



ATIS-0800019

MULTICAST NETWORK SERVICE SPECIFICATION



ATIS is the leading technical planning and standards development organization committed to the rapid development of global, market-driven standards for the information, entertainment and communications industry. More than 250 companies actively formulate standards in ATIS' 20 Committees, covering issues including: IPTV, Service Oriented Networks, Home Networking, Energy Efficiency, IP-Based and Wireless Technologies, Quality of Service, Billing and Operational Support. In addition, numerous Incubators, Focus and Exploratory Groups address emerging industry priorities including "Green", IP Downloadable Security, Next Generation Carrier Interconnect, IPv6 and Convergence.

ATIS is the North American Organizational Partner for the 3rd Generation Partnership Project (3GPP), a member and major U.S. contributor to the International Telecommunication Union (ITU) Radio and Telecommunications' Sectors, and a member of the Inter-American Telecommunication Commission (CITEL). For more information, please visit < <http://www.atis.org> >.

---

### Notice of Disclaimer & Limitation of Liability

The information provided in this document is directed solely to professionals who have the appropriate degree of experience to understand and interpret its contents in accordance with generally accepted engineering or other professional standards and applicable regulations. No recommendation as to products or vendors is made or should be implied.

NO REPRESENTATION OR WARRANTY IS MADE THAT THE INFORMATION IS TECHNICALLY ACCURATE OR SUFFICIENT OR CONFORMS TO ANY STATUTE, GOVERNMENTAL RULE OR REGULATION, AND FURTHER, NO REPRESENTATION OR WARRANTY IS MADE OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. ATIS SHALL NOT BE LIABLE, BEYOND THE AMOUNT OF ANY SUM RECEIVED IN PAYMENT BY ATIS FOR THIS DOCUMENT, WITH RESPECT TO ANY CLAIM, AND IN NO EVENT SHALL ATIS BE LIABLE FOR LOST PROFITS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES. ATIS EXPRESSLY ADVISES ANY AND ALL USE OF OR RELIANCE UPON THIS INFORMATION PROVIDED IN THIS DOCUMENT IS AT THE RISK OF THE USER.

NOTE - The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to whether use of an invention covered by patent rights will be required, and if any such use is required no position is taken regarding the validity of this claim or any patent rights in connection therewith.

---

### ATIS-0800019, *Multicast Network Service Specification*

Is an ATIS Standard developed by the **Architecture (ARCH)** Committee under the **ATIS IPTV Interoperability Forum (IIF)**.

Published by

**Alliance for Telecommunications Industry Solutions**  
**1200 G Street, NW, Suite 500**  
**Washington, DC 20005**

Copyright © 2009 by Alliance for Telecommunications Industry Solutions  
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher. For information contact ATIS at 202.628.6380. ATIS is online at < <http://www.atis.org> >.

Printed in the United States of America.

## MULTICAST NETWORK SERVICE SPECIFICATION

Alliance for Telecommunications Industry Solutions

Approved September 8, 2009

### Abstract

The multicast service must have a baseline set of requirements to ensure interoperability between the service provider IPTV multicast applications, the network provider domain, the home network, and the IPTV Terminal Function. This document describes an IP multicast service that the network provider can provide for use as a basis for a linear/broadcast TV service.

## FOREWORD

---

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The IPTV Interoperability Forum (IIF) develops requirements, standards, and specifications that will determine the industry's end-to-end solution for Internet Protocol Television (IPTV).

The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages. The word *may* denotes an optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, IIF Staff, 1200 G Street NW, Suite 500, Washington, DC 20005.

The Architecture (ARCH) Committee was responsible for the development of this document, with the leadership of the following people:

- D. O'Callaghan, IIF Chair
- R. Brand, IIF Vice Chair
- R. Sharpe, ARCH Committee Co-Chair
- S. Wright, ARCH Committee Co-Chair
- P. Anderson, Technical Editor
- C.A. Underkoffler, ATIS Chief Editor
- A. Blasgen, IIF Committee Administrator

## CONTRIBUTORS

---

Randy Sharpe, Alcatel-Lucent  
 Rajesh Vale, Alcatel-Lucent  
 Phyllis Anderson, AT&T  
 Steven Wright, AT&T  
 Simon Jones, BT  
 Nadine Guillaume, Cisco  
 Ray Killick, Cisco  
 George Foti, Ericsson  
 Kevin Boyle, Huawei  
 Scott Shoaf, Juniper Networks  
 Robert Sprouse, Juniper Networks  
 Michael Dolan, Microsoft  
 Mowaffak Midani, Motorola  
 Jayne Jacobs, Motorola  
 Shan Wey, Nokia Siemens Networks  
 Jean-Yves Bernard, Rogers Communications  
 Joe Buehl, Tandberg Television, part of the Ericsson Group  
 Matthew Goldman, Tandberg Television, part of the Ericsson Group  
 Richard Brand, Verivue  
 Michael Hluchyj, Verivue  
 Dan O'Callaghan, Verizon  
 Reza Shafiq, Verizon

## TABLE OF CONTENTS

---

<b>1 INTRODUCTION</b> .....	<b>1</b>
1.1 PURPOSE.....	1
1.2 SCOPE.....	1
<b>2 NORMATIVE REFERENCES</b> .....	<b>2</b>
<b>3 DEFINITIONS, ACRONYMS, &amp; ABBREVIATIONS</b> .....	<b>3</b>
3.1 DEFINITIONS.....	3
3.2 ACRONYMS & ABBREVIATIONS.....	3
<b>4 BACKGROUND: MULTICAST SERVICE DESCRIPTION</b> .....	<b>6</b>
4.1 MULTICAST SERVICE INTERFACE POINTS.....	7
4.2 MULTICAST SERVICE VARIANTS.....	9
4.2.1 <i>Transit Intra-Domain Transport</i> .....	10
4.2.2 <i>Consumer IPTV Multicast Delivery Service</i> .....	11
<b>5 MULTICAST SERVICE TECHNICAL REQUIREMENTS</b> .....	<b>11</b>
5.1 GENERAL REQUIREMENTS FOR THE CREATION OF A MULTICAST SERVICE.....	12
5.2 NETWORK AND SERVICE ATTACHMENT.....	13
5.3 GENERAL REQUIREMENTS FOR MULTICAST IN THE CONSUMER DOMAIN.....	14
5.3.1 <i>Quality of Experience</i> .....	15
5.3.2 <i>Security and Subscriber Control</i> .....	17
5.4 NETWORK OPERATIONS AND CONTROL.....	18
5.5 NGN MODEL SUPPORT.....	18
<b>6 MULTICAST SPECIFICATIONS</b> .....	<b>19</b>
6.1 GENERAL SPECIFICATIONS FOR THE CREATION OF A MULTICAST SERVICE.....	20
6.1.1 <i>General Multicast Specifications for IPv4</i> .....	20
6.1.2 <i>General Multicast Specifications for IPv6</i> .....	20
6.1.3 <i>Transit Intra-Domain Transport Specifications</i> .....	21
6.2 CONSUMER DOMAIN MULTICAST SPECIFICATIONS.....	24
6.2.1 <i>Consumer IPTV Service Delivery Specifications</i> .....	24
6.2.2 <i>Consumer Service Security</i> .....	25
6.2.3 <i>Consumer Domain Attachment Specifications</i> .....	26
6.3 NETWORK OPERATION AND CONTROL.....	29
6.3.1 <i>Multicast Group Assignment and Policy</i> .....	29
6.3.2 <i>Remote Trouble Resolution</i> .....	30
6.3.3 <i>Multicast Accounting</i> .....	31
6.3.4 <i>Multicast Group Access Authorization</i> .....	31
6.3.4 <i>Error Recovery</i> .....	31
6.3.5 <i>Location Information</i> .....	31
6.4 MULTICAST SPECIFICATIONS FOR RESOURCE MANAGEMENT.....	31
6.4.1 <i>Resource Oversubscription in Next Generation Networks (NGNs)</i> .....	32
6.4.2 <i>Access Resource Management for Multicast Applications</i> .....	33
6.4.3 <i>Core Resource Management for Multicast Applications</i> .....	36
<b>APPENDIX A: MULTICAST DISTRIBUTION TECHNOLOGIES</b> .....	<b>37</b>
A.1 MULTICAST DISTRIBUTION TREE FUNDAMENTALS.....	37
A.1.1 <i>Selective Trees and Aggregate Trees</i> .....	37
A.1.2 <i>Node and Link Resiliency</i> .....	37
A.1.3 <i>Deterministic Path Control</i> .....	38

A.2 MULTICAST DISTRIBUTION ARCHITECTURES.....	38
A.2.1 <i>Native IP Multicast Trees</i> .....	38
A.2.2 <i>Spoke Multicast Trees</i> .....	38
A.2.3 <i>Point to Multipoint Multiprotocol Label Switching (P2MP MPLS) Trees</i> .....	39
<b>APPENDIX B: MULTICAST SUPPORT IN THE ACCESS NETWORK.....</b>	<b>40</b>
B.1 MULTICAST OVER A SWITCHED DSL NETWORK .....	40
B.2 MULTICAST OVER A PON NETWORK.....	42
B.3 MULTICAST OVER A MOBILE NETWORK.....	44

## TABLE OF FIGURES

FIGURE 1: MULTICAST SERVICE WITH NETWORK REPLICATION .....	7
FIGURE 2: IPTV FUNCTIONAL DOMAINS.....	8
FIGURE 3: IPTV NETWORK REFERENCE ARCHITECTURE .....	9
FIGURE 4: IPTV MULTICAST SERVICE VARIANTS .....	10
FIGURE 5: SERVICE DISCOVERY PROCESS.....	13
FIGURE 6: MULTICAST TRANSPORT RESILIENCY OPTIONS .....	22
FIGURE 7: FAULT PROTECTION BETWEEN SP NODES AND CONSUMER ITF.....	25
FIGURE 8: HOME NETWORK LAYOUT.....	27
FIGURE 9: BANDWIDTH OVERSUBSCRIPTION .....	32
FIGURE 10: TEMPORAL OVERSUBSCRIPTION.....	33
FIGURE 11: RACF AND SERVICE CONTROL FUNCTION SIGNALING.....	34
FIGURE 12: MCP IN THE DATA PLANE .....	35
FIGURE 13: GENERIC XDSL NETWORK.....	41
FIGURE 14: XDSL IGMP JOIN MESSAGING.....	41
FIGURE 15: XDSL IGMP GENERAL MEMBERSHIP QUERIES AND REPORTS.....	42
FIGURE 16: GENERIC PON NETWORK.....	42
FIGURE 17: XPON IGMP JOIN MESSAGING .....	43
FIGURE 18: XPON IGMP GENERAL MEMBERSHIP QUERIES AND REPORTS .....	44

ATIS Standard on

# Multicast Network Service Specification

## 1 INTRODUCTION

Linear/Broadcast internet protocol television (IPTV) utilizes internet protocol (IP) multicast to efficiently deliver IP-encapsulated video content between video processing sites and ultimately to the IPTV Terminal Function (ITF). The network-level efficiencies are achieved through the creation of a multicast distribution tree for each multicast group (or aggregate trees where applicable). Each multicast group equates to a video stream. Instead of tuning to a specific stream, with all channels being received, the ITF selectively “joins” a multicast group and becomes a leaf node for that group’s distribution tree so that only the requested channels are sent into the consumer domain.

Because of these interactions between the ITF and the network to modify and attach to the multicast distribution tree, the multicast service must have a baseline set of requirements to ensure interoperability between the service provider IPTV multicast applications, the network provider domain, the home network, and the ITF. The baseline requirements should also encompass the resiliency, responsiveness, manageability, and security of the multicast service network.

NOTE – For clarity this document refers to “video” in relation to multicast groups. In reality, the multicast groups may represent audio or informational content that may be bound by the same or a similar set of service requirements.

### 1.1 Purpose

This document describes an IP multicast service that the network provider can provide for use as a basis for a linear/broadcast TV service. The intent is to focus on the service requirements from the perspective of the IPTV service provider rather than detail specific implementation mechanisms within the network operator domain, although a minimum set of network specifications is provided in section 6.1.3.1.

This document satisfies the requirements for multicast defined in ATIS-0800002, *IPTV Architecture Requirements*. These requirements are delineated in section 5 of this document.

### 1.2 Scope

The scope of this document is multicast that is sourced in the service stratum, delivered over the Next Generation Network (NGN) transport network, and terminated in the service stratum at another level of network hierarchy or in the consumer domain.

This specification is primarily concerned with multicast as a service provided by the network provider. Multicast functions may occur in other domains (e.g., the consumer’s home network) and must also adhere to the multicast service requirements, and are therefore considered within the scope of the multicast specification.

## 2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this ATIS Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this ATIS Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

- [1] ATIS-0800002, *IPTV Architecture Requirements*, September 12, 2006.<sup>1</sup>
- [2] ATIS-0800005, *IPTV Packet Loss Issue Report*, January 11, 2007.<sup>1</sup>
- [3] ATIS-0800013, *Media Formats and Protocols for IPTV Services*, January 30, 2009.<sup>1</sup>
- [4] ATIS-0800018, *IPTV Linear TV Service*, January 30, 2009.<sup>1</sup>
- [5] Broadband Forum TR-101, *Migration to Ethernet Based DSL Aggregation*, April 2006.<sup>2</sup>
- [6] ETSI TISPAN 102 034: *Digital Video Broadcasting (DVB); Transport of MPEG-2 Base Layer DVB Services over IP Based Networks*, Version 1.4.1.<sup>3</sup>
- [7] ETSI TISPAN 182 019, *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Content Delivery Network (CDN) architecture - Interconnection with TISPAN IPTV architectures; Draft 2/25/09*.<sup>3</sup>
- [8] IETF RFC 1112, *Host Extensions for IP Multicasting*, August 1989.<sup>4</sup>
- [9] IETF RFC 2236, *Internet Group Management Protocol, Version 1*, November 1997.<sup>4</sup>
- [10] IETF RFC 2710, *Multicast Listener Discovery (MLD) for IPv6*, October 1999.<sup>4</sup>
- [11] IETF RFC 3261, *SIP: Session Initiation Protocol*, June 2002.<sup>4</sup>
- [12] IETF RFC 3376, *Internet Group Management Protocol Version 3*, October 2002.<sup>4</sup>
- [13] IETF RFC 3810, *Multicast Listener Discovery Version 2 (MLDv2) for IPv6*, June 2004.<sup>4</sup>
- [14] IETF RFC 4604, *Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast*, August 2006.<sup>4</sup>
- [15] IETF RFC 4607, *Source-Specific Multicast for IP*, August 2006.<sup>4</sup>
- [16] IETF RFC 4608, *Source-Specific Protocol Independent Multicast in 232/8*, August 2006.<sup>4</sup>
- [17] ITU-T Y.2111, *Resource and admission control functions in Next Generation Networks*, November 2008.<sup>5</sup>

---

<sup>1</sup> This document is available from the Alliance for Telecommunications Industry Solutions, 1200 G Street N.W., Suite 500, Washington, DC 20005. <<http://www.atis.org>>

<sup>2</sup> This document is available from the Broadband Forum. <[www.broadband-forum.org/technical](http://www.broadband-forum.org/technical)>

<sup>3</sup> This document is available from ETSI TISPAN. <<http://www.etsi.org/tispan/>>

<sup>4</sup> This document is available from the IETF. <<http://tools.ietf.org/>>

<sup>5</sup> This document is available from the International Telecommunications Union. <<http://www.itu.int/ITU-T/>>