

CS 414 – Multimedia Systems Design
Lecture 22 –
Case Studies for Multimedia
Network Support (Layer 3)

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Outline

- Multimedia Network Technologies at the Layer 3
 - Past/Current technologies: IPv4
 - Future technologies: IPv6, IntServ, DiffServ




IP Packet Headers

Version	Header Length	TOS	Total length	
identification			Flag	Fragment offset
Time to Live (TTL)		Protocol	Header Checksum	
32-bit Source IP Address				
32 bit Destination IP Address				

IPv4

Version	Traffic Class	Flow Label		
Payload Length		Next Header	Hop limit	
128-bit Source IP Address				
128-bit Destination IP Address				

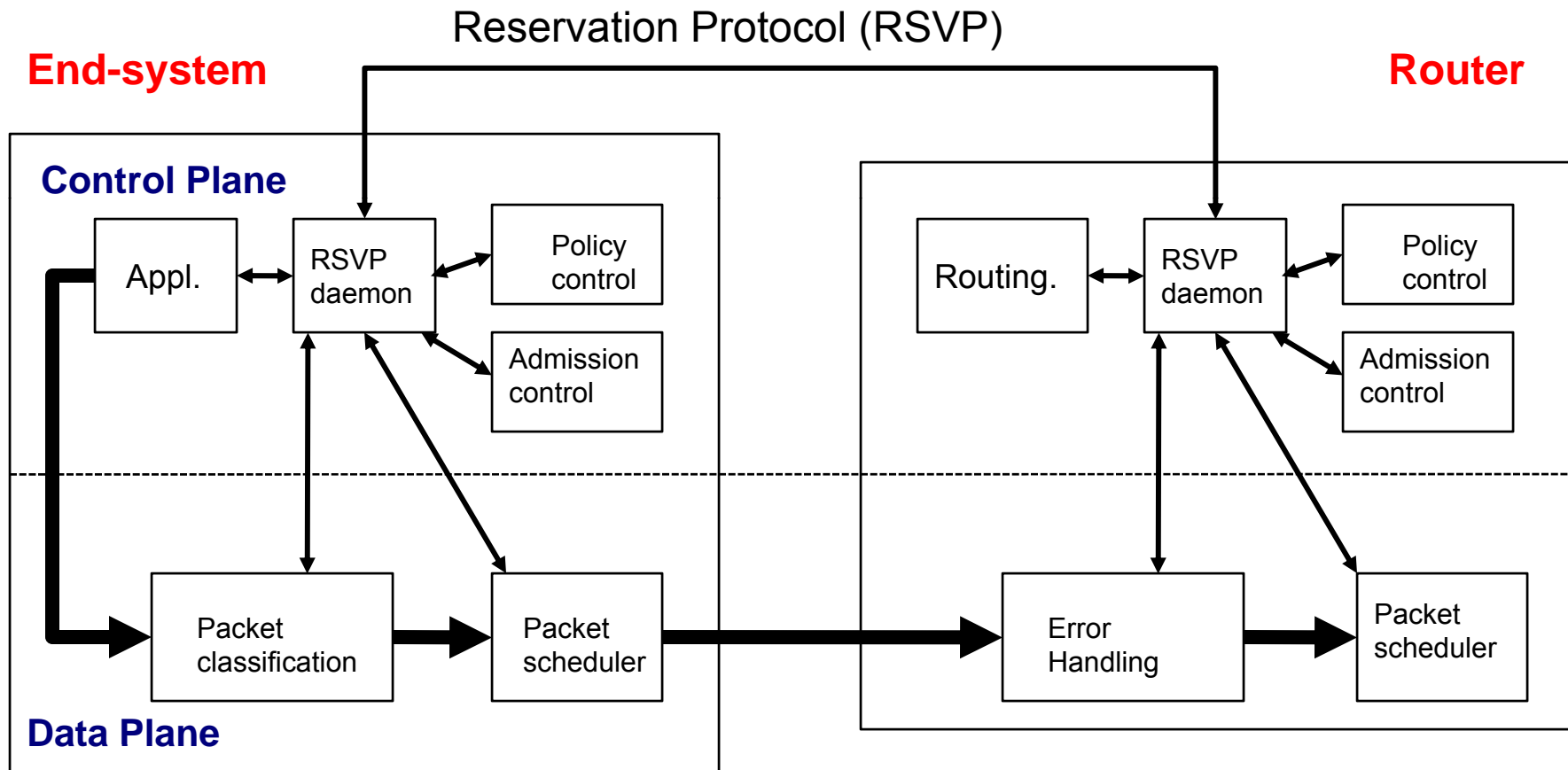
IPv6



QoS in Layer 3 - Internet Integrated Services

- To provide network QoS in the Internet, IETF reacted by
 - Creating Working Group (IntServ)
 - Deploying **Internet Integrated Services**
- Development of Control (Establishment) Protocol to reserve resources per flow
 - **Resource Reservation Protocol (RSVP)**
- Development of QoS-aware network services within IP
 - **Guaranteed class-of-service**
 - Deterministic QoS guarantees
 - **Controlled-load class-of-service**
 - Statistical QoS guarantees

Integrated Services (IntServ) Architecture

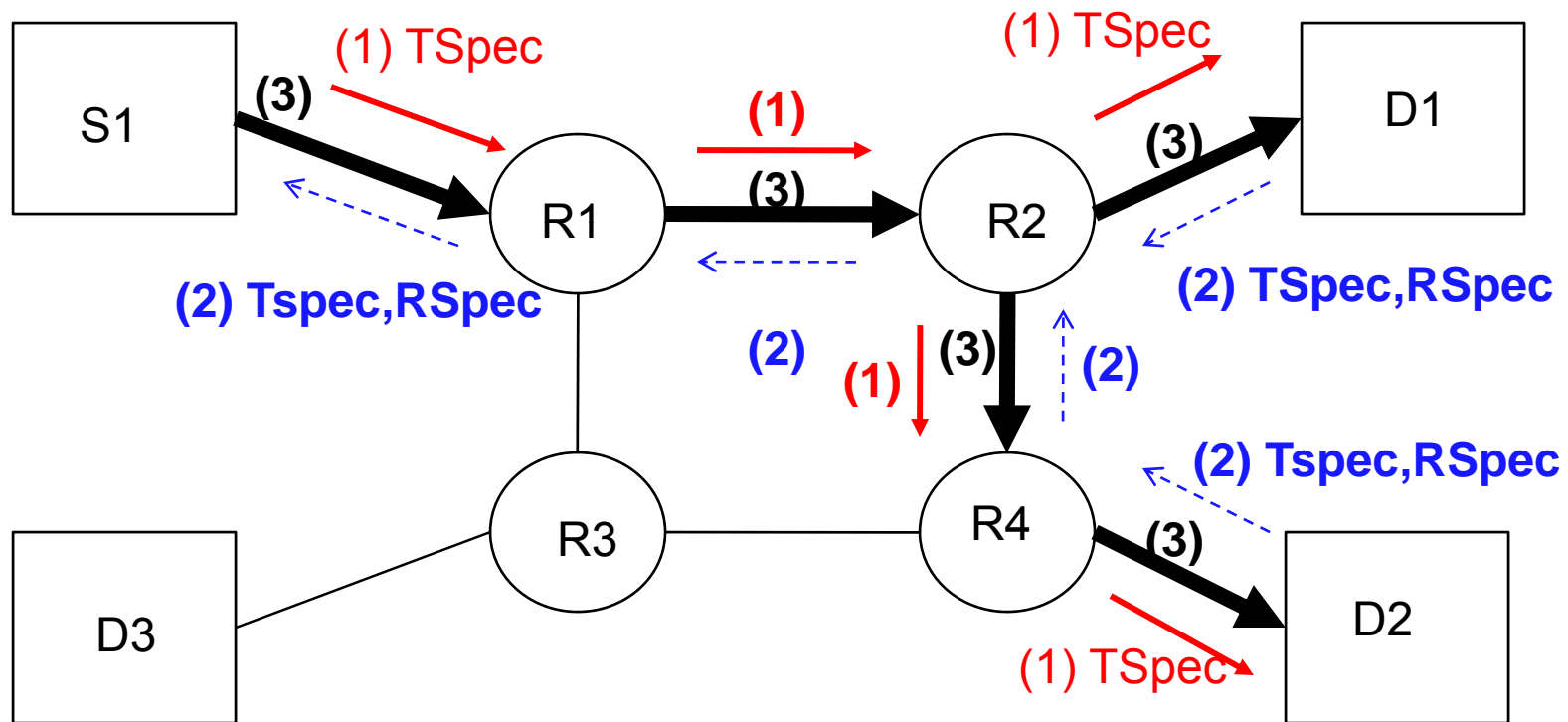




RSVP

- Provides reservation for data flows
 - Flow specification is represented via
 - **Traffic specification, TSpec**
 - Characteristics of the data flow
 - **Request specification, Rspec**
 - Description of required QoS (desired flow behavior)
- Is receiver-oriented and unidirectional
- Uses two types of messages:
 - PATH messages and RSVP messages
- Protocol
 1. Send PATH message with TSpec from Sender to Receiver(s)
 2. Send RESV message with Rspec from Receiver(s) to Sender
 3. Send DATA with resulting reserved QoS

RSVP Control and Data Flow

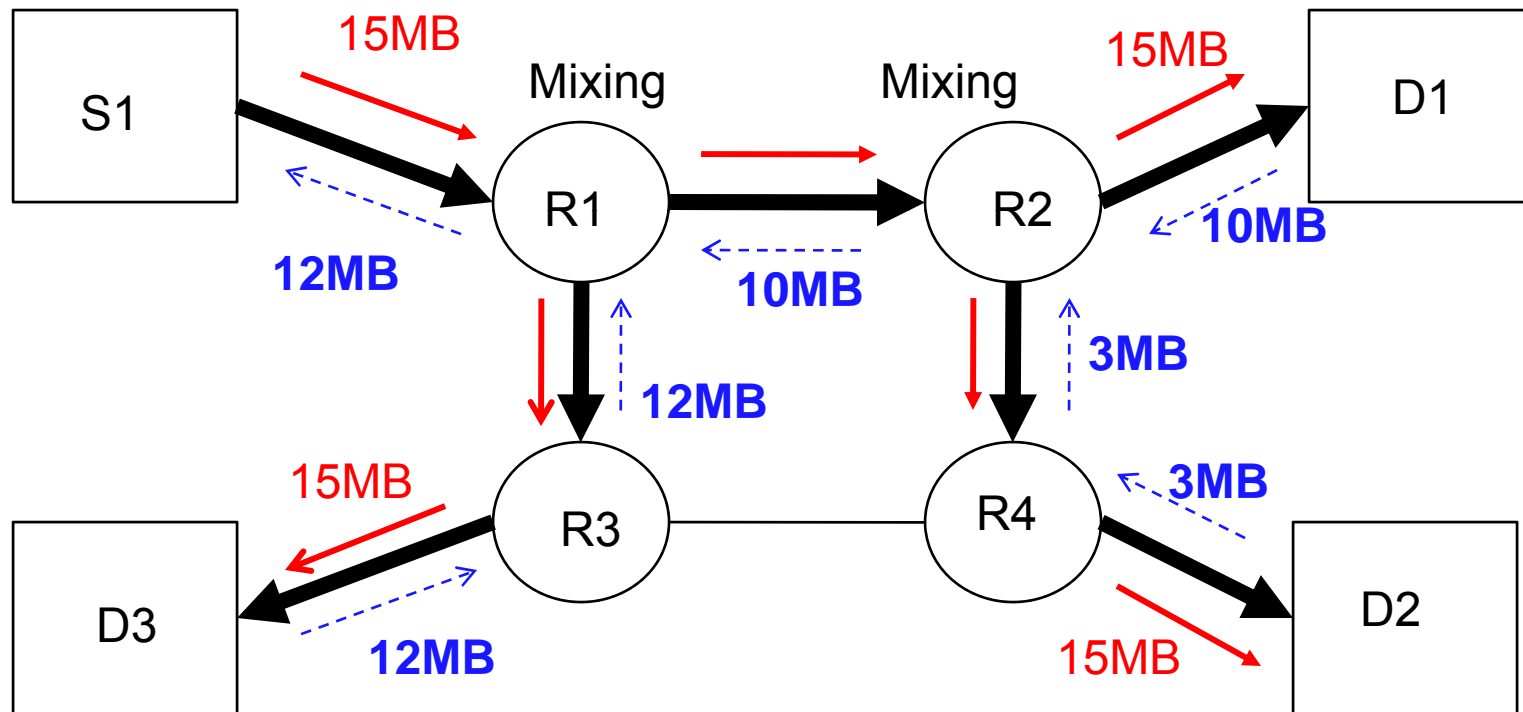


RESV messages

PATH messages

DATA

Mixing Reservations



RESV messages 

PATH messages 

DATA 



Reservation Structures

- Resource Reservation Table
 - Stores admitted/reserved resources
- RSVP Messages

Version	Flags	Message Type	RSVP Checksum
Send TTL		Reserved	RSVP Length



RSVP Features

- Simplex Reservation
 - Reservation only in one direction (simplex flow)
- Receiver Oriented
 - Supports multicast communication
- Routing Independent
- Policy Independent
- Soft State
 - Reservation state has timer associated with the state
 - When timer expires, state is automatically deleted
 - RSVP periodically refreshes reservation state to maintain state along the path



Reservation Styles (1)

■ Wild-card Filter Style

- WF implies shared reservation and wild-card sender selection
- All receivers share a single reservation whose size is the largest of the resource requests from the receivers
- All upstream senders can use the reservation
- **WF(*, {Q})**, where
 - * represents wild-card sender selection
 - {Q} represents Flow Spec.



Reservation Styles (2)

- Fixed-filter (FF) style
 - FF implies distinct reservation and explicit sender selection
 - Distinct reservation is established for specific sender
 - $FF(S_1(Q_1), S_2(Q_2), \dots, S_n(Q_n))$, where
 - S_1, \dots, S_n are senders
 - Q_1, \dots, Q_n are corresponding flow specs



Reservation Styles (3)

- Shared explicit (SE) style (Dynamic filter)
 - SE implies shared reservation but explicit sender selection
 - SE creates a single reservation shared by specific senders
 - Receiver can explicitly list what senders are to be included in reservation
 - **SE((S1,...,Sn){Q})**, where
 - S1,...,Sn are senders
 - Q corresponding flow spec



Service Models

- Describe interface between network and its users in resource allocation architecture
- Describe what services users can ask from network and what kind of resource commitments the network can offer
- IntServ standard
 - Guaranteed Service
 - Controlled-load Service



Flow Specification (1)

(Traffic Shape General Parameters)

- Peak rate – highest rate at which a source can generate traffic
- Average rate – average transmission rate over a time interval
- Burst size – max amount of data that can be injected into network at peak rate



Flow Specification (2)

(in IntServ)

- Traffic described in terms of **token bucket** parameters
 - Token arrival rate 'r'
 - Bucket depth 'b'
- Amount of bits transmitted during any interval of length t: $A(t) \leq r * t + b$



Service Requirements

(Application-specific)

- **Minimum Bandwidth** - min. amount of BW required by application
- **Delay** – can be specified as average delay or worst case delay
 - Propagation delay + Transmission delay + Queuing delay
- **Delay Jitter** – specifies max. difference between the largest and smallest delays that packets experience
- **Loss Rate** – ratio of lost packets and total packets transmitted



Conclusion

- IntServ over Link Layers
 - IETF created Integrated Services over Specific Link Layers (ISSLL)
 - Keep in mind that one needs to do
 - Service mapping
 - Setup protocol mappings