The General Switch Management Protocol GSMP 2.0

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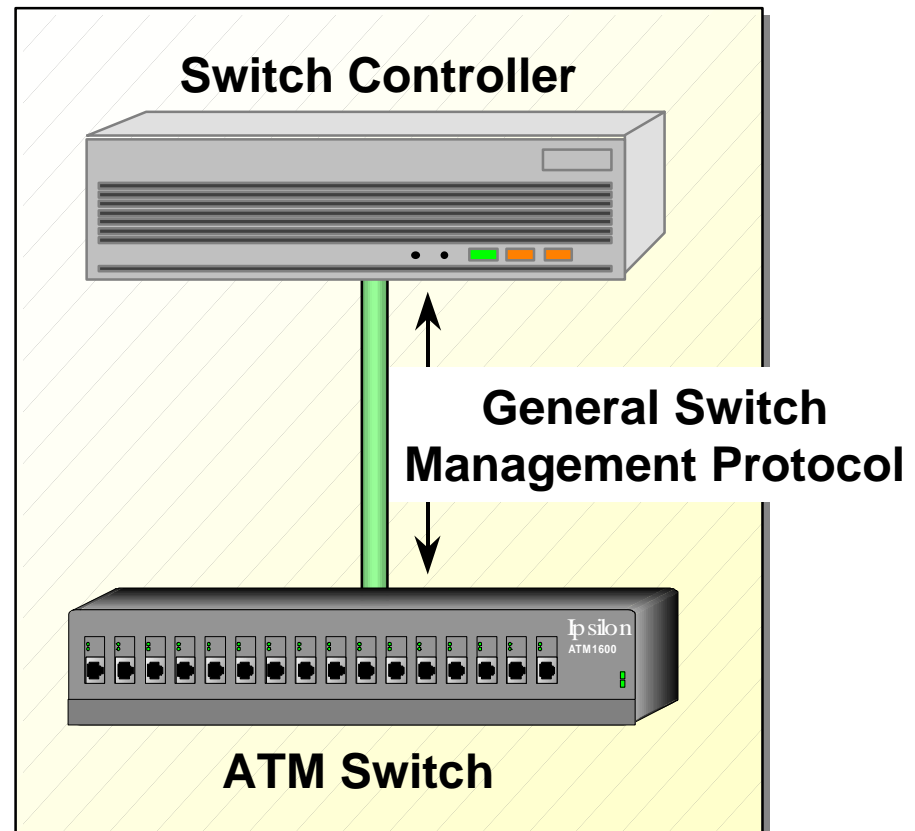http://www.ipsilon.com/~pn/gsmp/
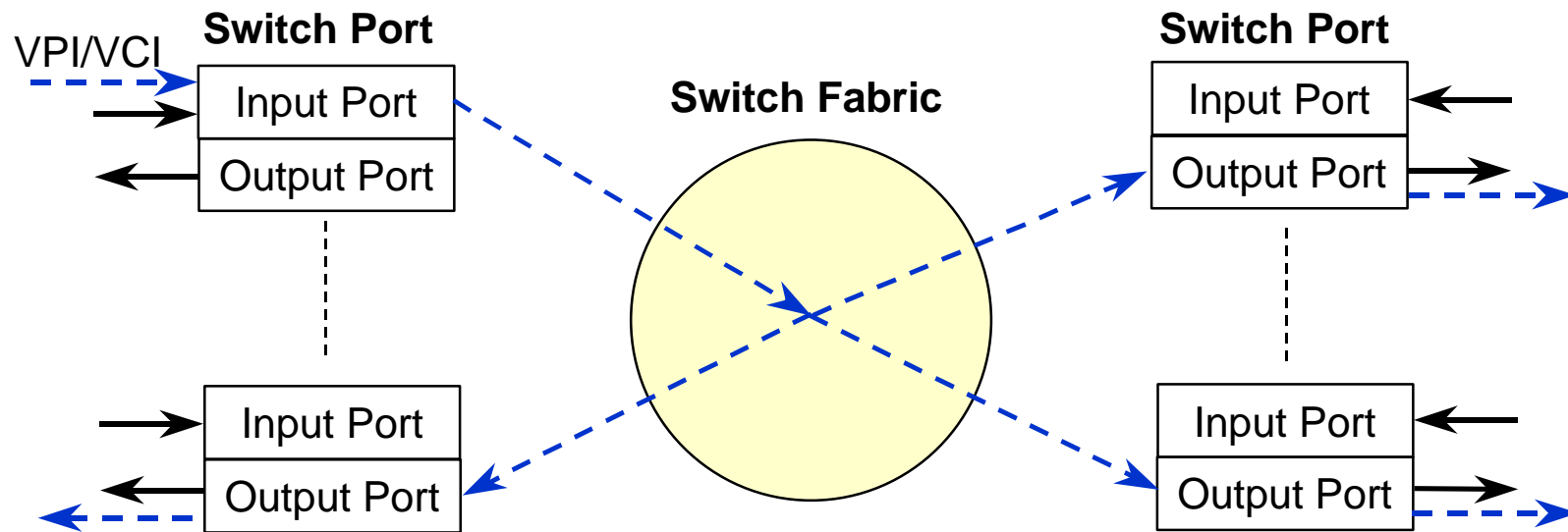
General Switch Management Protocol v1.1

GSMP (RFC 1987)

- **Simple protocol that provides call setup, tear-down, & call status**

- **As close to switch hardware as possible**

- **Capable of controlling all (reasonable) ATM switch designs**

- **Separates control software and switch hardware**

- **Less than 2,000 lines of code**

Switch Controller

General Switch Management Protocol

ATM Switch

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Abstract Switch Model

Switch Port

VPI/VCI

Input Port
Output Port

Switch Fabric

Switch Port

Input Port
Output Port

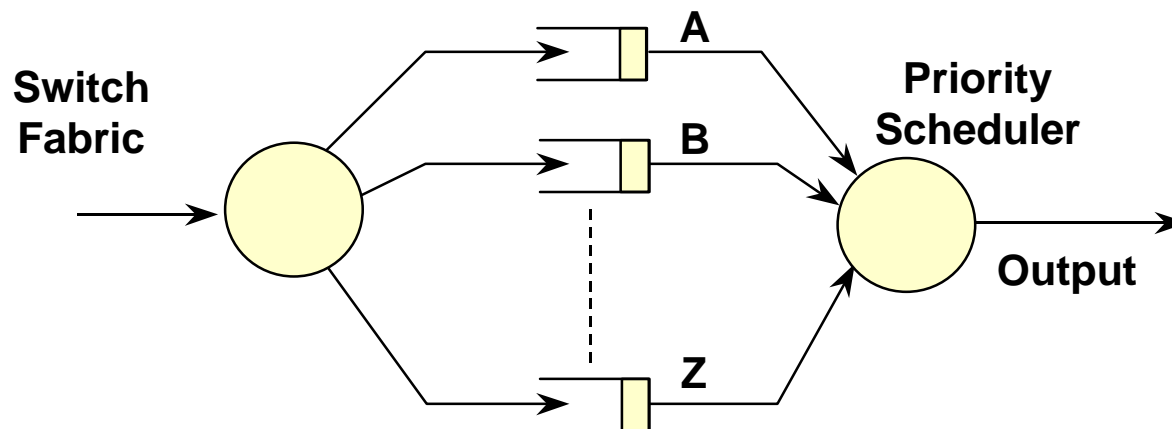| Input Port |
| --- |
| Output Port |

Input Port
Output Port

- *VPIs and VCIs are unidirectional*

- *VPI/VCI translation in Input Port*

- *VPI/VCI translation in Output Port for multicast*

- *Virtual connection identified by Input Port and VPI/VCI*

- *Internal and external loopback in switch port*

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Abstract Switch Model

Output Port

- *Assumes per-class FIFO queueing with priority scheduling.*
- *Switch declares number of priority queues at initialization*

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GSMP: Features

- **■ *Master-Slave, Request-Response Protocol***
  - *Controller (master) issues requests.*
  - *ATM switch issues positive or negative response when operation complete.*
  - *Positive response may be suppressed, for checking (bit-rot protection).*
  - *All messages are AAL-5 LLC/SNAP encapsulated.*
  - *Most frequent messages (connection management) are single-cell AAL-5 packets.*
  - *Adjacency protocol to synchronize state across the control link, to discover the identity of the peer entity, and to detect when it changes.*
  - *Event messages for switch to inform controller of asynchronous events.*
  - *Supports simple network management. For full service network management use SNMP.*

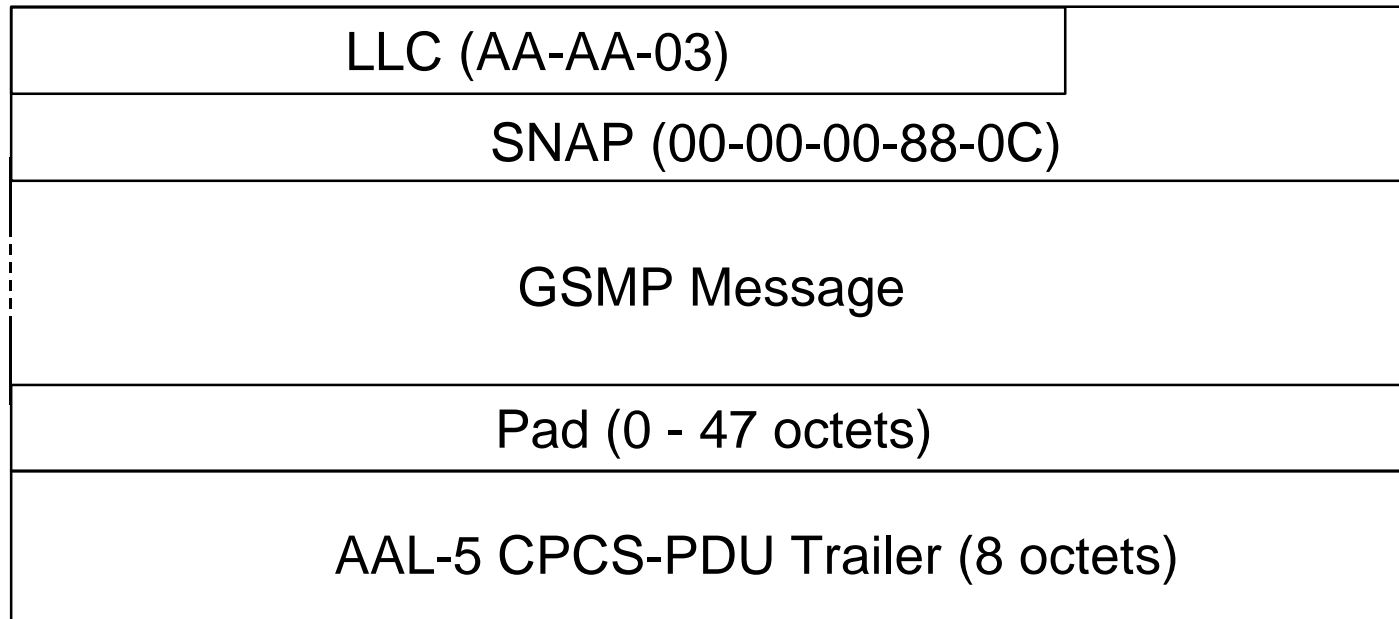IPSILON

GSMP: General

- **Port Numbers**
  - *32-bit opaque integers.*
  - *Port in the same location always has the same Port Number.*
  - *May be structured by the switch manufacturer (e.g. Slot, Shelf, Port) but structure opaque to GSMP.*
  - *Structure may be discovered by reference to database for purposes of network management.*

- **Port Session Number**
  - *32-bit random number that changes when the port becomes available or the line comes up.*
  - *Must use current Port Session Number to change state in a port.*
  - *Ensures controller detects link failure and keeps state synchronized across link.*
  - *Protects against out-of-date messages.*

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GSMP Encapsulation

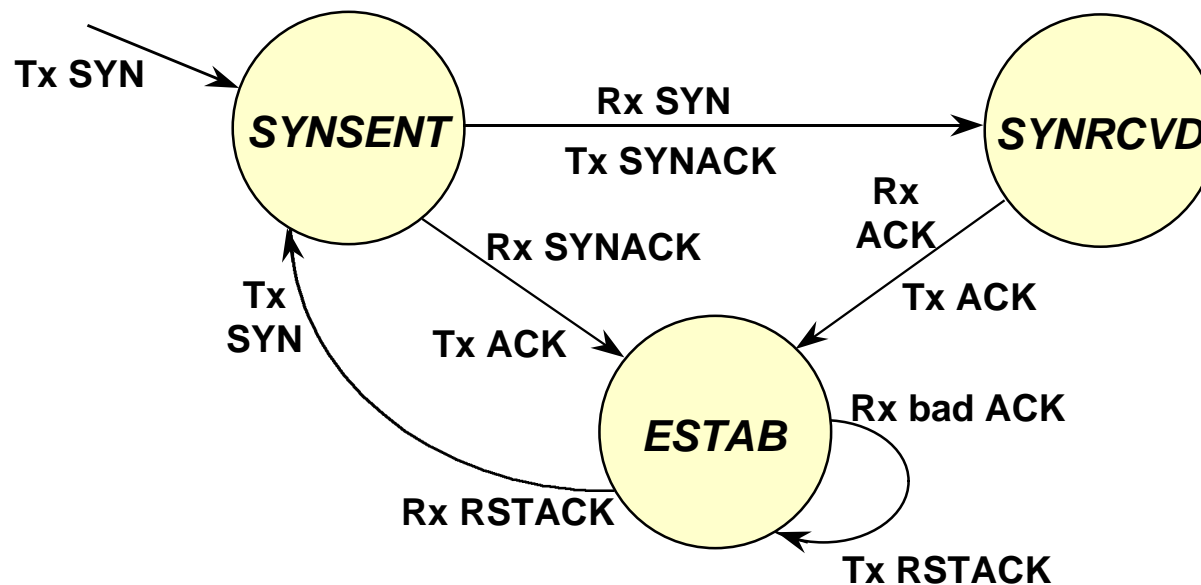| |
|---|
| LLC (AA-AA-03) |
| SNAP (00-00-00-88-0C) |
| GSMP Message |
| Pad (0 - 47 octets) |
| AAL-5 CPCS-PDU Trailer (8 octets) |

- *Ethertype for GSMP: 880C.*
- *Maximum transmission unit: 1500 bytes.*
- *Control connection: VPI=0, VCI=15.*

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Adjacency Protocol

- *Synchronizes state across the control link, discovers the identity of the remote entity, and detects when it changes.*

- *Periodically sends its identity (Name, Port Number, Instance Number) and identity of remote entity across control link.*

- *No other GSMP messages may be sent or received until Adjacency Protocol has reached ESTAB state.*

GSMP Message Format

Version	Message Type	Result	Code
Transaction Identifier			
Message Body			

- ## Message Types
  - Configuration, Connection Management, Port Management, Statistics, and Events.

- ## Result
  - Request: AckAll, NoSuccessAck.
  - Response: Success, Failure.

- ## Transaction Identifier
  - To associate response with request.

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Configuration Messages

- **Switch informs controller about its configuration.**

- **Switch Configuration**
  - Name, Rank, and Serial Number
  - Switch Name -- 48-bit MAC address, OUI identifies manufacturer
  - Switch Type -- manufacturer's product identifier

- **Port Configuration**
  - Port Session Number
  - VPI/VCI Ranges
  - Port Type -- Sonet, SDH, DS-3, etc. (IANAifTYPE MIB from RFC 1573)
  - Cell Rate -- in cells/s
  - Number of FIFO priority queues in output port
  - Port Status -- Available, Unavailable, Loopback
  - Line Status -- Up, Down, Test

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Connection Management

- **Parameters**
  - *Port Session Number of Input Port*
  - *Input Port VPI/VCI*
  - *Output Port VPI/VCI*
  - *Priority*

- **Messages**
  - *Add Branch, Move Branch*
  - *Delete Branch, Delete Tree, Delete All*
  - *Verify Tree*

- **No distinction between unicast and multicast**
  - *First Add Branch creates unicast connection.*
  - *Second Add Branch makes connection multicast.*

- **All messages single cell except Move Branch**

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Port Management

- **Parameters**
  - *Port Number, Port Session Number*
  - *Event Sequence Number, Event Flags*
  - *Loopback Duration*
- **Functions**
  - *Bring Up:*
    - *All connections deleted*
    - *New Port Session Number*
    - *Port becomes Available*
  - *Take Down: Port becomes Unavailable*
  - *Loopback: External, Internal, Both*
  - *Reset Input Port: Re-initialize port hardware*
  - *Reset Event Flags: Flow control for Event Messages*

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Statistics Messages

- ■ *VC Activity Detection*
  - • *Garbage collection for inactive VCs*

- ■ *Per Port and Per VC Statistics*
  - • *Input and Output Cell Counts*
  - • *Input and Output Frame Counts*
  - • *Input and Output Cell Discard Counts*
  - • *Input and Output Frame Discard Counts*
  - • *Input HEC Error Count*
  - • *Input Invalid VPI/VCI Count*

- ■ *Network Management*
  - • *If that's not enough use SNMP*

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Event Messages

- **Parameters**
  - *Port Number, Port Session Number*
  - *Event Sequence Number, VPI/VCI*
- **Events**
  - *Port Up: Carrier detected; New Port Session Number*
  - *Port Down: Carrier detect lost*
  - *Invalid VPI/VCI: Black hole prevention*
  - *New Port: Hot-swap, switch discovers new port*
  - *Dead Port: Hot-swap, existing port disappears*
- **Event Sequence Number incremented each time event occurs.**
- **Flow Control: One message per event type until acknowledged by Port Management Message**

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Not Supported in Version 1.1 (RFC 1987)

- *Virtual Path Switching*

- *UPC (policing) Parameters*

- *Per-VC or per-class queueing and weighted scheduling*

- *Enable/disable per VC functionality, e.g:*

  - *Selective discard*

  - *Early Packet Discard*

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GSMP 2.0 Enhancements

- *Quality of service messages.*

- *Virtual Path switching.*

- *Message to extract all connection state from a switch port.*

- *Message to reconfigure VPI and VCI ranges on a switch port.*

- *Message to delete a list of connections.*

- *More specific error message definitions.*

- *Window flow control to avoid overflow to receive buffer.*

- *Definition of loss of adjacency.*

- *Enhancement of adjacency protocol.*

- *Specification of set of mandatory messages.*

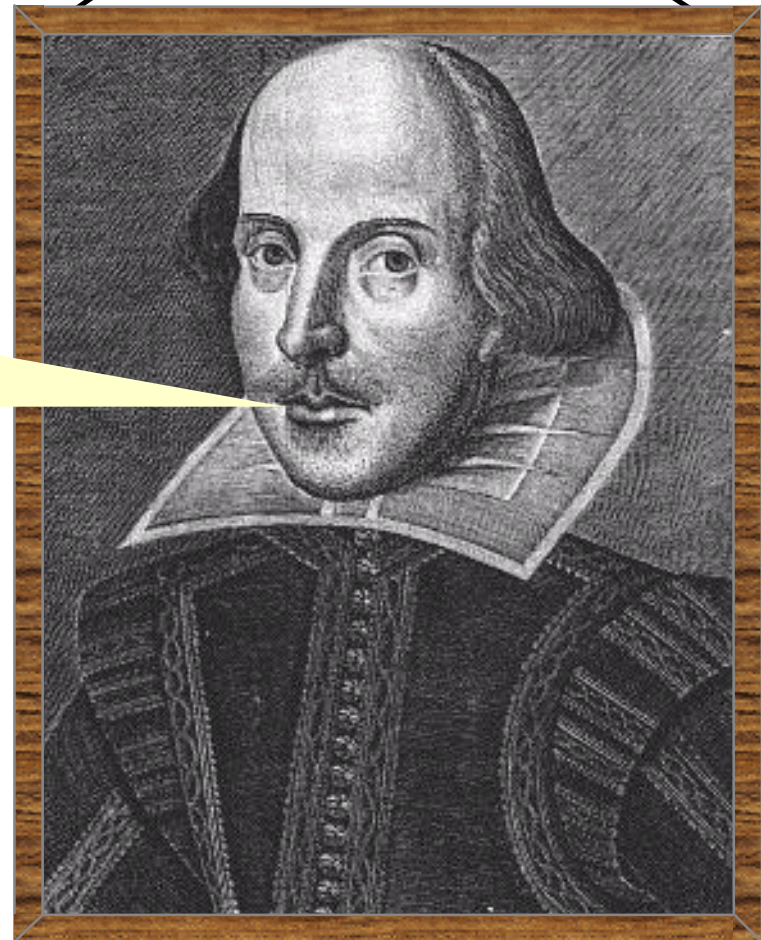- *Extension to multi-access link, Ethernet encapsulation.*

- *Version negotiation.*

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Quality of Service Enhancements…

The quality of service is constrained,
It droppeth as a gentle brick from heaven
Upon the hardware beneath…

"Quality of service does not generate additional bandwidth"
Lixia Zhang

Why Class-Based Queueing?
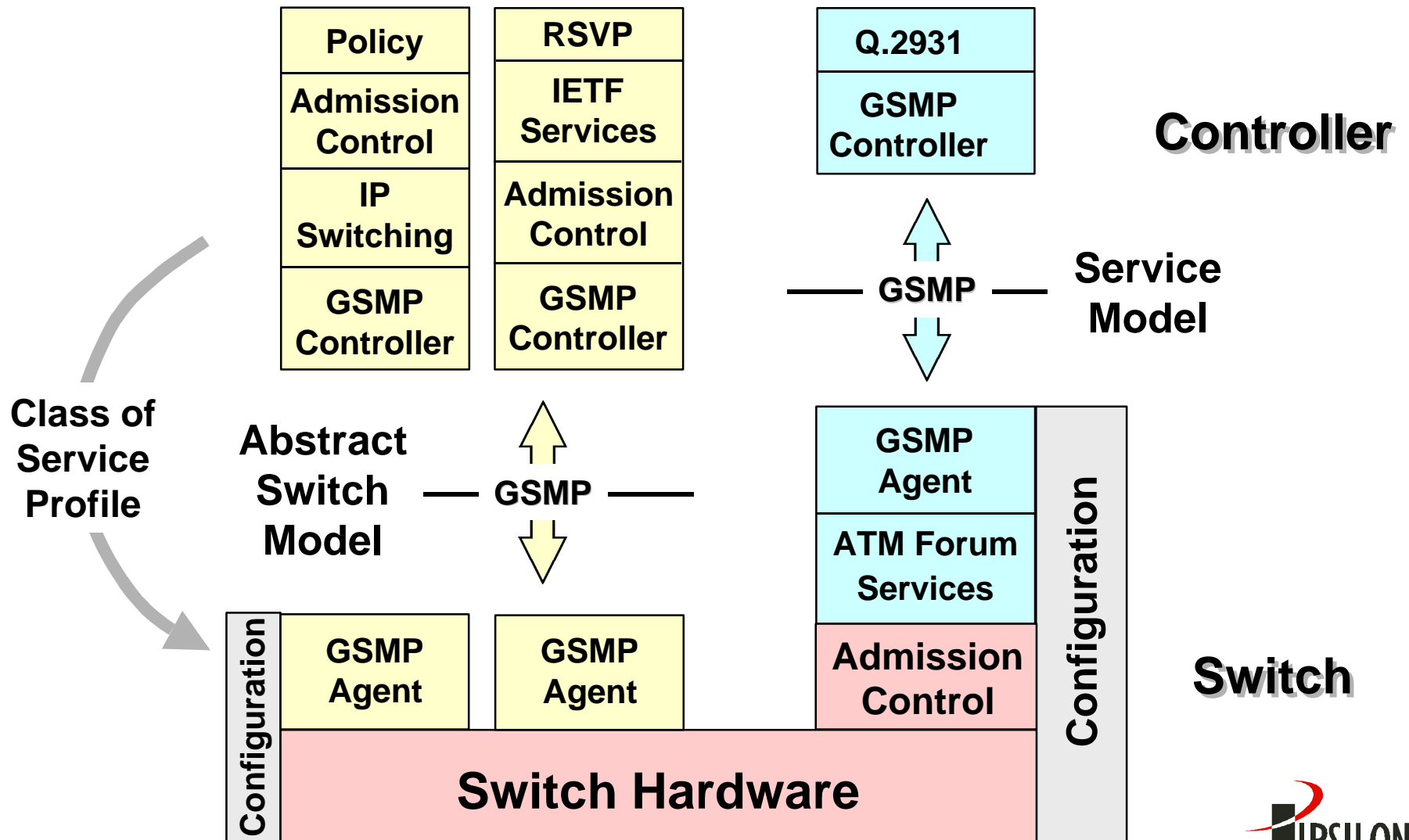
- **Aggregation**
  - Do you want to allocate resources to every call (flow)?
  - Do you want to allocate resources to every customer?
  - Answer:
    - It depends on who you are
    - It depends on what you want to do
- Aggregation allows a network operator to allocate resources to a class so that multiple calls (flows) share those resources.
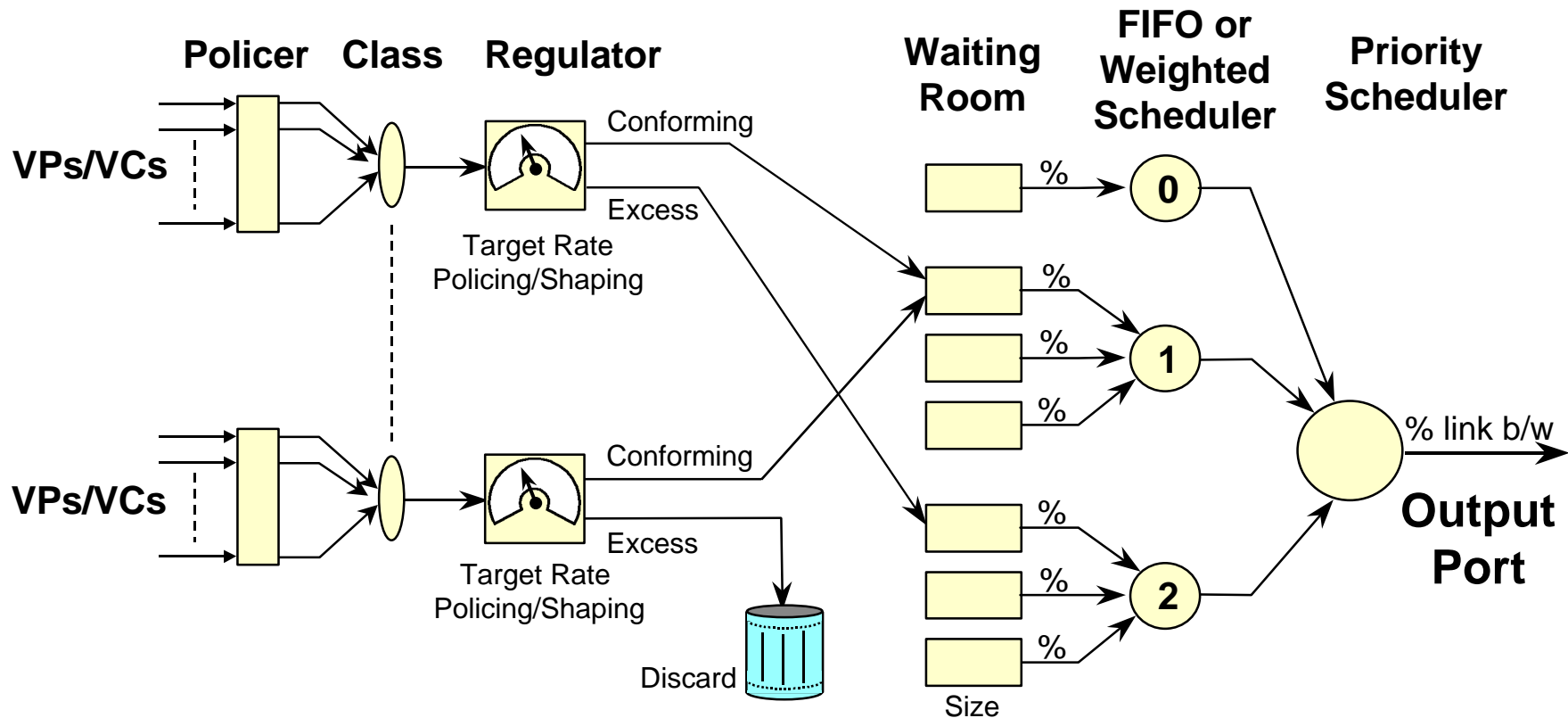- Alternative:
  - Each call allocated its own resources
  - Examples:
    - ATM Forum traffic management
    - Weighted fair queueing (classic)

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Architectural Model for GSMP with QoS

Policy	RSVP
Admission Control	IETF Services
IP Switching	Admission Control
GSMP Controller	GSMP Controller

Q.2931
GSMP Controller

Controller

Class of Service Profile

Abstract Switch Model — **GSMP** —

GSMP — Service Model

Configuration	GSMP Agent	GSMP Agent		GSMP Agent	Configuration
				ATM Forum Services	
				Admission Control	

Switch Hardware

Switch

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GSMP-QoS: Abstract Switch Model

- FIFO ordering of packets within a class must be preserved
- Regulator can offer policing function, shaping function, or none
- Waiting room selects class for next service opportunity and applies discard function when congested

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QoS Configuration Message

- Switch describes its QoS capabilities in terms of abstract switch model:

  - *Number of priority levels in priority scheduler*

  - *Capability for weighted sharing within a priority level*

  - *Capability for weighted sharing within a waiting room*

  - *Capability to merge multiple classes within a waiting room*

  - *Regulator:*   *Capable of policing*
    Capable of shaping for all priority levels
    Capable of shaping for highest priority level only
    Location: Input, output, centralized

  - *Excess capability for policer:* *Tagging*
    Discard
    Differentiated scheduling

  - *Excess capability for shaper:* *Tagging*
    Differentiated scheduling

  - *Maximum number of classes (zero: no support for aggregation)*

  - *Special capabilities:* *Frame-based scheduling*
    Packet discard, Discard threshold

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Scheduler Establishment

- QoS classes established dynamically

- First establish scheduler (not necessary if default values acceptable)

- Scheduler Establishment

  - *Scheduler identifier   0–255: default priorities*
    FFFF: reserved

  - *Priority level*

  - *Weight   '0': no weighted sharing*

  - *Discard threshold (in cells)*

  - *Enable frame-based scheduling*

  - *Enable packet discard*

  - *Enable internal weighted scheduling*

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Dynamic Class Establishment

■ Class establishment:

- *Class Identifier*

- *Regulator:*   *policing/shaping/none*

- *Peak Rate*

- *Max Burst Length*

- *Conforming traffic:*   *Scheduler Id*

- *Excess traffic:*   *Scheduler Id*
  'FFFF': discard excess traffic

- *Tagging*
- *Class Weight*

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Commercial GSMP 1.1 Implementations

- *Digital GigaSwitch/ATM*

- *GDC Apex*

- *NEC Atomis*

- *Hitachi*

- *Cabletron ZX 250*

- *IBM 8260*

- *US Robotics Stinger 5*

- *ATML Virata*

☞ **Your Switch Here**

Draft Specification of GSMP 2.0: http://www.ipsilon.com/~pn/gsmp

Comments: gsmp@ipsilon.com

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