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SPECIFICATIONS OF SIGNALLING SYSTEM No. 7
SIGNALLING SYSTEM No. 7 MANAGEMENT

SIGNALLING SYSTEM No. 7 MANAGEMENT FUNCTIONS MRVT, SRVT AND CVT AND DEFINITION OF THE OMASE-USER

ITU-T Recommendation Q.753

(Previously “CCITT Recommendation”)

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q.753 was prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 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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SIGNALLING SYSTEM NO. 7 MANAGEMENT FUNCTIONS MRVT, SRVT AND CVT AND DEFINITION OF THE OMASE-USER

(Helsinki, 1993)

1 Introduction

This Recommendation contains the informal text descriptions of the functions MRVT, SRVT and CVT, the semi-formal description of the OMASE-User SDL and primitive mapping. The name MRVT stands for "MTP Routing Verification Test", SRVT stands for "SCCP Routing Verification Test", and CVT stands for "Circuit Validation Test".

These functions require the resource modelled by the managed object at the initiating signalling point (SP) to communicate with similar resources at other SPs, using the signalling system number 7 network and protocol, in order to audit certain SS No. 7 data. The network is also checked in these audits on its use of this data.

See Figure 1 following for an illustration of the OMAP model for these functions.

In this Recommendation, the informal text description of the complete function as seen external to the signalling point is followed by a semi-formal description (including a mapping of primitives between OMASE-User and OMASE, and SDL for the OMASE-User) of the OMASE-User.

The logic in these functions is assumed to be located in the OMASE-User; the Management Process provides the mapping between the Signalling Point Management and the OMASE-User; and the communication functions reside in OMASE.

For a definition of OMASE, see Recommendation Q.754.

2 MTP management functions

2.1 General

At present, the only function defined here for managing the MTP is the MRVT.

2.2 Network routing management – MTP Routing Verification Test (MRVT)

The MTP routing verification test requirements are as follows:

a) Independence of MTP routing policy.

b) Independence of link set failures.

c) Use the existing MTP without modifications.

d) Response to all tests (positive or negative).

e) Independence of the network structure.

f) The procedure must

- detect loops in MTP routing;
- detect excessive length routes;
- detect unknown destinations;
- check the bidirectionality of signalling relations (i.e. if SP A can reach SP B, can SP B reach SP A?).

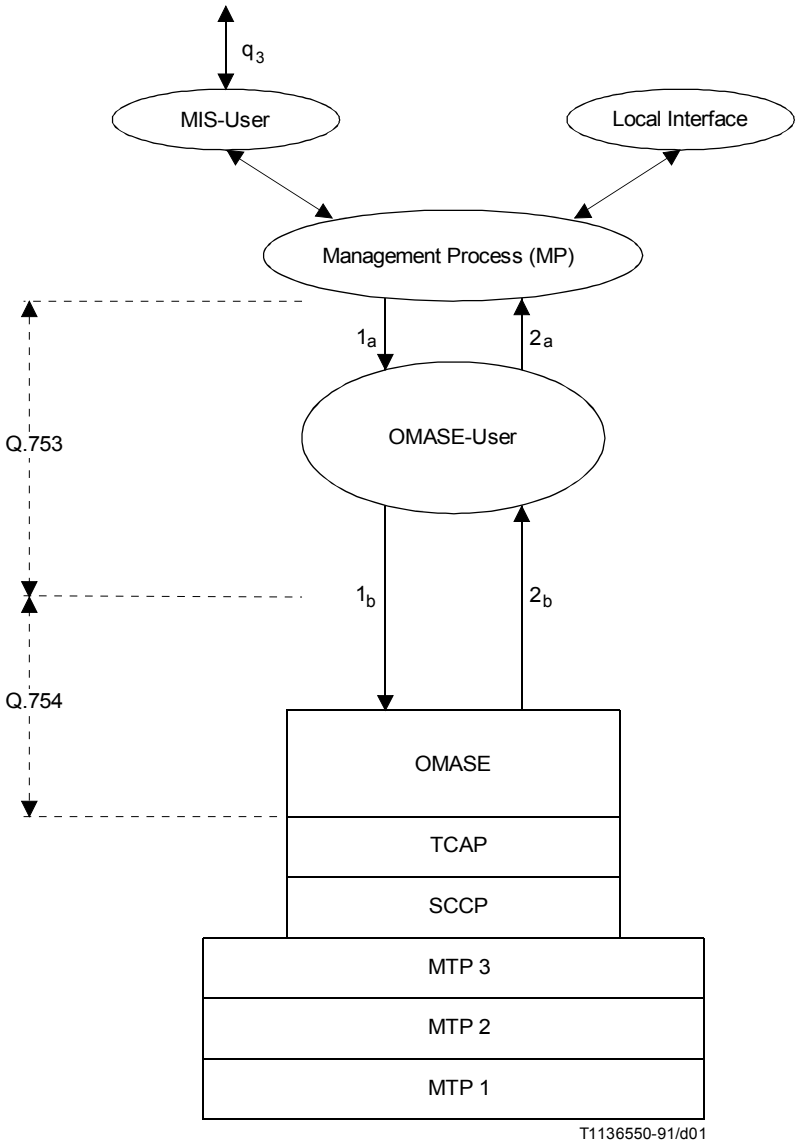

FIGURE 1/Q.753

Application layer and application process model

2.2.1 General Procedure considerations

The object of the MTP routing verification test is to determine if the data of the MTP routing tables in the network are consistent. It is based on a decentralized test procedure using test messages. It will follow all possible routes to reach the test destination, while tracking the identities of STPs crossed.

In defining the MRV test for a particular network, the following points should be considered:

a) Inter-Administration (or ROA) agreements are required if the test is to traverse inter-Administration (or ROA) MTP boundaries.

b) If there is network congestion, the MRV Test should be run (if at all) with circumspection to avoid overload of the network.

c) The MRVR trace on success should only be used if essential.

d) The value of timer T1 could be increased if the priority of the MRV Test is low at the nodes of the network. This approach requires discretion: T1 should be short enough to give a true picture of the network's routing, but long enough to provide a low message frequency.

The test is started in any point (SP or STP) for any destination which is in the MTP routing tables and is stopped at the test destination or any intermediate SP at which an error is detected. The test will check the complete routing tables in the network only if all intermediate signalling points have routing information for the initiator and no errors are detected at intermediate SPs.

When an inconsistency or failure is detected, local actions are to be specified. The initiator of the test is alerted. The MRVT procedure is applied to individual MTP routing tables.

If the MTP is to use structured routing tables (e.g. some or all of the entries in the routing tables may refer to sets of point codes) then the procedure (and/or its initiation) is for further study.

For backwards compatibility, if an MRVA, MRVR, or MRVT message received in an SP contains information in OPTIONAL parameters extra to that defined in 2.2.2, the extra information is ignored, and is not sent out in other messages generated by this SP in this test.

2.2.2 The MRVT messages

The MTP routing verification test procedure uses three Operations, Maintenance, and Administration Part (OMAP) messages.

2.2.2.1 The MTP Routing Verification Test (MRVT) message

The MRVT message is sent from an SP to an adjacent SP. The MRVT message may use any available signalling route to reach its destination. It contains:

a) information indicating an MRVT message;

b) the Point Code of the test destination;

c) the initiator Point Code;

d) the threshold N of the maximum allowed number of STPs crossed (including the initiator if it has the STP function)[1)] ;

e) the information indicating that a trace is requested; the possible values are:

   i) for all routes which may be used to reach the test destination the MRVR messages are returned regardless of the result of the test;

   ii) no detailed information requested (the MRVR messages sent only if a failure or inconsistency is detected);

f) the list of STPs crossed including the initiator Point Code if this point has the STP function.

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1) Determined by the network Administration and held in the OMASE-User

2.2.2.2 The MTP Routing Verification Aknowledgment (MRVA) message

The MRVA message is sent from the SP receiving an MRVT message back to the SP that has sent the MRVT message. The MRVA message may use any available signalling routes to reach its destination. It contains:

a) information indicating an MRVA message;

b) information indicating whether or not an MRVR message has been sent;

c) the reason for any failure (partial or complete). If any failure has occurred, one or more of the following indications is present:

i) detected loop;

ii) detected excessive length route;

iii) unknown Destination Point Code;

iv) MRVT not sent due to inaccessibility (e.g. network blockage or network congestion);

v) timer expired (MRVA not received);

vi) unknown initiator Point Code (this result means that the test destination or an intermediate point does not know the initiator of the test);

vii) test cannot be run due to local conditions (e.g. unavailability of processing resources);

viii) intermediate SP does not have the MTP transfer function;

Note that in the case of success, only a) will be present; in the cases of partial success and failure, a), b), and c) will be present. Also note that SCCP class 1 service should be used with the sequence information the same as that for any associated MRVR message sent out.

2.2.2.3 The MTP Routing Verification Result (MRVR) message

The MRVR message is sent from an SP to the initiator of the MTP routing verification test and also on receipt in the MTP of a message for an unknown destination (see 2.3.3/Q.704). It contains:

a) information indicating an MRVR message;

b) the Point Code of the tested destination;

c) the result of the test;

d) the information field;

The content of this information field depends on the result of the test. It contains:

i) if the result of the test is “success”:

– the Point Codes of the STPs crossed contained in the MRVT message;

ii) if the result of the test is “detected loop”:

– the Point Codes of STPs which are in the loop;

iii) if the result of the test is “detected excessive length route”:

– the Point Codes of STPs crossed, contained in the MRVT message;

iv) if the result of the test is “unknown Destination Point Code”:

– no additional information;

v) if the result of the test is “MRVT not sent due to inaccessibility”:

– the Point Code of the inaccessible SP;

vi) if the result of the test is “MRVA not received”:

– the identity of the SP(s) from which an MRVA was not received when expected;

vii) if the result of the test is “unknown initiator Point Code”:

– the Point Code of the SP returning an MRVA that caused the MRVR to be sent;

viii) if the result of the test is "test cannot be run due to local conditions":

– no additional information;

ix) if the result of the test is "intermediate SP does not have the MTP transfer function":

– the Point Codes of the STPs crossed contained in the MRVT message.

Note that the SCCP class 1 service should be used, with the sequence information the same as that of the associated MRVA messages sent out.

2.2.3 Initiation of the MRVT Procedure at a Signalling Point

The procedure is started when:

a) New MTP routing data is introduced. Each signalling relation should pass the MRVT procedure successfully before being opened to traffic.

b) MTP routing data is changed.

c) On receipt of an unexpected MRVR (due to unknown Signalling Point).

d) On receipt of an MRVT message.

e) On demand from local maintenance staff or an operations and maintenance centre.

f) Periodically at a Signalling Point (having the STP function) to detect cases of mutilation of routing data. (The period is network dependent and should be such that the load on the network is not seriously increased).

In cases c) and f) above, the "expected result type" field of the MRVT message should be set to indicate no trace is expected. In case d) above, the "trace requested" indicator is obtained from the received MRVT message. See 2.2.2.1.

2.2.4 The MRVT Procedure

2.2.4.1 At the Point Initiating the Procedure

2.2.4.1.1 Initial Actions

When a Signalling Point initiates an MRVT procedure, it sends an MRVT message for each signalling route which is contained in the MTP routing tables to reach the test destination. The destination (DPC) of each of these messages is the adjacent signalling point within the particular route under test. If the test destination is an adjacent signalling point, operated in the associated mode, an MRVT message is not sent to the tested destination itself.

When the MRVT procedure is initiated, a timer T1 (see 2.4) is started. An SP cannot initiate an MRVT procedure for a test destination until any previous MRVT procedure for that destination has completed.

2.2.4.1.2 Subsequent Actions

2.2.4.1.2.1 Reception of an MRVA Message

An MRVA message acknowledges an MRVT message previously sent.

The reception of the last expected MRVA message stops T1. When an MRVA message is received after T1, it is ignored. When all MRVA messages expected have been received or when T1 expires, the test is complete and results are given to the SP management.

The possible test results at this point in the procedure are listed in 2.2.2.2.

The result "unknown initiator Point Code" could be a positive result (e.g. when installing a new SP). A test is positive when all expected MRVA messages have been received inside T1 without fault indications.

2.2.4.1.2.2 Reception of an MRVR Message

The reception of an MRVR message regardless of whether or not the receiving SP was the initiator causes the information contained in the message to be given to the SP management (see 2.2.2.3)

2.2.4.2 In an Intermediate Point

2.2.4.2.1 Initial Actions (on reception of an MRVT message)

If the intermediate point does not have the MTP transfer function, the point acknowledges the received MRVT message by an MRVA message with indication "intermediate SP does not have the MTP transfer function" after an MRVR message has been sent to the initiating point, an indication is given to the SP management, and the test is stopped.

If the test cannot be run due to local conditions, an MRVR message is sent to the initiating point, if there is routing to the initiating point from the intermediate SP, and an MRVA message is sent to the sender of the MRVT. The MRVR message contents are as described in 2.2.2.3. The MRVA message contains the indication "test cannot be run due to local conditions". The test is stopped after informing the SP management.

If the test can be run, looking at the contained fields in the received MRVT message, the point determines if there is routing information for the initiating SP, and if information for the tested destination exists in the MTP routing tables. Then,

a) If there is no routing information for the initiating SP, an MRVA message is returned with result "unknown initiating SP" and the value of the "MRVR sent" indicator denotes that the MRVR message was not sent. The test is then stopped, after informing the SP management.

b) If there is no routing information for the destination, the point acknowledges the received MRVT message by an MRVA message with indication "unknown Destination Point Code", after an MRVR message has been sent to the initiating point. An indication is given to the SP management and the test stopped.

c) If there is routing information for the initiating point of the test as well as for the test destination within the SP's routing tables, the SP makes a list "A" of the following adjacent SPs:

   1) STPs used to route to the destination (according to the MTP routing tables), excluding the SP from which the MRVT message was received;

   2) the tested destination, if this is adjacent.

The SP then compares the list of STPs crossed contained in the MRVT message with its own list "A" for the following conditions:

i) If the Point Code of an SP is already in the list of STPs crossed contained in the MRVT message, a loop is detected. An MRVR message is sent to the initiator of the test with the indications described in 2.2.2.3, then an MRVA message is sent to the point which has sent the MRVT message with the indication "detected loop". The test is stopped (MRVT messages are not regenerated), after the SP management is informed.

ii) If the Point Code of an SP is not in the list of STPs crossed contained in the MRVT message, and if the size of the list is equal to a threshold N in the MRVT message, an excessive length route is detected. An MRVR message is sent to the initiator of the test with the indications described in 2.2.2.3, then an MRVA message is sent to the point which has sent the MRVT message with the indication "detected excessive length route". The test is stopped (MRVT messages are not regenerated), after the SP management is informed.

iii) If it is impossible to route an MRVT message, a MRVR message is sent to the initiator of the test with the indications described in 2.2.2.3, then an MRVA message containing the indication "MRVT not sent due to inaccessibility" is sent to the point which has sent the MRVT message. The test is stopped (no MRVT messages are regenerated), after the SP management is informed.

iv) In other cases a timer T1 is started, and MRVT messages are sent to all the SPs in list "A". When an MRVT message is sent by an STP, the STP adds its identity to the MRVT message sent. The contents of the "trace requested" field is obtained from the received MRVT message.

2.2.4.2.2 Subsequent Actions (On Reception of an MRVA Message)

The reception of an MRVA message acknowledges the corresponding MRVT message previously sent. The timer is stopped when all the expected MRVA messages have been received.

An MRVA message is sent when all expected MRVA messages have been received. The result of the test contains the different results from the MRVAs received.

If any MRVA message contained both the result "unknown initiating SP" and the value of the "MRVR sent" indicator denotes that the MRVR was not sent, an MRVR is returned to the initiator.

If one (or several) MRVA messages are not received before T1 expires, an MRVA message is sent after an MRVR message has been sent to the initiator of the test with the indications described in 2.2.2.3.

If an MRVA message cannot be sent, no action is taken.

If an MRVA message is received after T1 expires, it is ignored.

2.2.4.3 At the Test Destination Receiving an MRVT Message

On reception of an MRVT message, the test destination checks that there is routing information for the initiator of the test.

If there is no information for the initiator, an MRVA message is sent to the point which had sent the MRVT message. This MRVA message contains the result "unknown initiator Point Code" and the "MRVR sent" indicator set to denote that the MRVR was not sent.

If there is information for the initiator of the test, the test is finished with success and the following actions are taken:

a) If the MRVT message received contains the indication that a trace is expected (see 2.2.2.1) an MRVR message is sent to the initiator of the test with the indications described in 2.2.2.3. An MRVA message is then sent to the point which had sent the MRVT message.

b) If the MRVT message received contains the indication that a trace is not expected, (see 2.2.2.1), an MRVA message is sent to the point which had sent the MRVT message. No MRVR message is sent.

If an MRVA message cannot be sent, no action is taken.

2.3 Reception of a message for an Unknown Destination

When an indication is received from the MTP due to the reception of a message for an unknown destination, an MRVR message with the indications described in 2.2.2.3 is returned to the point which has sent the message.

When an SP receives such an unexpected MRVR message, an indication is given to the SP management and an MRV Test is started.

2.4 Timer definition and values

2.4.1 MRVT timers

T1 at a signalling point (Near End Signalling Point) initiating an MRVT is the guard time waiting for all MRVA messages in response to the MRVT messages sent from the Near End SP.

$$T1,(\text{Near End SP}) = D(N + 1)$$

where N is defined in 2.2.2.1 d), and D is defined in 2.4.2 below.

T1 at an intermediate signalling point is the guard time associated with a received MRVT message, waiting for all MRVA messages in response to all MRVT messages sent.

$$T1,(\text{Intermediate SP}) = T1,1 - D$$

where T1,1 is deduced from the received MRVT message.

2.4.2 Performance time definitions and values

$$D = \text{Max}(d1) + \text{Max}(d2) + \text{Max}(d3) + \text{Max}(d4)$$

where

d1 Time to transfer an MRVT message.

d2 Time to take account of an MRVT message received:

- In an Intermediate SP, performance time d2 is the time between the reception of an MRVT message and the sending of the MRVT messages to the concerned SPs (or the sending of the MRVA message to the point which has sent the MRVT message when a problem is detected).
- In the tested destination, performance time d2 is the time between the reception of an MRVT message and the sending of the MRVA message to the point which has sent the MRVT message.

d3 Time to transfer an MRVA message.

d4 Time to take account of an MRVA received:

– In an Intermediate SP, performance time d4 is the time between the reception of the last MRVA message and the sending of the MRVA message to the point which has sent the MRVT message.

Performance time	Estimated maximum value
d1	2 seconds (provisional)
d2	3 seconds (provisional)
d3	2 seconds (provisional)
d4	1 second (provisional)
D	8 seconds (provisional)

2.5 OMAP model for MRVT

See Figure 1 for a diagram.

The OMAP model assumes that the logic defined in 2.2 resides in the OMASE-User, which provides a service MRVT(Start) and MRVT(Result). The management process (MP) uses MRVT(Start) to initiate an MRV Test, and MRVT(Result) is used by the OMASE-User to give the results of the test to the MP. The actions, e.g. sending an MRVT message, described in the text of the MRV Test correspond to the sending of primitives from the OMASE-User to OMASE, and receiving primitives in the OMASE-User from OMASE. The mapping of the text-defined actions to primitives is described in the next subclause.

NOTE – The MRVT initiator's OMASE-User runs a timer T1 in addition to the T1 timer run in TC, which is marginally greater than the TC T1 timer. This extra timer at the initiator guards against rare untoward happenings, e.g. ill-formed APDUs passed from TC to OMASE.

2.5.1 Mapping of primitives

See Table 1.

TABLE 1/Q.753

Mapping of text-defined actions to OM service primitives

"a" interface		"b" interface	
1a	sendMRVT	1b	OM-CNF-ACTION request
2a	receiveMRVT	2b	OM-CNF-ACTION indication
1a	sendMRVA	1b	OM-CNF-ACTION response
2a	receiveMRVA	2b	OM-CNF-ACTION confirmation
1a	sendMRVR	1b	OM-EVENT-REPORT request
2a	receiveMRVR	2b	OM-EVENT-REPORT indication

2.5.2 State transition diagrams for MRVT – Logic in the OMASE-User

See Figure 2.

Procedure OMASE-User mrvt-1 (4)

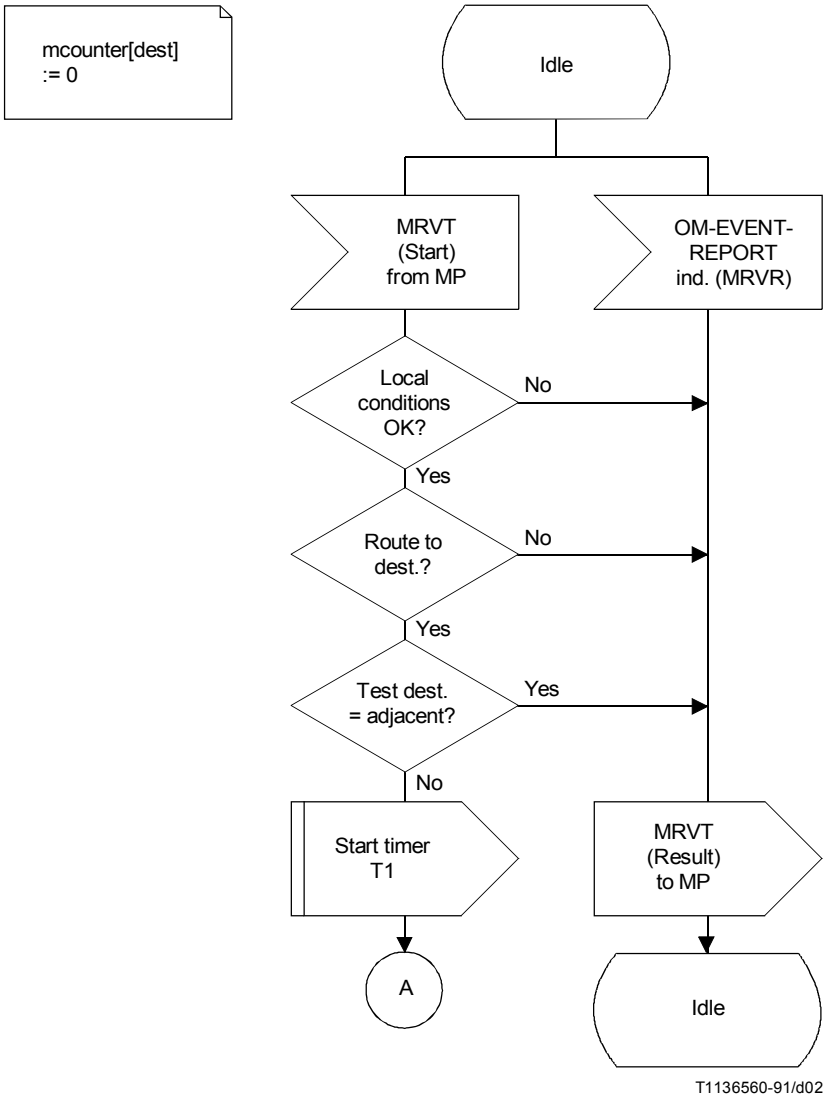


FIGURE 2/Q.753 (sheet 1 of 4)

MRVT SDL in the OMASE-User

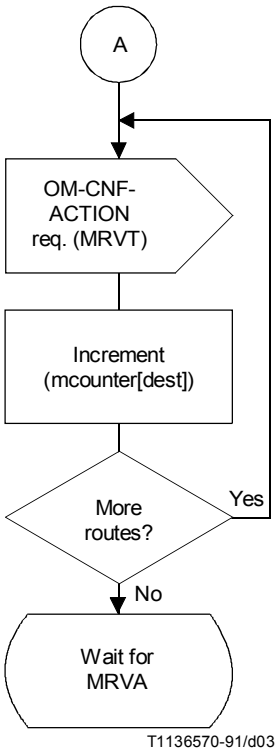


FIGURE 2/Q.753 (sheet 2 of 4)

MRVT SDL in the OMASE-User

Procedure OMASE-User mrvt-3 (4)

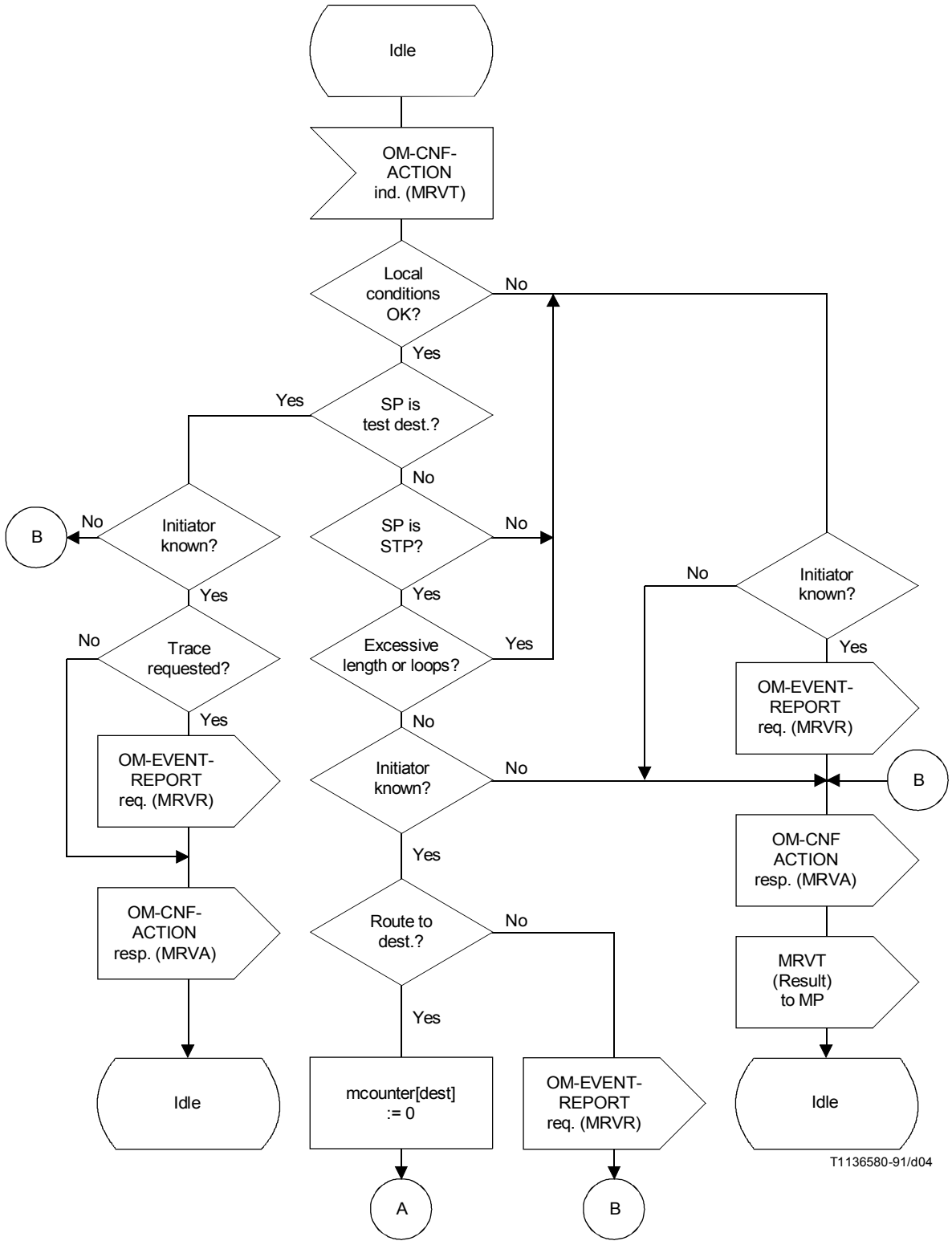


FIGURE 2/Q.753 (sheet 3 of 4)

MRVT SDL in the OMASE-User

Procedure OMASE-User mrvt-4 (4)

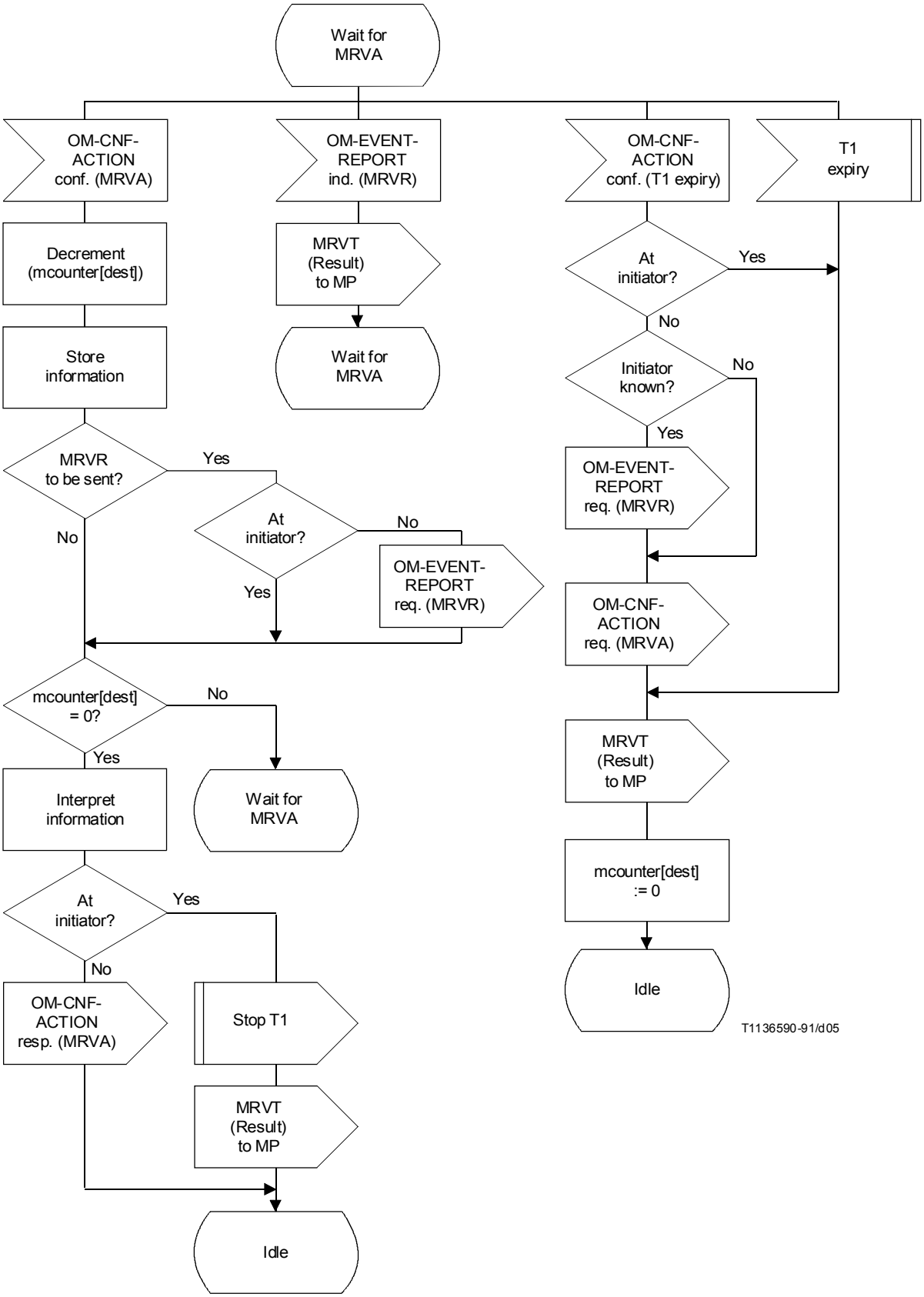


FIGURE 2/Q.753 (sheet 4 of 4)

MRVT SDL in the OMASE-User

3 SCCP Management functions

3.1 General

At present, the only SCCP management function defined in this Recommendation is the SRVT.

3.2 Network routing management – SCCP Routing Verification Test

3.2.1 Requirements upon an SCCP routing verification test (SRVT)

These are as follows:

a) No modification should be needed to the SCCP protocol Recommendation.

b) The SRVT should be independent of the SCCP routing policy.

c) The SRVT should be independent of the network structure.

d) The SRVT is not required to verify MTP routing, the MRVT is defined for that.

e) A response (either positive or negative) is to be given to all tests.

f) The procedure should

- be able to check all possible SCCP routes, including parallel SCCP routing points (e.g. duplicate Translation SPs), serial SCCP routing points (e.g. multiple Translation SPs), multiple destinations corresponding to the tested Global Title (this is understood to mean multiple SPs and sub-system numbers (SSNs), where SCCP permits a maximum of two destinations to be derived from a Global Title);
- detect loops in SCCP routing;
- detect unknown destinations (e.g. a destination does not correspond to a tested Global Title);
- verify SCCP routing data for accuracy, completeness and consistency.

3.2.2 Specific SCCP Routing Verification Tests

3.2.2.1 General Procedure considerations

This particular SCCP Routing Verification Test is the means of testing the Global Title Translation service of the Signalling Connection Control Part (SCCP). The test is designed to verify the accuracy and completeness of the Global Title Translation data in Global Title Translation service points. This test is only meant for the case of a single MTP network. The test will be used after a recent translation data change, when a translation problem is suspected, or on a periodic basis to detect cases of mutilation of translation data.

When an inconsistency or failure is detected, local actions are to be specified. The initiator of the test is alerted.

If an SRVA, SRVR, or SRVT message received in an SP contains information in OPTIONAL parameters extra to that defined in 3.2.2.2, the extra information is ignored, and is not sent out in other messages generated by this SP in this test.

3.2.2.2 Messages

The SCCP Routing Verification Test uses three OMAP messages whose contents are specified below.

3.2.2.2.1 SCCP Routing Verification Test (SRVT) Message

The SRVT message is sent from a signalling point (SP) initiating the appropriate part of the SRVT procedure based on the function (e.g. initiator, translator, etc.) of the respective SP. The message serves three different functions, depending upon the nature of the SP sending it. In coding, both Verify and Request are delineated by the No Compare setting of the Form Indicator parameter.

The Request form of the SRVT message is sent by an SP to request a Global Title Translation within the SRVT procedure. The originating SP may be either the initiator (i.e. the Near End SP), or an Intermediate Translation Signalling Point (ITSP). The destination of the message is a Translation Signalling Point (TSP) that is to perform a Global Title Translation on the Global Title contained in the message. Hence, the Translation Point Code (TPC) is the Destination Point Code (DPC) in the routing label.

The Verify form of the SRVT message is sent by a Final Translation Signalling Point (FTSP), i.e. the last SP that performs the Global Title Translation service, to both the Primary Point Code (PPC) and the Secondary Point Code (SPC), if any, derived from the Global Title Translation. Hence, the PPC and SPC are used as the DPC in the routing labels.

The Compare form of the SRVT message is sent by a TSP to an SP performing the duplicate Global Title Translation. The message is sent so the results of both translations can be compared. This message is necessary only in networks that have a duplicate Global Title Translation service (i.e. the identical translation is duplicated at a mate SP). The Point Code of the Duplicate Translation Signalling Point (DTSP) is the DPC in the routing label.

The message contains:

a) information indicating an SRVT message;

b) the Form Indicator (Compare or No Compare);

c) the test GTI + GT – Global Title Indicator + Global Title (Tested GT: Destination GT: Terminating GT);

d) the MTP Backward Routing Required Indicator for SRVA and SRVR;

e) the Initiator's PC (i.e. the NEPC) – the Near End Point Code from which test was initiated;

f) the Initiator's GTI + GT – Global Title Indicator + Near End Global Title;

g) the DPC – Destination Point Code (Translation PC or Primary PC);

h) the Destination SSN – Optional Sub-system Number based on DPC;

i) the Backup DPC – Backup Destination Point Code (Translation PC or Secondary PC);

j) the Backup SSN – Optional Sub-system Number based on Backup DPC;

k) the threshold N of maximum allowed number of crossed TSPs;

l) the Additional Trace Information Requested Indicator (SRVR Requested);

m) the list of TPCs – used to check for translation loops and whether or not the threshold number of translations is exceeded.

n) the Original GTI + GT – Global Title Indicator + Global Title (Original or prior value of Test GTI + GT)

3.2.2.2.2 SCCP Routing Verification Acknowledgement (SRVA) Message

The SRVA message is the standard message sent in response to an associated SRVT message. It carries the results of the test and is sent back using either direct routing on the Originating Point Code (OPC), or by global title translation on the Near End Global Title (i.e. the initiator GT). Both addresses are found from the original message to which the SRVA is responding. The Destination Point Code (DPC) in the routing label may be dependent upon a global title translation if the MTP Backward Routing Indicator in the SRVT message is not set.

The message contains:

a) information indicating an SRVA message;

b) information indicating whether or not an SRVR has been sent;

c) The result of the test.

This last field contains the following information:

– success (no error indication);

– partial Success (at least one SRVA indicating success or partial success); or

– failure.

In the case of partial success or failure, some or all of the following failure reasons are provided:

i) no translation data exists for the GTI + GT at TSP;

ii) incorrect translation for PPC + SSN at TSP;

iii) incorrect translation for SPC + SSN at TSP;

iv) incorrect intermediate translation for next TPC or new GT at TSP;

v) SRVT message arrived at wrong SP (Compare form SRVT arrived at an SP that is not duplicated or the mated SCCP relay node of the sender, or a Request form SRVT arrived at an SP that is not an SCCP relay node);

vi) the primary destination of the Global Title address does not serve GTI + GT as the primary destination;

vii) the secondary destination of the Global Title address does not serve GTI + GT as the secondary destination;

viii) the primary destination of the Global Title address does not recognize the SPC + SSN as the secondary destination for the GTI + GT;

ix) the secondary destination of the Global Title address does not recognize the PPC + SSN as the primary destination for the GTI + GT;

x) timeout waiting for SRVA message;

xi) inability to send message due to inaccessibility (network congestion or blockage);

xii) detected loop at SP;

xiii) exceeded threshold of N translations at SP;

xiv) unrecognized Point Code from translation Result (possible MTP routing problem – run MRVT);

xv) unknown initiator – The Initiator PC is unrecognized if the MTP Backward Routing Required Indicator is set, or the Initiator GT (NEGT) is unrecognized if the MTP Backward Routing Required Indicator is not set;

xvi) test cannot be run due to local conditions;

3.2.2.2.3 SCCP Routing Verification Result (SRVR) Message

The SRVR message is sent from an SP which stops the test to the initiator. It is sent from the tested destination when the Additional Trace Information Requested Indicator is set, or from an intermediate SP if the test is not completely successful. It carries the results of the test with additional information on a failure. It is sent back using either direct routing on the Initiator Point Code (NEPC) if the MTP Backward Routing Required Indicator is set or using Global Title Translation on the Initiator Global Title (NEGT) if the MTP Backward Routing Required Indicator is not set.

The message contains:

a) information indicating an SRVR message;

b) the result of the test;

c) the information field; the content of this information field depends on the result of the test. It contains:

i) if the result of the test is “success”:

– the Point Codes of the crossed SCCP Relay Nodes contained in the SRVT message;

ii) if the result of the test is “detected loop”:

– the Point Codes of the SCCP Relay Nodes which are in the loop;

iii) if the result of the test is "detected excessive length route":

– the Point Codes of crossed SCCP Relay Nodes contained in the SRVT message;

iv) if the result of the test is "no translation data exists":

– no additional information;

v) if the result of the test is "SRVT not sent due to inaccessibility":

– the Point Code of the inaccessible SP;

vi) if the result of the test is "SRVA not received":

– the Point Code of the SP(s) from which an SRVA was not received;

vii) if the result of the test is "unknown initiator":

– the Point Code of the SP returning a SRVA to cause the SRVR to be sent;

viii) if the result of the test is "test cannot be run due to local conditions":

– no additional information;

ix) if any other failure result:

– the Point Codes of the crossed SCCP Relay Nodes contained in the SRVT message.

3.2.2.3 Test Initiation

The procedure is started when there is an input from OA&M resulting in the sending of an SRVT message. The test is initiated

a) when new SCCP routing data is introduced (each Global Title Translation should pass the SRVT before being opened to traffic);

b) when SCCP translation data is changed;

c) on receipt of an SRVT message;

d) on demand from local maintenance staff or an operations and maintenance centre;

e) periodically at an SP to detect cases of mutilation of translation data. The period is network dependent and should be such that the load on the network is not seriously increased.

In case c), the "additional trace information requested indicator" is obtained from the received SRVT message. For case e), no additional trace information should be requested.

3.2.2.4 Procedures

The capability to execute a complete SCCP Routing Verification Test is realised by three procedures. These procedures are organized by the function of the SP in which they reside for a given test instance. The procedures are partitioned into functions at the initiator, functions at a TSP, and functions at the tested destination. The duplicate translation procedures are found in the TSPs.

3.2.2.4.1 Initiating Point

The procedure is started when there is an input from OA&M as defined under the conditions of 3.2.2.3. It is initiated at an SP with SCCP capabilities in the network, and is triggered by an SRVT request. The SRVT request must include the Global Title of the tested destination. An SCCP node cannot initiate an SRVT procedure for a test destination until any previous SRVT procedures for that destination have completed.

3.2.2.4.1.1 Initial Actions

Upon receipt of an SRVT request on a given Global Title, the initiator determines the TPC(s) of the initial Global Title Translation. The initiator then begins a guard timing period, T2, and sends SRVT messages to the TPC(s) previously determined. The initiator then waits for SRVA messages corresponding to each SRVT sent.

If the initiator was identified as a TSP for the respective Global Title, it performs the Global Title Translation, and follows the procedures defined at a TSP (see 3.2.2.4.2), depending upon the nature of the translation (i.e. intermediate or final).

3.2.2.4.1.2 Subsequent Actions

Upon receipt of all SRVA messages, the guard timer, T2, is stopped and the test is complete. The results are reported to the SP management in accordance with the result of test and information parameters (see 3.2.2.2.2) and proper actions are taken to fix any problems. If the timer expires before receipt of an SRVA message, the result, "Time out waiting for SRVA message" [see 3.2.2.2.2 c), x)], is reported to the SP management along with the Point Code of the SP. There is no penalty for not receiving an SRVR. However, it is assumed, analogous to the MRVT's MRVR message, that the SRVR will return before the final SRVA.

3.2.2.4.2 Translation Point

For the SRVT, two types of TSPs exist: intermediate and final. The procedure at the ITSP differs from the FTSP only in the content of the SRVT messages which emerge. An ITSP is an SP with SCCP functions that has been specified at the NESP for the translation of the Global Title originally given. However, due to the nature of the Global Title, further translation is needed at another SP to determine the PC of the tested destination.

A final TSP is an SP with SCCP functionality that has been specified at the initiator (NESP) or an ITSP for the translation of the Global Title. It performs the final Global Title Translation to determine a Primary Point Code + Sub-system Number (PPC + SSN) and a Secondary Point Code + Sub-system Number (SPC + SSN [optional]). Note that the initiator does not know if it sends an SRVT message to an ITSP or FTSP.

If a Request form SRVT arrives at an SP that is not designated as an SCCP relay node, the SP sends an SRVR message with the result "wrong SP" [see 3.2.2.2.3 c), ix)] to the test initiator, sends an SRVA to the sender of the SRVT and stops the test after informing the SP management.

3.2.2.4.2.1 Upon Receipt of an SRVT Message

When a TSP receives an SRVT message with the form indicator set to "No Compare", it:

a) checks if the TSP is unable to send the SRVT due to local conditions:

   i) If local conditions prohibit the continuing of the test, the TSP sends an SRVR to the initiator, an SRVA with "SRVR sent" indication and the corresponding result parameter [see 3.2.2.2.2 c), xvi)] to the OPC, and an indication to the SP management. The test is stopped. Note – Conditions of this type can be the unavailability of local processing resources, exceeding the maximum number of tests at a given node (implementation dependent threshold), or some other unspecified problem which might be implementation dependent.

   ii) If no local conditions exist to prohibit the sending of SRVT messages, then the test continues as follows.

b) Attempts to translate the GTI + GT (Destination) either to a PPC + SSN and optional SPC + SSN or to a new GTI + GT:

   i) If the SP is unable to perform the translation, the reason for failure is equal to "No translation data exists". The SP sends an SRVR to the initiator, an SRVA message with "SRVR sent" indication and corresponding result parameter [see 3.2.2.2.2 c), iv)] to the OPC, and an indication to the SP management.

   ii) If it recognizes that further translation is needed, a TPC and a backup TPC (optional) are derived from the GTI + GT.

   iii) If the translation is final and successful, the PPC + SSN and SPC + SSN (optional) are derived from the GTI + GT and retained.

   iv) The TSP determines the Test GTI + GT for any SRVT messages to be sent:

   If translation derived a new (i.e. different) GT, the Test GTI + GT for any SRVT messages sent is the new GT value. If translation did not derive a new GT, the Test GTI + GT for any SRVT messages sent is the Test GTI + GT in the received SRVT message.

v) The TSP determines the Terminating GT (Object Instance value) for any SRVR message sent:

If the received SRVT contained an Original GTI + GT parameter, then the Terminating GT for any SRVR message sent is the value of the Original GTI + GT parameter. If the received SRVT did not contain an Original GTI + GT parameter, then the Terminating GT for any SRVR message sent is the value of the Test GTI + GT parameter in the received SRVT message.

c) Checks for mated SCCP Relay Node;

i) If a mated SCCP Relay Node exists for the current TSP, an SRVT message is sent to the mate so that it may perform a duplicate translation for comparison purposes. The comparison is described in the procedure for Duplicate translation in 3.2.2.4.2.3. If translation derived a new GT then the SRVT message sent to the mate TSP contains an Original GTI + GT parameter set to the value of the Test GTI + GT in the received SRVT message. After the sending of the SRVT, the test proceeds with step d).

ii) If no mated SCCP Relay Node exists, the test proceeds with step d).

d) Examines the list of TSPs [see 3.2.2.2.1 m)];

i) If the Point Code of the next TSP or the Point Code of the mated SCCP Relay Node (optional) appears in the SRVT's list of TSPs, then the SP sends an SRVR to the initiator, an SRVA with "SRVR sent" indication and an "SCCP loop detected" indication [see 3.2.2.2.2 c), xii)] to the OPC of the received SRVT, and an indication to the SP management. The test is stopped.

ii) If the number of Point Codes in the SRVT's list of TPCs exceeds the predefined threshold number N of translations, then the SP sends an SRVR to the initiator, an SRVA message with "SRVR sent" indication and the "threshold exceeded" indication [see 3.2.2.2.2 c), xiii)] to the OPC of the received SRVT, and an indication to the SP management. The test is stopped.

iii) If neither the Point Code(s) of the next TSP(s) nor that of the mated SCCP Relay Node (Optional) appears in the SRVT's list of TSPs, then the TSP adds both its own Point Code and the Point Code of the mated SCCP Relay Node (if any) to the list of TSPs.

e) Attempts to send an SRVT message to the next TPC or Tested Destination [from b) above]:

i) If the TSP is unable to send the SRVT due to inaccessibility, the TSP sends an SRVR to the initiator, an SRVA with "SRVR sent" indication and corresponding result parameter(s) [see 3.2.2.2.2 c), xi)] to the OPC of the received SRVT, and an indication to the SP management. The test is stopped.

NOTE – A destination is determined to be inaccessible if it is blocked, accessed only by non-SS7 signalling, across a network boundary in a closed network, or rejected (e.g. UDTS error).

ii) If the TSP is unable to send the SRVT due to an MTP routing problem, the TSP sends an SRVR to the initiator, an SRVA with "SRVR sent" indication and the corresponding result parameter(s) [see 3.2.2.2.2 c), xiv)] to the OPC of the received SRVT, and an indication to the SP management. The test is stopped.

iii) If an SRVT may be sent, a guard timer, T2, is started and SRVT message(s) are sent to either the next TPC(s) or the PPC + SSN and SPC + SSN (optional) resulting from translation. This timer is the guard for SRVA(s) received in response to both the Compare and No Compare SRVT messages. The value of the "Additional trace information requested indicator" is obtained from the received SRVT message.

iv) If the SRVT message received contained an Original GTI + GT parameter, then the SRVT message sent contains an Original GTI + GT parameter set to the value in the received SRVT message.

If the SRVT message received did not contain an Original GTI + GT parameter then,

– if translation derived a new GT, then the SRVT message sent contains an Original GTI + GT parameter set to the value of the Test GTI + GT in the received SRVT message.

– if translation did not derive a new GT, then the SRVT message sent does not contain an Original GTI + GT parameter.

3.2.2.4.2.2 Subsequent Actions

Upon receipt of an SRVA message, the following actions are taken:

a) if all of the SRVA(s) in response to the SRVT(s) have not yet been received, the results are stored, waiting for pending SRVA(s).

b) if all other expected SRVA(s) have been received, the following actions are taken,

   i) The guard timer, T2, is stopped.

   ii) If the MTP Backward Routing Required indicator was set in the SRVT, a check is made to see if MTP routing information for the Initiator PC exists. If the MTP Backward Routing Required indicator was not set, a global title translation is made upon the Initiator GT (NEGT). If no MTP routing information or no translation exists, the "Unknown initiator" indication [see 3.2.2.2.2 c), xv)] is included in the SRVA returned to the previous SP, with "SRVR not sent" indicated.

   iii) Results of the duplicate translation comparison are incorporated into the results of the test parameters (see 3.2.2.2.2). This is optional in networks not subscribing to the concept of mated SCCP Relay Nodes and duplicate translations. If the SRVA in response to the SRVT has not yet been received, the ITSP waits for it up to the expiry of the T2 timer.

   iv) If the "SRVR sent" indication is not set and the received SRVA indicates that an error was detected, the SP sends an SRVR message with appropriate indications from the SRVA.

   v) The SP sends an SRVA message in response to the original SRVT message. The complete result of test parameter list is retained and the "SRVR sent" indication is set appropriately.

c) If the timer has already expired, the message is discarded.

   If the guard timer expires before receipt of all expected SRVA(s), an attempt is made to send an SRVR to the initiator with the result "SRVA not received" [see 3.2.2.2.3 c), vi)]. Results of any SRVAs received, along with the result "Timeout waiting for SRVA message" [see 3.2.2.2.2 c), x)] and an indication that an SRVR has been sent, are returned in an SRVA to the SP from which the SRVT message was received. If the SRVR cannot be sent because neither the Initiator GT nor the Initiator PC are recognized, the SRVA should add the result "Unknown initiator" [see 3.2.2.2.2 c), (xv)] and should indicate that an SRVR has not been sent [see 3.2.2.2.2 b)]. Any SRVAs received after the timer expires will be discarded. If an SRVA cannot be sent, no further action is taken.

3.2.2.4.2.3 Duplicate translation (Optional)

This procedure should be performed in networks which have translations duplicated at mated TSPs. When a TSP receives an SRVT message with the form indicator set to "Compare", it:

a) checks to determine if the originating SP is a mated SCCP Relay Node to the receiving SP. If not, an SRVA is returned with "SRVT arrived at wrong SP" [see 3.2.2.2.2 c), v)];

b) attempts a duplicate translation and compares the result with information contained in the received SRVT message. If the SRVT message contained an Original GTI + GT parameter, the duplicate translation is performed on the Original GTI + GT parameter and the result is compared with the Test GTI + GT parameter in the SRVT message. If the SRVT message did not contain an Original GTI + GT parameter, the duplicate translation is performed on the Test GTI + GT parameter of the SRVT message, and the result is compared with the Point Code information contained in the SRVT message.

   i) If the results of the duplicate translation match the data in the SRVT message from the previous translation, an SRVA message is returned with test result equal to success (see 3.2.2.2.2).

   ii) If no translation data exists for the Global Title, then an SRVA message is returned with the result, "No translation data exists for the GTI + GT" (see 3.2.2.2.2 c), i)].

iii) If the results of the duplicate translation do not match the data in the SRVT message from the previous translation, an SRVA message is returned with test result equal to either "Incorrect intermediate translation" [see 3.2.2.2.2 c), iv)], "Incorrect translation for PPC + SSN" [see 3.2.2.2.2 c), ii)] or "Incorrect translation for SPC + SSN" [see 3.2.2.2.2 c), iii)].

3.2.2.4.3 Tested Destination

The tested destination is an SP with SCCP functionality that has been specified at the FTSP by use of Global Title Translation. The address is referred to as either the PPC + SSN or SPC + SSN.

If the SRVT message received at the tested destination contains an Original GTI + GT parameter, then the Terminating GT parameter for any SRVR message sent is set to the value of this Original GTI + GT parameter.

3.2.2.4.3.1 Primary Point

This procedure is performed at the primary destination SP derived from the Global Title Translation. When the destination receives an SRVT message, it verifies that the PPC + SSN serves as the primary destination for the GTI + GT. The analyses and the actions that follow are:

a) If the test is successful, the SP sends an SRVR (if requested in SRVT Message) with "success" indication to the initiator, an SRVA with success indication to the OPC, and an indication to the SP management.

b) If the MTP Backward Routing Required indicator was set in the SRVT message and the Initiator PC (NEPC) is not contained in the MTP routing tables, or the MTP Backward Routing Indicator was not set and the Initiator GT (NEGT) does not yield a translation, the test is unsuccessful. The SP cannot send any SRVR to the test initiator, but it includes the "Unknown initiator" result [see 3.2.2.2.2 c), xv)] in the SRVA sent to the OPC of the SRVT message and sends an indication to the SP management.

c) If the SP does not serve GTI + GT as the primary destination, the test is unsuccessful and the SP sends an SRVR to the Initiator PC (NEPC), an SRVA with the "SRVR sent" indication set appropriately and the corresponding result parameter [see 3.2.2.2.2 c), vi)] to the OPC, and an indication to the SP management.

d) If the SP does not recognize SPC + SSN as the secondary destination for GTI + GT, then the test is unsuccessful and the SP sends an SRVR to the Initiator PC, an SRVA with the "SRVR sent" indication set appropriately and the corresponding result parameter [see 3.2.2.2.2 c), viii)] to the OPC, and an indication to the SP management.

If an SRVA cannot be sent, no further action is taken.

3.2.2.4.3.2 Secondary Point

This procedure is performed at the secondary destination SP (optional) derived from the Global Title Translation. When the destination receives an SRVT message, it verifies the SPC + SSN serves as the secondary destination for the GTI + GT. The following action should result:

a) If the test is successful, the SP sends an SRVR (if requested in an SRVT Message) with "success" indication to the initiator, an SRVA with "success" indication to the OPC, and an indication to the SP management.

b) If the MTP Backward Routing Required indicator was set in the SRVT message and the Initiator PC (NEPC) is not contained in the MTP routing tables, or the MTP Backward Routing Indicator was not set and the Initiator GT (NEGT) does not yield a translation, the test is unsuccessful. The SP cannot send any SRVR to the test initiator, but it includes the "Unknown initiator" result [see 3.2.2.2.2 c), xv)] in the SRVA sent to the OPC of the SRVT message and sends an indication to the SP management.

c) If the SP does not serve GTI + GT as the secondary destination, the test is unsuccessful and the SP sends an SRVR to the initiator, an SRVA with the "SRVR sent" indication set appropriately and the corresponding result parameter [see 3.2.2.2.2 c), vii)] to the OPC of the received SRVT, and an indication to the SP management.

d) If the SP does not recognize PPC + SSN as the primary destination for GTI + GT, then the test is unsuccessful and the SP sends an SRVR to the initiator, an SRVA with the "SRVR sent" indication set appropriately and the corresponding Result of Test parameter [see 3.2.2.2.2 c), ix)] to the OPC, and an indication to the SP management.

If an SRVA cannot be sent, no further action is taken.

3.2.2.5 T2 for SRVT

T2 at an SP initiating an SRVT is the guard time waiting for all SRVA messages in response to the SRVT message sent from the initiator.

$$T2Initiator = Dsrvt\ (Nsrvt + 1)$$

where Dsrvt is the estimated maximum delay between relay nodes (see 3.2.2.6) and Nsrvt, defined in the SRVT procedure, is the maximum number of relays allowed.

T2 at a Translation Signalling Point (TSP) is the guard time associated with a received SRVT message, waiting for all SRVA messages in response to all SRVT messages sent.

$$T2TSP = T2\ PreviousSP - Dsrvt$$

For the above definitions, it is important to note that SRVT/SRVA messages of the compare type are not considered since their propagation times are considered to be far less than $\tau S1$ and $\tau S3$ respectively.

3.2.2.6 Delay for SRVT

$$Dsrvt = MAX(\tau S1) + MAX(\tau S2) + MAX(\tau S3) + MAX(\tau S4)$$

where

$\tau S1$ – The time to transfer an SRVT message between applications. This includes the overhead time of the respective network layer functionality.

$\tau S2$ – The time to process SRVT request at the application level. This consists of the time to translate the Global Title at a Translation Signalling Point, or the time for determining the validity of a Translation at the tested destination.

$\tau S3$ – The time to transfer an SRVA message between applications. Again, this includes the overhead time of the respective network layer functionality.

$\tau S4$ – The time to process an SRVA received at the application level. This includes the compilation of any results into the result of test for the next SRVA.

NOTE – The table defining the estimated maximum time values for the SRVT is for further study.

3.2.3 OMAP model for SRVT

This is illustrated in Figure 1.

The OMAP model assumes that the logic defined in 3.2.2 resides in the OMASE-User, which provides a service SRVT(Start) and SRVT(Result). The actions defined in the text (e.g. sending an SRVT message), correspond to the sending of primitives to OMASE and receiving primitives from OMASE. The mapping is as shown in the next section.

NOTE – A timer T2 is run in the OMASE-User at the test initiator node as well as in TC, the OMASE-User timer is marginally greater than that run in TC. This is to cater for rare abnormal events (e.g. ill-formed APDUs being received in OMASE from TC).

3.2.3.1 Text-defined actions mapped to OM primitives

See Table 2.

TABLE 2/Q.753

Mapping of text-defined actions to OM service primitives

"a" interface		"b" interface	
1a	sendSRVT	1b	OM-CNF-ACTION request
2a	receiveSRVT	2b	OM-CNF-ACTION indication
1a	sendSRVA	1b	OM-CNF-ACTION response
2a	receiveSRVA	2b	OM-CNF-ACTION confirmation
1a	sendSRVR	1b	OM-EVENT-REPORT request
2a	receiveSRVR	2b	OM-EVENT-REPORT indication

3.2.3.2 State transition diagram for the SRVT procedure

Figure 3 shows the state transition diagram for the SRVT using SDL. This gives the logic for SRVT in the OMASE-User.

3.2.3.3 Example of SRVT

Figure 4 demonstrates the SRVT. It should be noted that the SPs shown are assumed to be SCCP adjacent and not MTP adjacent. Furthermore, the example shows both primary and secondary destinations, and duplicate translation points. The duplicate translation points and secondary destinations may be considered optional.

4 Circuit management functions

4.1 General

These management functions relate to testing of ISDN User Part or Telephony User Part (TUP) resources, or sections of the SS No. 7 network used by these User Parts, where communication in the SS No. 7 network is required for the test. Currently, just the Circuit Validation Test (CVT) is defined here.

4.2 Circuit Validation Test (CVT)

This test includes a connectivity check. For circuit used in just speech or 3.1 kHz audio connections, the connectivity check uses the hardware supplied for the continuity check employed in call handling as defined in Recommendations Q.724 and Q.764, but the CVT is a self-contained procedure with no impact on the Q.724 and Q.764 call handling procedures.

The circuits controlled by the ISDN User Part include speech, 3.1 kHz audio, or 64 kbit/s connections. TUP controls circuits offering digital connections (usually this means 64 kbit/s), as well as "normal" speech connections.

In international interconnections, digital circuits may be extended from one exchange to another via various transmission equipments such as digital cross-connect systems or digital multiplexers. If a digital cross-connect system is employed, the inherent fault indicators in the digital transmission facility might be disassociated from the individual bearers.

If a 1544 Mbit/s primary multiplex interworks with a 2048 Mbit/s system, rate conversion (and A/μ law conversion for speech/3.1 kHz audio) have to be provided.

Procedure OMASE-User srvt-1 (4)

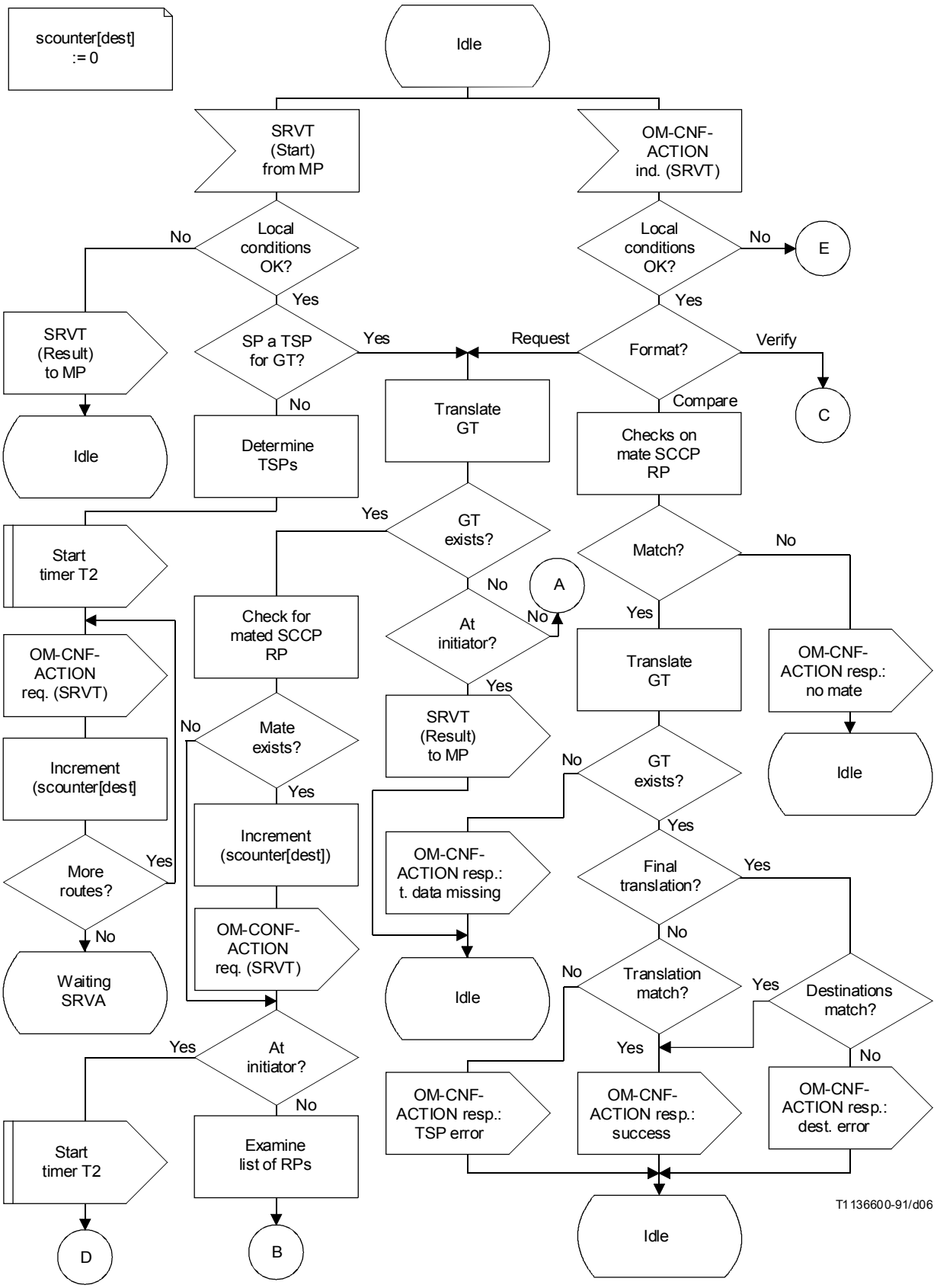


FIGURE 3/Q.753 (sheet 1 of 4)

SRVT SDL in the OMASE-User

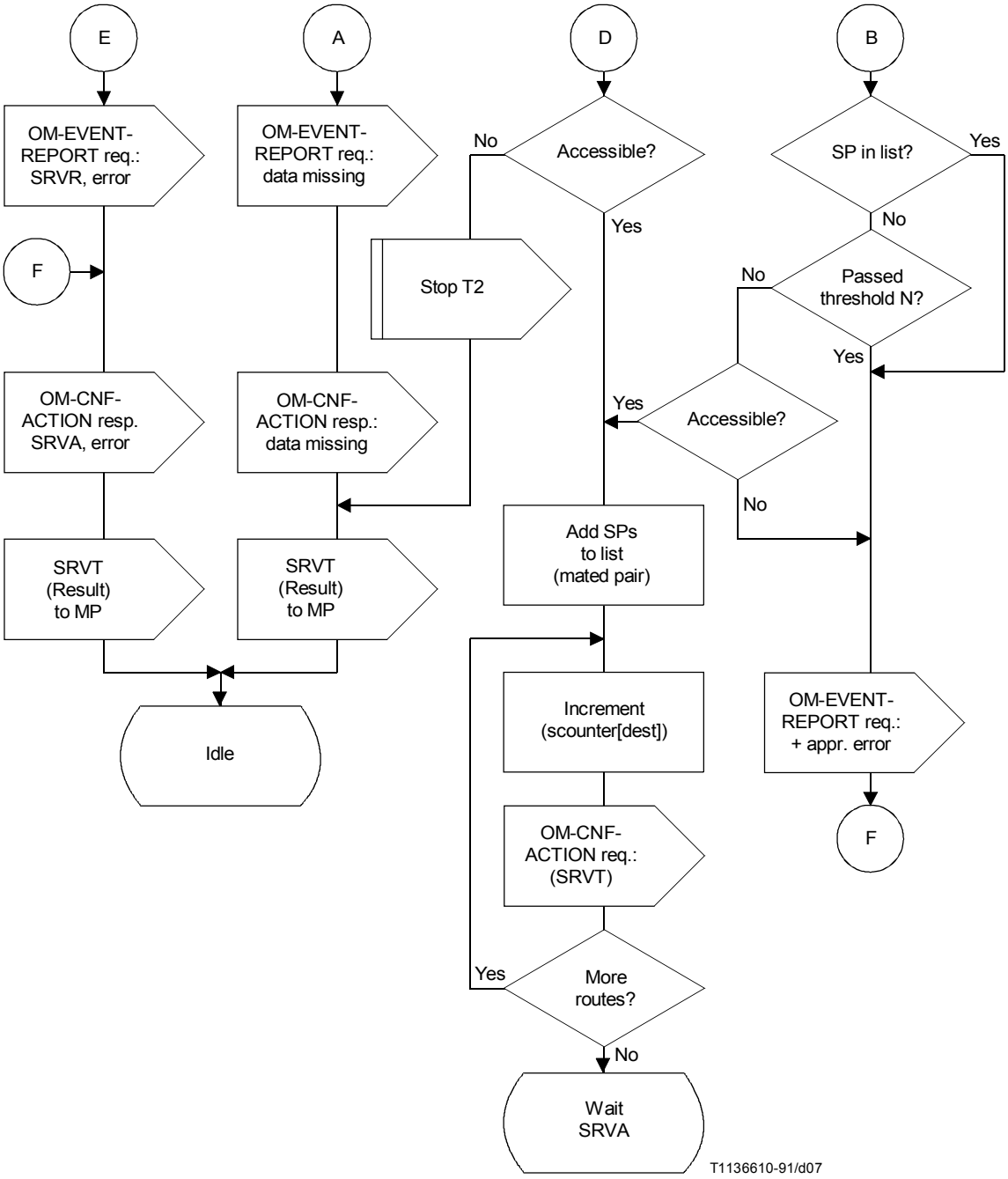


FIGURE 3/Q.753 (sheet 2 of 4)

SRVT SDL in the OMASE-User

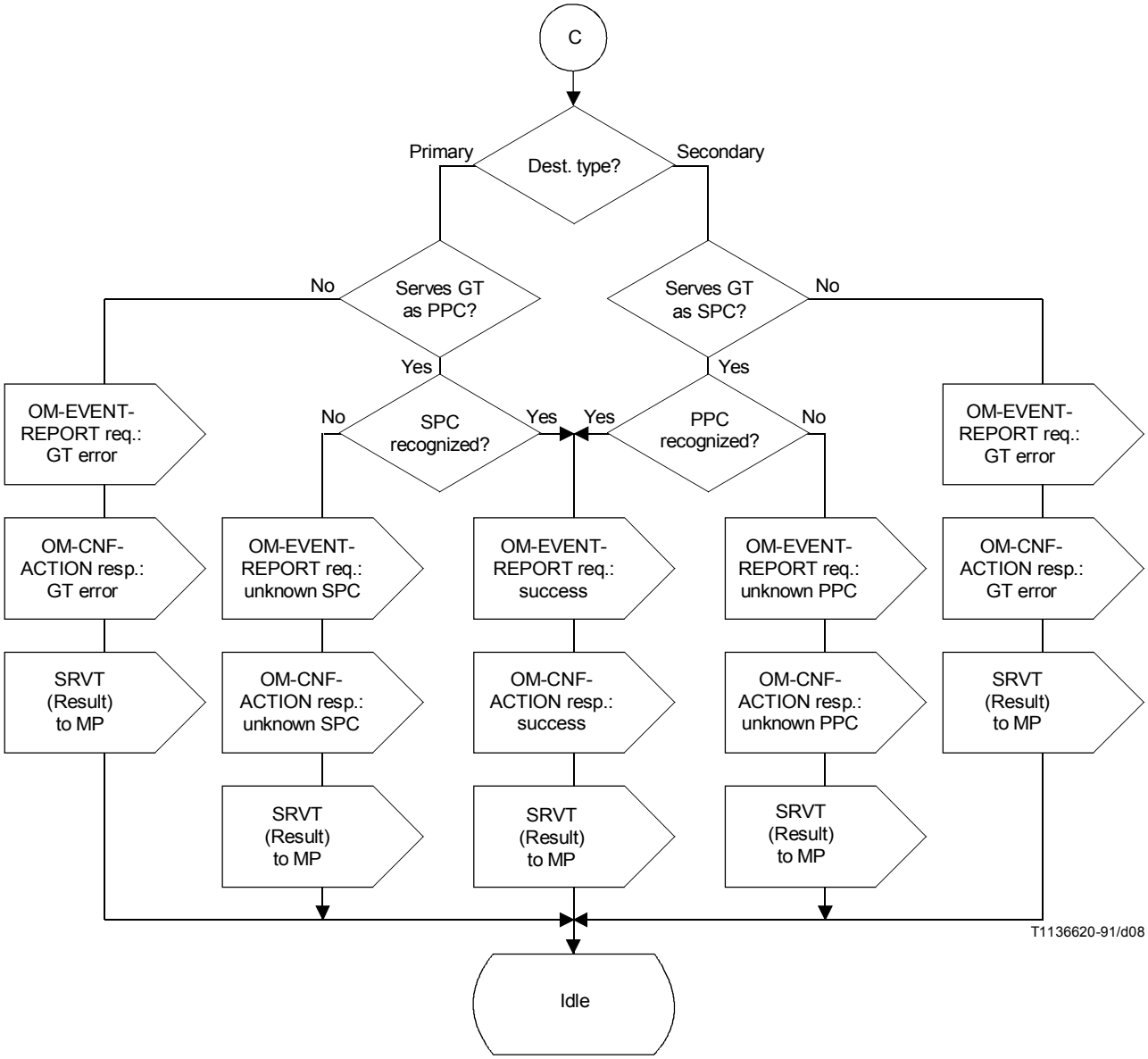


FIGURE 3/Q.753 (sheet 3 of 4)

SRVT SDL in the OMASE-User

Procedure OMASE-User srvt-4 (4)

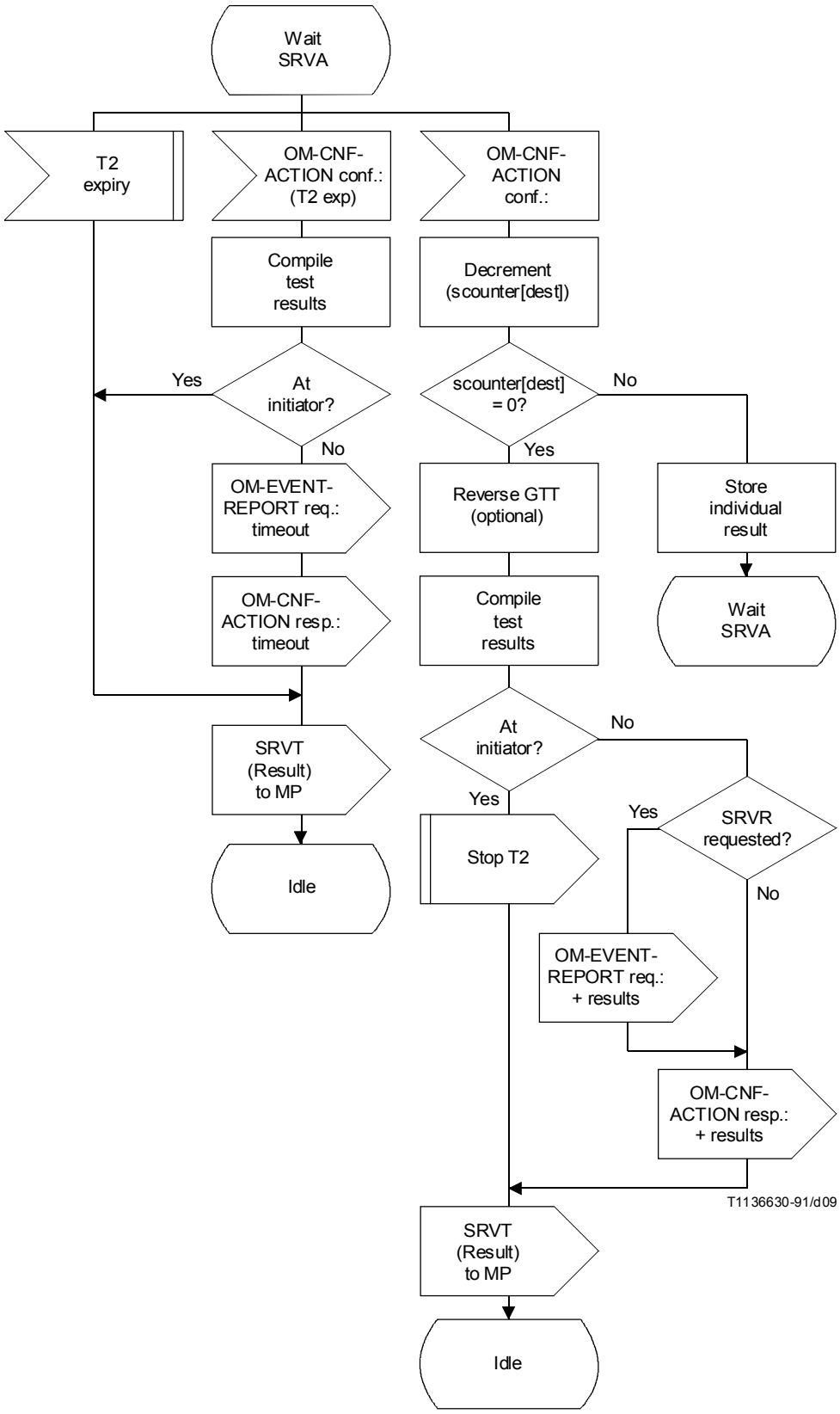
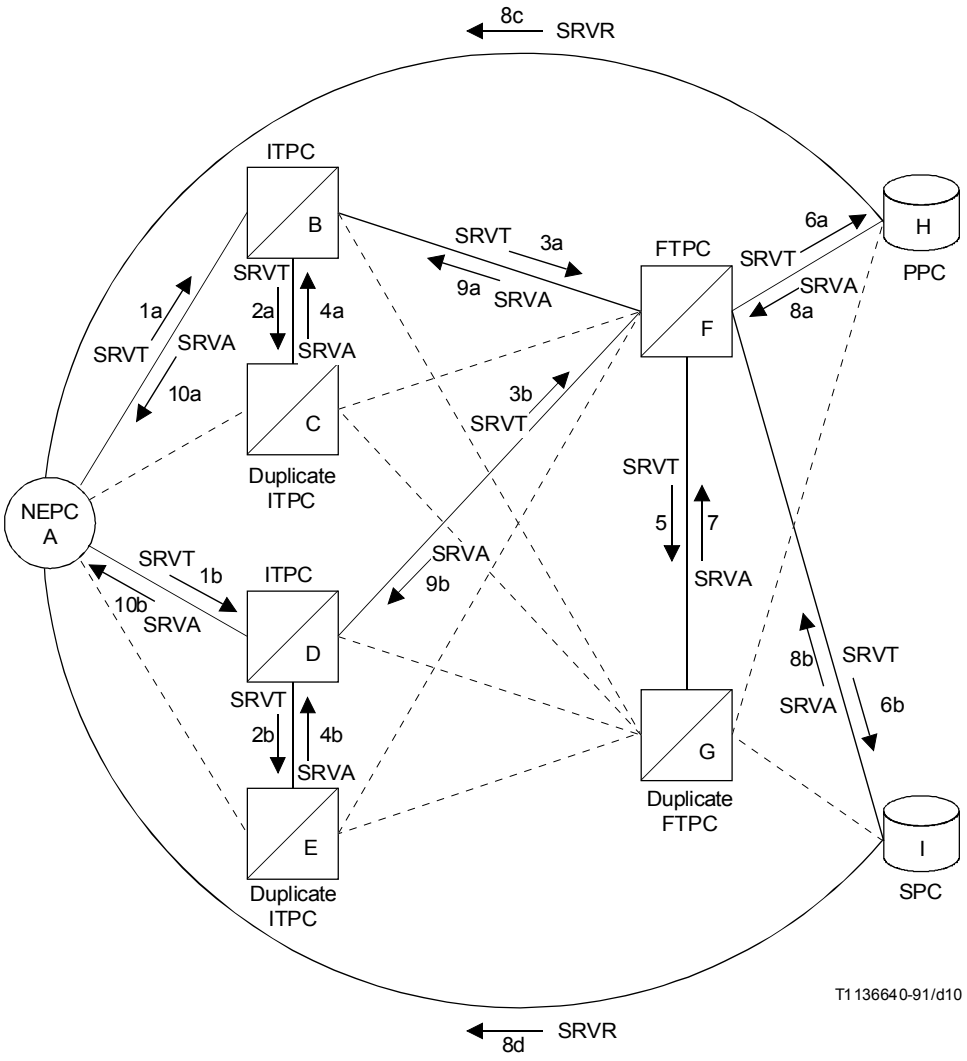


FIGURE 3/Q.753 (sheet 4 of 4)

SRVT SDL in the OMASE-User



NEPC	Near End Point Code
ITPC	Intermediate Translation PC
FTPC	Final Translation PC
PPC	Primary Destination PC
SPC	Secondary Destination PC
SRVT	SCCP Routing Verification Test Msg.
SRVA	SCCP Routing Verification Ack. Msg.
SRVR	SCCP Routing Verification Result Msg.

FIGURE 4/Q.753

Example of SRVT procedure

Digital transmission equipment evolution catering for requirements from a variety of digital interfaces has tended to lead to more complex (and hence more error prone) parameter settings. Certain errors in these parameters might affect only a 64 kb/s service, but not speech/3.1 kHz audio; in other cases bit integrity might be lost.

For circuits supporting only speech/3.1 kHz audio, the CVT connectivity check is based on the continuity check defined in 7/Q.724 and 8/Q.724; for 64 kbit/s circuits, a pseudo-random bit pattern test (e.g. a 2047 pseudo-random bit pattern test conforming to Recommendation O.152) should be carried out.

The purpose of a CVT is to ensure that the exchanges at each end of an interexchange circuit group have sufficient and consistent data for placing a call on a specific circuit of the group, and that the data refers to the same physical circuit.

A CVT may be initiated by either exchange on demand by SS No. 7 management, but the load on the exchanges should not be seriously increased by such tests. Only one CVT using tone transceivers should be run at a time in one signalling point, the start of CVTs using pseudo-random bit pattern tests should be separated by at least the synchronisation time (the value of which is for further study).

Bit patterns generated in concurrent tests should all be different, and no pattern used should be a cyclic rearrangement of any other pattern generated concurrently by the signalling point. A signalling point should only loop circuits for connectivity tests for one other signalling point at any one time, and should not itself generate tone or bit patterns for CVT tests during this time.

The test is to be performed before a circuit is put initially into service, or after rearrangement of its associated transmission ressources. Before a test is performed, it is necessary to ensure that messages are capable of being routed between the exchanges involved.

For 64 kbit/s connections, it is an option to use either the tone transceiver or the pseudo-random bit pattern transceiver for the connectivity check.

Note that the timer ranges defined for circuits supporting 64 kbit/s are minimum ranges, if a more comprehensive transmission test is required, the ranges should all be increased proportionately.

4.2.1 The test

Both the near end and far end checks are required to perform a complete CVT. The initiating end starts the test by accessing the circuit to be tested when stimulated by a management request. The circuit is identified by an identification code agreed upon by the two exchanges at each end of the circuit.

The data check at the initiating end must be adequate to ensure that data exists for

1) deriving a physical appearance for the circuit so that a transceiver may be connected to it; and

2) deriving a circuit identification code (CIC) and routing label so that a Common Channel Signalling circuit-related message may be generated.

If the near end data test fails, the management is notified with the reason for the near end failure (e.g. failure reason – circuit unequipped). The test is terminated and a CVT request message is not generated for the circuit under test.

If the near end data test succeeds, the following sequence occurs:

a) An overall test timer Tc is started at the near end. This is between 25 to 30 seconds for circuits on which the pseudo-random bit pattern connectivity test is to be run (e.g. 64 kbit/s circuits; it is between 3 and 4 seconds for the connectivity test using tone transceivers as defined in 7/Q.724 and 8/Q.724 (e.g. for circuits supporting just speech/3.1 kHz radio);

b) At the near end, if the test uses a tone transceive, any echo suppressor/canceller device associated with a circuit is disabled; otherwise, any associated bit manipulating devices (e.g. echo canceller, ADPCM equipment, A/μ law equipment) are disabled;

c) The CVT request message (CVI) is sent to the far end;

d) If the test uses a pseudo-random bit pattern sequence, an implementation dependent transceiver generating a pseudo-random test pattern in conformance with the requirements in Recommen-dation O.152 is connected at the near end of the circuit immediately after the CVI message is sent; otherwise, an implementation dependent continuity check transceiver in conformance with the requirements in 7/Q.724 and 8/Q.724 is connected at the near end of the circuit immediately after the CVI is sent;

e) The near end then waits for the pseudo-random bit pattern or continuity check tone to return in the circuit's return direction; if the test uses continuity check tone as defined in Recommendation Q.724, the transceiver should receive valid tone within 2 seconds (see 7.4/Q.724) after the CVI message has been sent, otherwise the test fails. If the test uses a pseudo-random bit pattern, the near end attempts to synchronise to the received pattern.

f) When the far end receives the CVI message, it checks to see if the CIC indicated in the message is assigned. If the CIC is unassigned, a failure indication is explicitly returned to the near end via a CVT response message (rather than via an unequipped CIC message). If the CIC is assigned, the far-end must perform adequate tests to ensure that data exists for deriving a physical circuit appearance from the received routing label and the CIC so that a loop or transceiver may be connected to the physical circuit appearance. Additionally, the far end must also check that an identification code for the circuit exists for the physical circuit appearance. If the far end checks fail, the CVR message contains the reason for failure and includes an identification code of the failing exchange, as agreed upon by the two exchanges. If the far end checks pass, the CVR message eventually sent contains the far-end-derived identification code for the circuit.

g) If the far end's data checks succeed, it disables any echo canceller/suppressor or bit manipulating device, attaches a loop to the circuit being tested – this should be a digital loop if the circuit is 64 kbit/s, and starts a timer Tx. Tx is 2 to 2.1 seconds if there is no time parameter in the CVI message, otherwise its value is given by the time parameter. This timer has a maximum value of 19 to 21 seconds, it must be at least the pattern synchronisation time plus Ty (see h) below) (the value is for further study).

h) If the near end uses a pseudo-random bit pattern test, and the transceiver manages to synchronise on the received pattern, it starts a timer Ty (14.9 to 15.1 seconds) to perform a Bit Error Ratio (BER) test.

i) When Tx expires, the far end removes the loop from the tested circuit, and enables any previously disabled bit manipulating/echo cancelling/suppressing devices.

j) The far end then returns the CVR.

k) The near end stops timer Tc on receipt of the CVR message.

If valid tone (for circuits supporting only speech/3.1 kHz audio) is received (see 7/Q.724), or a satisfactory BER test for the period Ty occurs (see e.g. Recommendations M.550 and G.821), either one followed by removal of tone/pattern before the CVR message is received and before timer Tc expires, then the test succeeds. The test fails if Tc expires without a CVR message being received at the near end.

The test also fails if a CVR message is received at the near end, or Tc expires, before synchronization is achieved (for the pseudo-random bit pattern test), or tone or pattern is still being received when the CVR is received or Tc expires.

At the near end, a comparison of the near end and the far end circuit identification codes is made. If they match, and the connectivity test has succeeded, an identification of a successful CVT is given to the management at the initiating end. If the comparison fails, a CVT failure indication with all the relevant data is given to the management for the purpose of isolating the problem.

The CVT message also contains data about the circuit with respect to the characteristics of the interexchange circuit group of which it is a part. The interexchange circuit group characteristics include whether:

a) odd or even CICs are in control in the case of double seizing;

b) the blocked circuit group is classified as “Block, immediately release the call” or “Block, as soon as the call is normally released”;

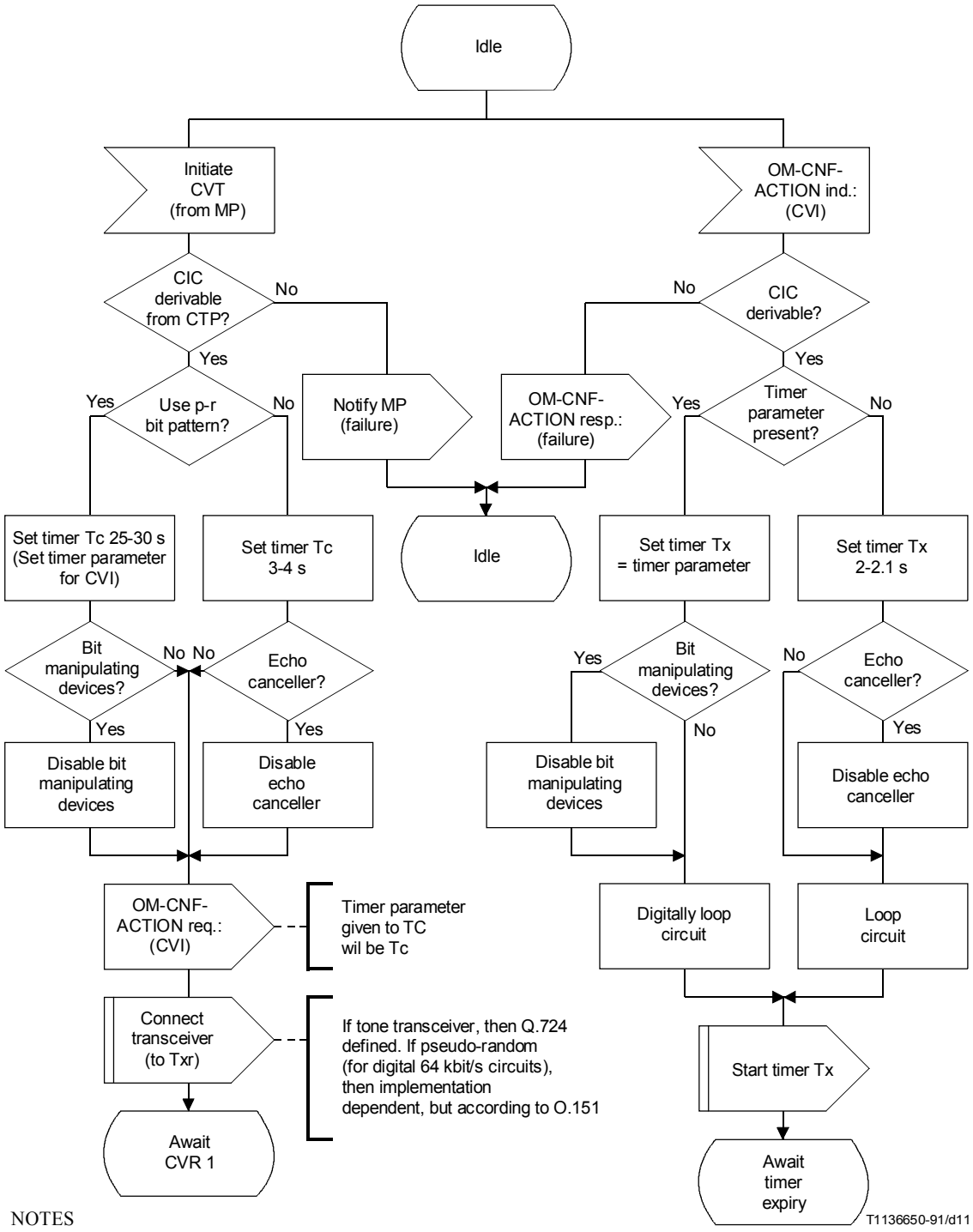
c) the interexchange circuit group contains analogue, digital or a mix of analogue and digital circuits. This determines if continuity checks should be performed during call set-up.

If the group characteristics are unavailable, the CVR message must explicitly indicate this with an unavailable indication. Inconsistencies between the interexchange circuit group characteristics of the two exchanges are reported to the initiating end management for corrective action.

4.2.2 CVT State Transition Diagrams

Figure 5 contains the state transition diagrams for the CVT in the form of SDL. There are three sets of diagrams, the first set is the logic in the OMASE-User, the next set is the logic for the near end pseudo-random bit pattern transceiver, the last set is for the continuity check transceiver.

Procedure OMASE-User cvt-1 (4)



NOTES

1 "Bit manipulating" devices include A/μ law converters, Echo Cancellers, ADPCM equipment, etc.

2 The CVI timer parameter has a maximum value of 19 to 21 seconds, its minimum is at least the pattern synchronisation time.

3 The result of the test "use p-r bit pattern?" is true if there is a timer parameter in the CNF-ACTION of the "initiate CVT" request from the MP. This timer parameter is copied into the optional timer parameter of the CVI message.

FIGURE 5/Q.753 (sheet 1 of 7)

CVT SDL in the OMASE-User

Procedure OMASE-User cvt-2 (4)

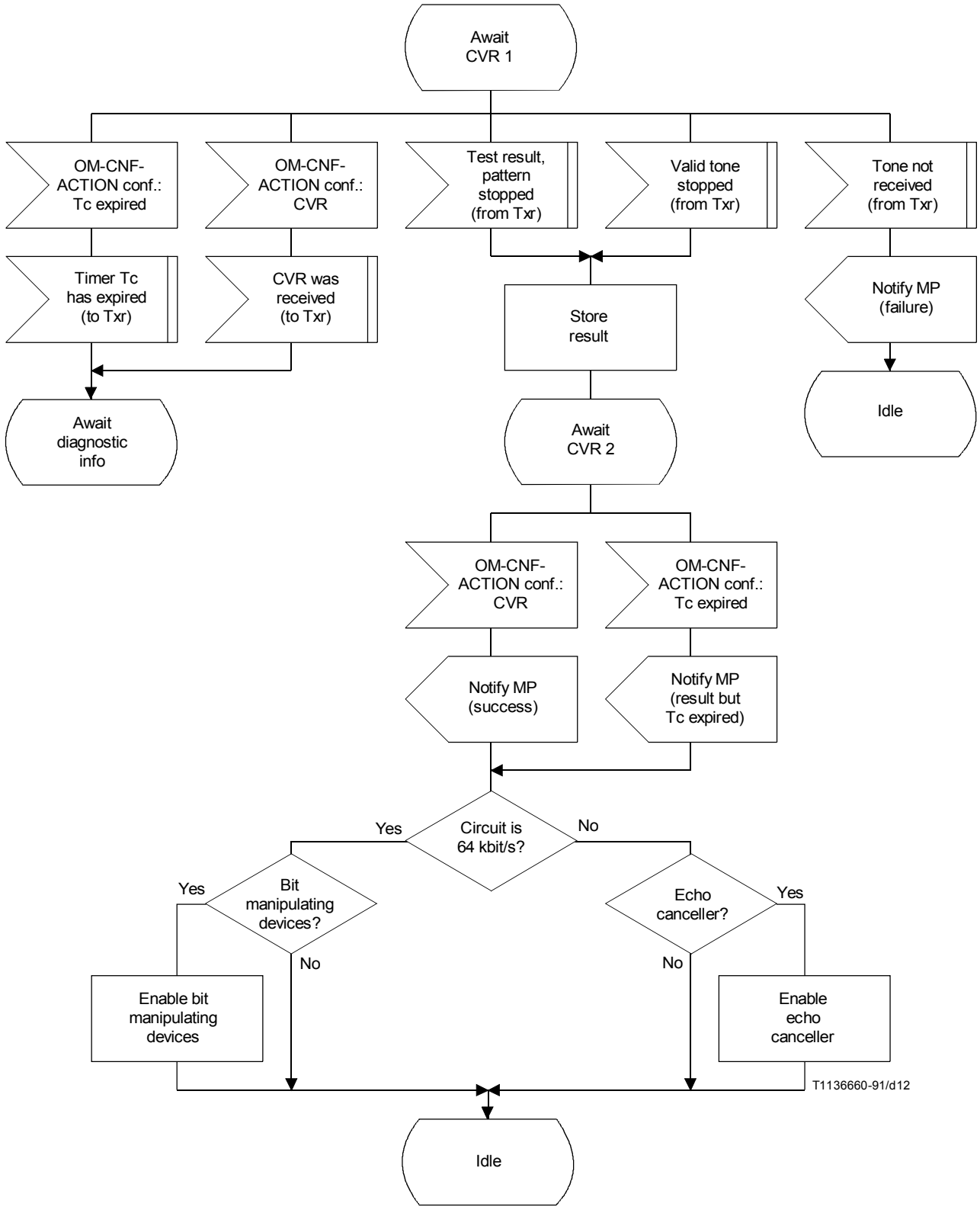


FIGURE 5/Q.753 (sheet 2 of 7)

CVT SDL in the OMASE-User

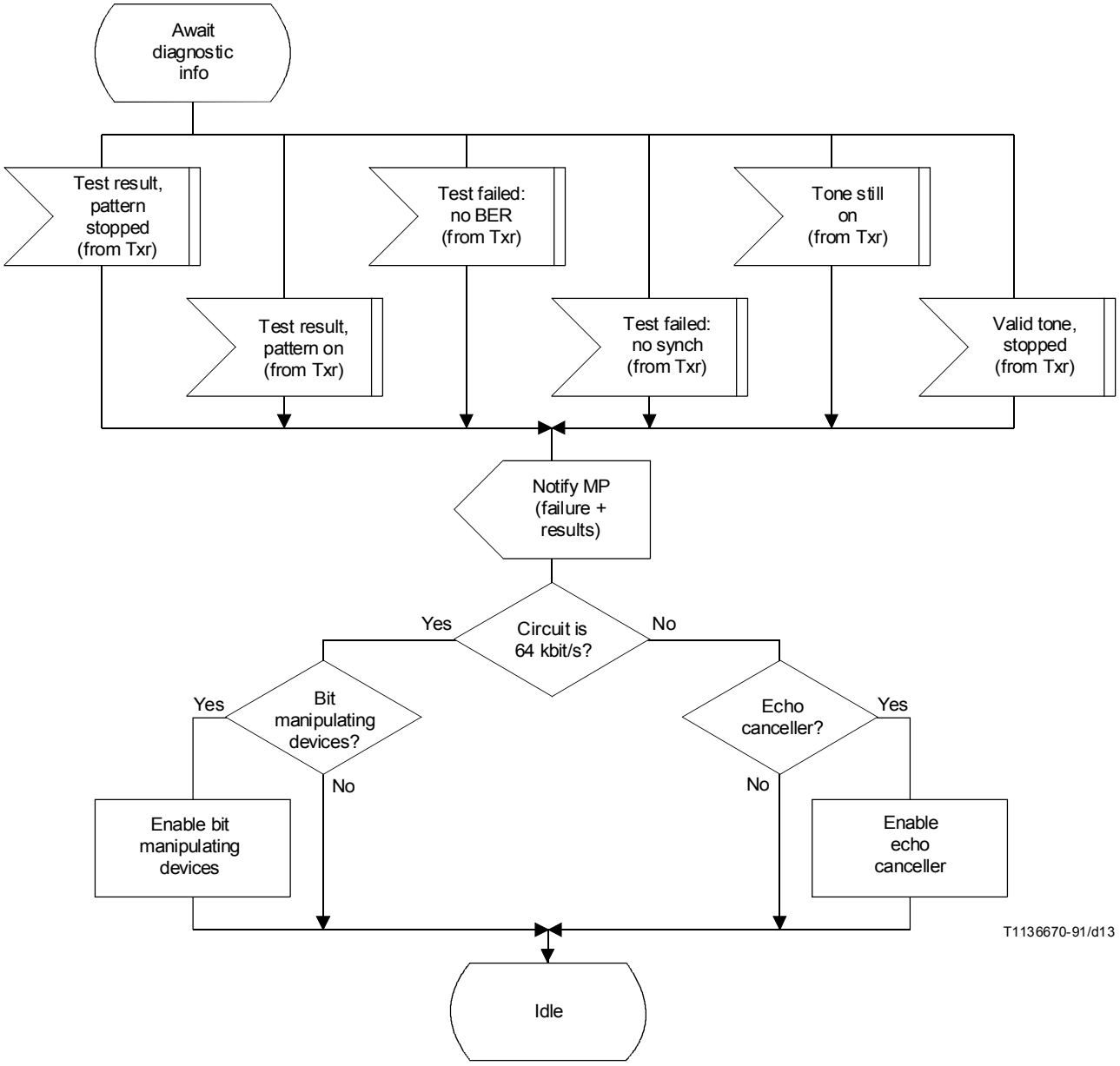


FIGURE 5/Q.753 (sheet 3 of 7)

CVT SDL in the OMASE-User

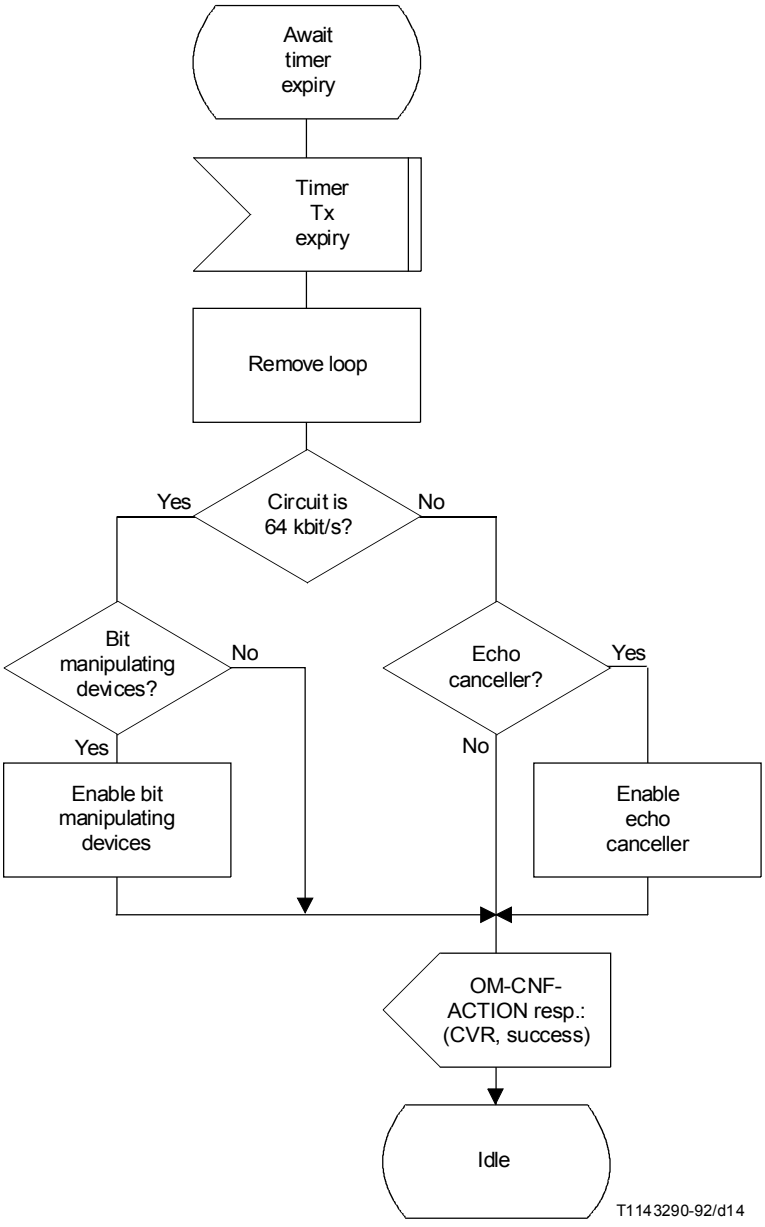


FIGURE 5/Q.753 (sheet 4 of 7)

CVT SDL in the OMASE-User

Procedure CVT-pseudo-random-generator-1 (2)

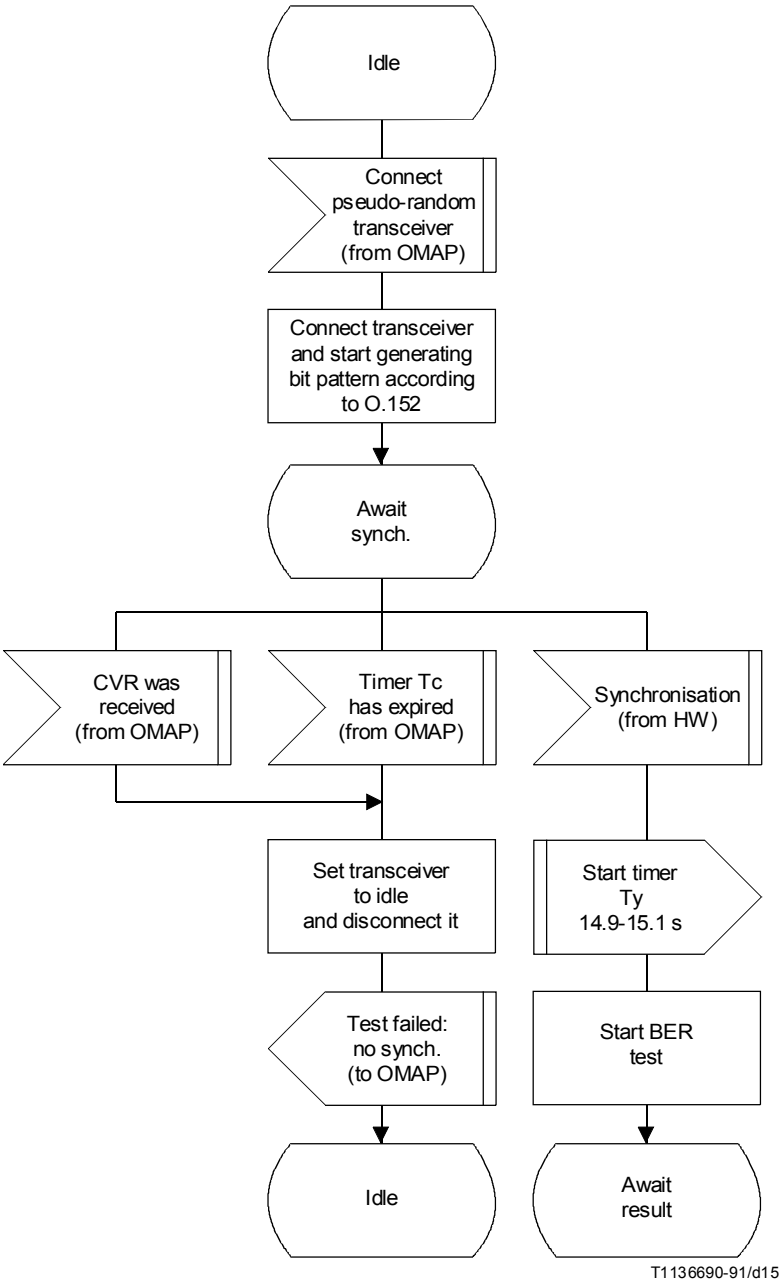


FIGURE 5/Q.753 (sheet 5 of 7)

CVT SDL pseudo-random generator (Txr)

Procedure CVT-pseudo-random-generator-2 (2)

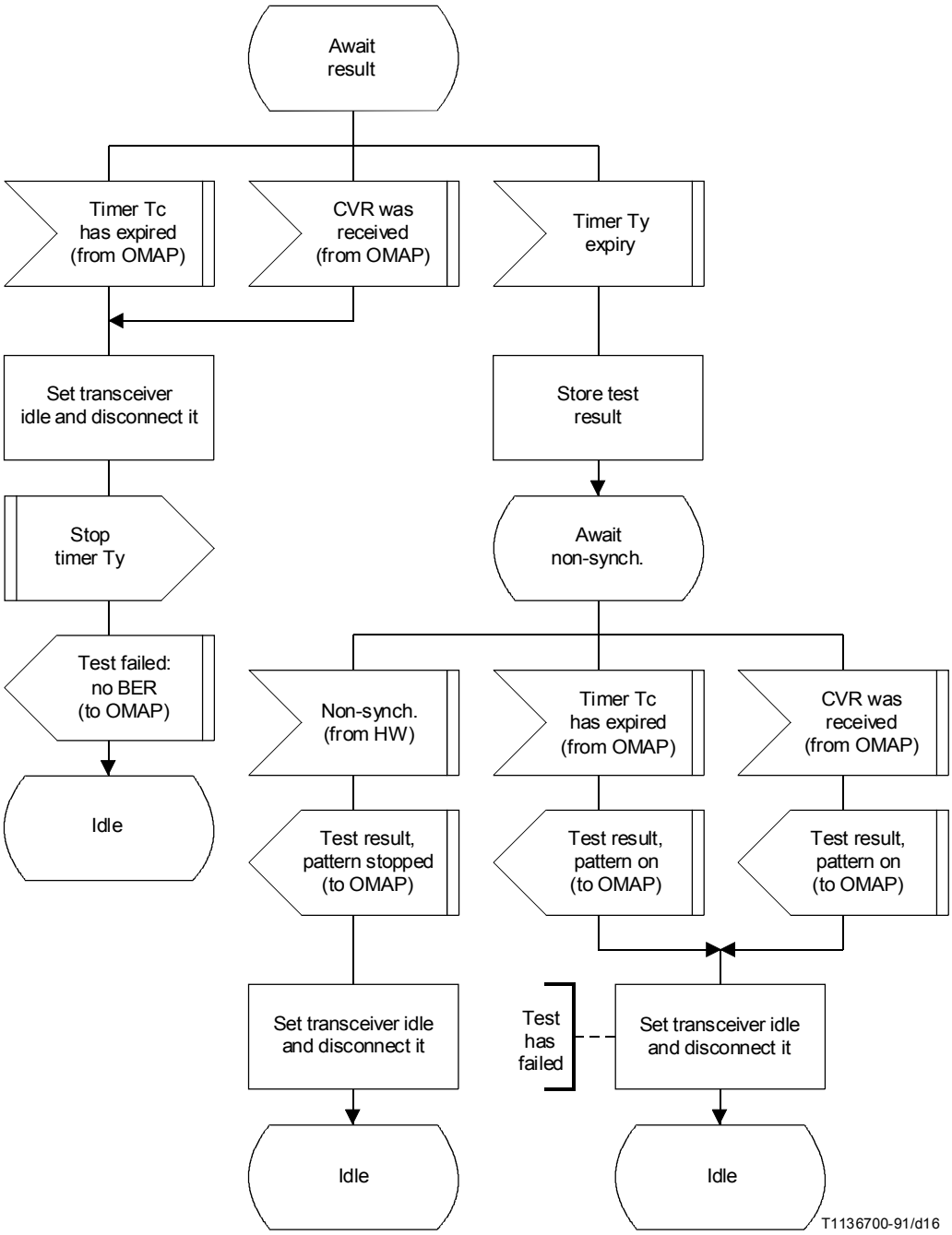


FIGURE 5/Q.753 (sheet 6 of 7)

CVT SDL pseudo-random generator (Txr)

Prodecure CVT-continuity-check-transceiver-1 (1)

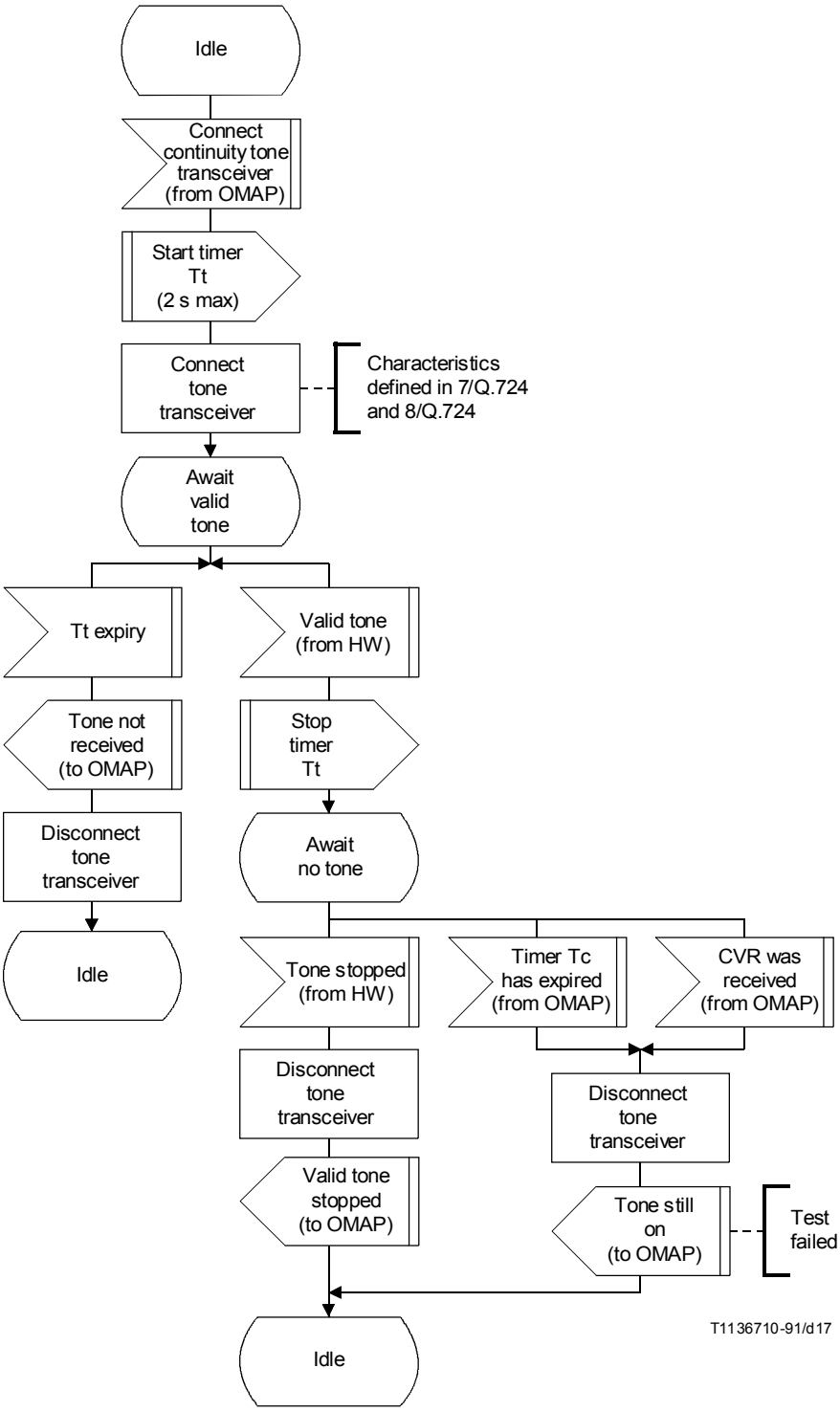


FIGURE 5/Q.753 (sheet 7 of 7)

CVT SDL continuity-check transceiver (Txr)

Annex A

(This annex forms an integral part of this Recommendation)

A.1 Generic considerations for the SRVT

A.1.1 General

These considerations are in addition to the SRVT requirements stated in 3.2.1. They cover some of the points that should be considered if an SRV Test is being specified, in particular the very general addressing capabilities of the SCCP.

A.1.2 Start of the procedure

The SRVT is started at a node by an operator wishing to verify

i) the SCCP routing from sub-system "x" at node "A" to sub-system "y" at node "B" and

ii) that the routing is bi-directional.

The operator has to input a calling and a called address, in the form that the SCCP would use at the node for routing. The first step in the procedure (assuming that no other SRVT is taking place for this destination and that the resources available allow the test) is for OMAP at the initiator node to check that both calling and called party addresses are sensible, and then for OMAP to start an SRVT check timer for this test.

A.1.2.1 Calling party address check

A calling party address has the form shown in Figure 13/Q.713, with an address indicator and an address.

The address indicator consists of a routing indicator, a global title indicator, an SSN indicator, and a point code indicator.

The following consistency checks should be done on the calling party address:

1) If the routing indicator indicates route on SSN and PC, that the SSN and PC indicators are set, the PC in the address is the node's own, and that the SSN is a local one.

2) For routing on global title, as indicated by the routing indicator, the global title indicator must be set, and to a value known in the network (at any node needing to do a translation of the calling party address). A global title must also be present.

3) If there is no PC present, but there is a global title, the SCCP should be asked for a translation. If a translation is obtained, it should yield the node's own point code and a local SSN.

   Any result of translation should be retained for the reasonableness check below.

A.1.2.2 Checks on the called party address

These are checks that the called party address is reasonable, with any global title indicator set to a value known by nodes having to translate the called party address.

A.1.2.3 Check that the communication is reasonable

OMAP should check that the calling party needs to contact the called party for a service that is provided in the network.

This check should help overcome, for example, the problem where global title routing is done, and a particular global title translation yields a known point code plus possibly an SSN that is local to the SP with the point code, but the translation is invalid.

A.1.3 SRVT message contents

The SRVT message contents to be sent out from OMAP to TC are:

a) The Tested Originator address.

b) The Tested Destination address. This consists of a list of identities for the Tested Destination. See Figure A.1 for the information content of the list.

At the Initiating SP, the list will contain the called party address handed to OMAP. If global title routing is used, as the test traverses the network the translation function in the SCCP might overwrite a global title with another. In this case, OMAP will form a list of Tested Destination addresses, each extra list element will consist of the replacement address and the identity of the SP where the replacement occurs. The replacing SP's identity is the PC of the SP as used in the MTP of the network whose SCCP uses the replacement GT, and this latter network's identity.

c) The address of the OMAP initiating the SRVT test.

This is in the same format as the Tested Originator address.

d) The address of the OMAP sending the SRVT message.

This is in the same format as the Tested Originator address, and will become the calling party address parameter of the SCCP message handed over to the MTP for transmission.

e) The OMAP address at the next "SCCP adjacent" node involved in testing the route to the destination.

This is in the same format (GT or PC+SSN) as in the last list element of the Tested Destination address, and will become the called party address parameter of the SCCP message handed over to the MTP for transmission.

f) The threshold N of the maximum number of SCCP relay points that may be crossed in the test.

g) An SRVR "trace required" indicator.

This asks for an SRVR message to be sent back from the tested destination, if the test is successful. An SRVR would be sent back in any case on test failure.

h) A list (initially empty apart from the originator's nodal identity), of SCCP relay points crossed in the test.

Each element has the identities of a relay point crossed. Each identity is held as a point code plus the identity of the MTP network where this PC is valid. See figure A.2 for the information content of the list. Note that there will be, for each relay point crossed, as many identities as there are PCs for that relay point.

Number of addresses in address list	
Tested Destination's address in original form, including RI and address indicators	
Tested Destination's address with first replacement GT	NC1
Tested Destination's address with second replacement GT	NC2
Tested Destination's address with PC + SSN	LC

RI is the routing indicator

NC is the point code plus network identify of this PC, of the SCCP relay point obtaining the replacement GT on GT translation of the previous GT in the list

LC is the PC plus network identify of the last SCCP relay point before the tested destination

FIGURE A.1/Q.753

Tested Destination's list of identities

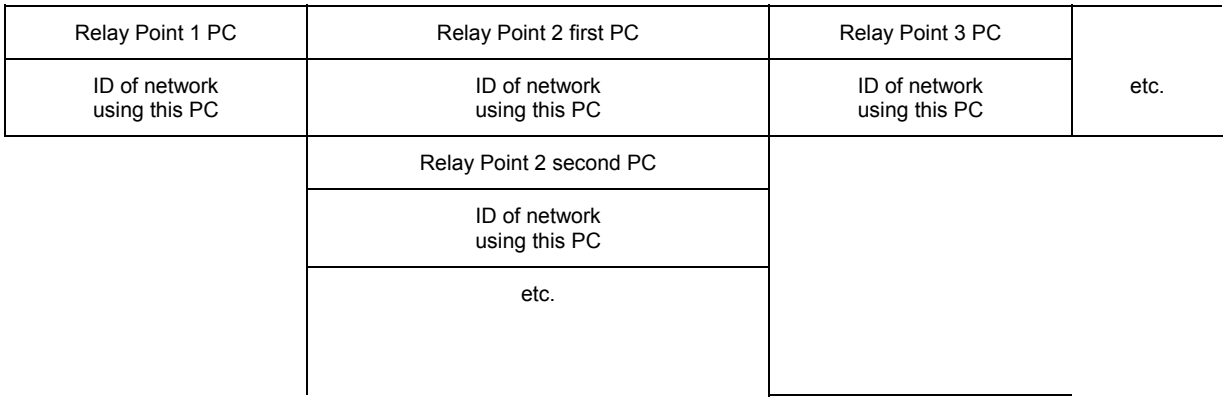


FIGURE A.2/Q.753

List of SCCP Relay Point crossed

A.1.4 SRVA message contents

The SRVA message contents sent from OMAP to TC are:

a) The Tested Originator address list – There may be two entries, the first is the address copied from the prompting SRVT message; if there is a second entry, it is the latest address obtained by global title replacement, and then it also contains the PC plus network identity of the SCCP relay point doing the GT replacement. See Figure A.3 for the information content of the address list.

b) Tested Destination address (list) – Copied from the SRVT message.

c) The address of this OMAP – In the same form as the prompting SRVT message's OMAP destination [i.e. e) of A.1.3]. This will become the calling party address in the SCCP message given to the MTP for transmission.

d) The address of the OMAP sending the prompting SRVT message – This is in the same form as in the last entry in the Tested Originator address list, and will become the called party address in the SCCP message handed to the MTP.

e) "SRVR sent" indicator.

f) Test result indicator:

"success" – All SRVT messages sent out acknowledged within the test period with SRVAs all indicating success.

"partial success" – At least one SRVA received within the test period indicating either success or partial success. One or more SRVAs received indicating failure, or timeout waiting for more SRVAs.

"failure" – No SRVA received within the test period indicating success or partial success.

In the case of partial success or failure being indicated in an SRVA message, the test will have generated one or more SRVR messages with additional diagnostic information, the contents depending upon the particular failure being reported.

Receipt of an SRVA indicating failure or partial success causes OMAP to "logically or" the failure reason with those from other such SRVAs, and a report is made to the prompting node in an SRVA message if the originator is a remote OMAP, or to the local management if not or if the prompting OMAP is now inaccessible.

Failure reasons are:

i) Intermediate SP is not an SCCP relay point.

ii) Unknown initiator OMAP.

The PC or GT are not recognized for the OMAP initiator address. This also includes inconsistencies between the various indicators in the address.

iii) Unknown Tested Originator (inconsistency in address; GT does not provide an SSN, or GT does not provide a PC from attempting a translation of Tested Originator address).

iv) Unknown Tested Destination (inconsistency in address; the GT does not provide a PC, or GT does not provide an SSN when attempting translation of GT).

v) Number of crossed SCCP nodes exceeded threshold.

vi) Loop detected.

vii) Timeout waiting for SRVA message(s).

viii) Inability to send SRVT message(s) due to network failure.

ix) Test cannot be run due to local conditions.

x) MTP routing problem – The address of the Tested Destination is in the SCCP routing tables, and a DPC (plus possibly an SSN) can be obtained for onward routing, but the MTP does not have the DPC as a known destination.

In addition, if an SRVT test is already being run for the Tested Destination at the initiator OMAP, management will be refused another test.

Number of addresses in address list	
Tested Origin's address in orginal form, including RI and address indicators	
Tested Origin's address with replacement GT	NC

RI is the routing indicator. The last element might be absent.

NC is the point code plus network identity of this PC, of the SCCP relay point obtaining the replacement GT on GT translation of the previous GT in the list. This last address might also contain the PC + SSN of the Tested Origin.

FIGURE A.3/Q.753

Tested Originator Address (list)

A.1.5 SRVR message

The SRVR message contents are:

a) The identity of OMAP at the node sending the SRVR (the address is in the same form as the Tested Destination's first identity in the prompting SRVT message). This will become the calling party address in the SCCP SRVR message handed to the MTP.

b) The Tested Originator address, copied from the prompting SRVT.

c) The address of OMAP at the node initiating the SRVT test.

   This is copied from the prompting SRVT message, and will become the called party address in the SCCP message handed over to the MTP.

d) The Tested Destination address (list).

e) An information field containing:

   i) for success:

      – the list of SCCP relay points crossed by the SRVT message;

   ii) for loop detected:

      – the list of SCCP relay points in the loop;

   iii) for "unknown Tested originator" or "unknown initiator OMAP":

      – the identity of the SCCP relay point returning the SRVA causing this SRVR to be sent;

   iv) for intermediate SP not an SCCP relay point:

      – the list of SCCP relay points crossed by the SRVT message, plus the node detecting the error;

   v) for an excessive length route:

      – the list of SCCP relay points crossed by the SRVT message;

   vi) for "unknown destination":

      – no additional information;

   vii) for timeout waiting for SRVA(s):

      – the identity of the relay point(s) from which the SRVA(s) should have been received;

   viii) for network failure causing inability to send SRVT (including MTP routing problem, a UDTS received from SCCP or inaccessible SCCP relay point):

      – the identity of the node(s) where failure occurred (PC plus network identity for this PC);

   ix) for test cannot be run due to local conditions:

      – no further information.

A.1.6 Sending the SRVT message(s) from the initiator OMAP

If there is a global title but no Point Code in the Tested Destination address, SCCP translation at this node needs to be called to return a PC (+ possibly an SSN).

If the above, or any SCCP translation at this node, does global title replacement, the SRVT message(s) to be sent out should contain an address list for the Tested Destination address, with the old version and the new, each in called party address format with the appropriate routing indicator and global title indicator.

SRVT "messages" are then constructed for all SCCP routes to the tested destination: both primary and alternative routes must be tested to verify that there are no loops.

Each SRVT "message" is passed through TC for onwards routing by SCCP and MTP.

A.1.7 Receipt of an SRVT message in OMAP

i) If the node receiving the SRVT message is neither a tested destination nor an SCCP relay point, an SRVA message indicating failure is sent, after any associated SRVR message, to OMAP of the node that sent the prompting SRVT. The "SRVR sent" indicator is set appropriately – if the node recognises the initiator OMAP address, then it sends an SRVR message to the initiator, otherwise the "SRVR sent" indicator in the SRVA message is set to "SRVR not sent".

A report is made to the local SP management, and the test stops.

ii) If local conditions do not allow the test to be run (e.g. resource shortage at this node), OMAP returns an SRVA message (after any associated SRVR message) to OMAP in the node that sent the SRVT, indicating failure. In addition, if the initiator OMAP address is recognised, an SRVR message would be sent to the initiator OMAP.

A report is made to the local SP management, and the test stops.

iii) OMAP then checks the Tested Originator address and also the initiator OMAP address, with the help of the SCCP routing function and tables. If either address is not known, an SRVA message is sent to the previous node, with the "SRVR sent" indicator marked as SRVR not sent. The test then stops, after reporting to the local SP management.

If the checks succeed,

iv) the Tested Destination address (list) is checked.

a) If there is a representation for this as PC + SSN, then the PC ought to be the node's own, and the SSN should be local. If either of these conditions is false, an SRVA is sent back to the previous node, after an SRVR is sent to the originator OMAP. A report is made to the local SP management and the test is stopped.

If the PC is the node's own, the SSN is local, and the calling party should sensibly access the called party for some service provided in the network, the test has succeeded. An SRVA is sent to the previous node indicating "success", after an SRVR is returned to the originator OMAP if requested. The test is then stopped.

b) If the Tested Destination address indicates route on global title, SCCP translation is used to obtain a PC.

If the translation indicates multiple (parallel or serial) translation points exist, PCs are derived for each.

If the translation indicates that multiple destinations exist, all PCs for these destinations are derived.

In the above, replacement GTs will result in additional addresses being inserted into the Tested Destination address list.

If any PC obtained is the node's own, then an SSN should also be obtained and should be a local one. OMAP then proceeds as in iv) a) above.

If no PC is the node's own:

– if the threshold of SCCP relay points is exceeded, an SRVA is returned to the prompting node, indicating failure, after an SRVR is sent to the initiating OMAP. A report is made to the local SP management, and the test stops.

Otherwise,

the list of crossed SCCP relay points is examined. The presence of any address (as an entry or forming part of an address list) that is used by this node to reach the Tested Destination means that a loop has been found. An SRVA is returned to the previous node, after an SRVR to the initiator OMAP, and the test is stopped.

– If the list does not contain any such address, a check is made that the MTP recognises the PC(s) obtained for routing to the Tested Destination. If the MTP does not recognise such a PC, an SRVA indicating failure is sent to the OMAP that sent the prompting SRVT, after an SRVR is sent to the initiator OMAP. The local SP management is informed, and the test is stopped.

Otherwise,

the checks have succeeded, the SRVT timer is started, and SRVT messages are sent out on all SCCP routes used to reach the tested destination. Where global title translation indicates that multiple destinations exist, then SRVT messages are sent to all destinations of the set.

A.1.8 Receipt of an SRVA message

If this is the last expected SRVA message, the test timer is stopped.

If the SRVA message indicates failure or partial success, its failure reason is "ored" with any other SRVA failure reason obtained in this test.

If this OMAP is the initiator OMAP, the Tested Originato's SSN should be checked to see if it is still local (if not, "or" this into the failure reason also).

A report is then made to management.

If this OMAP is not the initiator, an SRVA is constructed when all SRVAs expected are received, or the test timer expires, and, if the received SRVA did not indicate success, and did indicate an SRVR has not been sent, an SRVR is constructed and sent.

A.1.9 Receipt of an SRVR message in non-originator OMAP

This can occur if an SCCP detects an unknown destination, in which case the receiving OMAP starts an SRVT test if appropriate.

If the OMAP is being asked to relay the SRVR to an originator OMAP, the action to be taken is as in the section above describing the SRVR contents.

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