



LEDBAT APPLICATIONS PRACTICES AND RECOMMENDATIONS

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FEEDBACK FROM IETF-76

- Clearly state what is current practice vs. best recommendations
- Discuss which recommendations are due to defective implementations vs. open problems
- Whether 'user control' be a recommendation.
- Diffserv in another document (done)

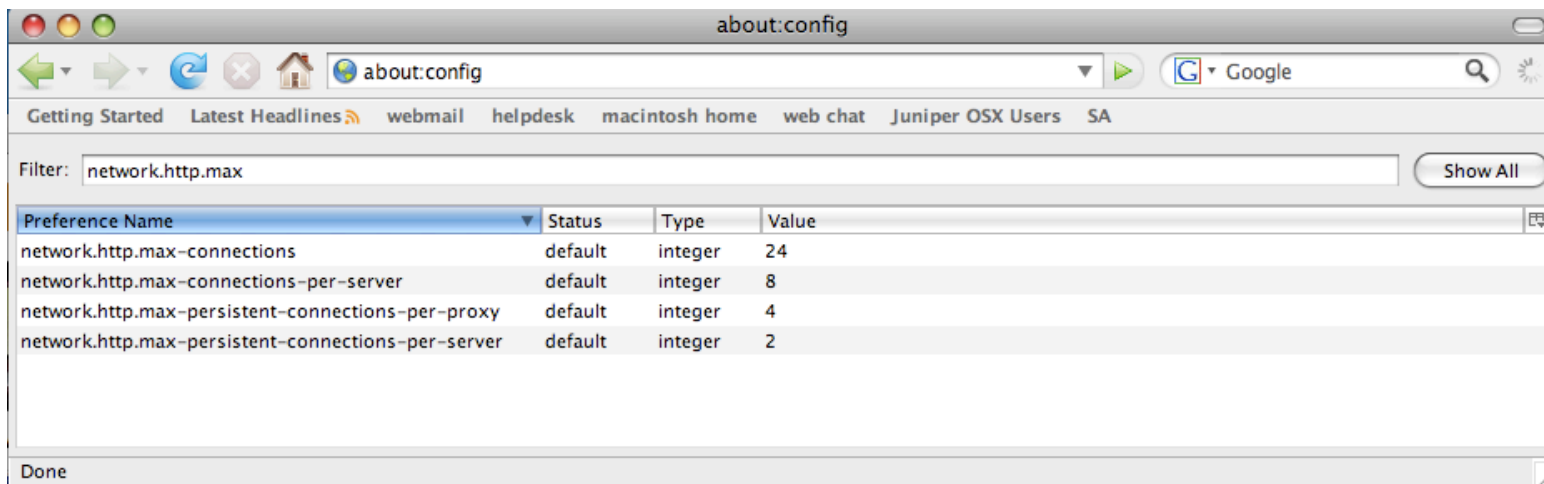


CURRENT PRACTICE – MULTIPLE TCP CONNECTIONS

- Browsers open multiple TCP connections per domain to download content
- Web Servers divide content in multiple domains to allow content to be downloaded in parallel
- Clients (download managers) open multiple connections to download content
 - http://en.wikipedia.org/wiki/Comparison_of_download_managers



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/>

CURRENT PRACTICE – HTTP PIPELINING

- Not used in any significant way today on the Internet
- Comes disabled on most browsers
- http://en.wikipedia.org/wiki/HTTP_pipelining



CURRENT PRACTICE – WINDOW SCALE

- Widely implemented and enabled by default in desktop OSs
- Not clear how much is used in the wild
- A project is in the works to find out which TCP options are actually used in the wild. Results at the next IETF.



CURRENT PRACTICE – USER CONTROL

- Today users already have a good deal of control over how many connections are opened by both Web Browsers (as seen in previous slides) and P2P Clients



RECOMMENDATIONS - WINDOW SCALE

- 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 – MULTIPLE CONCURRENT CONNECTIONS

- REC-3: Applications in general should not open more than 6 connections to download the same object.
- Does this new working address the concerns raised in the previous meeting?



RECOMMENDATIONS – HTTP PIPELINING

- REC-4: HTTP based applications should use HTTP/1.1 pipelining when transferring multiple small objects from the same server.
- We can recommend HTTP Pipelining but whether it will be adopted given the current Internet model is to be determined. The trend today is to not be adopted.
- There are some initiatives to overcome HOL and multiple connections using a protocol on top of HTTP
 - <http://dev.chromium.org/spdy/spdy-protocol/spdy-protocol-draft2>.
 - <http://devcentral.f5.com/weblogs/macvittie/archive/2009/11/17/google-spdy-protocol-would-require-mass-change-in-infrastructure.aspx>



RECOMMENDATIONS – USER CONTROL

- REC-5: Application developers should provide users with a way to configure the number of concurrent TCP connections used to transfer a single object.



OTHER RECOMMENDATIONS

- Should we recommend GZIP compressions by Web Servers in some cases?
- <http://devcentral.f5.com/weblogs/macvittie/archive/2009/05/27/i-am-wondering-why-not-all-websites-enabling-this-great.aspx>
- Bi-directional HTTP
 - HyBi working group effort at IETF

