Understanding Low Bandwidth and High Latency

By Sam Dutton

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It's important to understand what using your app or site feels like when connectivity is poor or unreliable, and build accordingly. A range of tools can help you.

Test with low bandwidth and high latency

An increasing proportion of people experience the web on mobile devices. Even at home, many people are abandoning fixed broadband for mobile.

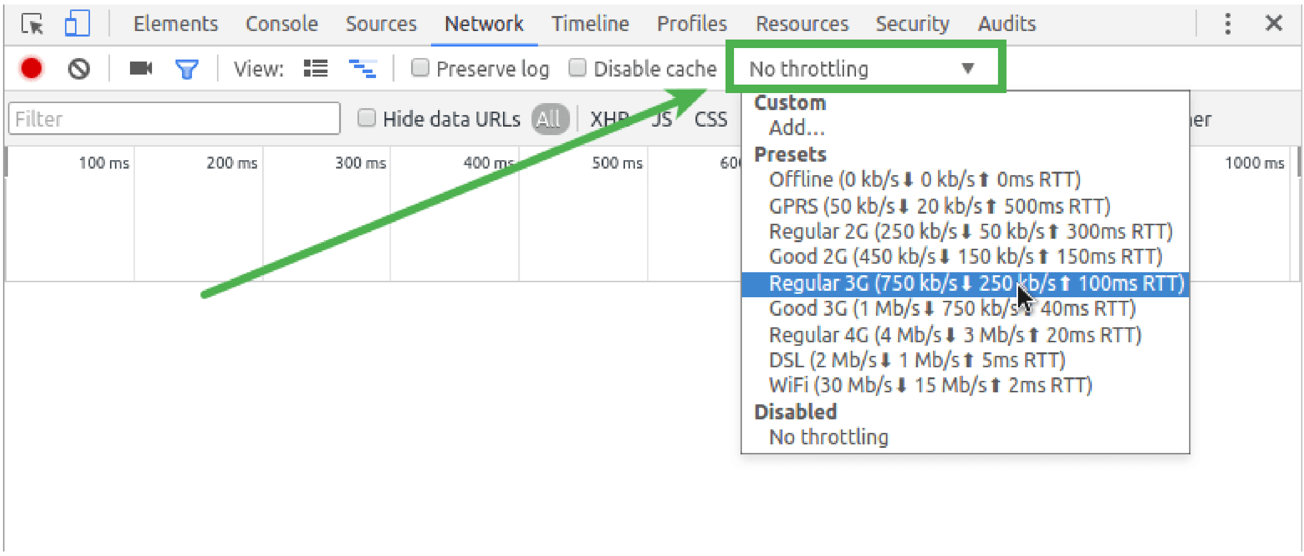
In this context, it's important to understand what using your app or site feels like when connectivity is poor or unreliable. A range of software tools can help you emulate and simulate low bandwidth and high latency.

Emulate network throttling

When building or updating a site, you must ensure adequate performance in a variety of connectivity conditions. Several tools can help.

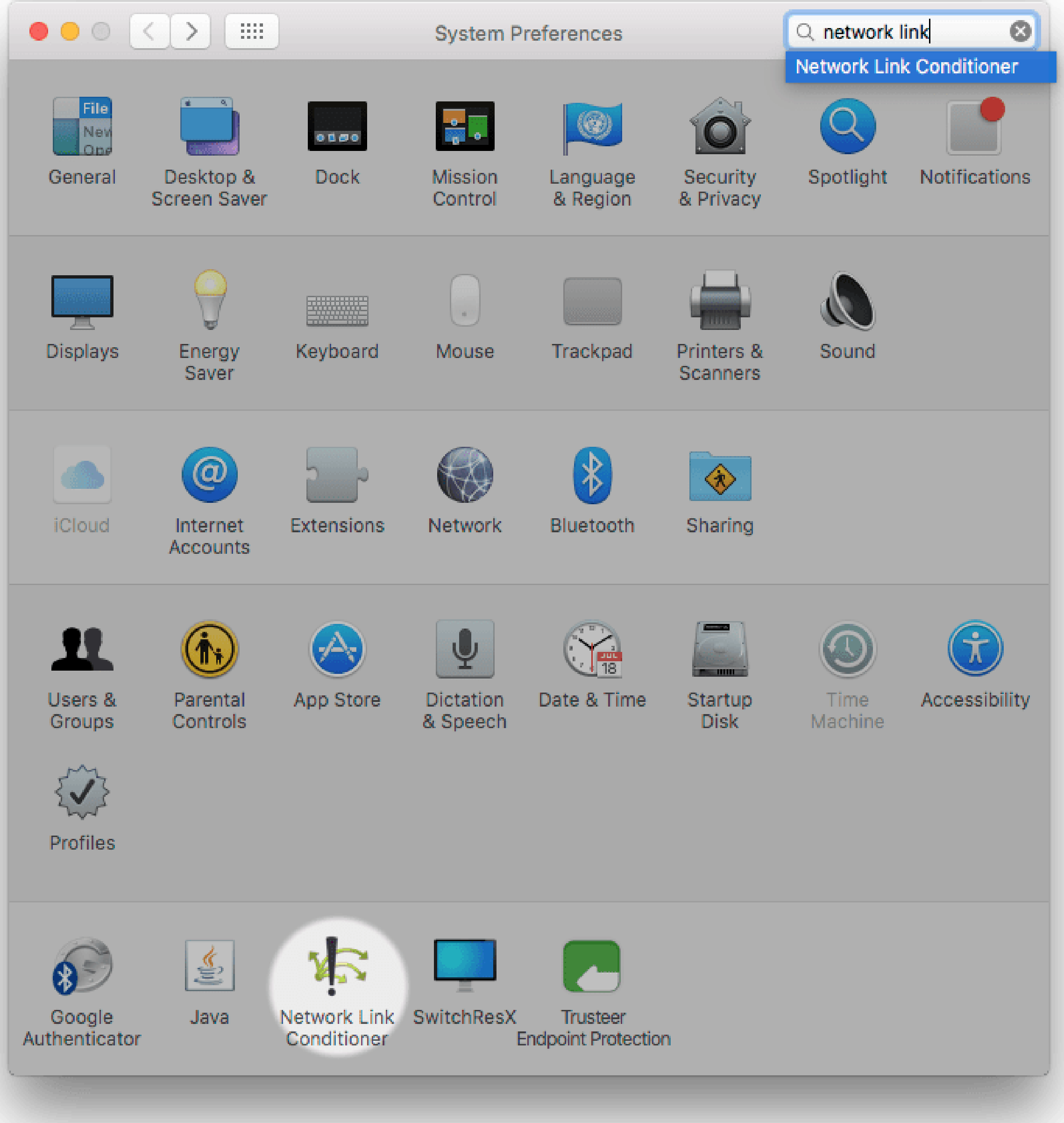
Browser tools

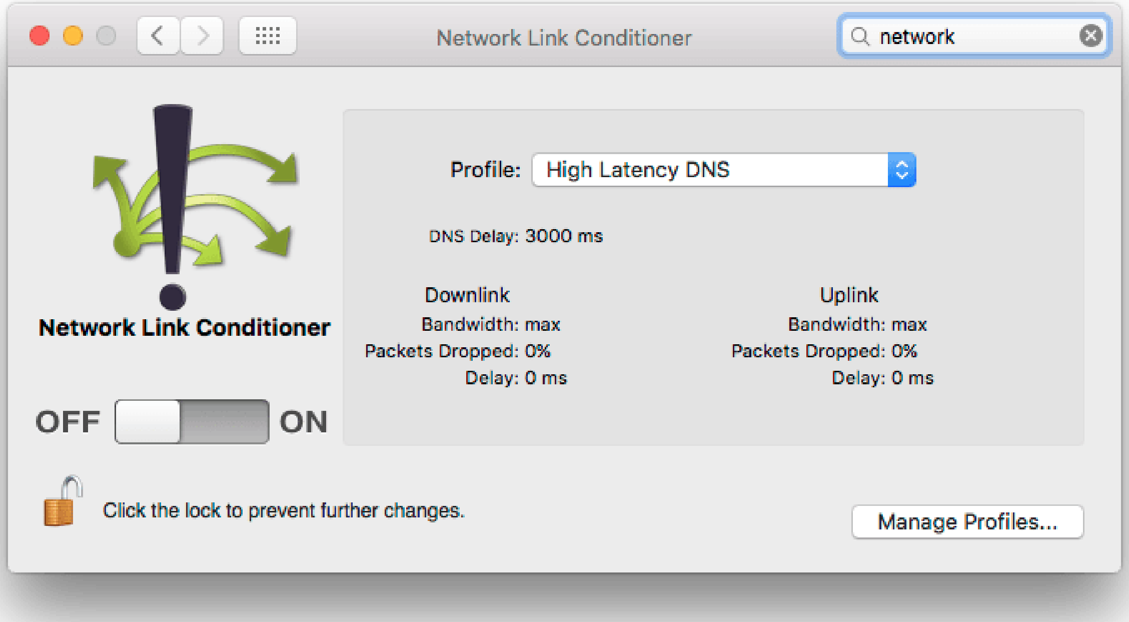
Chrome DevTools lets you test your site with a variety of upload/download speeds and round-trip times, using presets or custom settings from the Network panel. See Get Started with Analyze Network Performance to learn the basics.


Elements
Console
Sources
Network
Timeline
Profiles
Resources
Security
Audits
View:
Preserve log
Disable cache
No throttling
Filter
Hide data URLs
All
XHR
JS
CSS
100 ms
200 ms
300 ms
400 ms
500 ms
1000 ms
Custom
Add...
Presets
Offline (0 kb/s⬇ 0 kb/s⬆ 0ms RTT)
GPRS (50 kb/s⬇ 20 kb/s⬆ 500ms RTT)
Regular 2G (250 kb/s⬇ 50 kb/s⬆ 300ms RTT)
Good 2G (450 kb/s⬇ 150 kb/s⬆ 150ms RTT)
Regular 3G (750 kb/s⬇ 250 kb/s⬆ 100ms RTT)
Good 3G (1 Mb/s⬇ 750 kb/s⬆ 40ms RTT)
Regular 4G (4 Mb/s⬇ 3 Mb/s⬆ 20ms RTT)
DSL (2 Mb/s⬇ 1 Mb/s⬆ 5ms RTT)
WiFi (30 Mb/s⬇ 15 Mb/s⬆ 2ms RTT)
Disabled
No throttling

System tools

Network Link Conditioner is a preference panel available on Mac if you install Hardware IO Tools for Xcode:


System Preferences
network link
Network Link Conditioner
General
Desktop & Screen Saver
Dock
Mission Control
Language & Region
Security & Privacy
Spotlight
Notifications
Displays
Energy Saver
Keyboard
Mouse
Trackpad
Printers & Scanners
Sound
iCloud
Internet Accounts
Extensions
Network
Bluetooth
Sharing
Users & Groups
Parental Controls
App Store
Dictation & Speech
Date & Time
Startup Disk
Time Machine
Accessibility
Profiles
Google Authenticator
Java
Network Link Conditioner
SwitchResX
Trusteer Endpoint Protection



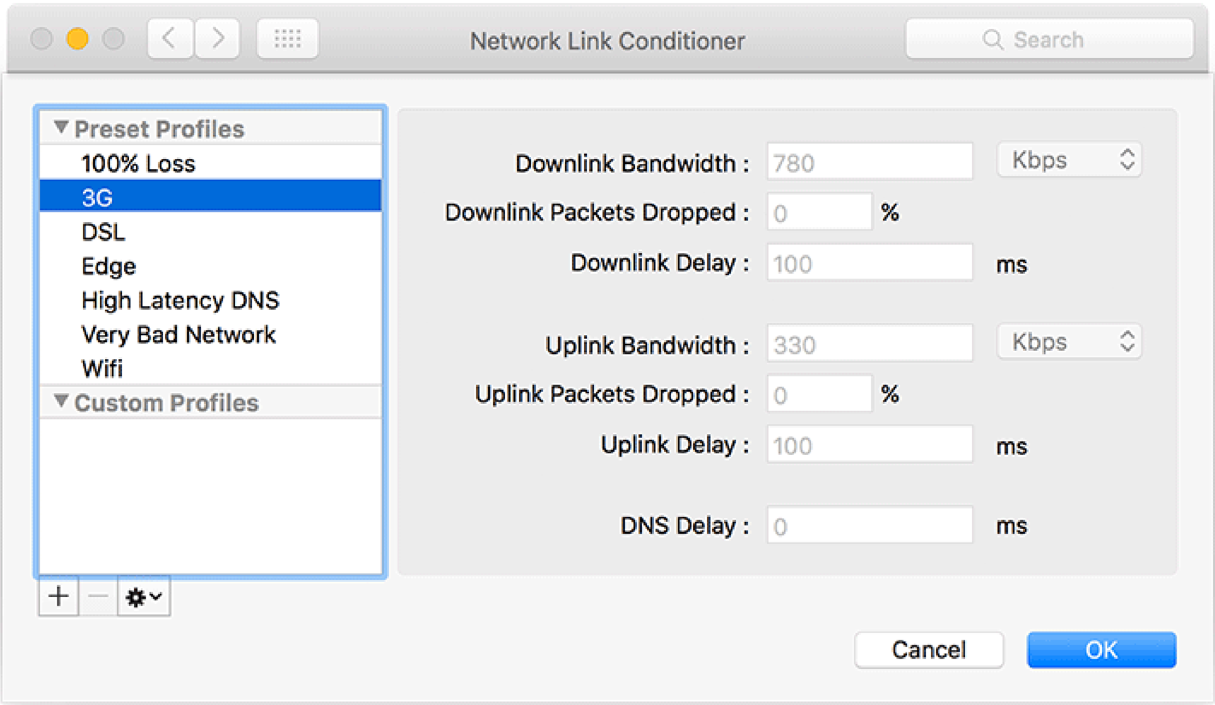
Profile: High Latency DNS

DNS Delay: 3000 ms

Downlink
Bandwidth: max
Packets Dropped: 0%
Delay: 0 ms

Uplink
Bandwidth: max
Packets Dropped: 0%
Delay: 0 ms

Click the lock to prevent further changes.



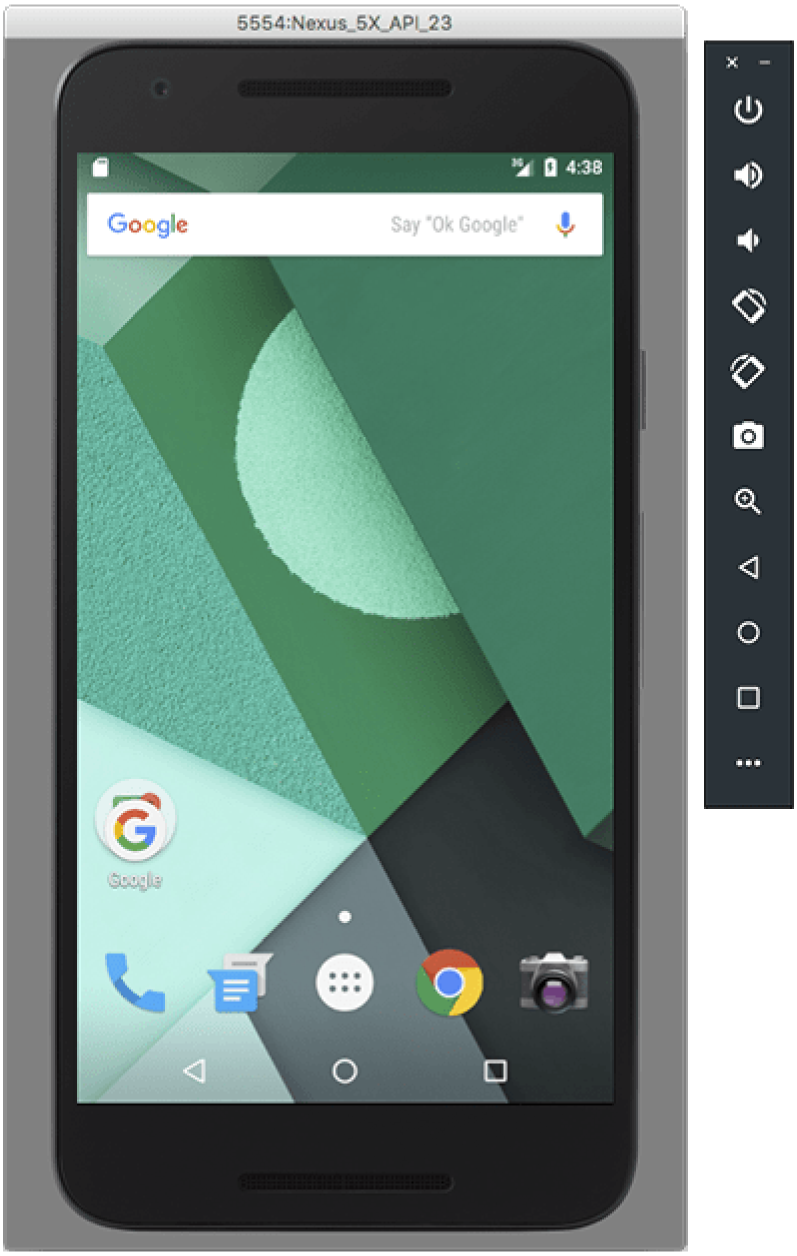
Downlink Bandwidth : 780 Kbps
Downlink Packets Dropped : 0 %
Downlink Delay : 100 ms

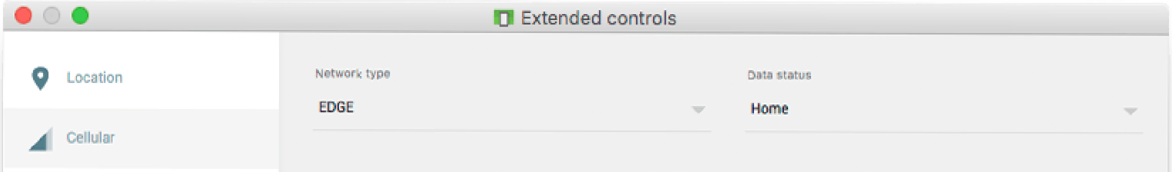
Uplink Bandwidth : 330 Kbps
Uplink Packets Dropped : 0 %
Uplink Delay : 100 ms

DNS Delay : 0 ms

Device emulation

Android Emulator allows you to simulate various network conditions while running apps (including web browsers and hybrid web apps) on Android:





Network type
EDGE

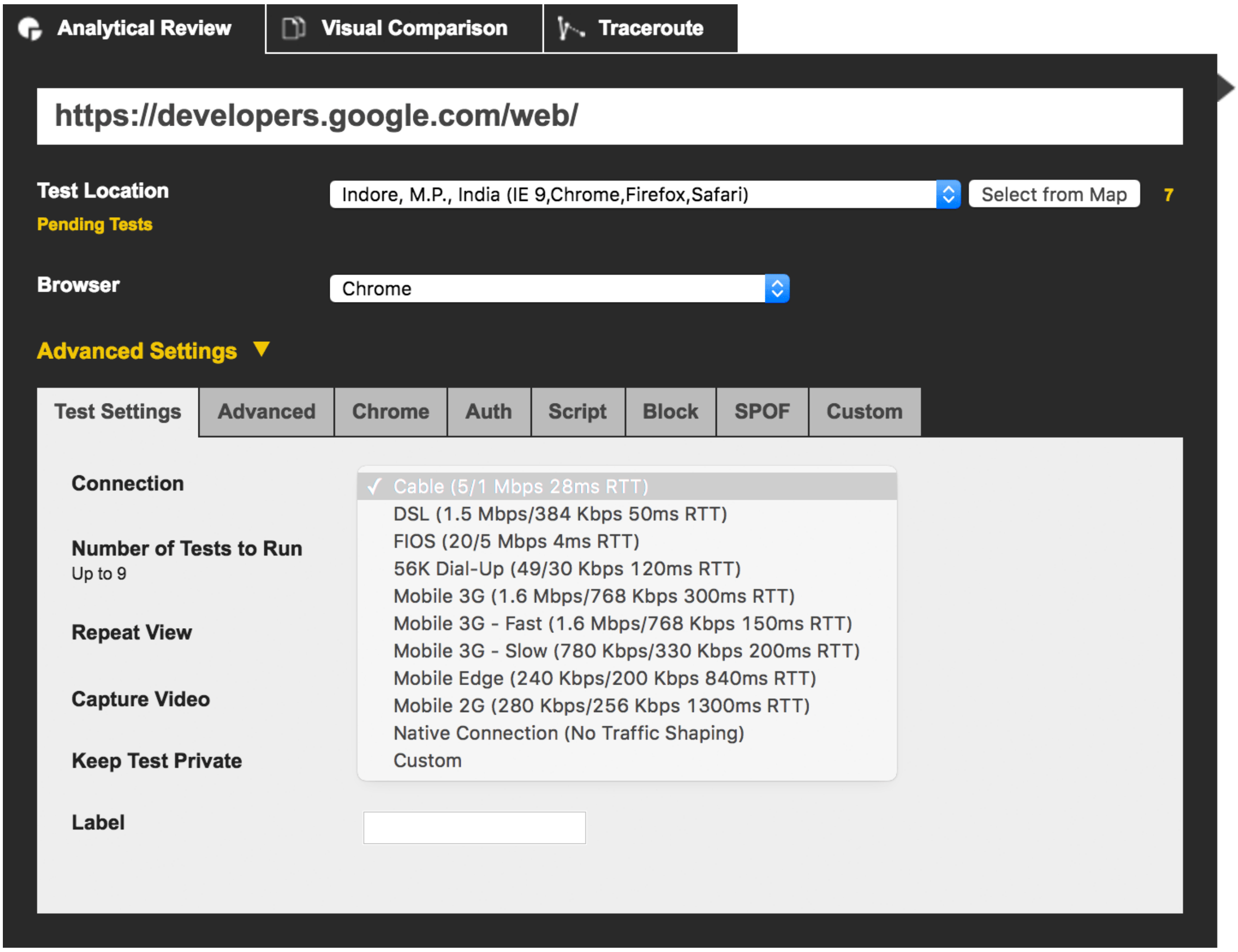
Data status
Home

For iPhone, Network Link Conditioner can be used to simulate impaired network conditions (see above).

Test from different locations and networks

Connectivity performance depends on server location as well as network type.

WebPagetest is an online service that enables a set of performance tests to be run for your site using a variety of networks and host locations. For example, you can try out your site from a server in India on a 2G network, or over cable from a city in the US.



https://developers.google.com/web/

Test Location: Indore, M.P., India (IE 9,Chrome,Firefox,Safari)

Pending Tests

Browser: Chrome

Connection:

✓ Cable (5/1 Mbps 28ms RTT)
DSL (1.5 Mbps/384 Kbps 50ms RTT)
FIOS (20/5 Mbps 4ms RTT)
56K Dial-Up (49/30 Kbps 120ms RTT)
Mobile 3G (1.6 Mbps/768 Kbps 300ms RTT)
Mobile 3G - Fast (1.6 Mbps/768 Kbps 150ms RTT)
Mobile 3G - Slow (780 Kbps/330 Kbps 200ms RTT)
Mobile Edge (240 Kbps/200 Kbps 840ms RTT)
Mobile 2G (280 Kbps/256 Kbps 1300ms RTT)
Native Connection (No Traffic Shaping)
Custom

Number of Tests to Run
Up to 9

Repeat View

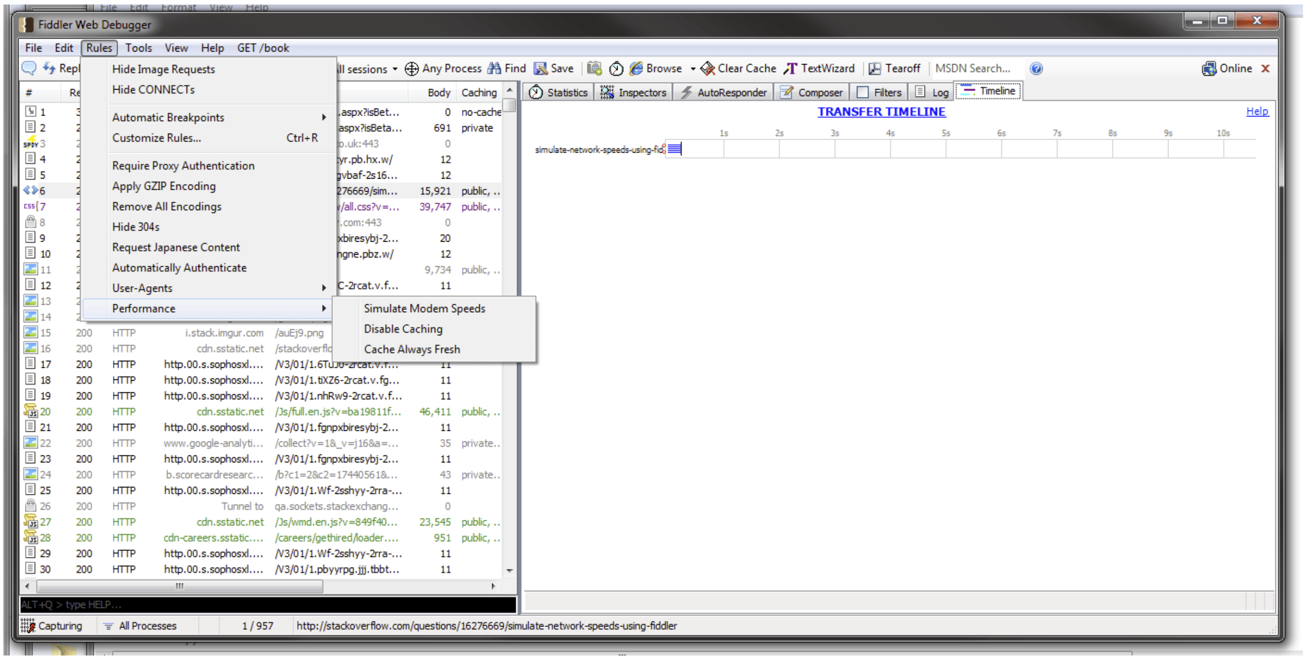
Capture Video

Keep Test Private

Label

Select a location and, from advanced settings, select a connection type. You can even automate testing using scripts (for example, to log in to a site) or using their RESTful APIs. This helps you to include connectivity testing into build processes or performance logging.

Fiddler supports Global proxying via GeoEdge, and its custom rules can be used to simulate modem speeds:



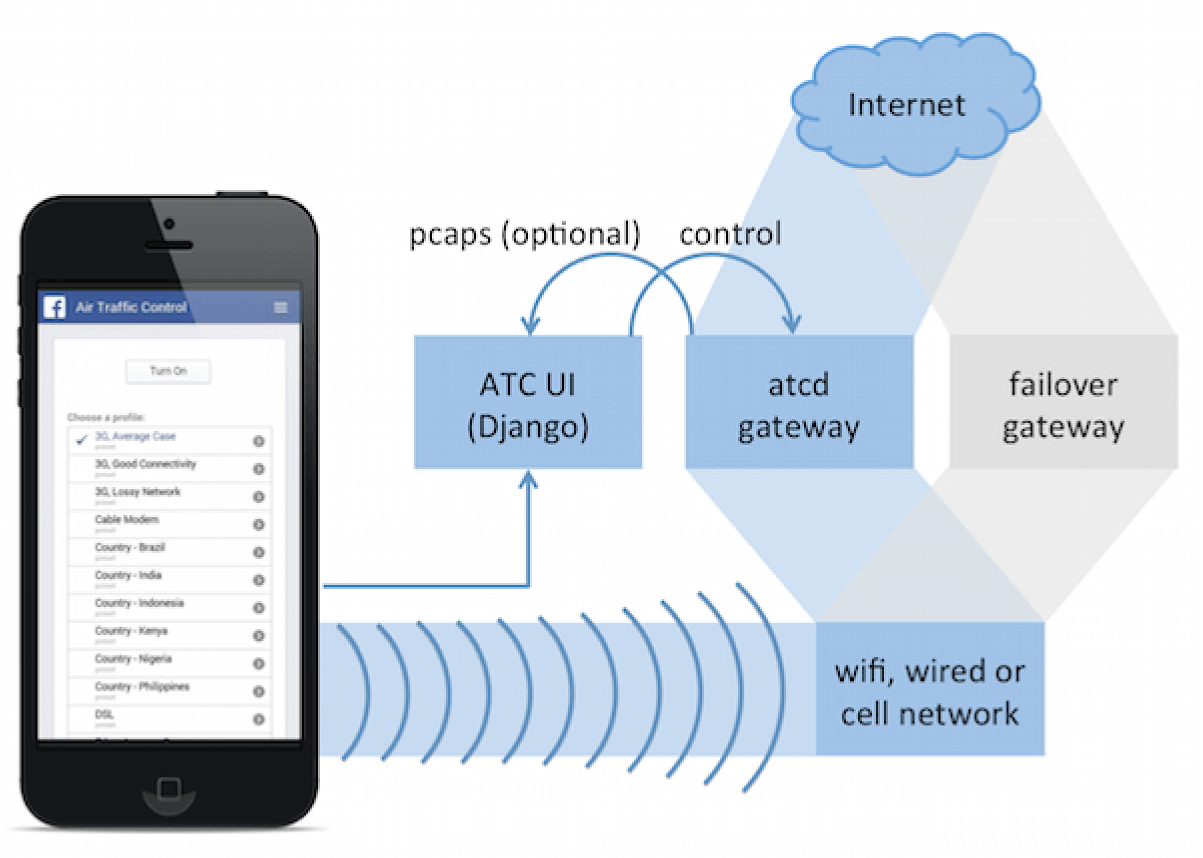
#	Re				Body	Caching
1	3			.aspx?isBet...	0	no-cache
2	2			aspx?isBeta...	691	private
3	2			o.uk:443	0	
4	2			yr.pb.hx.w/	12	
5	2			gvbaf-2s16...	12	
6	2			276669/sim...	15,921	public, ..
7	2			/all.css?v=...	39,747	public, ..
8	2			.com:443	0	
9	2			xbiresybj-2...	20	
10	2			ngne.pbz.w/	12	
11	2				9,734	public, ..
12	2			C-2rcat.v.f...	11	
13	2					
14	2					
15	200	HTTP	i.stack.imgur.com	/auEj9.png		
16	200	HTTP	cdn.sstatic.net	/stackoverflo		
17	200	HTTP	http.00.s.sophosxl....	/V3/01/1.6TuJ0-2rcat.v.f...	11	
18	200	HTTP	http.00.s.sophosxl....	/V3/01/1.tiXZ6-2rcat.v.fg...	11	
19	200	HTTP	http.00.s.sophosxl....	/V3/01/1.nhRw9-2rcat.v.f...	11	
20	200	HTTP	cdn.sstatic.net	/Js/full.en.js?v=ba19811f...	46,411	public, ..
21	200	HTTP	http.00.s.sophosxl....	/V3/01/1.fgnpxbiresybj-2...	11	
22	200	HTTP	www.google-analyti...	/collect?v=1&_v=j16&a=...	35	private..
23	200	HTTP	http.00.s.sophosxl....	/V3/01/1.fgnpxbiresybj-2...	11	
24	200	HTTP	b.scorecardresearc...	/b?c1=2&c2=17440561&...	43	private..
25	200	HTTP	http.00.s.sophosxl....	/V3/01/1.Wf-2sshyy-2rra-...	11	
26	200	HTTP	Tunnel to	qa.sockets.stackexchang...	0	
27	200	HTTP	cdn.sstatic.net	/Js/wmd.en.js?v=849f40...	23,545	public, ..
28	200	HTTP	cdn-careers.sstatic....	/careers/gethired/loader....	951	public, ..
29	200	HTTP	http.00.s.sophosxl....	/V3/01/1.Wf-2sshyy-2rra-...	11	
30	200	HTTP	http.00.s.sophosxl....	/V3/01/1.pbyyrpg.jjj.tbbt...	11	

Capturing All Processes 1 / 957 http://stackoverflow.com/questions/16276669/simulate-network-speeds-using-fiddler

Test on an impaired network

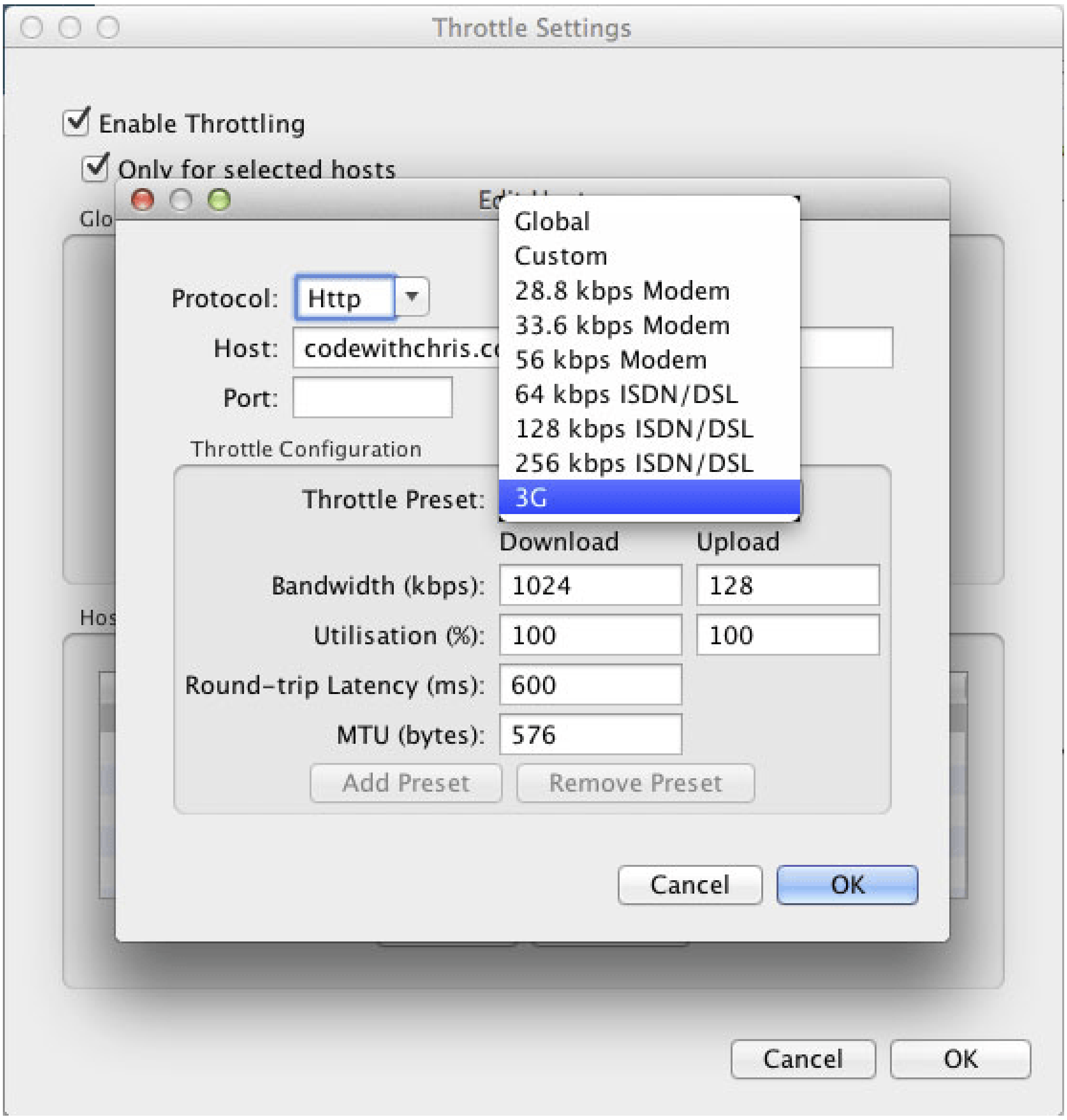
Software and hardware proxies enable you to emulate problematic mobile network conditions, such as bandwidth throttling, packet delay, and random packet loss. A shared proxy or impaired network can enable a team of developers to incorporate real-world network testing in their workflow.

Facebook's Augmented Traffic Control (ATC) is a BSD-licensed set of applications that can be used to shape traffic and emulate impaired network conditions:



> Facebook even instituted 2G Tuesdays to help understand how people on 2G use their product. On Tuesdays, employees get a pop-up that gives them the option to simulate a 2G connection.

The Charles ↗ HTTP/HTTPS proxy can be used to adjust bandwidth and latency. Charles is commercial software, but a free trial is available.



Throttle Settings

☑ Enable Throttling

☑ Only for selected hosts

Protocol: Http

Host: codewithchris.c

Port:

Throttle Configuration

Throttle Preset: 3G

Download Upload

Bandwidth (kbps): 1024 128

Utilisation (%): 100 100

Round-trip Latency (ms): 600

MTU (bytes): 576

More information about Charles is available from codewithchris.com.

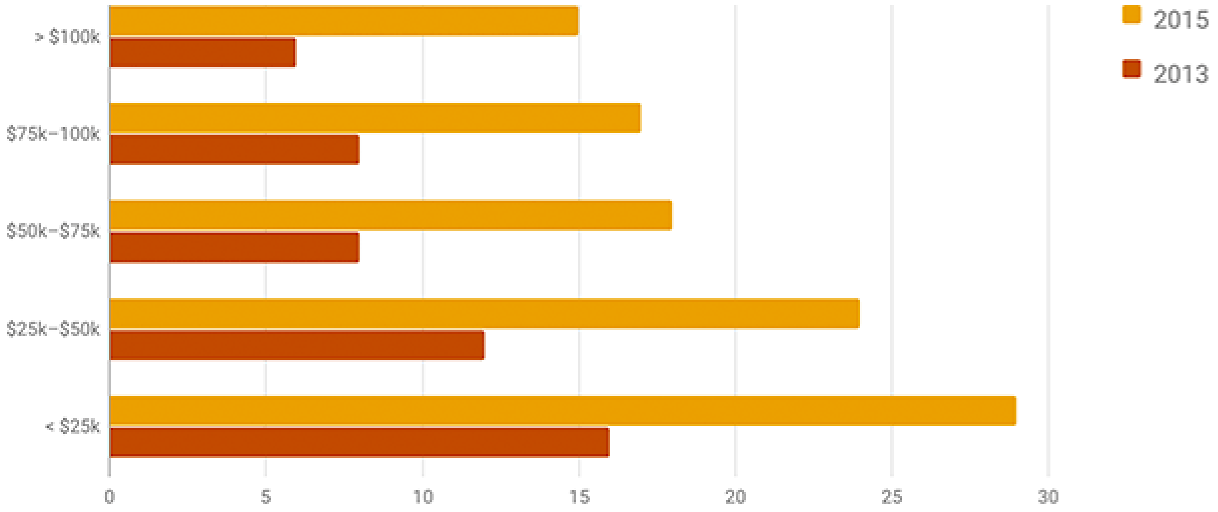
Handle unreliable connectivity and "lie-fi"

What is lie-fi?

The term lie-fi dates back to at least 2008 (when phones looked like this), and refers to connectivity that isn't what it seems. Your browser behaves as if it has connectivity when, for whatever reason, it doesn't.

Misinterpreted connectivity can result in a poor experience as the browser (or JavaScript) persists in trying to retrieve resources rather than giving up and choosing a sensible fallback. Lie-fi can actually be worse than offline; at least if a device is definitely offline, your JavaScript can take appropriate evasive action.

Lie-fi is likely to become a bigger problem as more people move to mobile and away from fixed broadband. Recent US Census data shows a move away from fixed broadband. The following chart shows the use of mobile internet at home in 2015 compared with 2013:



Use timeouts to handle intermittent connectivity

In the past, hacky methods using XHR have been used to test for intermittent connectivity, but service worker enables more reliable methods to set network timeouts. This can be achieved using Workbox with only a few lines of code:

```
workboxSW.router.registerRoute(
  '/path/to/image',
  workboxSW.strategies.networkFirst({networkTimeoutSeconds: 3})
);
```

You can learn more about Workbox in Jeff Posnick's Chrome Dev Summit talk, Workbox: Flexible PWA Libraries.

Timeout functionality is also being developed for the Fetch API, and the Streams API should help by optimizing content delivery and avoiding monolithic requests. Jake Archibald gives more details about tackling lie-fi in Supercharging page load.

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