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General Switch Management Protocol (GSMP) Applicability

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Abstract

This memo provides an overview of the GSMP (General Switch Management Protocol) and includes information relating to its deployment in a IP network in an MPLS environment. It does not discuss deployment in an ATM (Asynchronous Transfer Mode) network or in a raw ethernet configuration.

1. Overview

The General Switch Management Protocol (GSMP) has been available to the IETF community for several years now as informational RFCs. Both GSMPv1.1 (released in March 1996 as RFC 1987 [2]) and GSMPv2.0 (released in August 1998 as RFC 2297 [3]) are available. Several vendors have implemented GSMPv1.1.

In V1.1 and V2 GSMP was intended only for use with ATM switches. During the course of the last two years, the GSMP working group has decided to expand the purview of GSMP to the point where it can be used to control a number of different kinds of switch and can thus live up to what its name indicates; a general switch management protocol. To do this, commands and arguments needed to be generalised and sections needed to be added, discussing the manner in which the generalised protocol could be applied to specific kinds of switches and port types. In short, the protocol has gone through major changes in the last 24 months.

GSMP provides an interface that can be used to separate the data forwarder from the routing and other control plane protocols such as LDP. As such it allows service providers to move away from monolithic systems that bundle the control plane and the data plane into a single tightly coupled system - usually in a single chassis. Separating the control components from the forwarding components and using GSMP for switch management, enables service providers to create multi-service systems composed of various vendors equipment. It also allows for a more dynamic means of adding services to their networks.

The IETF GSMP working group was established in the routing area because GSMP was being seen as an optional part of the MPLS solution. In a MPLS system, it is possible to run the routing protocols and label distribution protocols on one system while passing data across a generic switch, e.g., an ATM switch. GSMP provides the switch resource management mechanism needed in such a scenario.

GSMP has also been selected by the Multiservice Switching Forum (MSF) as its protocol of choice for the Switch Control Interface identified in their architecture. The MSF is an industry forum which, among its activities establishes their member's requirements and then works with the appropriate standards bodies to foster their goals. In the case of GSMP, the MSF presented the IETF GSMP Working Group with a set of requirements for GSMP. The working group has made a determined effort to comply with those requirements in its specifications.

2. GSMP V3 Document Set

The current version of GSMP is documented in 3 documents:

- GSMP: General Switch Management protocol V3 [5]

- GSMP-ENCAPS: General Switch Management Protocol (GSMP) Packet Encapsulations for Asynchronous Transfer Mode (ATM), Ethernet and Transmission Control Protocol (TCP) [4]

- GSMP-MIB: Definitions of Managed Objects for the General Switch Management Protocol [1]

3. General Description

The General Switch Management Protocol V3 (GSMPv3) [5], is a general purpose protocol to control a label switch. GSMP allows a controller to establish and release connections across the switch; add and delete leaves on a multicast connection; reserve resources; manage switch ports; request configuration information; and request statistics. It also allows the switch to inform the

controller of asynchronous events such as a link going down. The GSMPv3 protocol is asymmetric, the controller being the master and the switch being the slave.

A physical switch can be partitioned into many virtual switches. GSMPv3 does not provide support for defining switch partitions. GSMPv3 treats a virtual switch as if it were a physical switch.

GSMPv3 may be transported in three ways:

- GSMPv3 operation across an IP network is specified.

- GSMPv3 operation across an ATM virtual channel is specified.

- GSMPv3 operation across an Ethernet link is specified.

Other encapsulations are possible, but have not been defined. Encapsulations are defined in [4].

A label switch is a frame or cell switch that supports connection oriented switching using the exact match forwarding algorithm based on labels attached to incoming cells or frames.

A label switch may support multiple label types. However, each switch port can support only one label type. The label type supported by a given port is indicated in a port configuration message. Connections may be established between ports supporting different label types using the adaptation methods. GSMPv3 supports TLV labels similar to those defined in MPLS. Examples of labels which are defined include ATM, Frame Relay, DS1, DS3, E1, E3, MPLS Generic Labels and MPLS FECs.

A connection across a switch is formed by connecting an incoming labelled channel to one or more outgoing labelled channels. Connections are generally referenced by the input port on which they arrive and the label values of their incoming labelled channel. In some messages, connections are referenced by the output port.

GSMPv3 supports point-to-point and point-to-multipoint connections. A multipoint-to-point connection is specified by establishing multiple point-to-point connections, each of which specifies the same output label. A multipoint-to-multipoint connection is specified by establishing multiple point-to-multipoint connections each of which specifies a different input label with the same output labels.

In general a connection is established with a certain quality of service (QoS). GSMPv3 includes a default QoS Configuration and additionally allows the negotiation of alternative, optional QoS configurations. The default QoS Configuration includes three QoS Models: a default service model, a simple priority model and a QoS profile model. GSMPv3 also supports the reservation of resources when the labels are not yet known. This ability can be used in support of MPLS.

GSMP contains an adjacency protocol. The adjacency protocol is used to synchronise states across the link, to negotiate which version of the GSMP protocol to use, to discover the identity of the entity at the other end of a link, and to detect when it changes.

3.1 Switch Partitioning

In GSMPv3 switch partitioning is static and occurs prior to running the protocol. The partitions of a physical switch are isolated from each other by the implementation and the controller assumes that the resources allocated to a partition are at all times available to that partition and only that partition. A partition appears to its controller as a physical label switch. The resources allocated to a partition appear to the controller as if they were the actual physical resources of a physical switch. For example if the bandwidth of a port is divided among several partitions, each partition would appear to the controller to have its own independent port with its fixed set of resources.

GSMPv3 controls a partitioned switch through the use of a partition identifier that is carried in every GSMPv3 message. Each partition has a one-to-one control relationship with its own logical controller entity (which in the remainder of the document is referred to simply as a controller) and GSMPv3 independently maintains adjacency between each controller-partition pair.

3.2 Switch and controller interactions

Multiple switches may be controlled by a single controller using multiple instantiations of the protocol over separate control connections.

Alternatively, multiple controllers can control a single switch. Each controller would establish a control connection to the switch using the adjacency protocol. The adjacency mechanism maintains a state table indicating the control connections that are being maintained by the same partition. The switch provides information to the controller group about the number and identity of the attached controllers. It does nothing, however, to co-ordinate the activities

of the controllers, and will execute all commands as they are received. It is the controller group's responsibility to co-ordinate its use of the switch. This mechanism is most commonly used for controller redundancy and load sharing. Definition of the mechanism by which controllers use to co-ordinate their control is not within GSMPv3's scope.

3.3 Service support

All GSMPv3 switches support the default QoS Configuration. A GSMPv3 switch may additionally support one or more alternative QoS Configurations. GSMP includes a negotiation mechanism that allows a controller to select from the QoS configurations that a switch supports.

The default QoS Configuration includes three models:

The Service Model is based on service definitions found external to GSMP such as in CR-LDP, Integrated Services or ATM Service Categories. Each connection is assigned a specific service that defines the handling of the connection by the switch. Additionally, traffic parameters and traffic controls may be assigned to the connection depending on the assigned service.

In the Simple Abstract Model a connection is assigned a priority when it is established. It may be assumed that for connections that share the same output port, a cell or frame on a connection with a higher priority is much more likely to exit the switch before a cell or frame on a connection with a lower priority if they are both in the switch at the same time.

The QoS Profile Model provides a simple mechanism that allows QoS semantics defined externally to GSMP to be assigned to connections. Each profile is an opaque indicator that has been predefined in the controller and in the switch.

4. Summary of Message Set

The following table gives a summary of the messages defined in this version of the specification. It also makes a recommendation of the minimal set of messages that should be supported in an MPLS environment. These messages will be labelled as "Required", though the service provided by the other messages are essential for the operation of carrier quality controller/switch operations. GSMPv1.1 or GSMPv2 commands that are no longer support are marked as "Obsolete" and should no longer be used.

4.1 Messages Table

Message Name	Message Number	Status
Connection Management Messages		
Add Branch	16	Required
ATM Specific - VPC	26	
Delete Tree	18	
Verify Tree	19	Obsoleted
Delete All Input	20	
Delete All Output	21	
Delete Branches	17	Required
Move Output Branch	22	
ATM Specific - VPC	27	
Move Input Branch	23	
ATM Specific - VPC	28	
Port Management Messages		
Port Management	32	Required
Label Range	33	
State and Statistics Messages		
Connection Activity	48	
Port Statistics	49	Required
Connection Statistics	50	
QoS Class Statistics	51	Reserved
Report Connection State	52	
Configuration Messages		
Switch Configuration	64	Required
Port Configuration	65	Required
All Ports Configuration	66	Required
Service Configuration	67	
Reservation Messages		
Reservation Request	70	Required
Delete Reservation	71	Required
Delete All Reservations	72	
Event Messages		
Port Up	80	
Port Down	81	
Invalid Label	82	
New Port	83	
Dead Port	84	

Abstract and Resource Model Extension Messages
Reserved.Message Range.....200-249

Adjacency Protocol.....10 Required

5. Security Considerations

The security of GSMP's TCP/IP control channel has been addressed in [4]. For all uses of GSMP over an IP network, it is REQUIRED that GSMP be run over TCP/IP using the security considerations discussed in [4].

References

[1] Sjostrand, H., Buerkle, J. and B. Srinivasan, "Definitions of Managed Objects for the General Switch Management Protocol (GSMP)", RFC 3295, June 2002.

[2] Newman, P., Edwards, W., Hinden, R., Hoffman, E., Ching Liaw, F., Lyon, T. and Minshall, G., "Ipsilon's General Switch Management Protocol Specification Version 1.1", RFC 1987, August 1996.

[3] Newman, P., Edwards, W., Hinden, R., Hoffman, E., Ching Liaw, F., Lyon, T. and G. Minshall, "Ipsilon's General Switch Management Protocol Specification Version 2.0", RFC 2297, March 1998.

[4] Worster, T., Doria, A. and J. Buerkle, "General Switch Management Protocol (GSMP) Packet Encapsulations for Asynchronous Transfer Mode (ATM), Ethernet and Transmission Control Protocol (TCP)", RFC 3293, June 2002.

[5] Doria, A., Sundell, K., Hellstrand, F. and T. Worster, "General Switch Management Protocol (GSMP) V3", RFC 3292, June 2002.

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