



# Differentiated Services (DiffServ)

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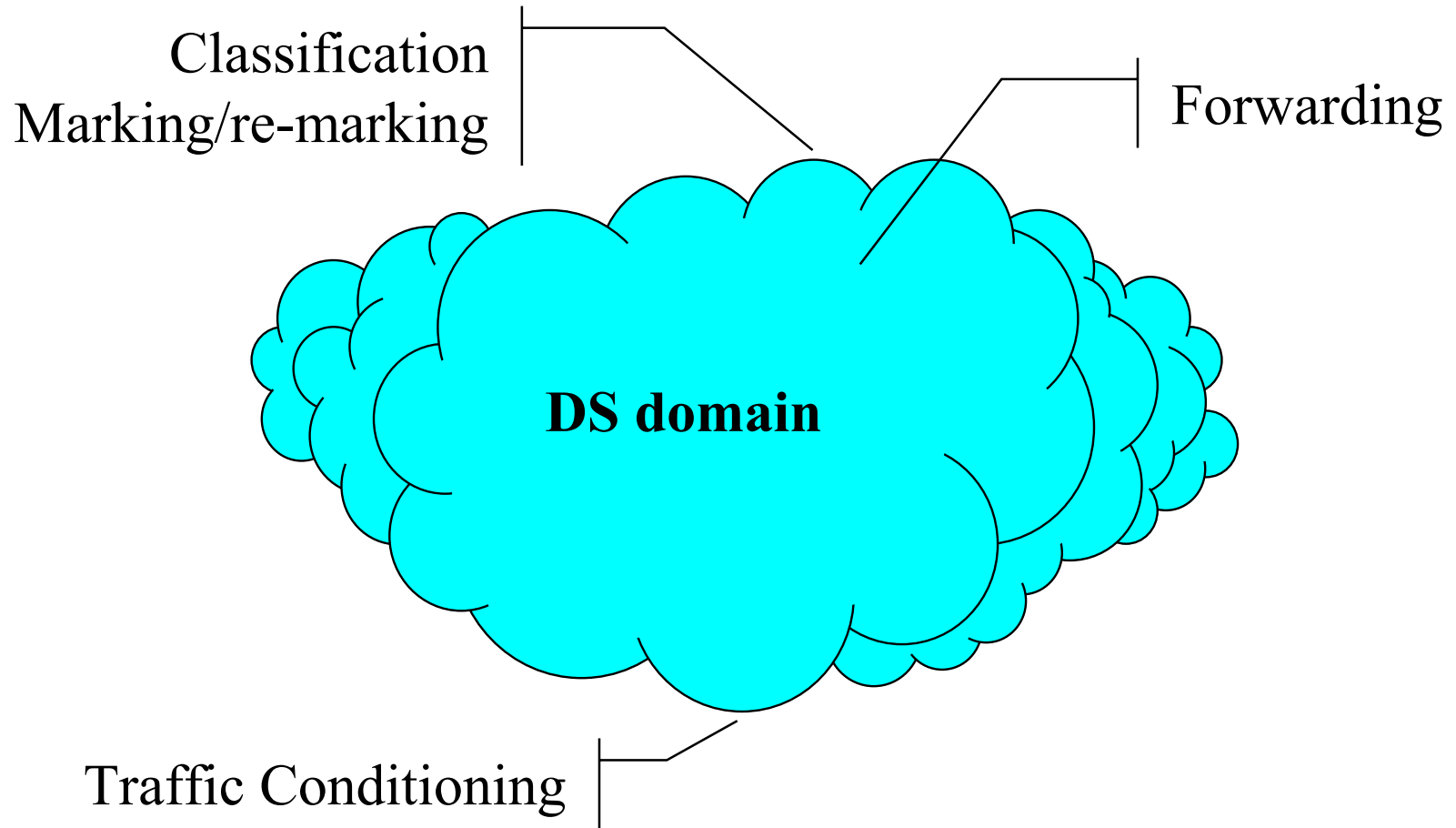




# Basic Principles

- DS Field
  - DS codepoint
- Policing and shaping (*traffic conditioning*) at the edges
- Per class handling in the core
- DS domain
- Service Level Agreement (SLA)
  - between customer and provider
  - between providers
- Service Level Specification (SLS)
  - Traffic Conditioning Specification (TCS)

# Architecture

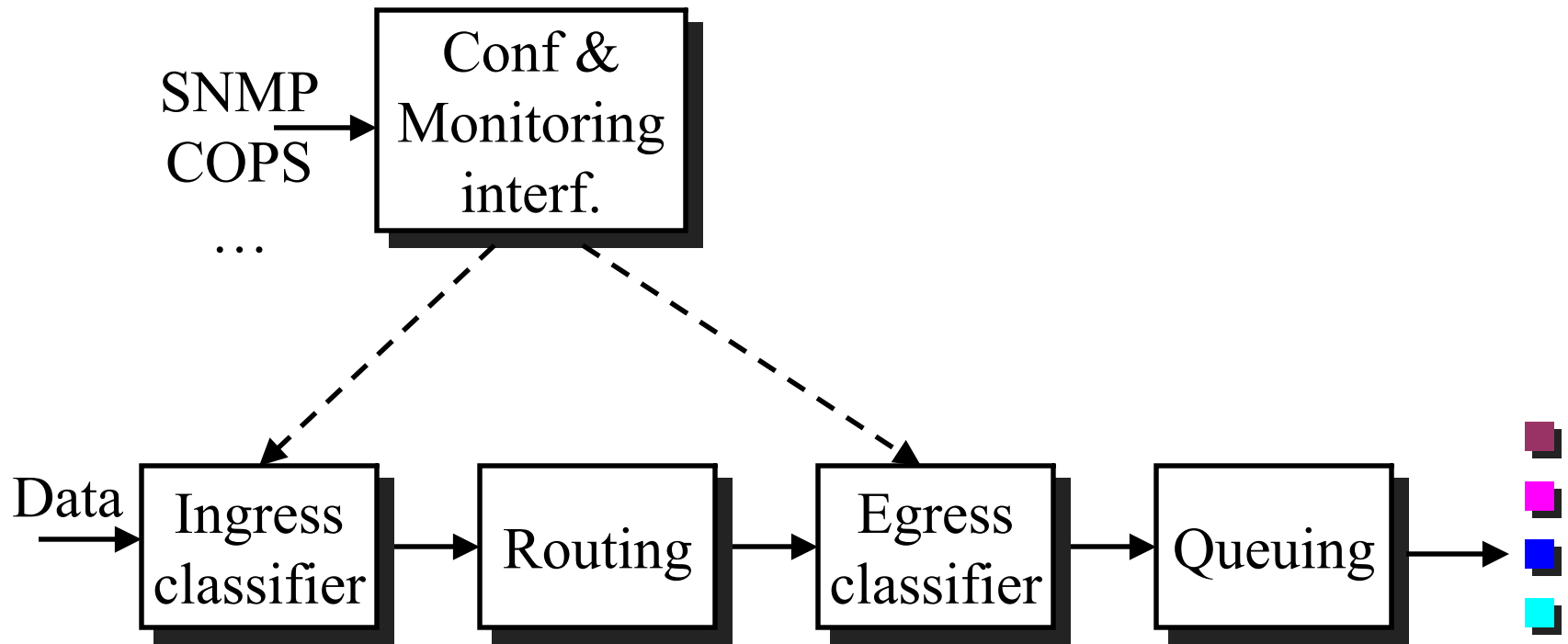




## DS Field

- 6 bits for codepoint
- 2 bits per ECN (explicit congestion notification)
  - Currently not used in practice
- DS codepoints compatible with old type of service (TOS)

# DiffServ Router Architecture






# Features

- No guarantees
- No per-flow (microflow) handling
  - No end-to-end service
- Simplicity
- Scalability



# Per Hop Behavior (PHB)

- Correspondence between DS codepoint and PHB
    - standardized
    - local to the DS domain
  - Re-marking
  - Implementation is a vendor and network administrator choice
  - End-to-end service is a concatenation of PHBs
- 





## Expedite Forwarding (EF)

- “... the departure rate of the aggregate's packets from any DiffServ node must equal or exceed a configurable rate.”
- “The EF traffic **SHOULD** receive this rate independent of the intensity of any other traffic attempting to transit the node.”

From RFC 2598



# Expedite Forwarding (EF)

- Example implementations

- Simple priority queuing
- Weighted Round Robin
- Class Based Queuing

- Example applications

- Virtual Leased Lines

- Packets experience low delay and jitter


**The definition of EF and conformance to it in RFC 2598 has been deemed un-realizable!!!**

**A new RFC with a revised definition is being published**



# Assured Forwarding (AF)

## ■ PHB Group

- Various independent *AF classes*
  - within each class various *levels of drop precedence*
  - “Packets in one AF class **MUST** be forwarded independently from packets in another AF class...”
  - “Each class **SHOULD** be serviced in a manner to achieve the configured service rate ...”
- 



## Assured Forwarding (AF)

- “An AF implementation **MUST** detect and respond to long-term congestion within each class by dropping packets ...”
- “[AF] requires an active queue management algorithm.”
- “traffic conditioning actions **MAY** include traffic shaping, discarding of packets, increasing or decreasing the drop precedence of packets, and reassigning of packets to other AF classes.”

From RFC 2597

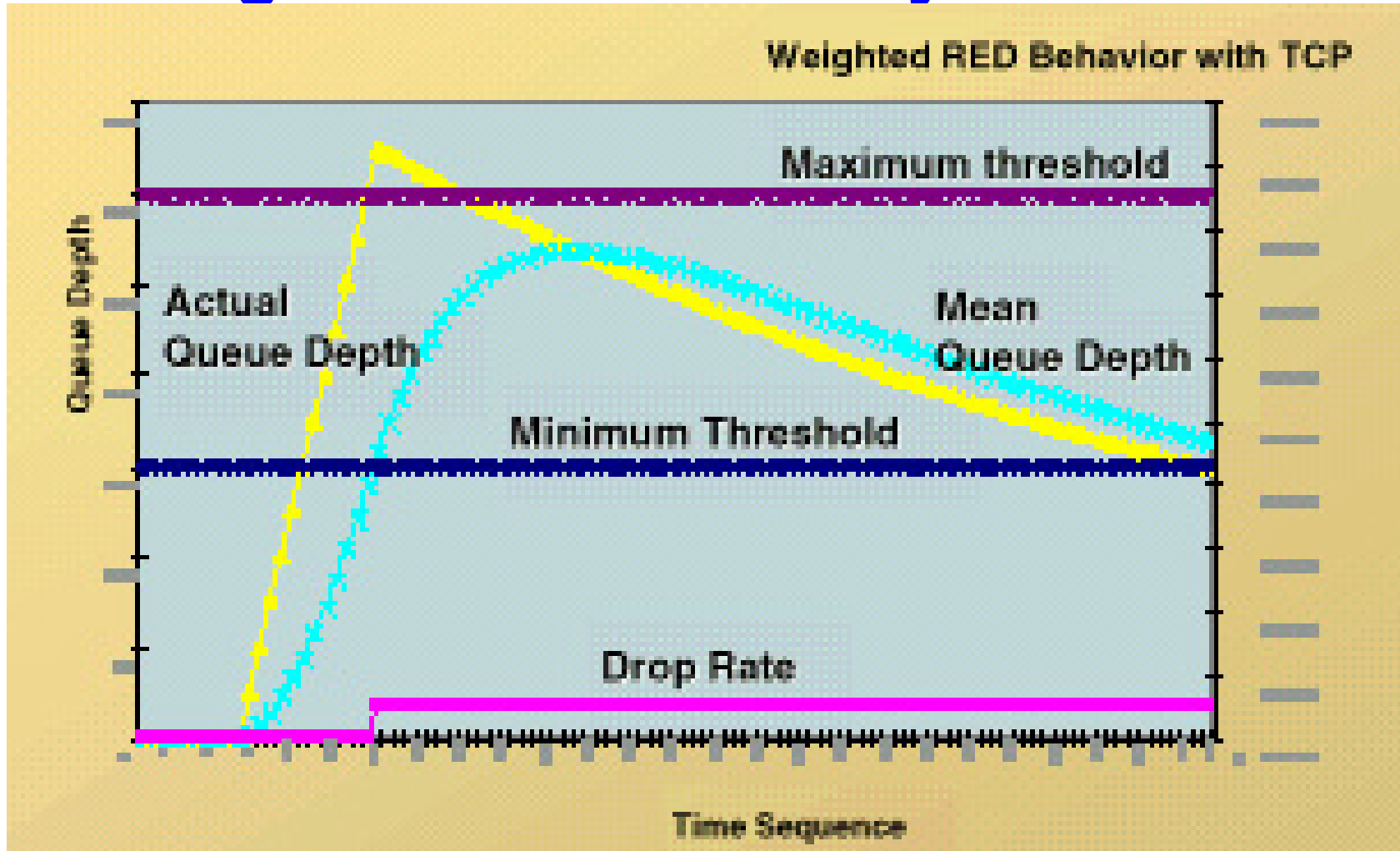




# Assured Forwarding (AF)

- Example implementation: Random Early Detection
- Example service: Olympic Service

# Weighted Random Early Detection





## Per Domain Behavior (PDB)

- Late addition
- Set of packets handled the same way through a DS domain
- Associated description of service packets receive



- Classifiers mark packets belonging to PDB
  - Conditioners perform policing
  - End-to-end service is a concatenation of PDBs
- 



## Bibliography

- A Framework for Differentiated Services, Internet-Draft
  - Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers, RFC 2474
  - An Architecture for Differentiated Services, RFC 2475
  - An Expedited Forwarding PHB, RFC 2598
  - Assured Forwarding PHB Group, RFC 2597
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