

LEDBAT APPLICATIONS PRACTICES AND RECOMMENDATIONS

Presenter: Reinaldo Penno,
rpenno@juniper.net

Co-Authors: Joe Touch, touch@ISI.EDU
Richard Woundy, richard_woundy@cable.comcast.com
Vijay K. Gurbani, vkg@bell-labs.com
Satish Raghunath, satishr@juniper.net

IETF-76, Hiroshima

VERSION 01

- Text considerably revised
- New sections added to address comments received on IETF-74+
- New sections added to discuss further the advantages and disadvantages of multiple TCP connections
- Existing sections reviewed for accuracy and content improved
- New co-authors
- Recommendations section now present



COMMENTS FROM IETF-74

- Need to discuss and differentiate between Multiple control vs. data connections
- Diffserv within scope or not
- Rule of thumb of how many connections are needed.
- Reassembly at app layer: some apps use multiple connections to send different objects, but some may be splitting one big object among multiple connections. These need to be differentiated.



MULTIPLE CONTROL VS. DATA CONNECTIONS

- New Section 3
- General discussion and several example protocols
- Multiple connections used for control and data (HTTP)
- Multiple control and data connections (Bittorrent, Skype)
- Different Control and Data Connections (FTP)
- One control and multiple data (SIP)



DIFFSERV

- Section 6.1
- Diffserv recommendation still in the text (RFC 3662)
- WG input to decide if recommendation should stay.



HOW MANY CONNECTIONS ARE NEEDED

- New Section 6.3
- Many recent studies on the number of parallel TCP connections
- One cannot make recommendations for control connections since they are needed for the basic workings of each protocol



DISADVANTAGE DUE TO REASSEMBLY ON TOP OF TCP AT THE APPLICATION LAYER.

- Some studies around the cost of reassembly at application level.
- More input needed, new section will be added to next revision



RECOMMENDATIONS

- REC-1: Applications involved in bulk data transfer with low priority in time could mark their packets according with the guidelines of RFC 3662 [RFC3662].
- REC-2: Where appropriate, sender & receiver window should be scaled using RFC1323 based negotiation in order to make the best use of network resources. Recommendations to adjust window size are not new and have been recommended in networks where the BDP (Bandwidth Delay Product) is large [RFC3481].

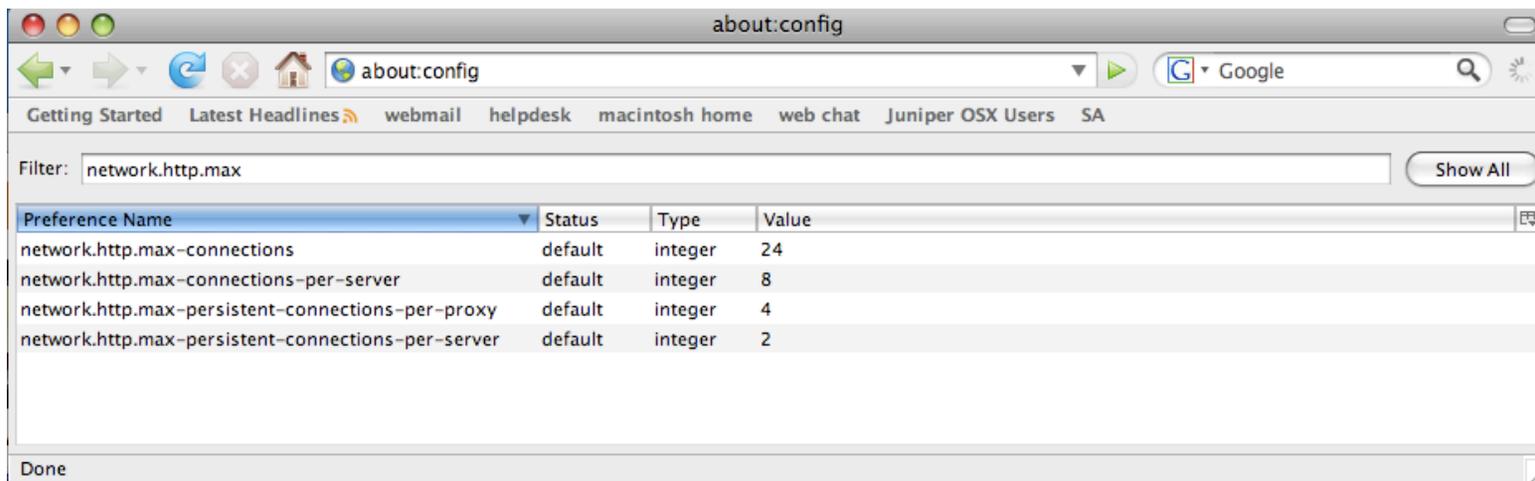


RECOMMENDATIONS

- REC-3: Applications should only open more than 6 connections to download the same object if the first hop link is not saturated.



FIREFOX NUMBER OF CONNECTIONS



The screenshot shows the Firefox 'about:config' page with a search filter of 'network.http.max'. The table below lists the relevant configuration preferences.

Preference Name	Status	Type	Value
network.http.max-connections	default	integer	24
network.http.max-connections-per-server	default	integer	8
network.http.max-persistent-connections-per-proxy	default	integer	4
network.http.max-persistent-connections-per-server	default	integer	2



INTERNET EXPLORER

- “By default, Windows Internet Explorer 7 and earlier versions limit the number of files that you can download at one time to two. Windows Internet Explorer 8 limits the number of files that you can download at one time to six. This change reflects the faster connection speeds that are now typical for most users. For dial-up connections, the limits from earlier versions still apply.”
- <http://support.microsoft.com/kb/282402>
- [http://msdn.microsoft.com/en-us/library/cc304129\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/cc304129(VS.85).aspx)



INTERNET EXPLORER

Version	HTTP 1.0 server (broadband connection)	HTTP 1.1 server (broadband connection)	HTTP 1.0 server (dial-up connection)	HTTP 1.1 server (dial-up connection)
Internet Explorer 7 and earlier	4	2	4	2
Internet Explorer 8	6	6	4	2



CONCURRENT CONNECTIONS

Major Mobile Browsers

Browser	GZIP	Caching	Domain1	Domain 2	Domain 3	Domain 4	Total Connections
Blackberry Browser	20%	71%	4	0	0	0	4
IE Mobile 6.x	83%	100%	3	0	0	0	3
IE Mobile 7.x	100%	89%	3	0	0	0	3
Opera Mini 3.x	100%	100%	10	10	10	10	40
Opera Mini 4.x	100%	0%	2	1	1	1	5
Opera Mobile 8.x	86%	89%	2	2	2	2	8
Safari (iPhone/iPod)	100%	100%	4	4	4	4	16
Symbian (WebKit)	100%	100%	7	0	0	0	7

Cloud Four



Source:Concurrency Test: <http://cloudfour.com/mobile/>

RECOMMENDATIONS

- REC-4: HTTP based applications should use HTTP/1.1 pipelining when transferring multiple small objects from the same server.



TO BE DONE

- Bi-Directional HTTP recommendations?
- Reassembly at the application level discussion

