Performance of New Variants of TCP

Presenter - Bob Kinicki
The march of congestion control mechanisms

End-to-end
- DUAL
- CARD
- DECbit
- SACK
- Westwood
- FAST
- EBCC
- Binomial
- Vegas
- Eifel
- Veno
- Compound
- LEBAT
- Tahoe
- Reno
- NewReno
- BIC
- H-TCP
- Cubic
- PRR
- Sprout

1980s - 2000s

In-net
- GPS
- RED
- ECN
- CHOKe
- XCP
- RCP
- DCTCP
- PDQ
- WFQ
- BLUE
- AVQ
- VCP
- CoDel
- D^2TCP
- DeTail

2000s - 2010s
Fairness in TCP Variants

ns-2 dumbbell simulations

- C = 1 Gbps
- Min RTT = 104 ms.
- Drop tail routers
- 1500 byte packets
- Buffer size = BDP
- 20 flows of each TCP variant
- 1200 sec. simulated

Fig. 2. Congestion window curves for CUBIC, BIC, CTCP and NewReno flows. A congestion window curve represents the sum of 20 flows of a type

Munif 2007
Fairness in TCP Variants

Table 1: Average transfer rates and average link utilization

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Average Transfer Rate (Mbs)</th>
<th>Average Link Utilization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUBIC</td>
<td>151.11</td>
<td>15.11</td>
</tr>
<tr>
<td><strong>BIC</strong></td>
<td>764.42</td>
<td>76.42</td>
</tr>
<tr>
<td>CTCP</td>
<td>27.80</td>
<td>2.78</td>
</tr>
<tr>
<td>NewReno</td>
<td>26.59</td>
<td>2.66</td>
</tr>
</tbody>
</table>

[Too Aggressive] [Munif 2007]
Figure 1: Wide Area Network Scenario: High Speed Congestion Control Algorithms on a Transocean Optical Fiber Link

[Wu 2008a]
Utilization and Response Time

(a) Link Utilization Ratio  
(b) WWW (Response Data Size=64KB)

Figure 7: Twenty High Speed Flows on the Simulated Transocean Optical Fibre Link

[Wu 2008a]
Simulated Satellite Network

Fig. 1. Network Topology: Two High Speed Networks Connected Through Satellite Network

[Wu 2008b]
Satellite Simulations

<table>
<thead>
<tr>
<th>Nodes</th>
<th>Delay of Side Link</th>
<th>Traffic Type</th>
<th>Traffic Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWW_Server and WWW_Client nodes</td>
<td>Random Number [5ms-15ms]</td>
<td>Background Web Traffic</td>
<td>800 Sessions / s (forward path) 200 Sessions / s (backward path)</td>
</tr>
<tr>
<td>HSCC_S_i HSCC_C_i</td>
<td>Random Number [5ms-15ms]</td>
<td>Long-Lived FTP Flows</td>
<td>4 Flows (forward path)</td>
</tr>
<tr>
<td>WWW_S WWW_C</td>
<td>10ms</td>
<td>HTTP Sessions</td>
<td>10 Sessions / s (forward path)</td>
</tr>
<tr>
<td>VoIP_S VoIP_C</td>
<td>10ms</td>
<td>ITU G.711 PCM Traffic</td>
<td>1 Connection (forward path)</td>
</tr>
<tr>
<td>HFTP_S HFTP_C</td>
<td>10ms</td>
<td>Long-Lived FTP Flow</td>
<td>1 Flow (forward path)</td>
</tr>
<tr>
<td>FTP_S FTP_C</td>
<td>10ms</td>
<td>FTP Flow (small buffer)</td>
<td>1 Flow (forward path)</td>
</tr>
</tbody>
</table>

**TABLE I**
PARAMETERS OF GENERATED TRAFFIC

HFTP flows: 100000 packet window
FTP flows: 64 packet window

Fig. 5. FTP User Experience

[Wu 2008b]
TCP Variant Utilization

Fig. 6. Satellite Network Utilization Ratio

[Wu 2008b]
Scenario 1: throughput-delay plot
Scenario 2: Verizon LTE, $n = 8$
References


References
