Resource Management in Differentiated Services

A Prototype Implementation

Final Thesis Presentation

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Outline

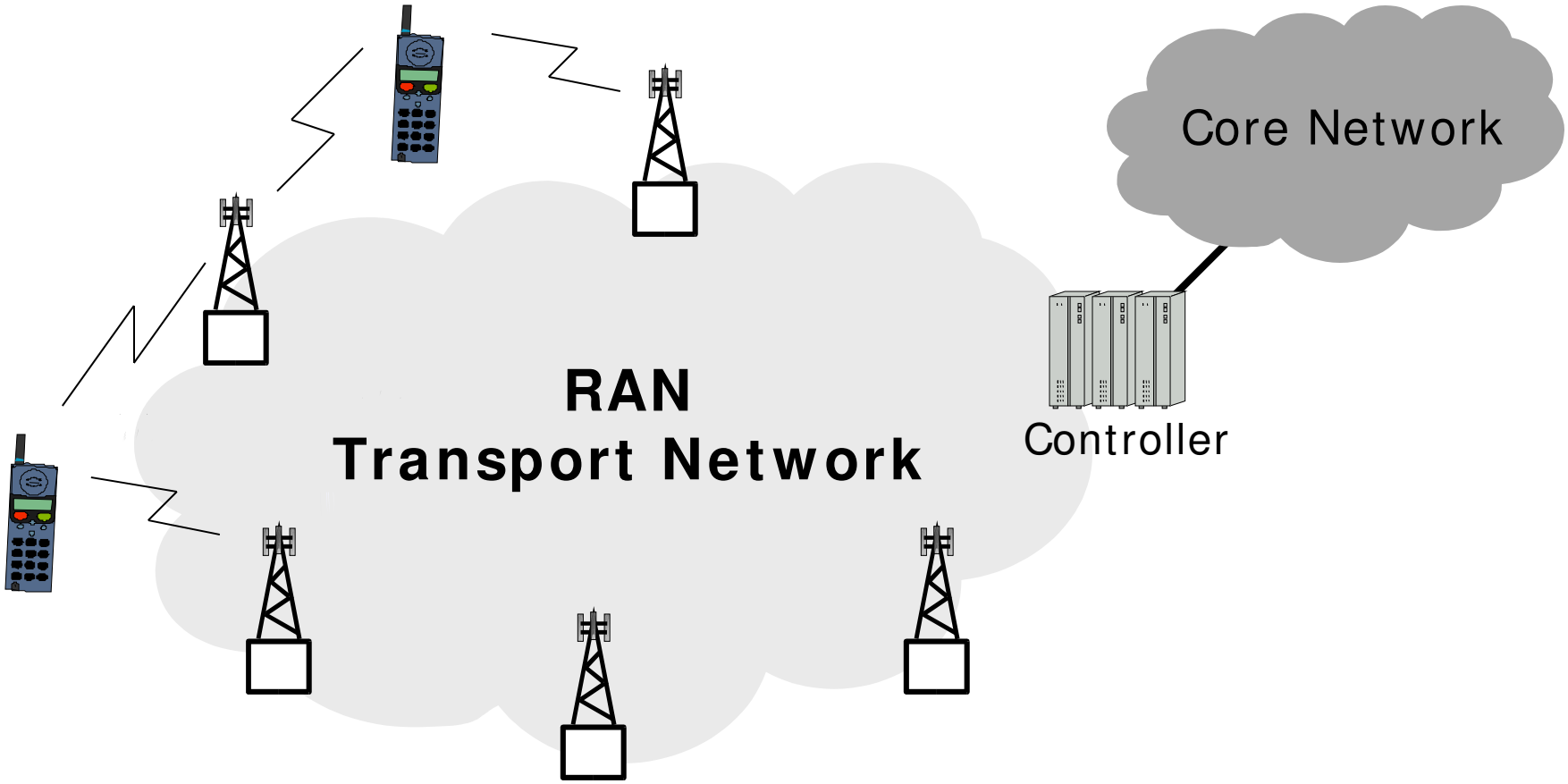
- Introduction
- Motivations for RMD
- Existing resource management schemes
- Resource Management in Diffserv
- Prototype implementation and tests
- Conclusions and future work

Introduction

- Define the RMD framework
  - On-demand Reservation PHR protocol
  - An experimental PDR protocol
- Implement a prototype
- Make basic functional tests

Motivations for RMD

IP-based Radio Access Network (RAN)

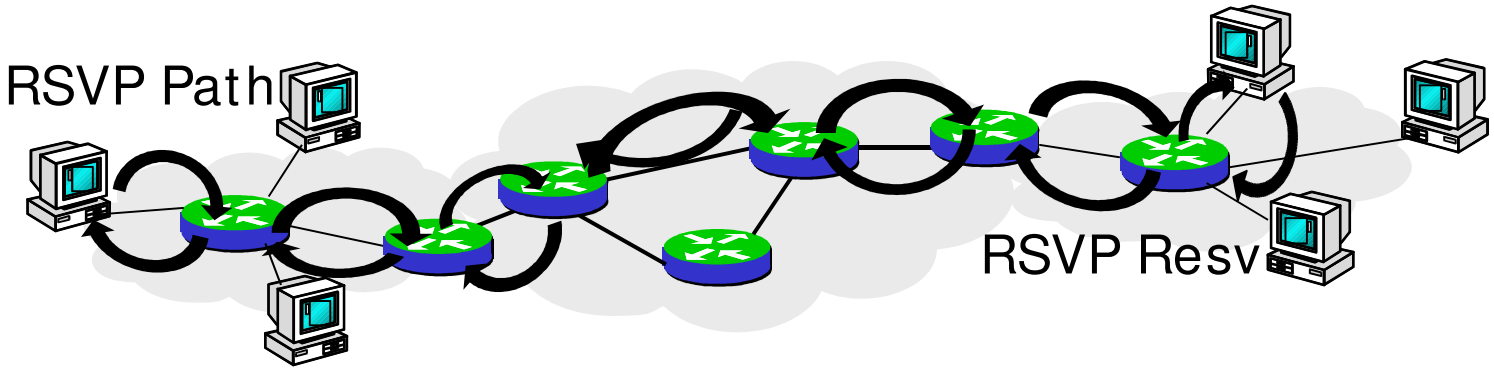


Why Resource Management in Diffserv?

- Radio Access Networks
- Reservation guarantees
- Scalable
- Dynamic and fast reservations
- No existing solution solves the entire problem!

Existing Resource Management Schemes

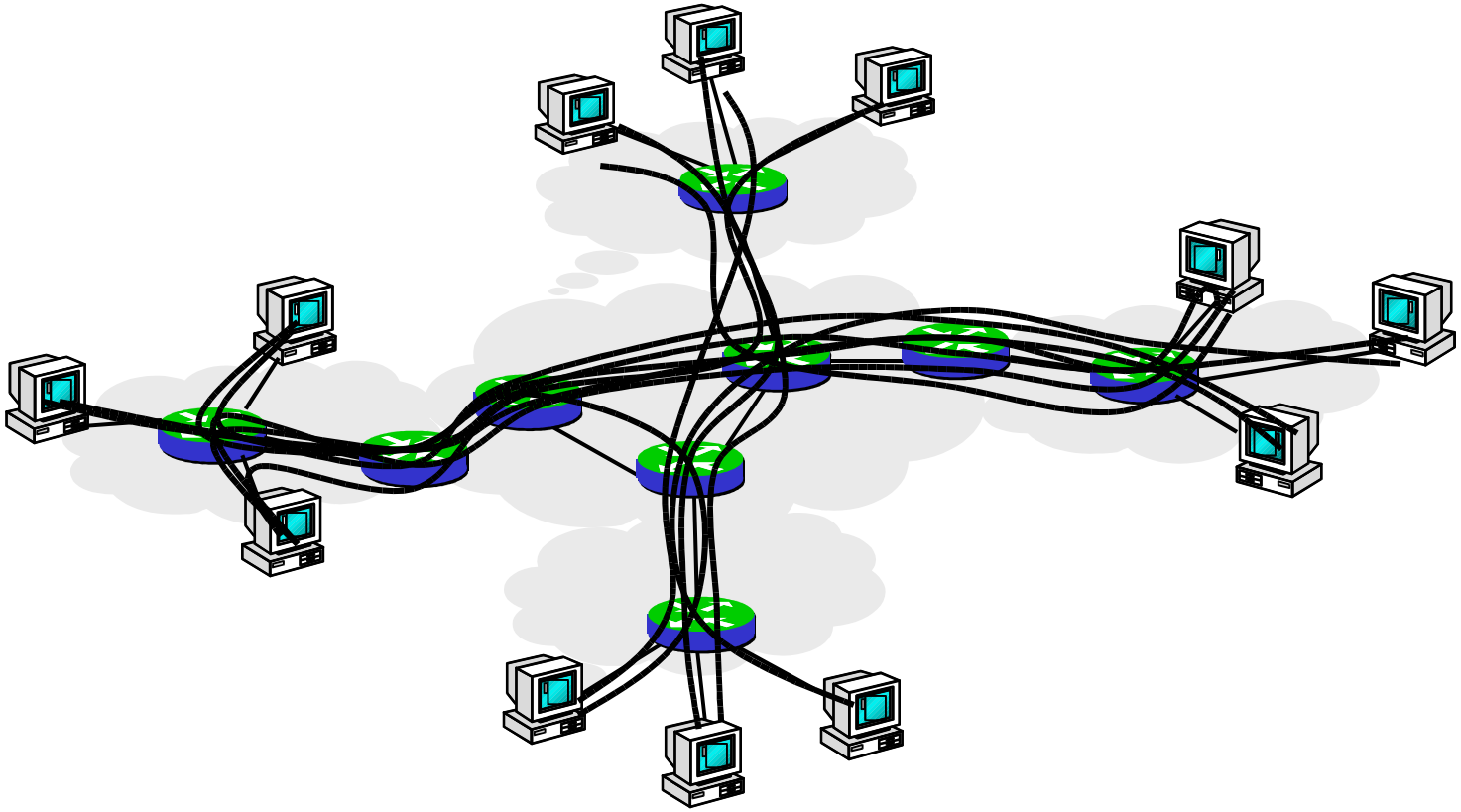
RSVP / Integrated Services (1)



Integrated Services characteristics:

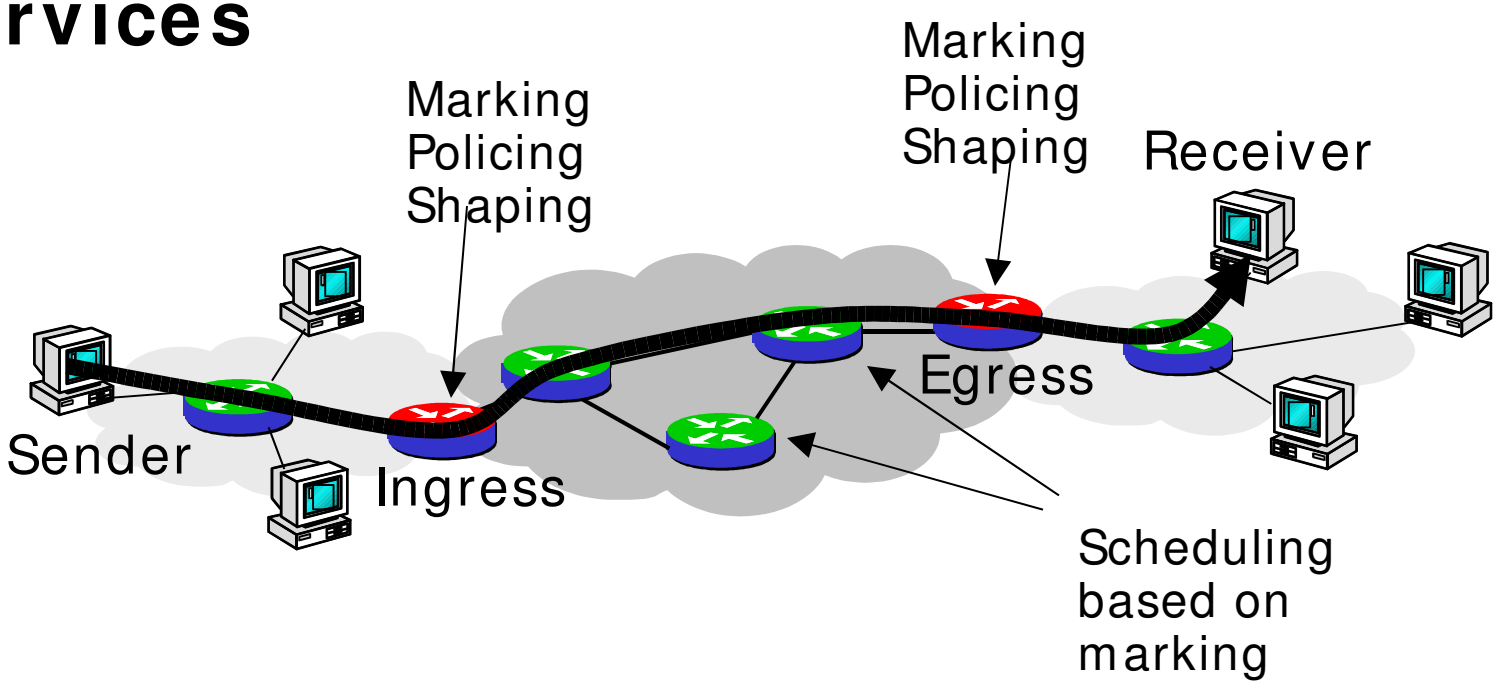
- Quantitative resource reservations
- End-to-end QoS
- Offers a rich set of functionalities

RSVP / Integrated Services (2)



RSVP is not scalable!

Differentiated Services

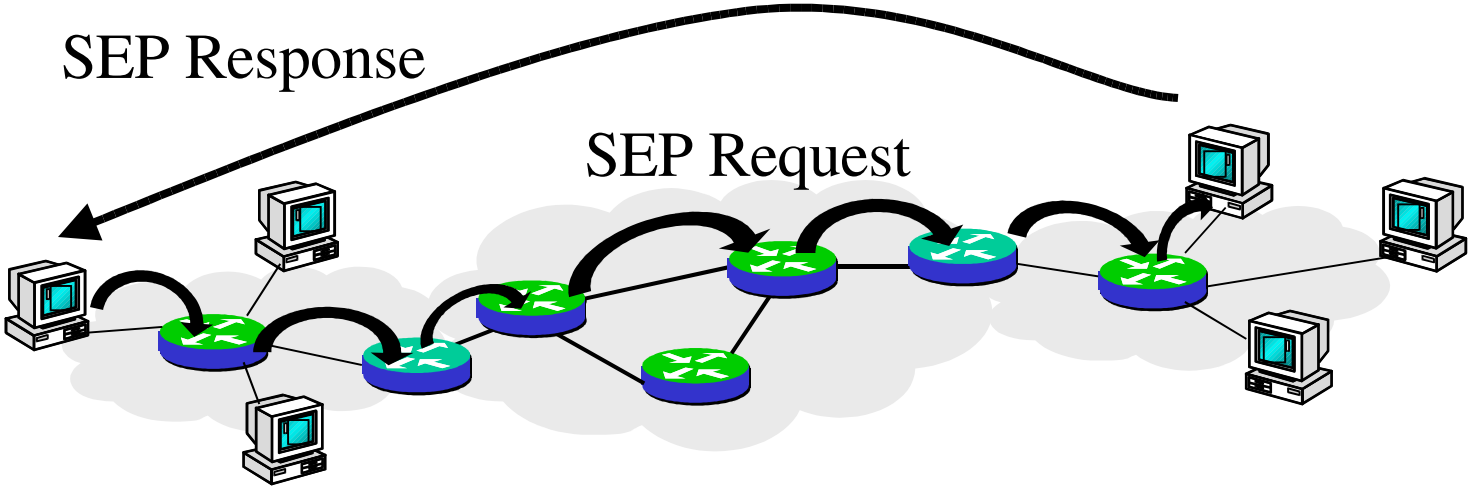


Differentiated Services characteristics:

+ No per-flow states in interior nodes
+ Complex functions at the edge nodes
- Not end-to-end QoS

Resource Management in Diffserv (RMD)

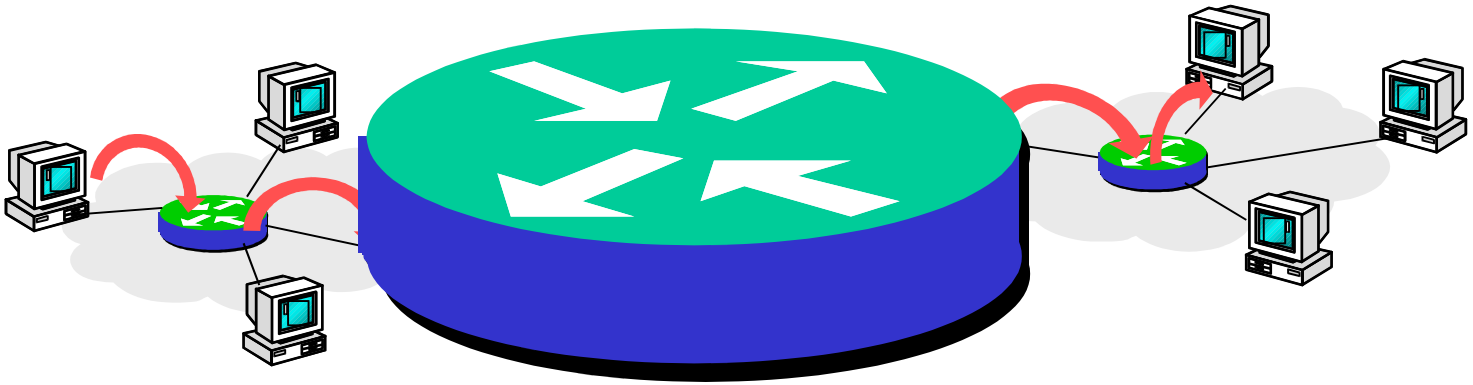
Simple External Protocol (1)



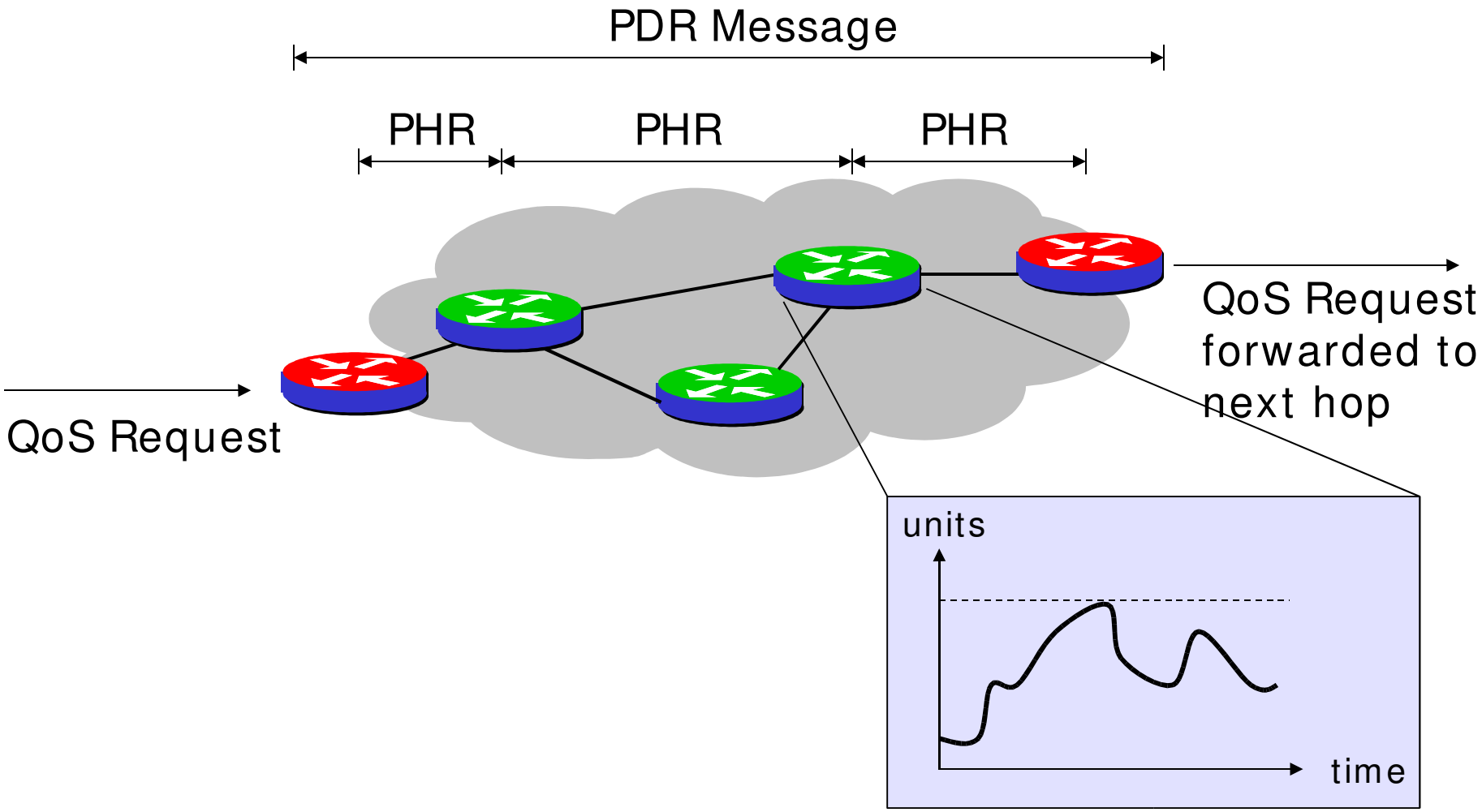
Simple External Protocol (2)

- Features
  - Sender-initiated
  - End-to-end reservation
  - Extremely simple
- Lack of features
  - IPv6, multicast, IPSec
  - Rerouting
  - Soft-state

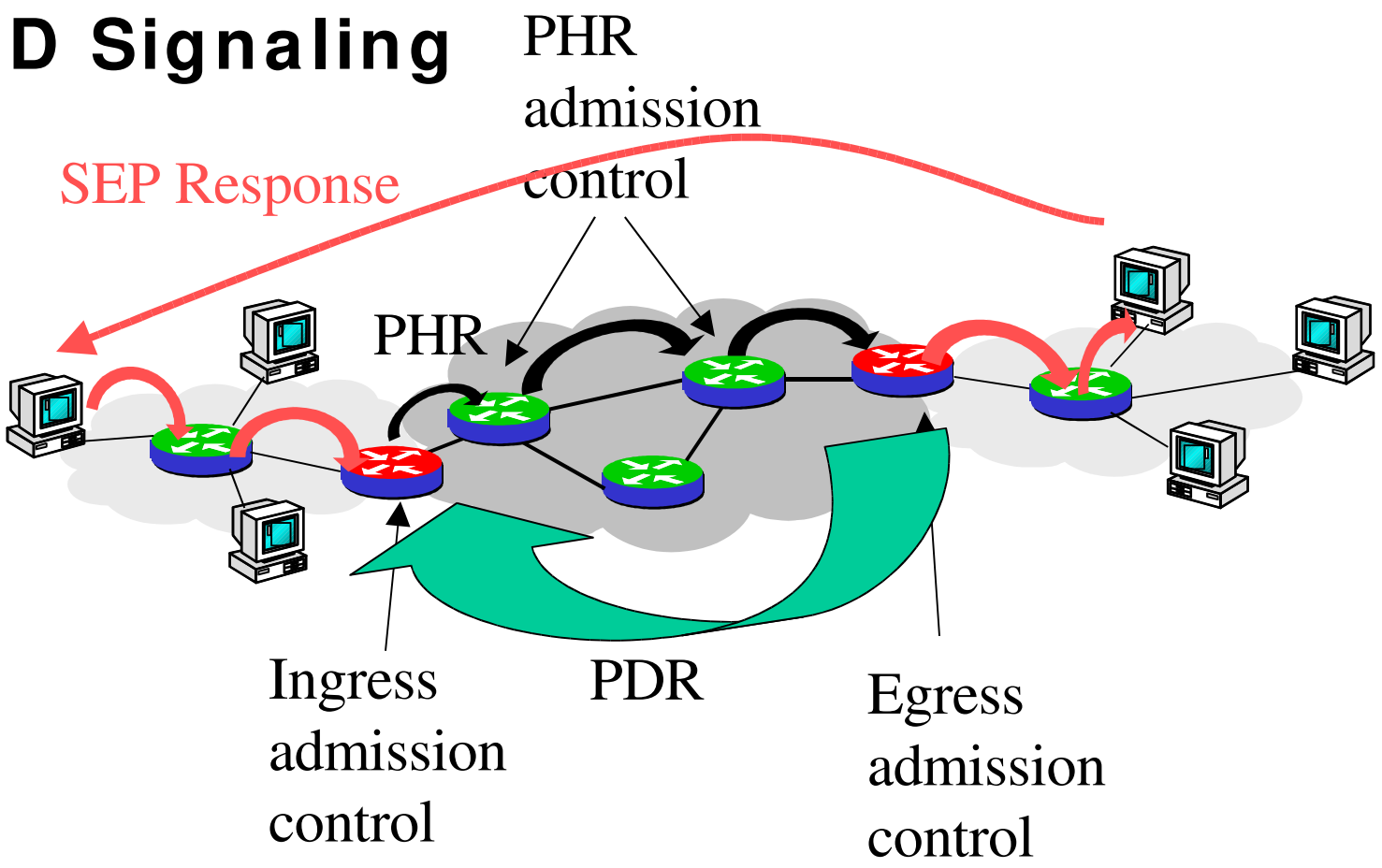
Call Admission Control



RMD Framework



RMD Signaling



RMD On-demand Reservation (RODA) PHR

- Per Hop Reservation (PHR)
  - From ingress towards egress
  - Processed by every node
- RODA PHR
  - Maintains reservation states per traffic class, using “resource units"
  - Interior nodes marks rejected reservations
  - Soft-state
  - Severe congestion signaling

Per Domain Reservation (PDR)

- Ingress <-> egress
  - Ingress addressing and reporting to ingress
  - Flow Identifier
  - External protocol information transportation
  - Error control
- External protocol interaction
  - Service mappings
  - Message interaction

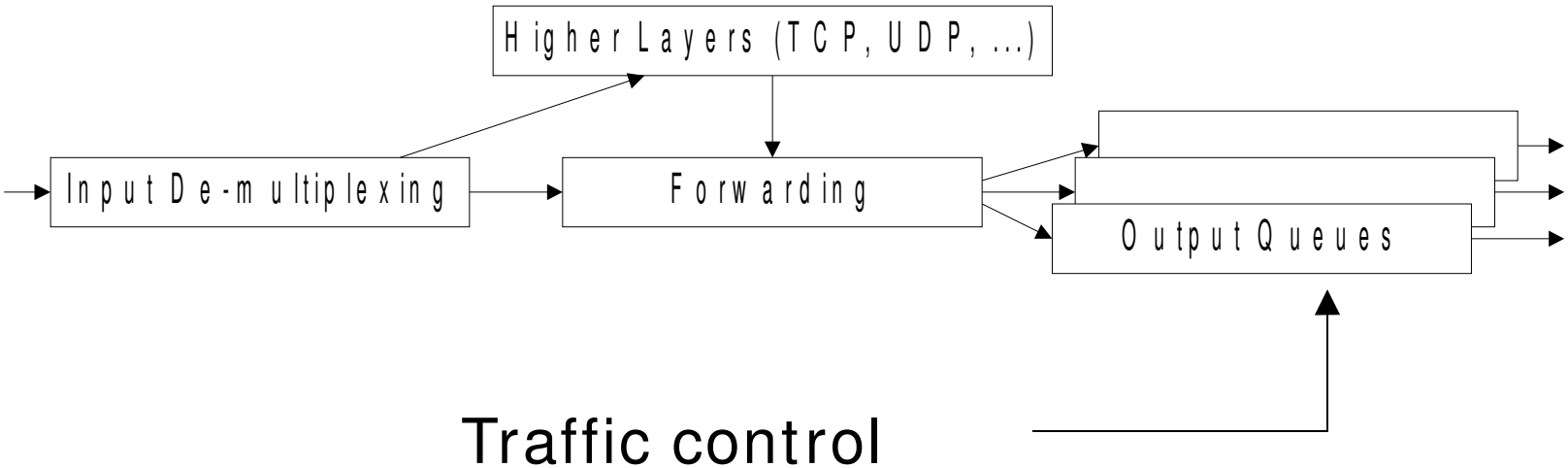
A PDR for Simple External Protocol

- Message interaction
  - SEP Flow-ID (source IP, source port and protocol)
  - SEP Token bucket specifier (r, b, M)
- A service mapping
  - Resource unit: A slice of bandwidth
  - Rate (r) translates into resource units

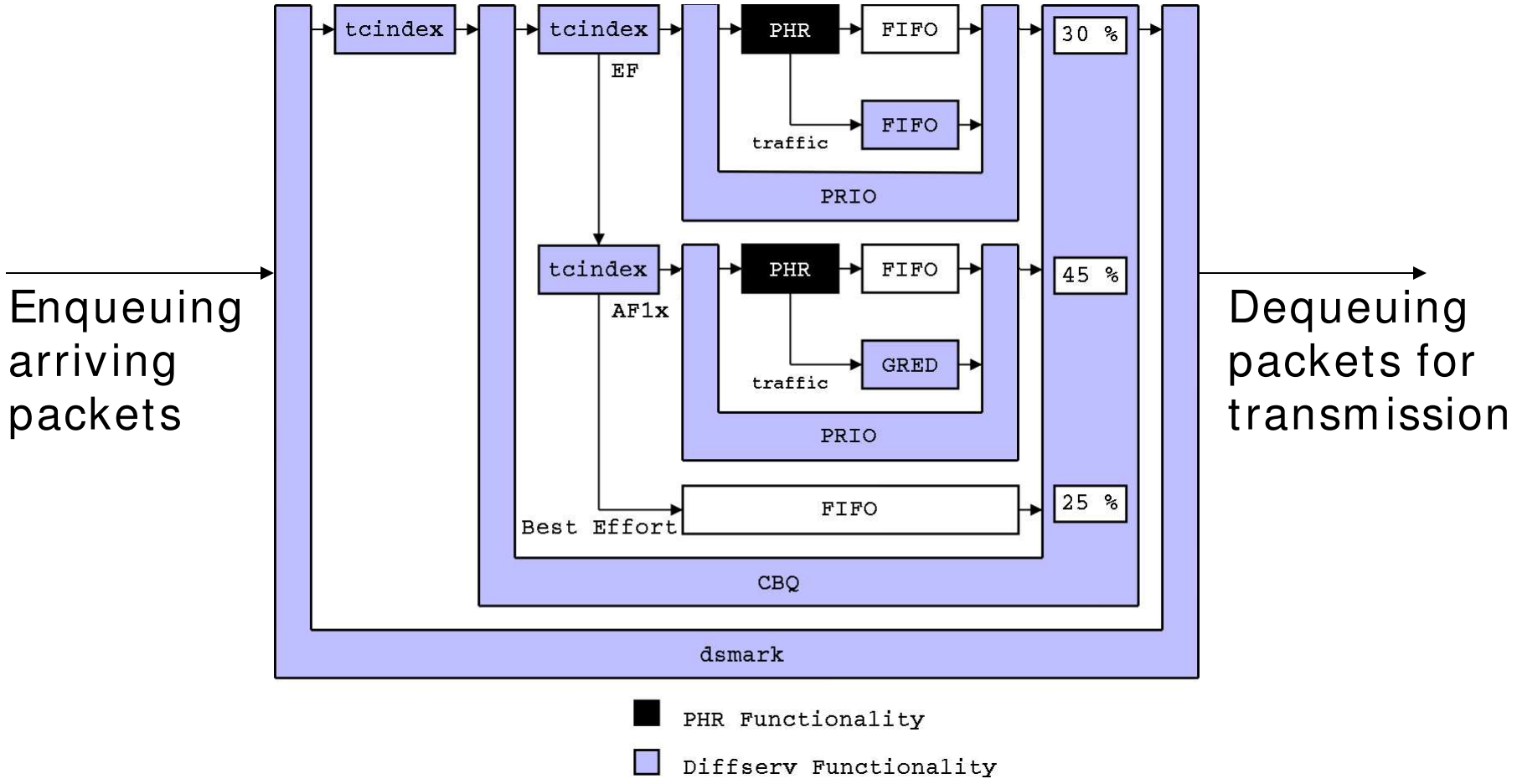
Prototype Implementation and Tests

Using Linux

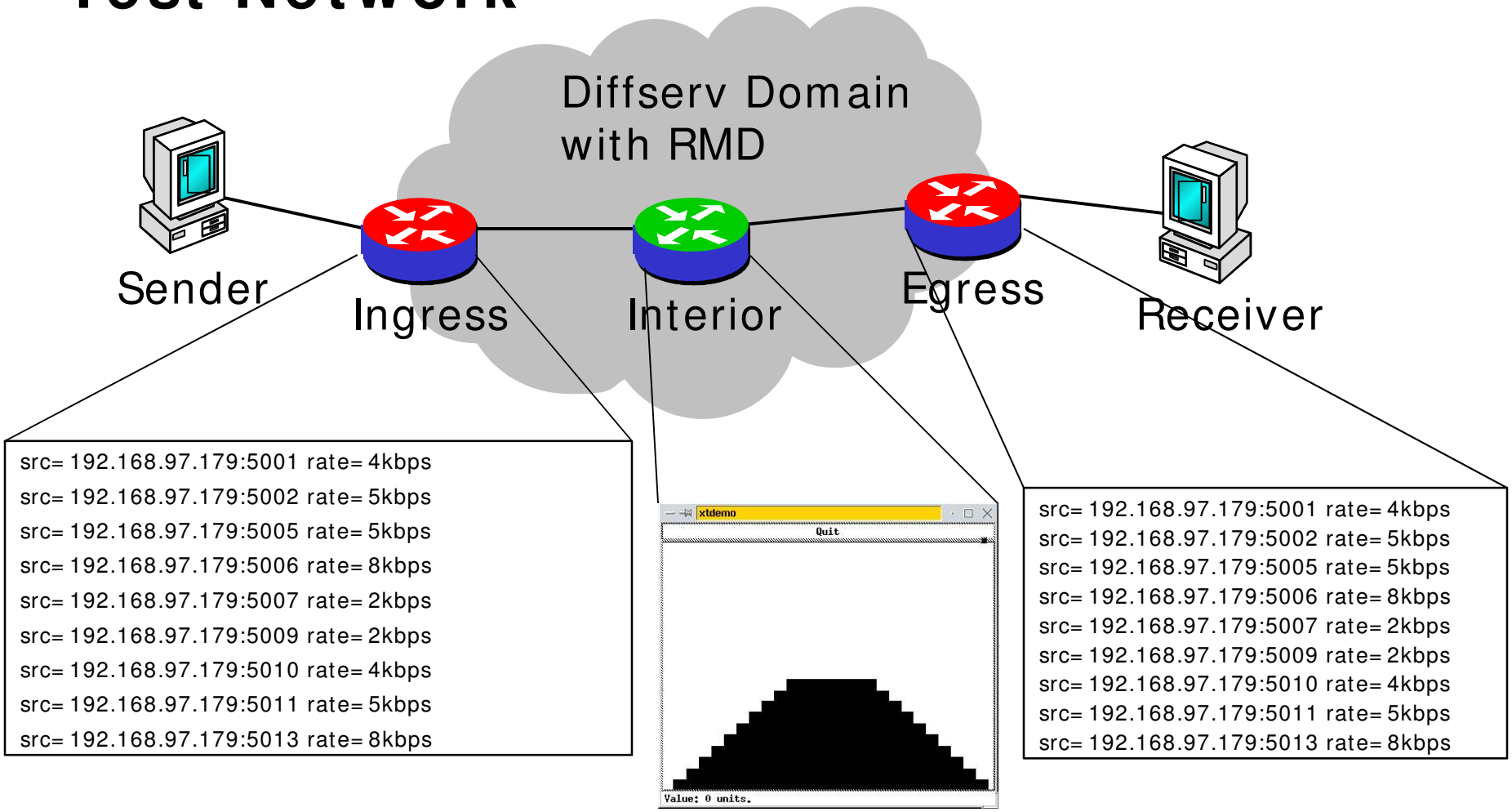
Linux TCP/IP Stack Implementation



Interior Functionality



Test Network



Conclusions and Future Work

Conclusions

- Possible to implement
- Scalable
- Interior functionality in hardware

Future Work

- PDR Protocols for other external protocols
- Measurement-based PHR protocol
- Enhance RODA PHR protocol
- Test RMD in more advanced network topologies
- How to define a unit?
- Correlation between traffic load and reservations

Thank you for your attention.

Questions?