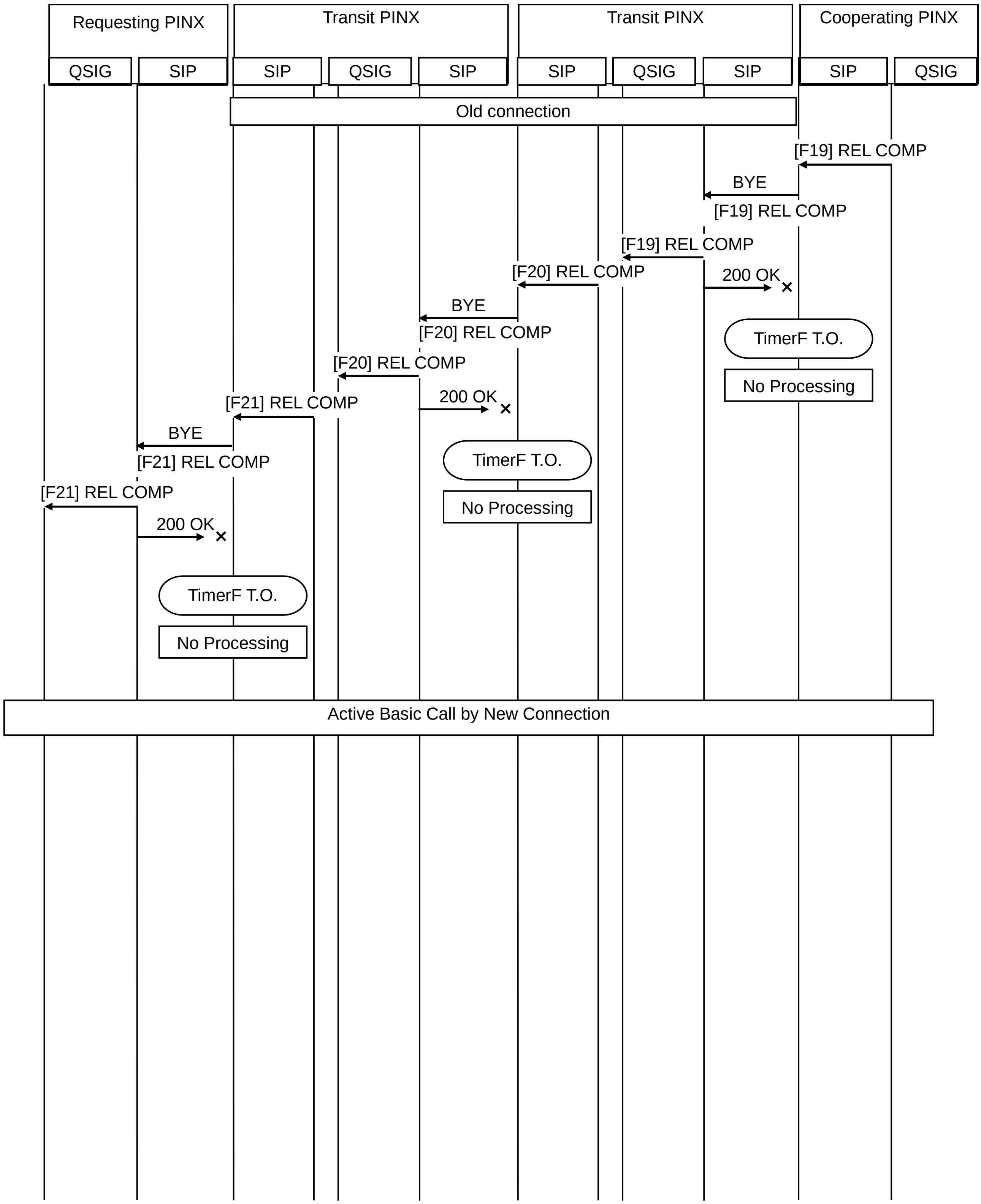
Attached Figure 2.4.3.1 (5/8)　Message sequence for the quasi-normal procedure of ANF-PR



Attached Figure 2.4.3.1 (6/8)　Message sequence for the quasi-normal procedure of ANF-PR



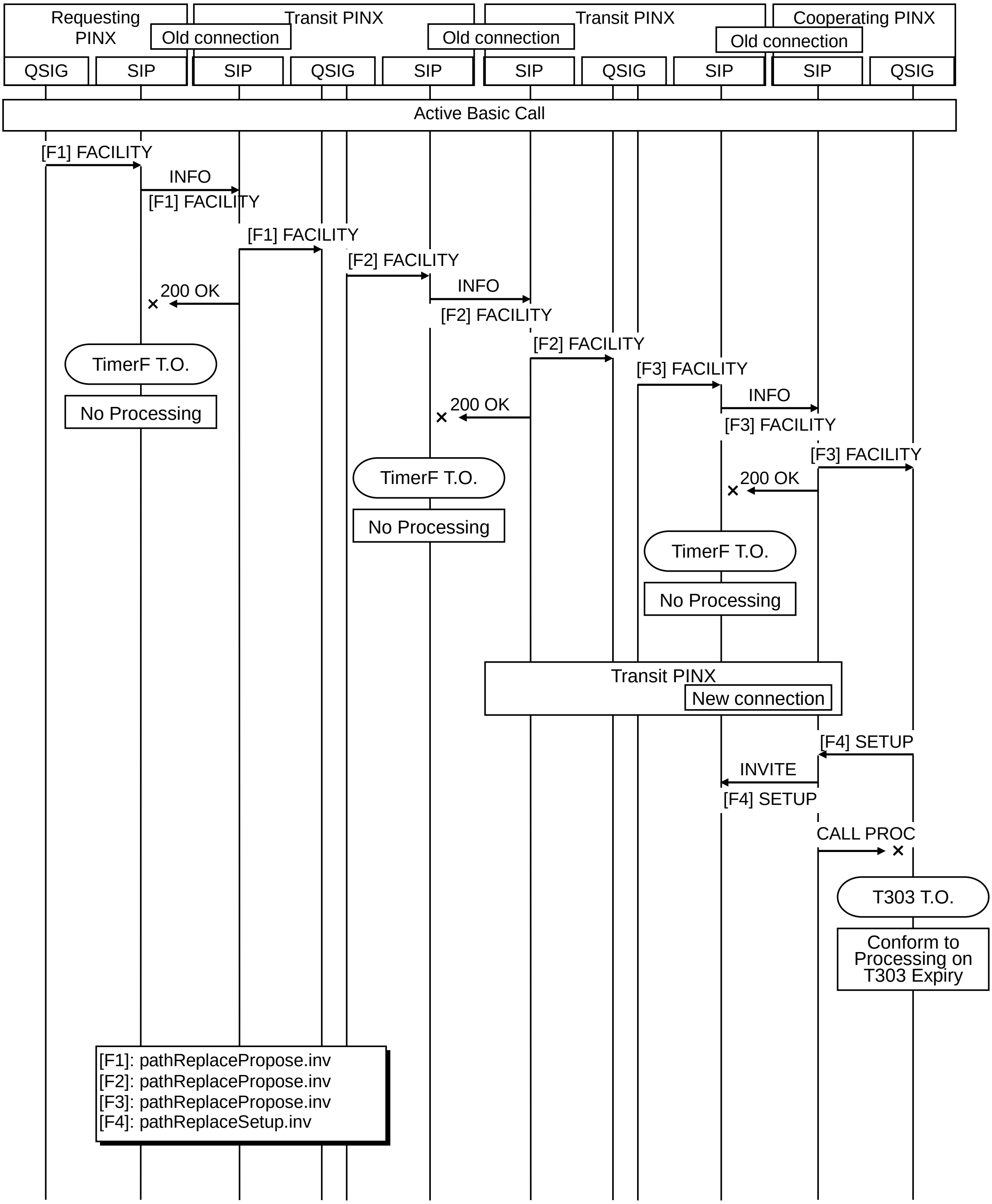
Attached Figure 2.4.3.1 (7/8)　Message sequence for the quasi-normal procedure of ANF-PR



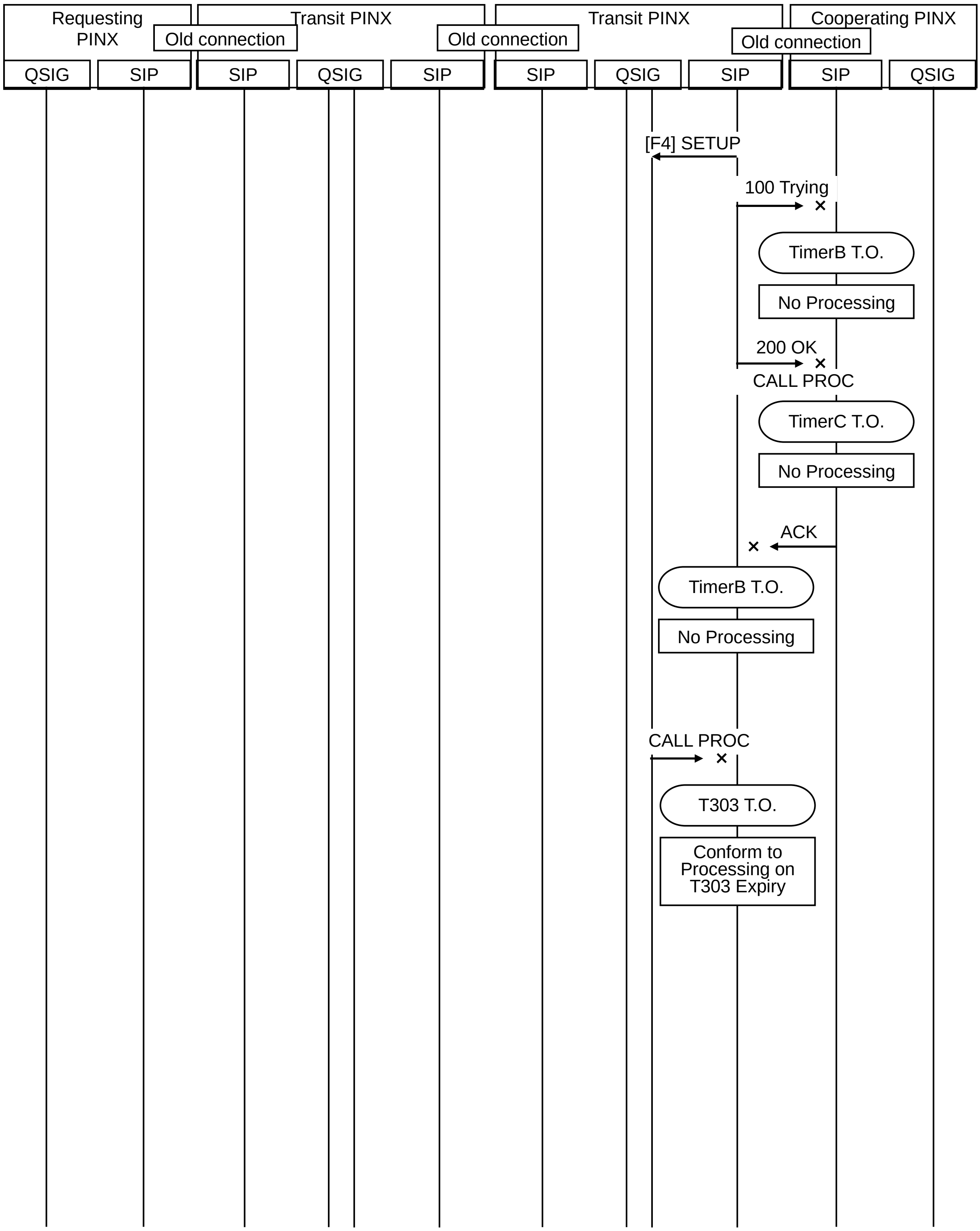
Attached Figure 2.4.3.1 (8/8) Message sequence for the quasi-normal procedure of ANF-PR

2.4.3.2 Example message sequence in case of congestion encountered at Transit PINX

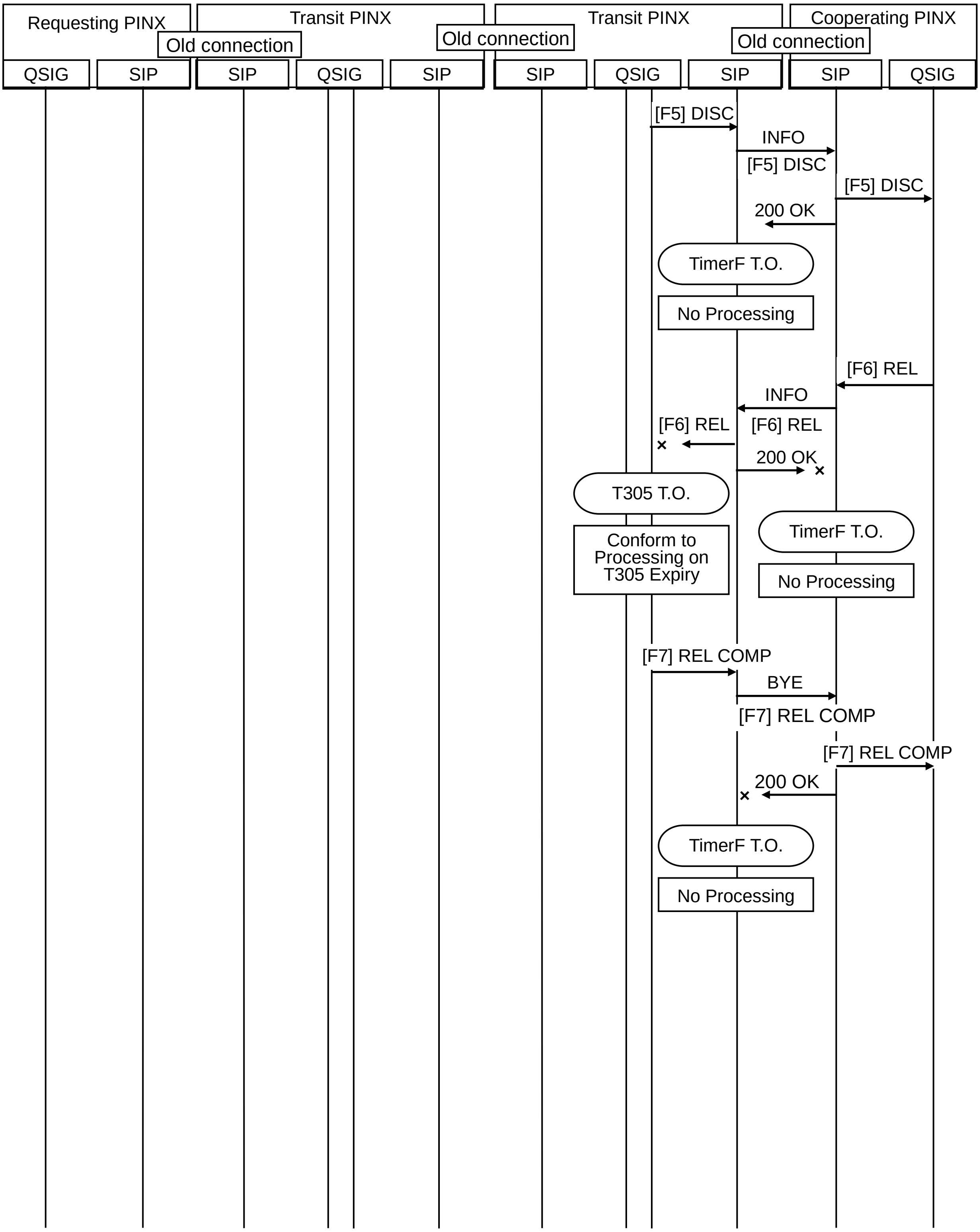
Attached Figure 2.4.3.2 shows an example of the operation of ANF-PR for the case where a Transit PINX on the new connection is unable to proceed with connection establishment, e.g., because of congestion. Consequently ANF-PR fails.



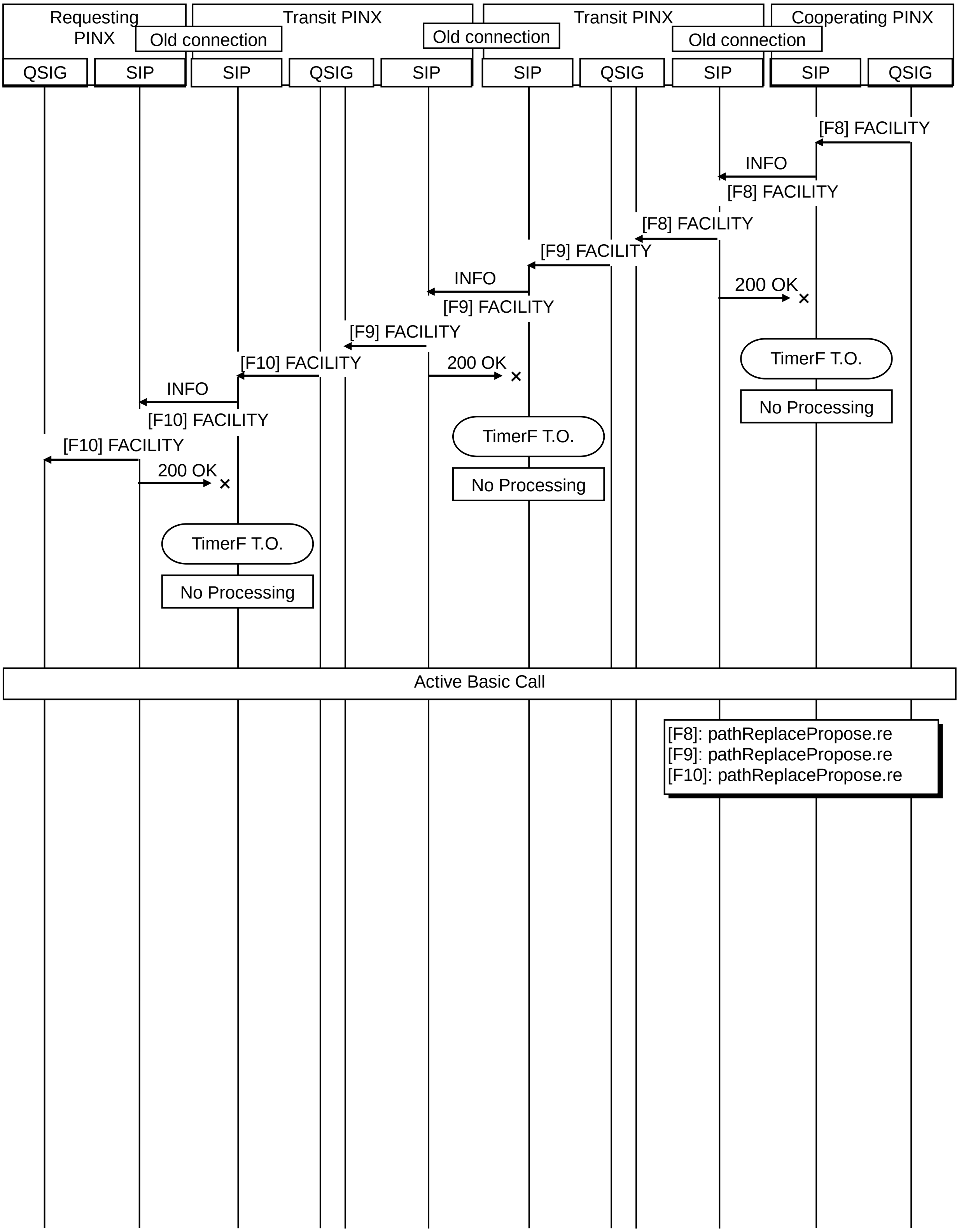
Attached Figure 2.4.3.2 (1/4) Message sequence for congestion case of ANF-PR



Attached Figure 2.4.3.2 (2/4) Message sequence for congestion case of ANF-PR



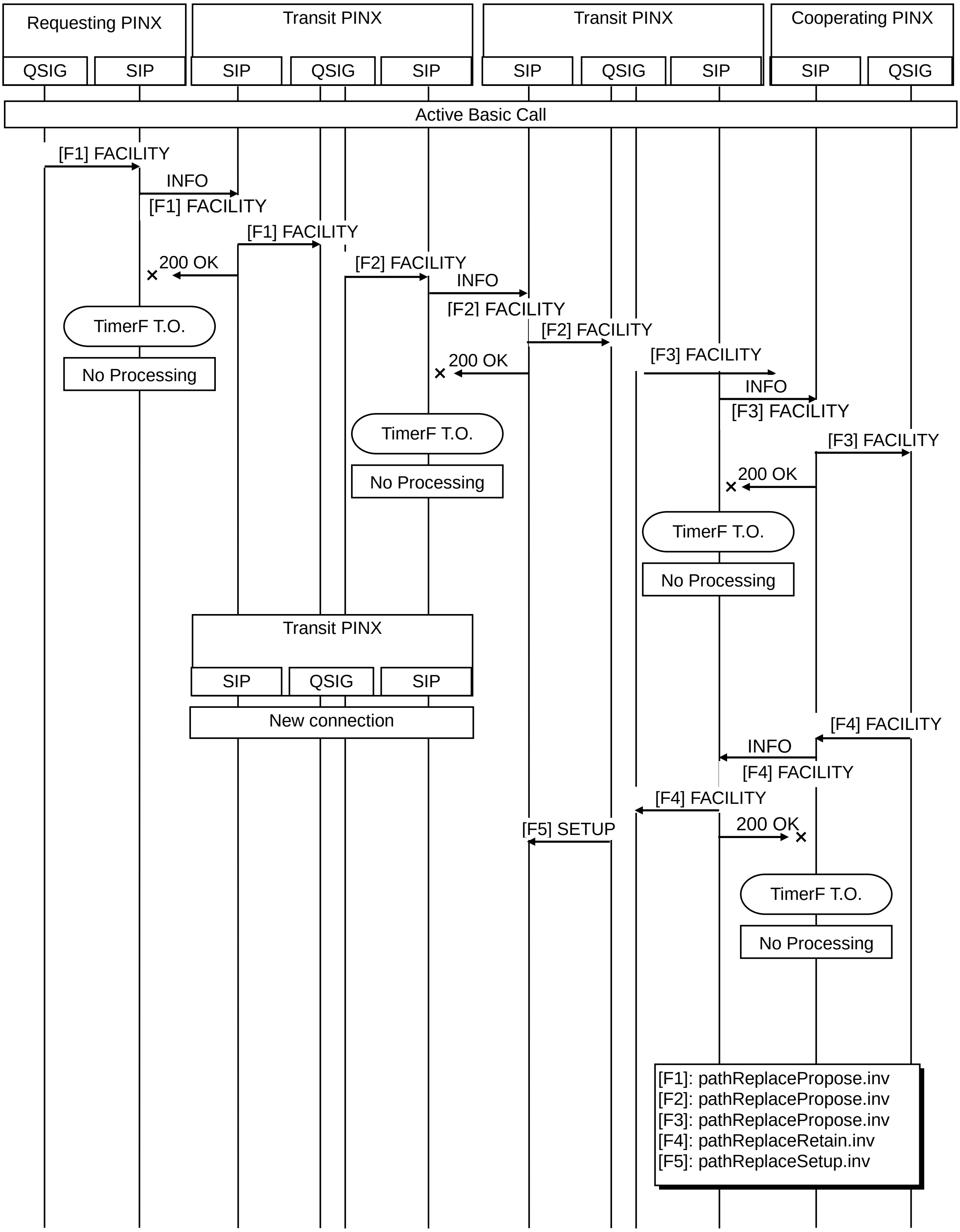
Attached Figure 2.4.3.2 (3/4) Message sequence for congestion case of ANF-PR



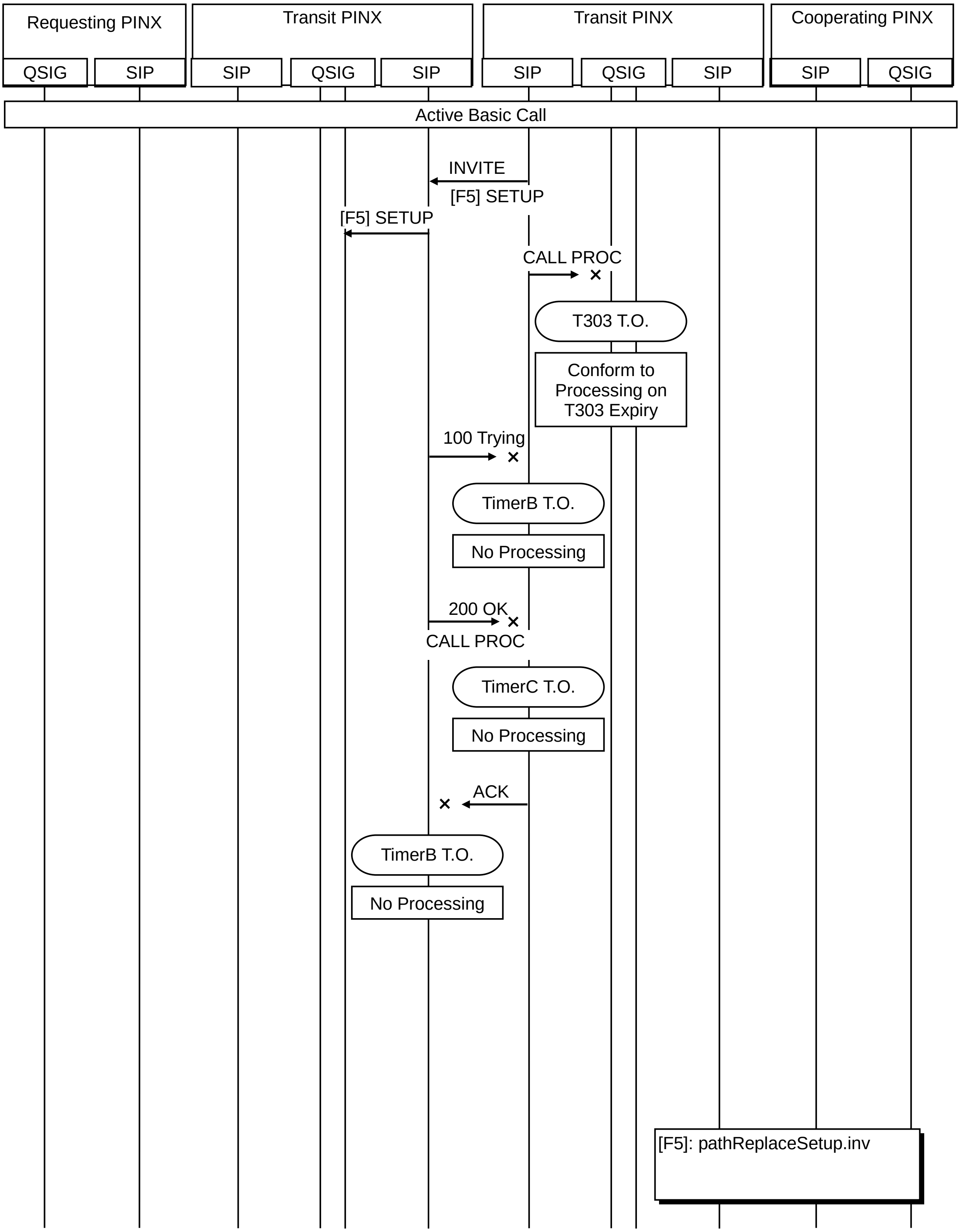
Attached Figure 2.4.3.2 (4/4)　Message sequence for congestion case of ANF-PR

2.4.3.3 Example message sequence for quasi-normal operation, retaining part of the old connection

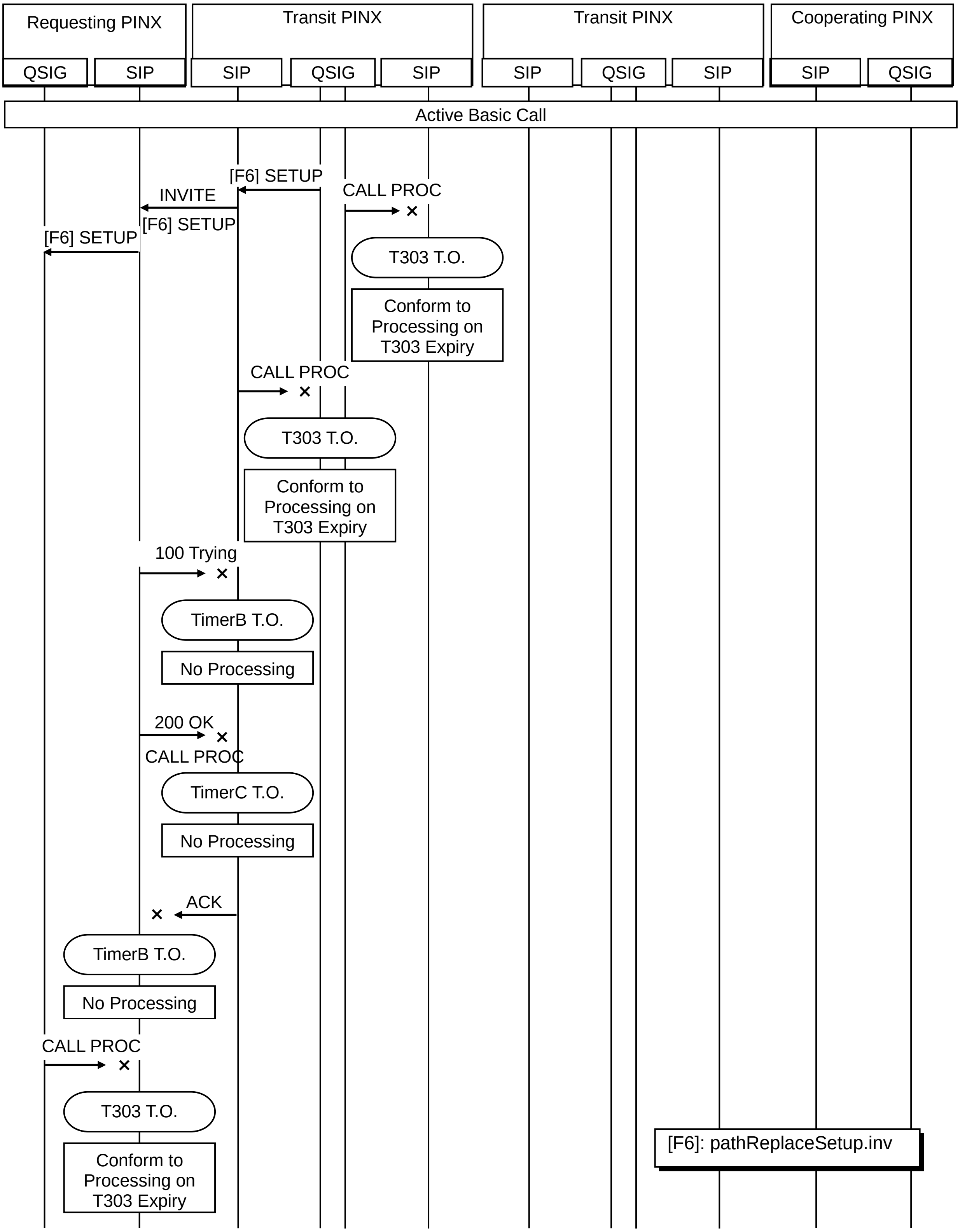
Attached Figure 2.4.3.3 shows an example of quasi-normal operation of ANF-PR with elements of the old connection ~~is~~ retained as far as the first Transit PINX. The old connection and the new connection~~s~~ are each shown passing through one Transit PINX.



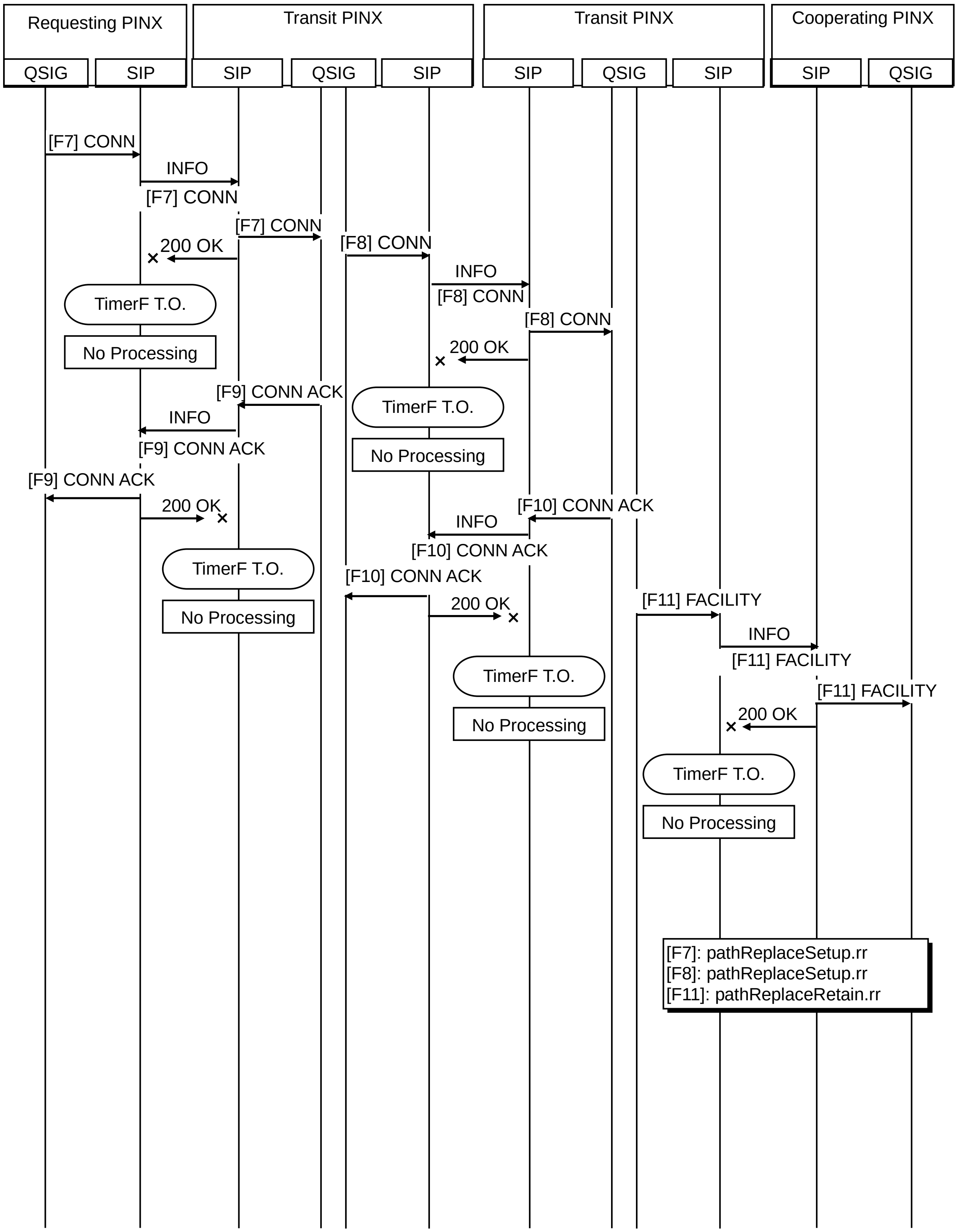
Attached Figure 2.4.3.3 (1/6) Message sequence for quasi-normal operation of ANF-PR, retaining part of the old connection



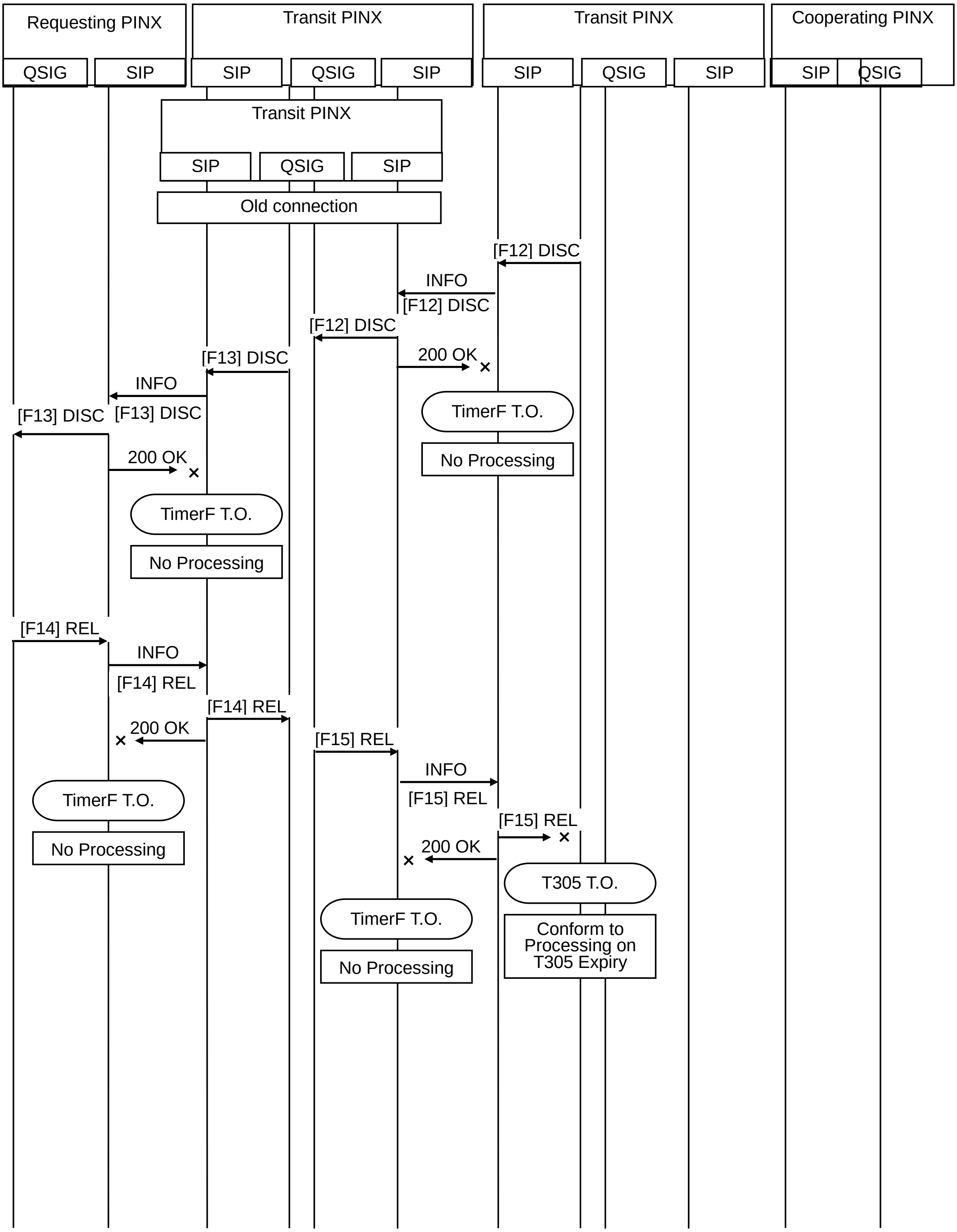
Attached Figure 2.4.3.3 (2/6) Message sequence for quasi-normal operation of ANF-PR, retaining part of the old connection



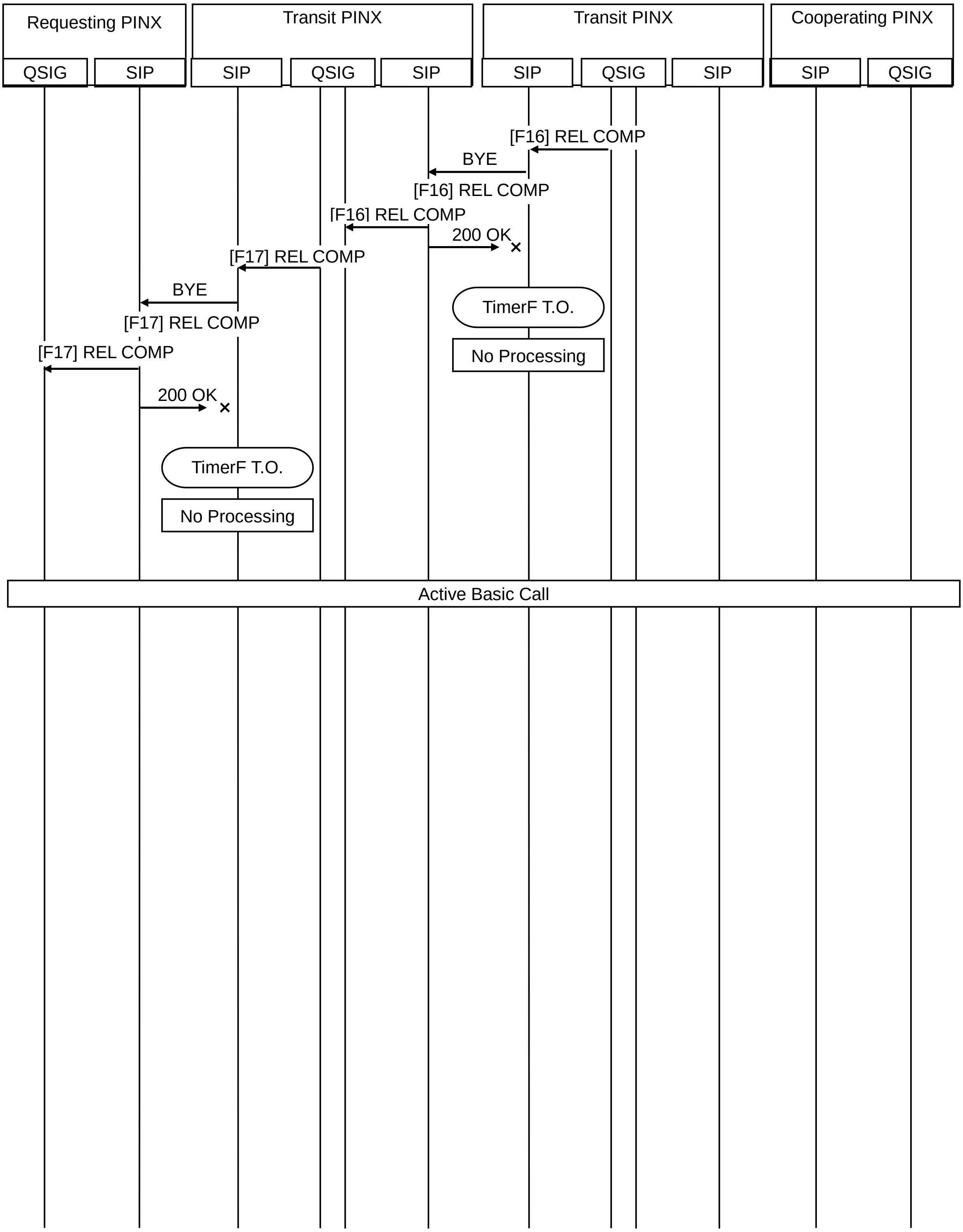
Attached Figure 2.4.3.3 (3/6)　Message sequence for quasi-normal operation of ANF-PR, retaining part of the old connection-



Attached Figure 2.4.3.3 (4/6) Message sequence for quasi-normal operation of ANF-PR, retaining part of the old connection



Attached Figure 2.4.3.3 (5/6) Message sequence for quasi-normal operation of ANF-PR, retaining part of the old connection

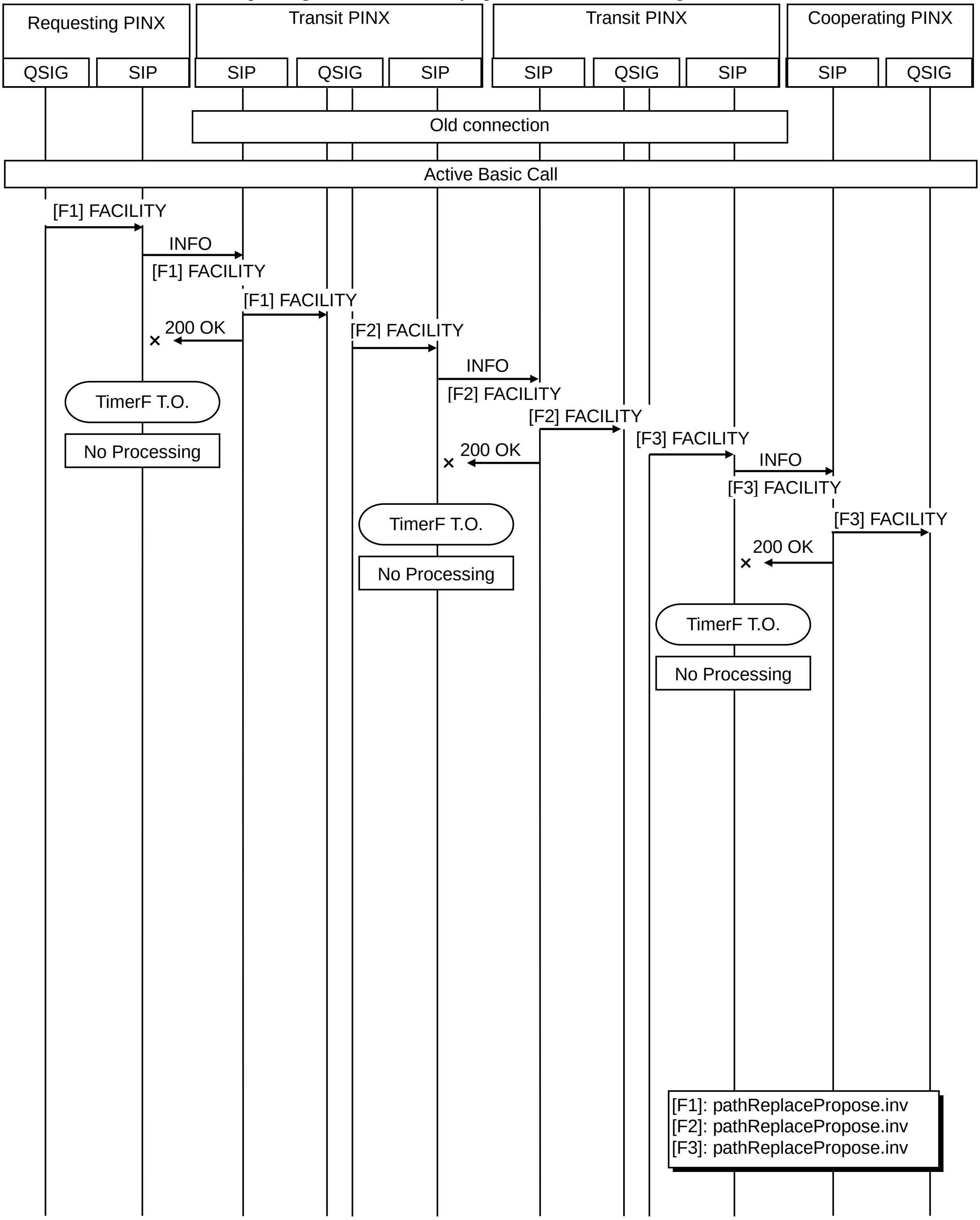


Attached Figure 2.4.3.3 (6/6) Message sequence for quasi-normal oparation of ANF-PR, retaining part of the old connection

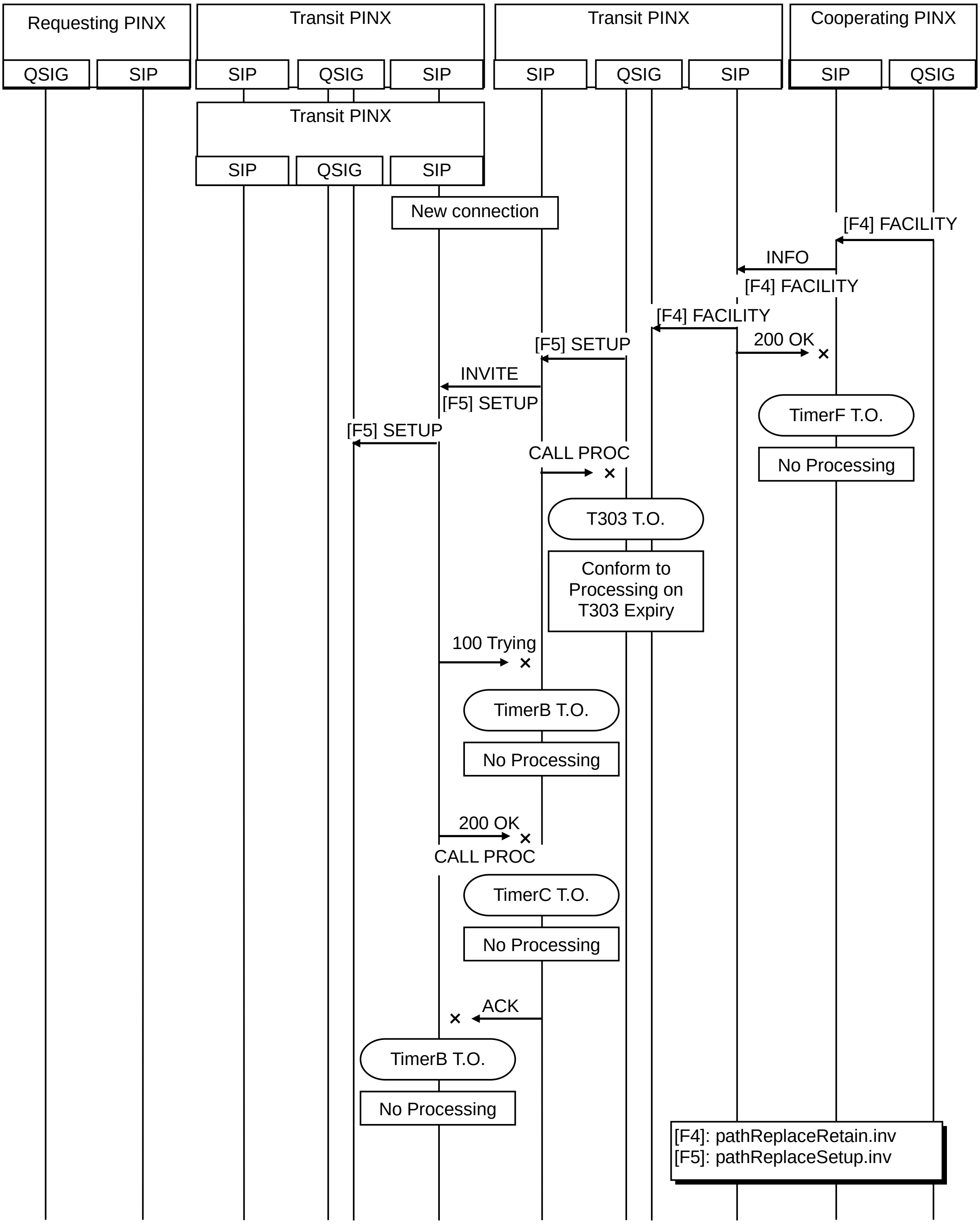
2.4.3.4 Example message sequence in case of congestion encountered at PINX after retaining part of the old connection

Attached Figure 2.4.3.4 shows an example of operation of ANF-PR with elements of the old connection ~~is~~ retained as far as the first Transit PINX (branch PINX) and failed in the establishment of the new connection at the second Transit PINX because of congestion or for other reasons.

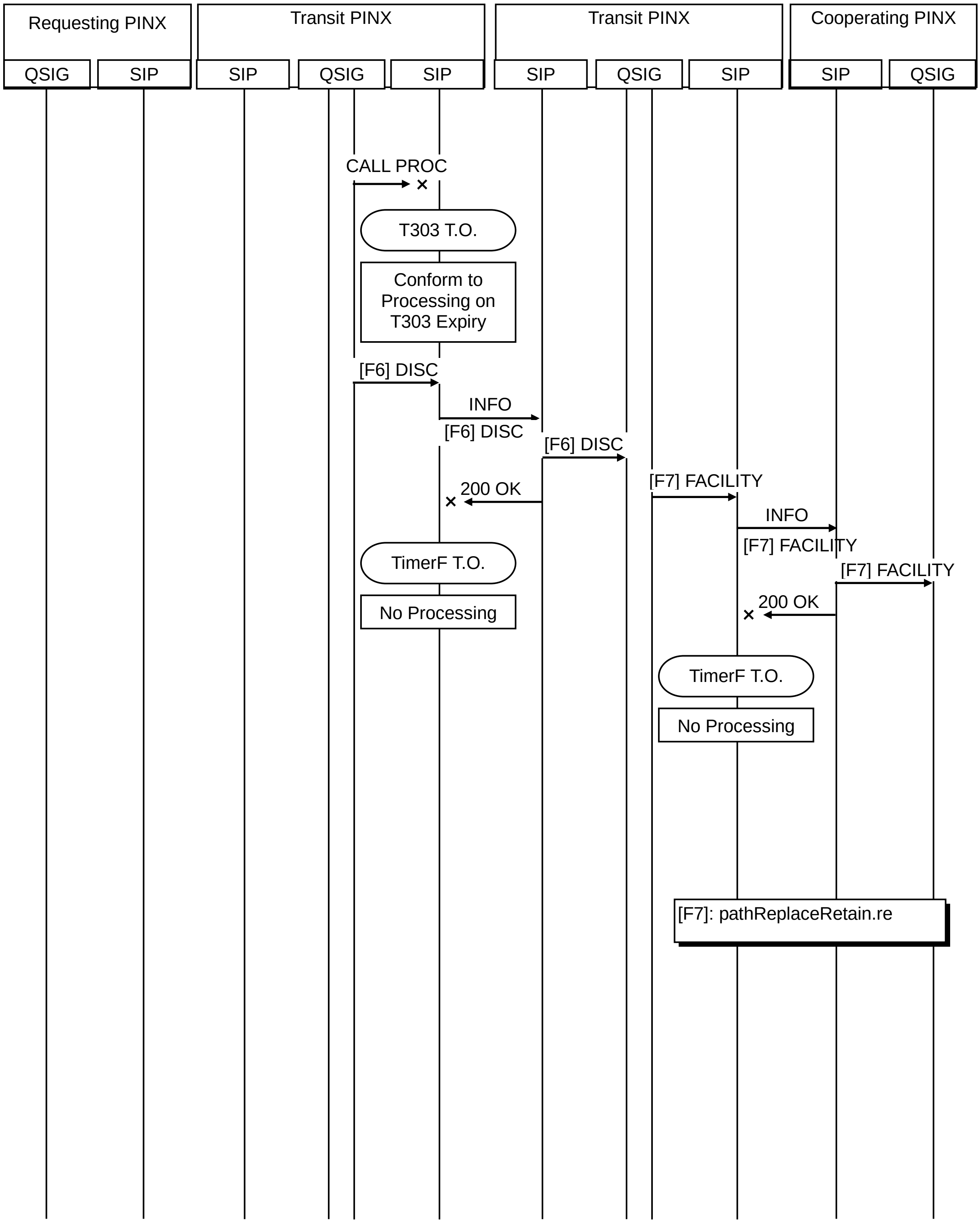
ANF-PR fails because the C~~c~~ooperating PINX does not retry operation of ANF-PR using a new connection at all.



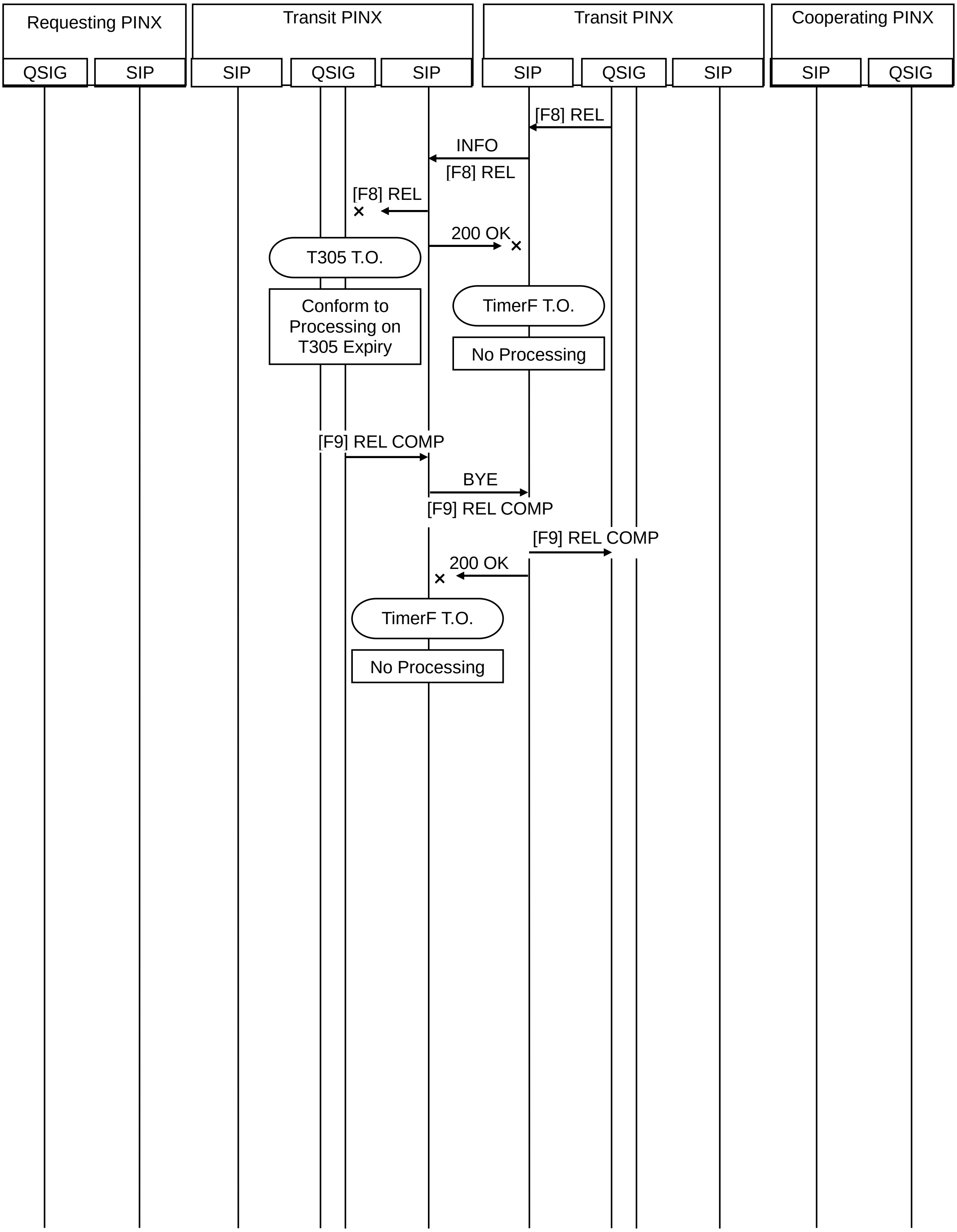
Attached Figure 2.4.3.4(1/5) Message sequence for congestion case, retaining part of the old connection



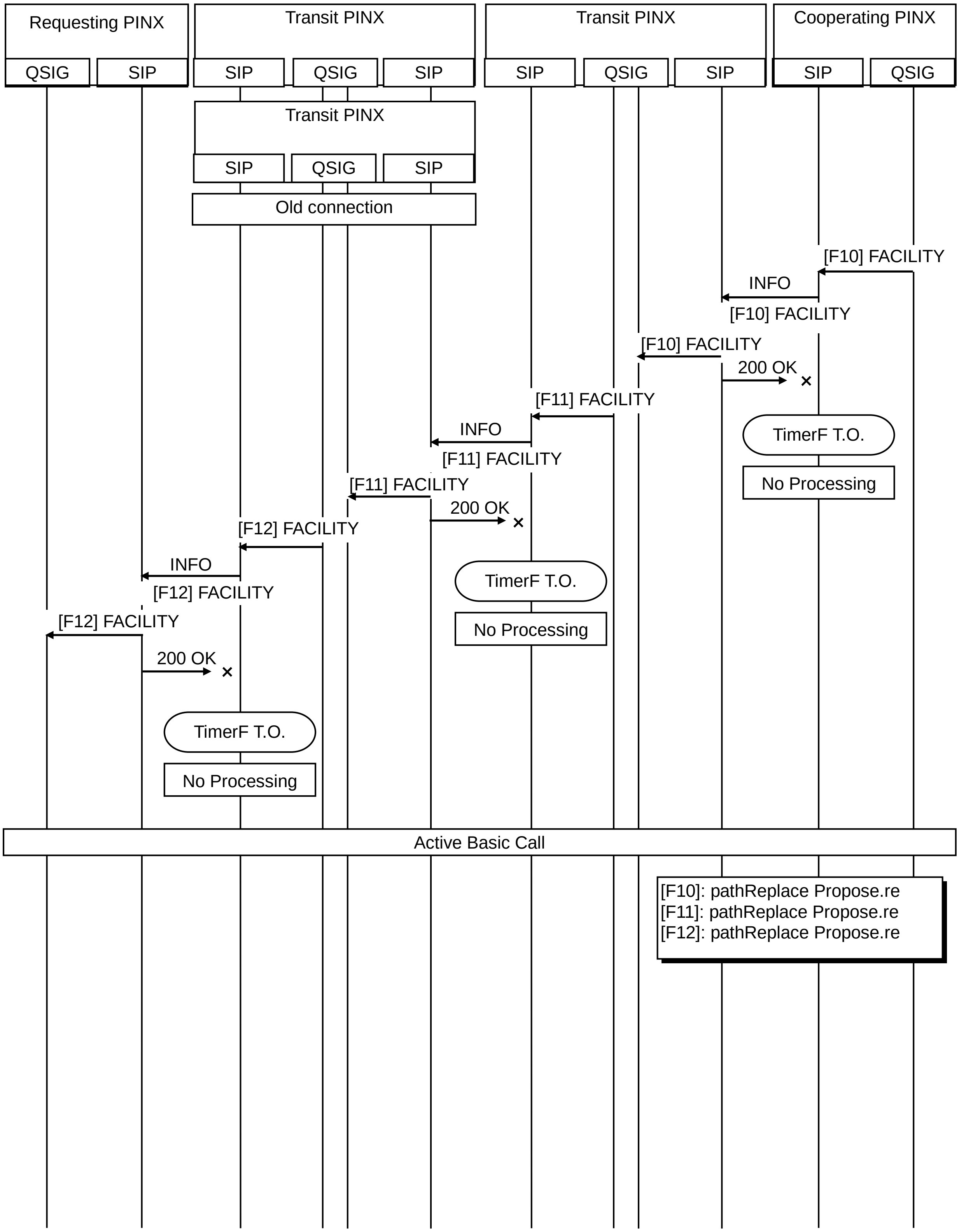
Attached Figure 2.4.3.4 (2/5) Message sequence for congestion case, retaining part of the old connection



Attached Figure 2.4.3.4 (3/5) Message sequence for congestion case, retaining part of the old connection



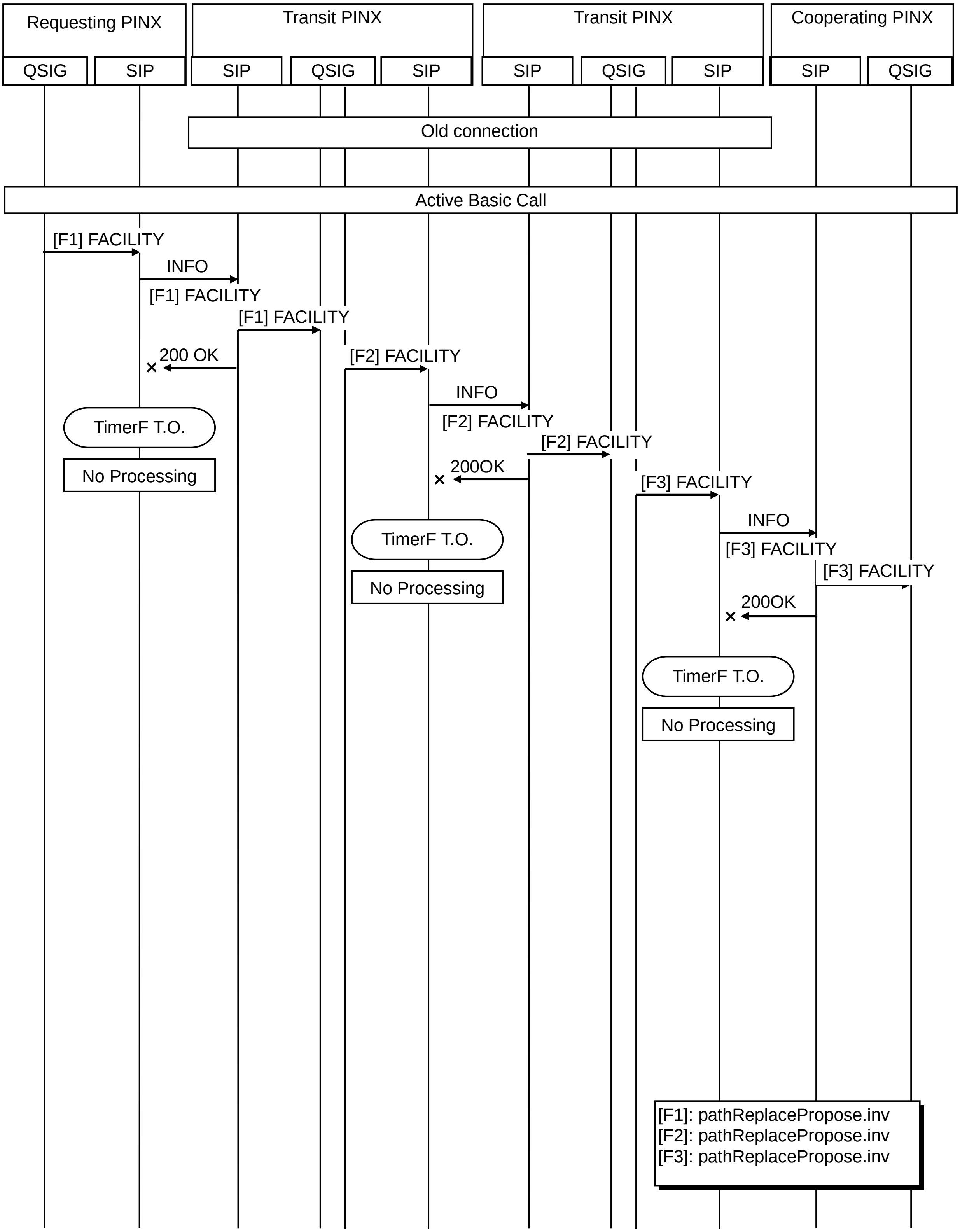
Attached Figure 2.4.3.4 (4/5) Message sequence for congestion case, retaining part of the old connection



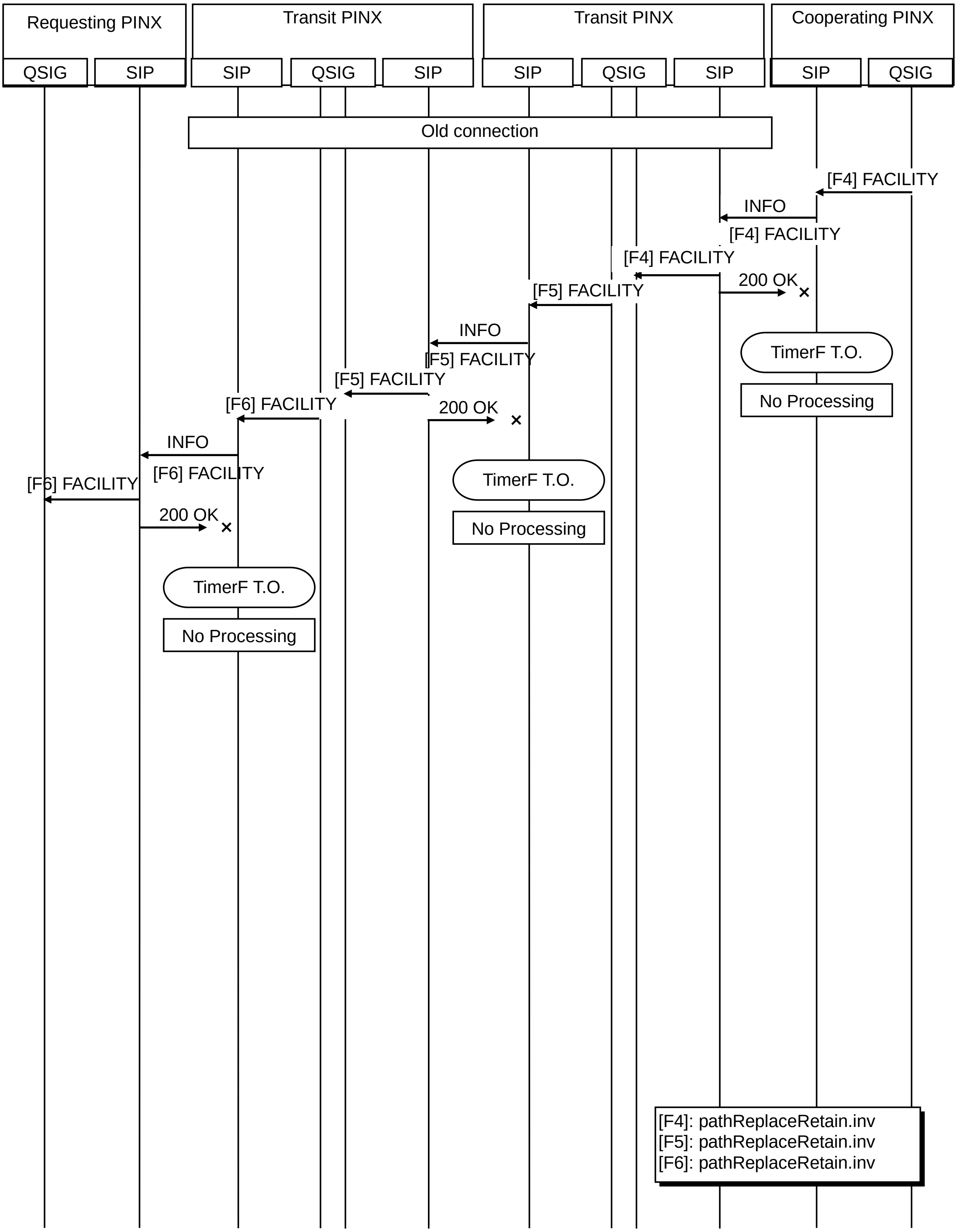
Attached Figure 2.4.3.4 (5/5) Message sequence for congestion case, retaining part of the old connection

2.4.3.5 Example message sequence for the quasi-normal operation, retaining all of the old connection

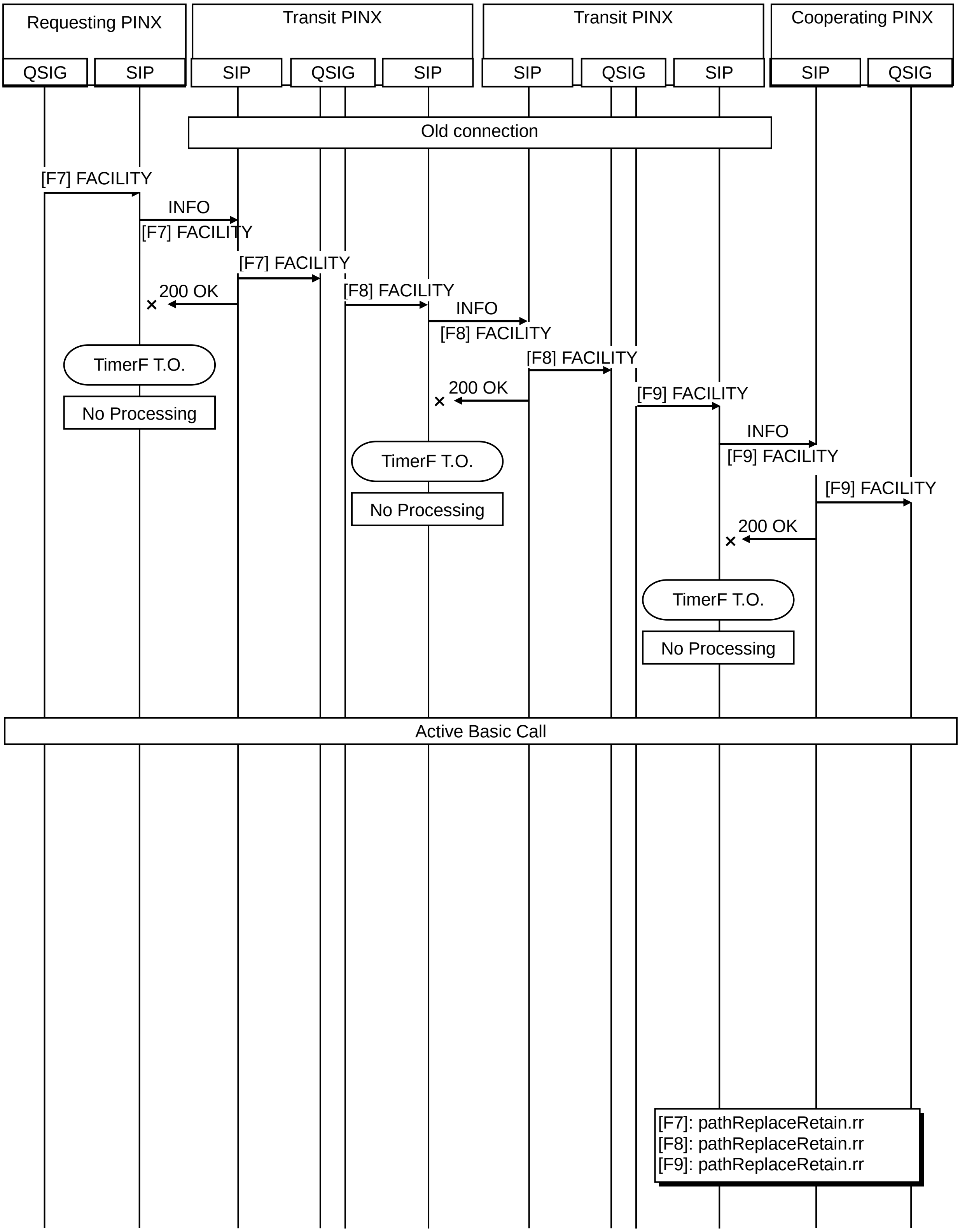
Attached Figure 2.4.3.5 shows an example of quasi-normal operation of ANF-PR with all of the old connection.



Attached Figure 2.4.3.5(1/3) Message sequence for quasi-normal operation of ANF-PR retaining all of the old connection



Attached Figure 2.4.3.5(2/3) Message sequence for quasi-normal operation of ANF-PR-retaining all of the old connection



Attached Figure 2.4.3.5 (3/3)　Message sequence for quasi-normal operation of ANF-PR retaining all of the old connection