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SERIES E: OVERALL NETWORK OPERATION,
TELEPHONE SERVICE, SERVICE OPERATION AND
HUMAN FACTORS

Operation, numbering, routing and mobile services – ISDN
provisions concerning users – International routing plan

Routing guidelines for efficient routing methods

ITU-T Recommendation E.352

(Formerly CCITT Recommendation)

ITU-T E-SERIES RECOMMENDATIONS
OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS

OPERATION, NUMBERING, ROUTING AND MOBILE SERVICES

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ROUTING GUIDELINES FOR EFFICIENT ROUTING METHODS

Summary

Routing policies typically used in ATM- and IP-based networks do not fully consider the possible instabilities and drastic loss of throughput that can occur under congestion. Use of bandwidth reservation and avoidance of long paths are recommended under such congestion, which can lead to more efficient use of network resources. Also, there is an emphasis in ATM- and IP-based networks on the use of state-dependent-routing (SDR) methods. However, the flooding methods typically used by these SDR methods to disseminate network status information can lead to inefficient use of network resources. Use of event-dependent-routing (EDR) methods and/or more efficient dissemination of network status information are recommended as other possible approaches to consider. Finally, QoS routing rules are recommended to ensure service performance quality, such as avoidance of excessive transfer delay by limiting the number of satellite hops in an end-to-end connection.

Source

ITU-T Recommendation E.352 was prepared by ITU-T Study Group 2 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 13 March 2000.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. 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, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

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Introduction

There are many network operators who have implemented multiple networks using different protocols, which include Public Switched Telephone Networks (PSTNs) which use Time Division Multiplexing (TDM) technology, Asynchronous Transfer Mode (ATM) technology, and/or Internet Protocol (IP) technology. Various routing protocols are used in TDM-, ATM-, and IP-based networks. In TDM-based networks, for example, Recommendation E.350 describes fixed and dynamic routing methods for use in TDM-based networks. In ATM-based networks, for example, the Private Network-Network Interface (PNNI) standard adopted by the ATM Forum [ATM960055] provides for exchange of node and link status information, automatic update and synchronization of topology databases, and dynamic route selection based on topology and status information. In IP-based networks, for example, the open shortest path first (OSPF) and other standards adopted by the Internet Engineering Task Force [M98] and [S95] provide for many of the same features as PNNI, but in a connectionless IP-based packet network. OSPF also provides for exchange of node and link status information, automatic update and synchronization of topology databases, and dynamic route selection based on topology and status information.

This Recommendation addresses guidelines for efficient routing methods that have been studied, learned, and implemented over many years of experience in TDM-based networks. These routing guidelines and methods are applicable as well to ATM- and IP-based networks, and are recommended for these networks. It is noted in the Recommendation that routing policies typically used in ATM- and IP-based networks do not fully consider the possible instabilities and drastic loss of throughput that can occur under congestion. Use of bandwidth reservation and avoidance of long paths are recommended under such congestion, which can lead to more efficient use of network resources. Also, there is an emphasis in ATM- and IP-based networks on the use of state-dependent-routing (SDR) methods. However, the flooding methods typically used by these SDR methods to disseminate network status information can lead to inefficient use of network resources. Use of event-dependent-routing (EDR) methods and/or more efficient dissemination of network status information are recommended as other possible approaches to consider. Finally, QoS routing rules are recommended to ensure service performance quality, such as avoidance of excessive transfer delay by limiting the number of satellite hops in an end-to-end connection.

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ROUTING GUIDELINES FOR EFFICIENT ROUTING METHODS

(Geneva, 2000)

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1 Scope

This Recommendation provides guidelines for the design of routing methods within TDM-, ATM-, and IP-based networks, and makes particular recommendations on bandwidth reservation, route selection, and QoS routing. It recommends these guidelines based on established practice, particularly as applied within TDM-based PSTN networks, and addresses the cases when PSTN's evolve to incorporate IP- or ATM-based technology. Guidelines on routing methods are covered in clause 5, and examples are given in clause 6 for the use of the routing methods.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the