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SERIES J: CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

IPCablecom

IPCablecom management event mechanism

ITU-T Recommendation J.172

ITU-T J-SERIES RECOMMENDATIONS

CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

General Recommendations	J.1–J.9
General specifications for analogue sound-programme transmission	J.10–J.19
Performance characteristics of analogue sound-programme circuits	J.20–J.29
Equipment and lines used for analogue sound-programme circuits	J.30–J.39
Digital encoders for analogue sound-programme signals	J.40–J.49
Digital transmission of sound-programme signals	J.50–J.59
Circuits for analogue television transmission	J.60–J.69
Analogue television transmission over metallic lines and interconnection with radio-relay links	J.70–J.79
Digital transmission of television signals	J.80–J.89
Ancillary digital services for television transmission	J.90–J.99
Operational requirements and methods for television transmission	J.100–J.109
Interactive systems for digital television distribution	J.110–J.129
Transport of MPEG-2 signals on packetised networks	J.130–J.139
Measurement of the quality of service	J.140–J.149
Digital television distribution through local subscriber networks	J.150–J.159
IPCablecom	**J.160–J.179**
Miscellaneous	J.180–J.199
Application for Interactive Digital Television	J.200–J.209

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

ITU-T Recommendation J.172

IPCablecom management event mechanism

Summary

This Recommendation defines the Management Event Mechanism that IPCablecom elements can use to report asynchronous events that indicate malfunction situations and notification about important non-fault situations.

Source

ITU-T Recommendation J.172 was prepared by ITU-T Study Group 9 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 February 2002.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 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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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

ITU-T Recommendation J.172

IPCablecom management event mechanism

1 Scope

This Recommendation defines the Management Event Mechanism that IPCablecom elements can use to report asynchronous events that indicate malfunction situations and notification about important non-fault situations.

Events are defined in this Recommendation as conditions requiring the reporting of information to management systems and/or a local log.

A goal of IPCablecom is to maintain consistency with the Cable Modem event-reporting mechanisms.

Appendix I contains the specific IPCablecom management event identifiers.

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; 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.

2.1 Normative references

- ITU-T Recommendation J.164 (2001), *Event message requirements for the support of real-time services over cable television networks using cable modems*.
- ITU-T Recommendation J.167 (2001), *Media terminal adapter (MTA) device provisioning requirements for the delivery of real-time services over cable television networks using cable modems*.
- ITU-T Recommendation M.3100 (1995), *Generic network information model*.
- ITU-T Recommendation X.733 (1992), *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function*.

2.2 Informative references

- ITU-T Recommendation J.160 (2002), *Architectural framework for the delivery of time-critical services over cable television networks using cable modems*.
- ITU-T Recommendation J.166 (2001), *IPCablecom management information base (MIB) framework*.
- ITU-T Recommendation J.168 (2001), *IPCablecom media terminal adapter (MTA) MIB requirements*.
- IETF RFC 2573 (1999), *SNMP Applications*.
- IETF RFC 2670 (1999), *Radio Frequency (RF) Interface Management Information Base for MCNS/DOCSIS compliant RF interfaces*.

3 Terms and Definitions

This Recommendation defines the following terms:

3.1 access node: As used in this Recommendation, an Access Node is a layer two termination device that terminates the network end of the J.112 connection. It is technology specific. In J.112 Annex A it is called the INA, while in Annex B it is the CMTS.

4 Abbreviations, acronyms and conventions

4.1 Abbreviations and acronyms

The IPCablecom project uses the following abbreviations and acronyms.

AN	Access Node
CMS	Call Management Server
FQDN	Fully Qualified Domain Name (Refer to IETF RFC 821 for details.)
IANA	Internet Assigned Numbers Authority
MAC	Media Access Control
MGC	Media Gateway Controller
MIB	Management Information Base
MTA	Media Terminal Adapter
OSS	Operations Support System
SNMP	Simple Network Management Protocol
UDP	User Datagram Protocol

4.2 Conventions

If this Recommendation is implemented, the keywords "MUST" and "SHALL" as well as "REQUIRED" are to be interpreted as indicating a mandatory aspect of this Recommendation.

The keywords indicating a certain level of significance of a particular requirement that are used throughout this Recommendation are summarized below:

"MUST"	This word or the adjective "REQUIRED" means that the item is an absolute requirement of this Recommendation.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this Recommendation.
"SHOULD"	This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or event useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

5 Background

The IPCablecom architecture is an end-end broadband architecture that supports voice, video, and other multimedia services. The individual components that compose the IPCablecom architecture are defined in ITU-T Rec. J.160.

The OSS back office contains business, service, and network management components supporting the core business processes.

The IPCablecom set of Recommendations defines a limited set of OSS functional components and interfaces to support MTA device provisioning, Event Messaging to carry billing information, and the Management Event Mechanism defined in this Recommendation to carry fault and other data.

In addition to the Management Event Mechanism, the IPCablecom architecture supports the following additional reporting mechanism:

- *ITU-T Rec. J.164 IPCablecom event messages*. This reporting mechanism uses the RADIUS transport protocol, a pre-defined set of Event Message attributes (e.g. BillingCorrelationID, CalledPartyNumber, TrunkGroupID, etc.), and the IPCablecom Event Messages data format to carry per-call information between IPCablecom network elements (CMS, AN, MGC) and a Record Keeping Server (RKS). For each call, the RKS combines all associated Event Messages into a single Call Detail Record (CDR) which may be sent to a back-office billing, fraud detection or other system. Vendor-proprietary data attributes may be included along with the IPCablecom-defined set of attributes in an IPCablecom Event Message.
- *Other reporting methods*. It is possible that IPCablecom elements implement reporting methods specified in Cable Modem MIBs, IPCablecom MIBs or other standard MIBs. It is possible that IPCablecom elements implement methods such as SNMPv3, CMIP, TL1. These event-reporting mechanisms are not defined in this Recommendation.

6 IPCablecom Management Event Mechanism functional requirements

The functional requirements addressed by the message event mechanism Recommendation are as follows:

1) An event report MUST provide the MAC address.
2) The event report MUST provide either the FQDN or IP address of the reporting device.
3) The IPCablecom management event reporting mechanism MUST support two types of events: pre-defined and programmable. Examples of programmable events are the Primary Line telemetry events. Both IPCablecom-specific and vendor-specific pre-defined events MUST be supported.
4) The management event reporting mechanism MUST support the provisioning and viewing of the programmable events.
5) The IPCablecom management event reporting mechanism MUST support SYSLOG.
6) The management event reporting mechanism MUST support SNMPv3 TRAPS, SNMPv3 INFORMS.
7) The management event reporting mechanism MUST be to able to integrate with the notification MIBS in IETF RFC 2573 since these MIBs provide the mechanism for distributing SNMPv3 TRAPS and INFORMS. The elements MUST support a mechanism to allow the element management system to map each event to a reported notification mechanism(s). For example: none, local, SYSLOG, SNMPv3 TRAP, SNMPv3 INFORM.
8) Each event MUST be uniquely identifiable to the point of origin such as a specific endpoint on an MTA.
9) The capability SHOULD exist to map event IDs to priorities in the back office.

10) IPCablecom elements MUST send a timestamp with each management event.

11) IPCablecom elements MUST send a severity level with each management event. Elements MAY use the Severity level within the network element to determine the order in which events are sent.

12) The severity level of management events generated by the network element MUST be modifiable on the IPCablecom element by the management system.

13) The display string of programmable management events generated by the IPCablecom element MUST be modifiable on the network element by the management system.

14) A default notification mechanism MUST be associated with each event.

15) IPCablecom-specific event definitions SHOULD contain a NULL display string in order to reduce memory requirements on the IPCablecom element.

16) Programmable event definitions MUST contain a display string.

17) Vendor-specific event definitions MAY contain a NULL display string in order to reduce memory requirements on the IPCablecom element.

18) Event throttling mechanism MUST be configurable by the management system.

19) All events are uniquely identified by vendor through the IANA assigned enterprise number. IPCablecom events use the IPCablecom IANA assigned enterprise number

20) An event MUST provide the Event ID of the event.

7 Management event reporting mechanism

The Management Event Mechanism and the associated Management Event Mechanism MIB MUST be implemented on the MTA.

The Management Event Mechanism and the associated Management Event Mechanism MIB MAY be implemented on any IPCablecom element such as the CMS, MGC, and others.

7.1 IPCablecom management event format

The format of an IPCablecom Management Event is made up of the following information:

- Event counter – Indicator of event sequence;
- Event time – Time of occurrence;
- Event severity – Severity of condition as defined in 7.4;
- Event enterprise number – Vendor-specific enterprise number;
- Event ID – Determines event function;
- Event text – Describes the event in human readable form;
- Mac address – Describes the MAC address of the device;
- FQDN/Endpoint ID – Describes the device FQDN and the specific endpoint associated with the event.

7.2 IPCablecom management event access method

The IPCablecom event access methods is defined through the use of SNMPv3 in the case of local log access and TRAP or INFORM access. The SYSLOG uses UDP packets to convey the event data.

For local event log access, an EMS MAY send SNMP GET, GET-NEXT or GET-BULK requests to the IPCablecom element, accessing rows of the local event table. Each row MUST contain the event data in the format as defined in 7.1.

The SYSLOG method of accessing events involves sending the events to a SYSLOG server via the UDP protocol to the UDP SYSLOG port as defined in ITU-T Rec. J.167. This event data MUST follow the event data format as defined in 7.1.

The SNMPv3 TRAP and INFORM access methods involve defining a notification within the IPCablecom MGMTEVENT MIB. The notification MUST contain the event data in the format as defined in 7.1.

Any notification MUST be generated according to the entries in the associated SNMPv3 tables described in IETF RFC 2573 in a vendor-dependent manner. These provide the ability to address one or more management systems, the option to send TRAPS or INFORMS, and specify the security requirements for each management system.

7.3 Management Event ID

IPCablecom management events are defined in an appendix of IPCablecom Recommendations. Not all IPCablecom Recommendations define management events. Each management event described in the appendix of an IPCablecom Recommendation is assigned an IPCablecom Event ID. For a complete list of IPCablecom Event IDs, refer to Appendix I.

7.4 Management Event severities

Each event is assigned an initial (default) IPCablecom MultiMedia-centric severity. The definitions for the IPCablecom MultiMedia-centric severities are loosely based on ITU-T Rec. M.3100 and OSI System Management Alarm Reporting Function X.733. IPCablecom expands on the definitions to include the following list:

- **critical(1)** – A service-affecting condition that requires immediate corrective action.
- **major(2)** – A service-affecting condition that requires urgent corrective action.
- **minor(3)** – A non-service-affecting fault condition which warrants corrective action in order to avoid a more serious fault.
- **warning(4)** – A potential or impending condition which can lead to a fault; diagnostic action is suggested.
- **information(5)** – Normal event meant to convey information.

Events, if they need to be cleared, MUST be cleared by other events.

Each application (e.g. Cable Modem, IPCablecom) has its own event space. There is no predetermined relationship of event severity defined or enforced between applications.

When managing events that affect multiple applications, two scenarios are possible. They are as follows:

1) A particular application is considered the master. The master application sends the multiple destination events to its element manager. The application's element manages then broadcasts that event to all other element managers that are interested in that event. Severity translation is vendor dependent.

2) When an event occurs, every application interested in that event has its own event notification data template defined. An event is then sent out by each interested application according to its event notification data template.

Event vendor in conjunction with the cable operators will implement its mechanism based on one of the scenarios described above.

7.4.1 Changing default event severities

The default event severity MUST be changeable to a different value for each given event via the SNMP interface.

7.5 Programmable events

7.5.1 Description

A programmable event is an event that looks at stimulus within or external to an element. The stimulus does not necessarily have a predefined definition among all cable operators or sites. The programming of these events is operator dependent and MUST have a display string that defines what occurs, such as "power fail". For example, the MTA MAY support a programmable event with event ID of SNMP TELEMETRY_EV1, default display string of "AC Power Fail" and a default severity of Critical.

7.5.2 Default display string change mechanism

The default display string text MUST be changeable via the SNMP interface.

7.6 Notification mechanism

The notification mechanism for each event MUST be programmable via the SNMP interface.

Each event MUST be able to be sent to one or more notification mechanisms.

The notification mechanism definitions are as follows:

- local: The event is stored locally on the device in which it is generated. The event can be retrieved via polling from the SNMP agent interface.
- trap: The event is sent via the SNMPv3 TRAP mechanism to the targeted management systems. Due to the unacknowledged nature of the SNMPv3 TRAP mechanism, these event notifications are not guaranteed to be delivered to the targeted management systems.
- inform: The event is sent via the SNMPv3 INFORM mechanism to the targeted management systems. Since the SNMPv3 INFORM mechanism is acknowledged, these events will be reliably transmitted to the targeted management systems.
- syslog: The event is sent to the SYSLOG server.
- none: No reporting action is taken; this is the equivalent of disabling the event. If "none" is specified, the other notification mechanism choices MUST be ignored.

7.7 Local log of events

The local log MUST be accessed via SNMP using the objects defined in the MGMTEVENT MIB. A vendor may provide alternative access procedures.

7.8 Event throttling

Throttling is implemented globally through a rate-based threshold mechanism, as defined in the IPCablecom MGMTEVENT MIB.

Control of the throttling mechanism is through a MIB object that specifies one of four states:

- Event generation inhibited – Events defined through the event mechanism are no longer sent via syslog, traps, or informs.
- Throttling inhibited – Events are sent without any throttling.
- Dynamic thresholding enabled – Threshold-based throttling is enabled.
- Manual thresholding enabled – Manual intervention is required to resume event generation after crossing the initial threshold halts event generation.

Manual intervention through setting a MIB object is used to resume event generation when manual thresholding is enabled.

Inhibiting the generation of events MUST be handled through the use of the MIB objects, one to specify a number of events, and another to specify a time period over which those events are generated. The default frequency is defined as 2 events per second in the MGMTEVENT MIB. When event generation exceeds this rate, no more events are sent via SYSLOG, traps, or informs. The throttling of local logging of events is vendor specific.

Dynamic thresholding requires setting MIB objects to resume events. One object specifies the number of events, and the other is the time period object specified above. The default frequency is defined as 1 event per second. This defines the rate at which event generation is resumed.

Threshold settings are not persistent, and MUST be reinitialized when the IPCablecom element reboots.

In addition to this mechanism, vendors may support other throttling mechanisms.

7.9 Severity and priority definition

7.9.1 **Severity** is the degree of failure related to a specific event by a reporting device. Three degrees of severity are commonly used:

- Critical – Used to indicate that a severe, service-affecting condition has occurred and that immediate corrective action is imperative, regardless of the time of day or day of the week.
- Major – Used for hardware and software conditions that indicate a serious disruption of service or the malfunctioning or failure of important circuits. These troubles require the immediate attention and response of a craftsperson to restore or maintain system capability. The urgency is less than in critical situations because of a lesser immediate or impending effect on service or system performance.
- Minor – Used for troubles that do not have a serious effect on service to customers or for troubles in circuits that are not essential to Network Element operation.

7.9.2 **Priority** is the precedence established by order of importance or urgency. The back office manages the priority of how and when a particular event is serviced based on the severity of the reported event. The following priority sequences for trouble notifications shall prevail:

- Critical alarms have the highest priority and shall be serviced before any major or minor alarms.
- Major alarms have higher priority than minor alarms and shall be serviced before any minor alarms.
- Minor alarms shall be serviced before non-alarmed trouble notifications.

8 IPCablecom Management Event data template

In order to ensure multi-vendor interoperability of network management functionality, the specific meaning of IPCablecom management events are defined. Because the IPCablecom management events are based on conditions identified in IPCablecom Recommendations, management events are defined in the appendix of the appropriate IPCablecom Recommendations.

The following table shows the data required to describe the meaning of IPCablecom management events. The data contained in this table is for informational purposes only; this table will contain specific data when added to the appendix of an IPCablecom Recommendation.

Example management event data						
Enterprise number	**Event name**	**Default severity for event raises**	**Default display string**	**Comments**	**Programmable/ Pre-defined**	**Associated events**
4491	PL-EV-1	minor	"AC Power Fail"	Telemetry pin 1 has been asserted.	Programmable	PL-EV-2
4491	PL-EV-2	minor	"AC Power Restore"	Telemetry pin 1 has been de-asserted.	Programmable	PL-EV-1
4491	PROV-EV-1	major	"MTA Missing Name"	The MTA was not provisioned with an FQDN.	Pre-defined	none

Appendix I

Management event identifiers

I.1 Introduction

IPCablecom elements generate OSS events to indicate an alarm or other noteworthy condition and may report these events using the IPCablecom Management Event Mechanism Recommendation. Events reported using the IPCablecom OSS event reporting mechanism must be identified by an EventID assigned in this appendix.

All events delivered by this Recommendation fit into two main categories: IPCablecom-specific and vendor-specific. The exact meaning of IPCablecom-specific events is defined in the individual IPCablecom Recommendations. The exact meaning of vendor-specific events is out of the scope of the IPCablecom project.

I.2 Event ID assignments

The EventID is a 32-bit unsigned integer.

- IPCablecom-specific EventIDs must be defined in the range of 0x00000000 (decimal 0) to 0xFFFFFFFF (decimal 4,294,967,295). It is expected that this range is sufficiently large to accommodate both IPCablecom-specific pre-defined EventIDs and IPCablecom-specific programmable EventIDs.
- For IPCablecom-specific pre-defined events, the EventID for the first event must be 0x00000000 and the EventID must be incremented by one for each additional event EventID assigned.
- For IPCablecom-specific programmable events, the EventID for the first event must be 0xFFFFFFFF and the EventID must be decremented by one for each additional EventID assigned.
- Vendor-specific EventIDs must be defined in the range of 0x00000000 (decimal 0) to 0xFFFFFFFF (decimal 4,294,967,295). It is expected that this range is sufficiently large to accommodate both vendor-specific pre-defined EventIDs and vendor-specific programmable EventIDs.

- Vendor-specific EventIDs must be unique for a particular vendor's enterprise number in sysObjectID.
- For vendor-specific pre-defined events, the EventID for the first event must be 0x00000000 and the EventID must be incremented by one for each additional EventID assigned.
- For IPCablecom programmable events, the EventID for the first event must be 0xFFFFFFFF and the EventID must be decremented by one for each additional EventID assigned.

I.2.1 IPCablecom-specific pre-defined event IDs

None defined at this time.

I.2.2 IPCablecom-specific programmable event IDs

IPCablecom-specific programmable event IDs			
Enterprise number	**IPCablecom event ID**	**Event name**	**IPCablecom Recommendation that defines the event**
4491	65,535	PL-EV-1	J.173
4491	65,534	PL-EV-2	J.173
4491	65,533	PL-EV-3	J.173
4491	65,532	PL-EV-4	J.173
4491	65,531	PL-EV-5	J.173
4491	65,530	PL-EV-6	J.173
4491	65,529	PL-EV-7	J.173
4491	65,528	PL-EV-8	J.173

I.2.3 Vendor-specific pre-defined event IDs

None will be defined at this time.

I.2.4 Vendor-specific programmable event IDs

None will be defined at this time.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	**Cable networks and transmission of television, sound programme and other multimedia signals**
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
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Series N	Maintenance: international sound programme and television transmission circuits
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Series P	Telephone transmission quality, telephone installations, local line networks
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