Experience on RSVP QoS Router Implementation

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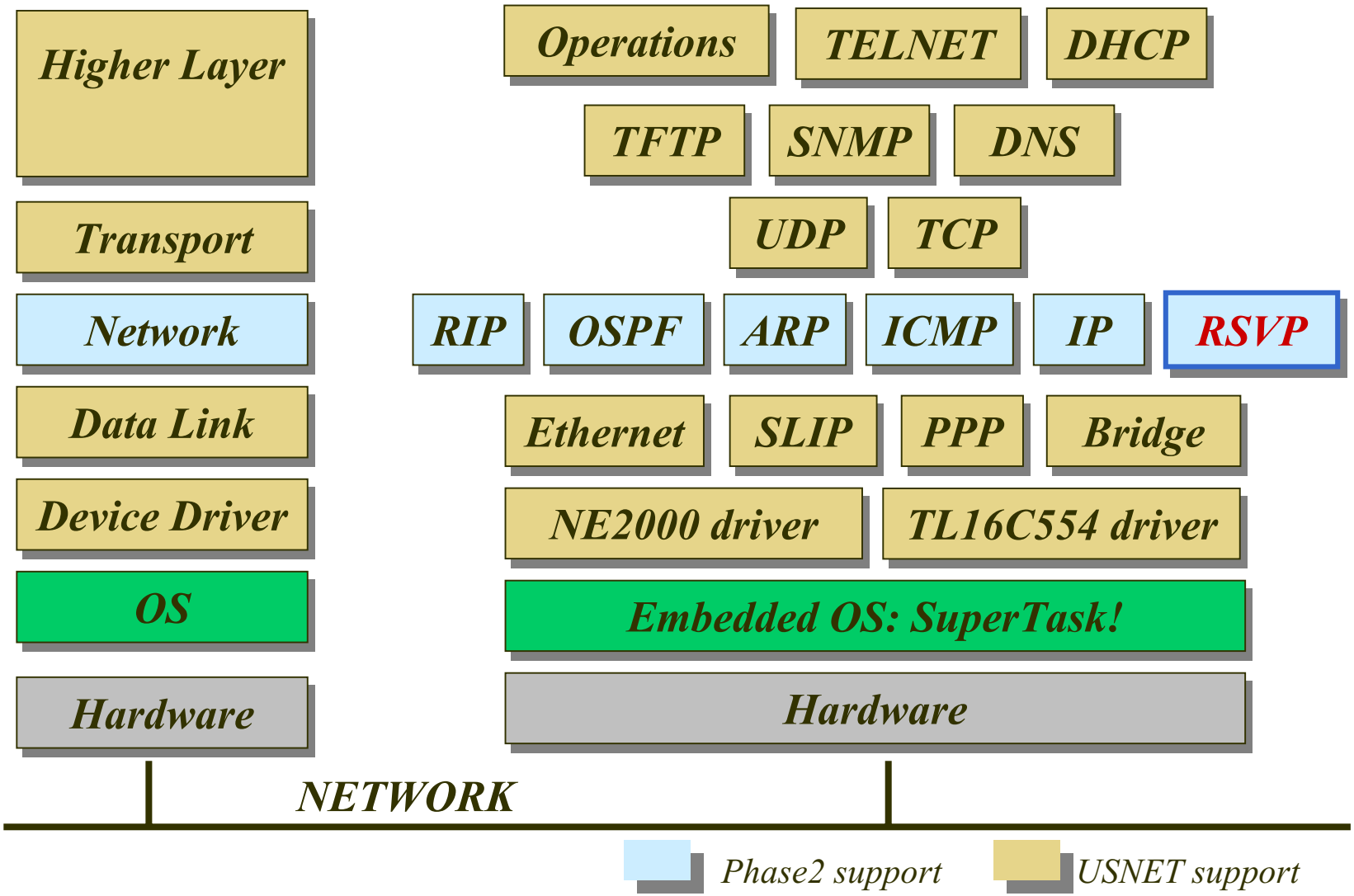
Protocol Stack in RAS



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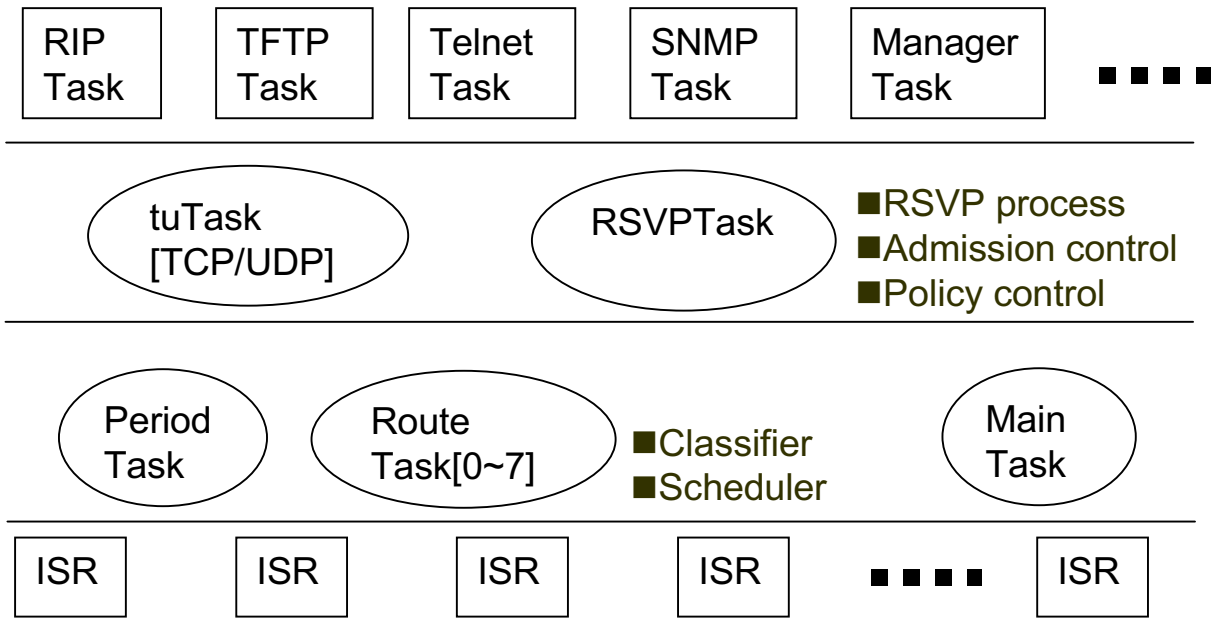
Layered Tasks in RAS

- *The original CCL RAS (Remote Access Server) kernel just processes "**RSVP signaling**" messages.*
- *There are no " **traffic control modules**".*



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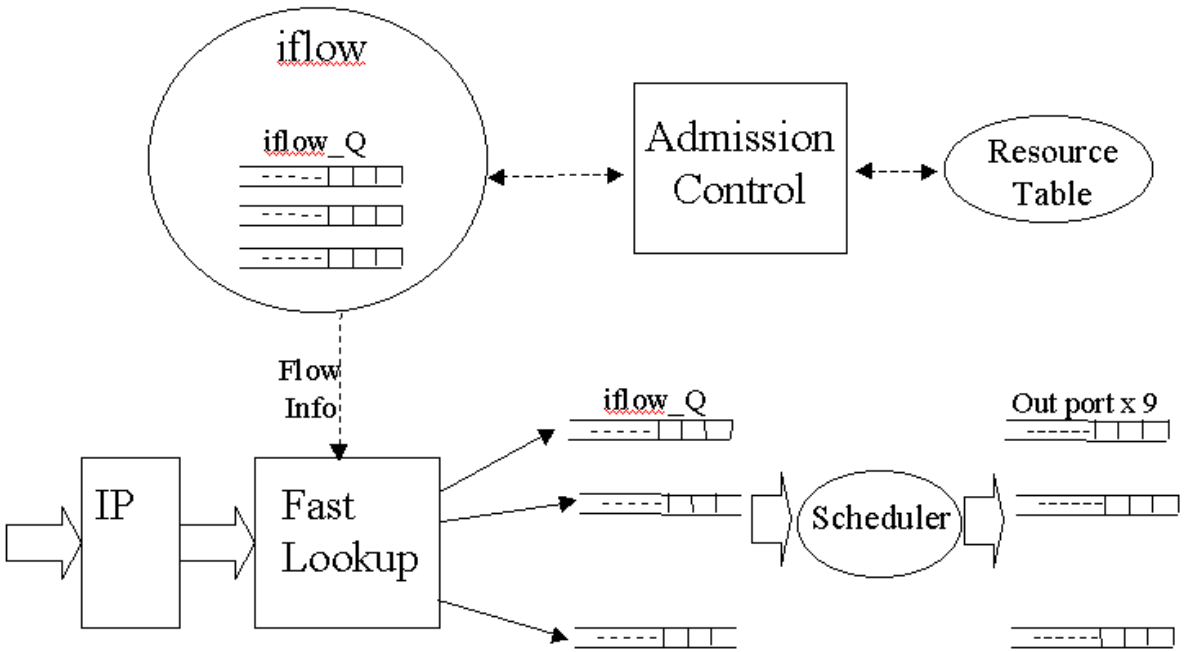
Traffic Control Modules

intercepting packets for QoS treatment

- *Admission Control*
- *Classifier*
- *Scheduler*



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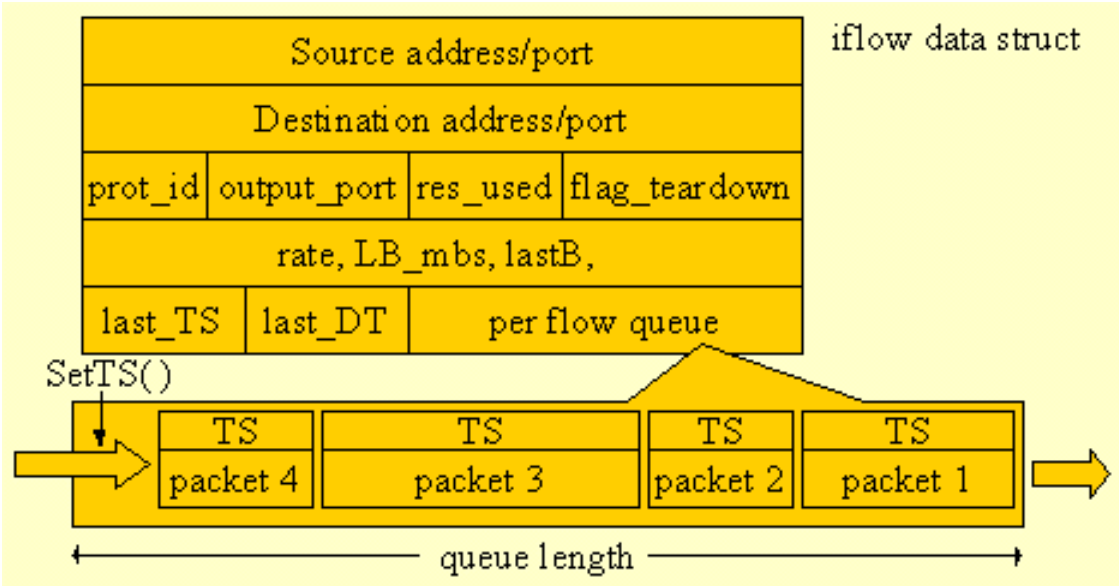
Per-Flow Data Structures

each *FLOW*

- *Classifier para.*
- *Scheduler para.*
- *Data queue*



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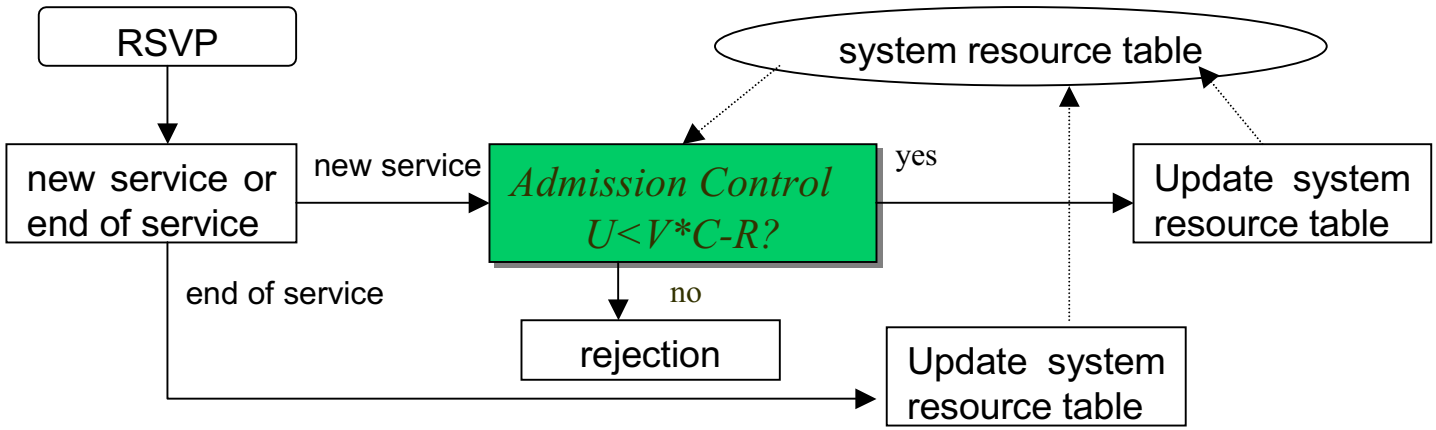
Process of Admission Control

Accept a new service request if …. $U < V * C - R$

- *Current utilization (U)*
- *Link capacity (C)*
- *Target utilization (V)*
- *Bandwidth of new request (R)*



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System Resource Management

After accepting a new request

- *update data structure of iflow*
  - ➤***5 Flow IDs*** *for classifying*
  - ➤***Flow Spec.*** *for scheduling*
- *update* ***system resource table***

As the service ends

- *finish the transmission of those packets already in its queue*
- *update* ***system resource table***

port cid	0	1	2	..	8
C(bps)	10,000,000	33600	33600	..	33600
U(bps)				..	
v	0.9	0.9	0.9	..	0.9

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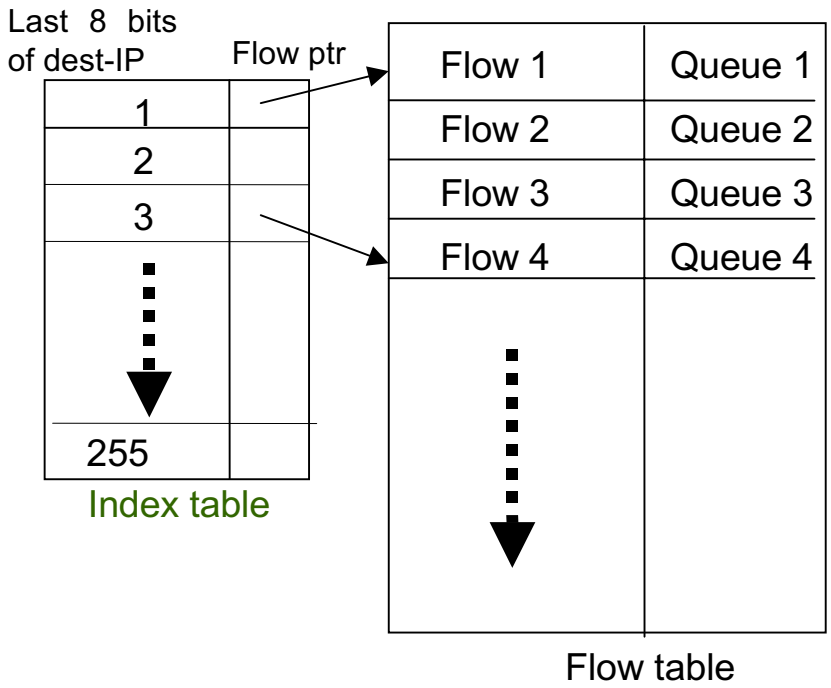
Algorithm for Classifier

1. Look up the *last 8 bits of Dest-IP*
2. Get the flow's data and queue
   from Flow Table
   by its ptr in Index Table
3. Put the packet into the queue.



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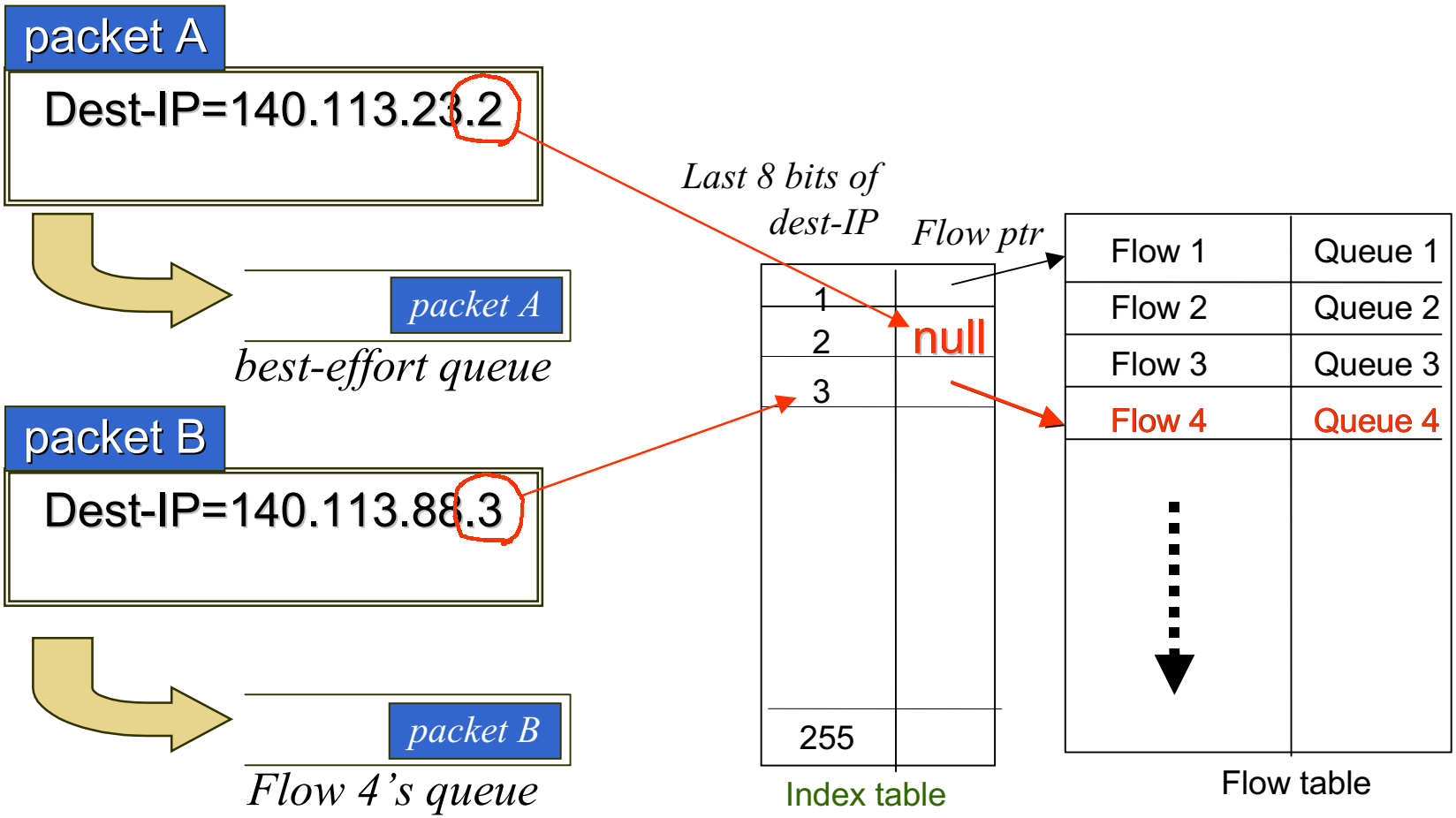
Examples for Classifier



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Architecture of Scheduler

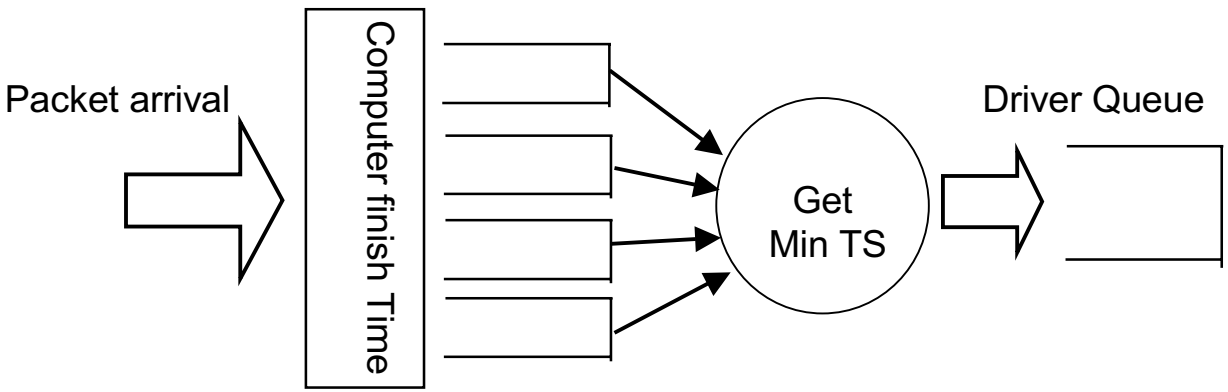
- *Upon a packet arrival ……*

  Compute its finish time *TS*

$$TS_i^k = \max\left(TS_i^{k-1}, v(t)\right) + \frac{L_i}{r_i}$$

- *v(t) = TS of the packet been serving as the k^th packet of flow i arrives (SCFQ)*

- Scheduler continuously picks up the *"Min Finish Time"* packet among the first packets of all queues



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Conclusions

- *A QoS-capable router needs:*
  - *RSVP signaling for reservation*
  - *traffic control modules to enforce the reservation*

- *Scalability issues:*
  - *number of flows*
  - *number of packets*
  - *bandwidth: link vs node*

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Reference

- *[1] T.V. Lakshman and D. Stiliadis, "High-Speed Policy-based Packet Forwarding using Efficient Multi-dimensional Range Matching", SIGCOMM 98*
- *[2] V. Srinivasan, G. Varghese, "Fast and Scalable Layer Four Switching", SIGCOMM 98*
- *[3] Braden, R., Ed., Zhang, L., Berson, S.,Horzog, S. and S. Jamin, "Resource ReSerVation Protocol (RSVP) – Version 1 Functional Specification", RFC 2205, September 1997.*
- *[4] S. Jamin, P.B. Danzing, S.J. Shenker, and L. Zhang. "A Measurement-based Admission Control Algorithm for Integrated Service Packet Networks (Extended Version)". ACM/IEEE Transactions on Networking, Feb. 1997.*
- *[5] D.Stiliadis and A.Varma, "Latency-Rate Servers: A General Model for Analysis of Traffic Scheduling Algorithms," Proc IEEE INFOCOM '96 Apr. 1996, pp. 111-19.*
- *[6] A.K.Parekh and R.G.Gallager, "A Generalized Processor Sharing Approach to Flow Control – The Single Node Case," Proc. INFOCOM'92, vol. 2, May 1992, pp. 915-24.*
- *[7] S. Golestani, " A Self-Clocked Fair Queuing scheme for Broadband Applications," Proc. IEEE INFOCOM '94, Apr. 1994, pp. 636-46.*
- *[8] L.Zhang, "VirtualClock:A New Traffic Control Algorithm for Packet Switching Networks," ACM Trans. Comp. Sys., vol. 9, May 1991, pp. 101-24.*

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