

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Q.4103

(02/2022)

SERIES Q: SWITCHING AND SIGNALLING, AND
ASSOCIATED MEASUREMENTS AND TESTS

Protocols and signalling for peer-to-peer communications

Hybrid peer-to-peer communications: Overlay management protocol

Recommendation ITU-T Q.4103

ITU-T

ITU-T Q-SERIES RECOMMENDATIONS
SWITCHING AND SIGNALLING, AND ASSOCIATED MEASUREMENTS AND TESTS

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4, 5, 6, R1 AND R2	Q.120–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
Q3 INTERFACE	Q.800–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
SPECIFICATIONS OF SIGNALLING RELATED TO BEARER INDEPENDENT CALL CONTROL (BICC)	Q.1900–Q.1999
BROADBAND ISDN	Q.2000–Q.2999
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR THE NGN	Q.3000–Q.3709
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR SDN	Q.3710–Q.3899
TESTING SPECIFICATIONS	Q.3900–Q.4099
PROTOCOLS AND SIGNALLING FOR PEER-TO-PEER COMMUNICATIONS	Q.4100–Q.4139
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2020	Q.5000–Q.5049
COMBATING COUNTERFEITING AND STOLEN ICT DEVICES	Q.5050–Q.5069

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Q.4103

Hybrid peer-to-peer communications: Overlay management protocol

Summary

Recommendation ITU-T Q.4103 specifies a hybrid peer-to-peer overlay network management protocol that runs on the interface between a hybrid peer and a hybrid overlay management server. This protocol provides management functionalities such as creation, removal, retrieval, and update, and describes the behaviour of protocols including the specifications of protocol messages.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Q.4103	2022-02-13	11	11.1002/1000/14924

Keywords

Hybrid peer-to-peer, overlay management, overlay network, protocol.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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Table of Contents

	Page
1 Scope.....	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere	1
3.2 Terms defined in this Recommendation.....	2
4 Abbreviations and acronyms	2
5 Conventions	2
6 Resource element types and message syntax of HOMP.....	2
6.1 Resource elements.....	2
6.2 Messages syntaxes.....	5
7 Protocol operations and information flows.....	15
7.1 Hybrid overlay network management	15
7.2 Hybrid overlay peer management	18
Bibliography.....	21

Recommendation ITU-T Q.4103

Hybrid peer-to-peer communications: Overlay management protocol

1 Scope

This Recommendation describes the overlay management protocol for hybrid peer-to-peer communications as follows:

- protocol elements;
- protocol messages and its parameters;
- protocol behaviours including information flow.

2 References

The following ITU-T Recommendations and other references contain provisions that, 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; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T Q.4100] Recommendation ITU-T Q.4100 (2020), *Hybrid peer-to-peer communications: Functional architecture*.
- [ITU-T Q.4101] Recommendation ITU-T Q.4101 (2021), *Hybrid peer-to-peer communications: Tree and data recovery procedures*.
- [IETF RFC 7159] IETF RFC 7159 (2014), *The JavaScript Object Notation (JSON) Data Interchange Format*.
- [IETF RFC 7231] IETF RFC 7231 (2014), *Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 hybrid overlay network [ITU-T Q.4100]: A peer-to-peer overlay network in which participating peers exchange data using the pull and push method. The hybrid overlay network also provides a way to organize and maintain a tree-style path for pushing data to all peers without loops, as well as fetching data from other peers simultaneously.

3.1.2 hybrid peer [ITU-T Q.4100]: A peer capable of exchanging data using mesh-based and tree-based methods running over a hybrid overlay network.

3.1.3 overlay network [b-ITU-T X.1162]: An overlay network is a virtual network that runs on top of another network. Like any other network, the overlay network comprises a set of nodes and links between them. Because the links are logical ones, they may correspond to many physical links of the underlying network.

3.1.4 peer [b-ITU-T X.1161]: Communication node on a P2P network that functions simultaneously as both "client" and "server" to the other nodes on the network.

3.1.5 peer-to-peer (P2P) [b-ITU-T Y.2206]: A system is considered to be P2P if the nodes of the system share their resources in order to provide the service the system supports. The nodes in the system both provide services to other nodes and request services from other nodes.

NOTE – Peer is the node in a P2P system.

3.1.6 reference point [b-ITU-T Y.2012]: A conceptual point at the conjunction of two non-overlapping functional entities that can be used to identify the type of information passing between these functional entities.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

FQDN Fully Qualified Domain Name

HOMP Hybrid Overlay Management Protocol

HON Hybrid Overlay Network

HP2P Hybrid Peer-to-Peer

IoT Internet of Things

P2P Peer-to-Peer

URI Uniform Resource Identifier

5 Conventions

Resource elements in clause 6.1 and fields of the message under clause 6.2 are encoded in JavaScript object notation (JSON) [IETF RFC 7159], and the grammar used in representing objects defined in this Recommendation is as follows:

- "STRING", "BOOLEAN", "DICT", "LIST" and "NUMBER" types are used to indicate string, Boolean, dictionary, list and number, respectively;
- An array of collective values are enclosed in brackets "[]" with values separated by commas ",";
- Selective options are separated by a vertical bar " | ".

6 Resource element types and message syntax of HOMP

This clause describes the message formats for the hybrid overlay management protocol (HOMP). For extensibility, HOMP is a representational state transfer (REST) architecture [b-Fielding] and messages are encoded in JavaScript object notation (JSON) [IETF RFC 7159].

6.1 Resource elements

This clause specifies the basic resource elements to be used for conveying information regarding the activities on the overlay network.

6.1.1 OVERLAY_INFO

The OVERLAY_INFO element include details about a hybrid overlay network (HON). This element contains overlay network attributes as shown in the following Table 6-1:

Table 6-1 – OVERLAY_INFO resource element

Keyword	Type	Description
overlay-id	STRING	<i>overlay-id</i> is an identifier for a specific HON.
title	STRING	<i>title</i> is a human readable description on the HON.
type	STRING	<i>type</i> indicates the type of the HON, and it should be one of 'core' or 'sub'.
sub-type	STRING	<i>sub-type</i> indicates the shape of the overlay topology, and it should be one of 'tree' or 'mesh'.
owner-id	STRING	<i>owner-id</i> indicates the peer identifier who created the HON.
expires	NUMBER	<i>expires</i> indicates the time that the HON will be removed in seconds.
status	OVERLAY_STATUS	<i>status</i> indicates the status of the HON such as the number of peers, peer list, and human readable status like 'active', 'terminated', etc.
description	STRING	<i>descriptions</i> provide more detailed information regarding the HON.
heartbeat-interval	NUMBER	<i>heartbeat-interval</i> indicates the interval for checking the aliveness of peers.
heartbeat-timeout	NUMBER	<i>heartbeat-timeout</i> indicates when a peer decides a corresponding peer is no longer alive.
auth	OVERLAY_AUTH	<i>auth</i> includes the authentication information to be used for access control to the HON.
cr-policy	CR_POLICY	<i>cr-policy</i> includes caching and recovery policies for the tree and data recovery policies of the HON.
trans-policy	TRANS_POLICY	<i>trans-policy</i> includes policy regarding data broadcasting floor control.

6.1.2 PEER_INFO

The PEER_INFO element includes details about peer information such as peer identifier, the network address and authentication information as shown in the following Table 6-2.

Table 6-2 – PEER_INFO resource element

Keyword	Type	Description
peer-id	STRING	<i>peer-id</i> includes the identifier of a hybrid peer.
Address	STRING	<i>Address</i> includes the network address that another peer is able to access.
auth	PEER_AUTH	<i>auth</i> includes authentication information needed for establishing a connection among peers.

6.1.3 OVERLAY_AUTH

The OVERLAY_AUTH element includes authentication details for managing the overlay network as shown in the following Table 6-3. This element is used for creating and manipulating the attributes of a hybrid overlay network.