Experience on RSVP QoS Router Implementation

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Protocol Stack in RAS

- **Higher Layer**: Operations, TELNET, DHCP
  - TFTP, SNMP, DNS
  - UDP, TCP
- **Network**: RIP, OSPF, ARP, ICMP, IP, RSVP
  - Ethernet, SLIP, PPP, Bridge
  - NE2000 driver, TL16C554 driver
- **Data Link**: 
- **Device Driver**: 
- **OS**: Embedded OS: SuperTask!
- **Hardware**:
Layered Tasks in RAS

The original CCL RAS (Remote Access Server) kernel just processes "RSVP signaling" messages.

There are no "traffic control modules".
Traffic Control Modules
intercepting packets for QoS treatment

- Admission Control
- Classifier
- Scheduler
Per-Flow Data Structures

each *FLOW*

➤ Classifier para.

➤ Scheduler para.

➤ Data queue
Process of Admission Control

Accept a new service request if ….

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

\[ U < V \times C - R \]
System Resource Management

After accepting a new request

- update data structure of iflow
- update system resource table

As the service ends

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

<table>
<thead>
<tr>
<th>port cid</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>..</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(bps)</td>
<td>10,000,000</td>
<td>33600</td>
<td>33600</td>
<td>..</td>
<td>33600</td>
</tr>
<tr>
<td>U(bps)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>..</td>
<td>0.9</td>
</tr>
</tbody>
</table>

5 Flow IDs for classifying
Flow Spec. for scheduling
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.
Examples for Classifier

packet A
Dest-IP=140.113.23.2

packet B
Dest-IP=140.113.88.3

best-effort queue

Flow 4’s queue

Last 8 bits of dest-IP

Flow ptr

null

Index table

Flow 1 | Queue 1
1
2
3

Flow 2 | Queue 2

Flow 3 | Queue 3

Flow 4 | Queue 4

Flow table
Architecture of Scheduler

- Upon a packet arrival ...... Compute its finish time \( TS \)

- \( v(t) = TS \) 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

\[
TS_i^k = \max(TS_i^{k-1}, v(t)) + \frac{L_i}{r_i}
\]
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
Reference


