Developer Tools

## Optimizing Web Content in Your App Session 420

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## Web Inspector

Analyzing Memory

Profiling Javascript

## Profiling Javascript

Analyzing Memory

Analyzing Memory

Profiling Javascript

## Profiling Javascript

Analyzing Memory





## JSContext





## Introducing Safari View Controller

### WWDC 2015







## WKWebView



## Introducing Safari View Controller

### WWDC 2014







## Web Inspector

|              |            |                      |         | 8                       |
|--------------|------------|----------------------|---------|-------------------------|
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| General Tabs | AutoFill I | Passwords            | Search  | Security                |
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Bonjour in the Bookmarks menu Bonjour in the Favorites bar

g-ins to save power

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| Bonjour:           | Include Bor  |
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| Internet plug-ins: | Stop plug-i  |
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Bonjour in the Bookmarks menu Bonjour in the Favorites bar

g-ins to save power







| Bonjour:           | Include Bor   |
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Bonjour in the Bookmarks menu Bonjour in the Favorites bar

g-ins to save power









| ookmarks Develop                      | Window Help   |                                  |
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| Open P<br>User Ag                     | age With<br>gent  | <ul> <li>•</li> <li>•</li> </ul> |
| iPhone                                |   | ►                                |
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| Simulat                               | tor   |                                  |
| Enter R                               | esponsive Design Mode   | Ϋ́R                              |
| Show Show E                           | Snippet Editor<br>Extension Builder                               |                                  |
| Connect<br>Show E<br>Show F<br>Show F | et Web Inspector<br>Fror Console<br>Page Source<br>Page Resources | 1第合フ<br>2第了<br>U第了<br>A第了        |
| Start T<br>Start E                    |   |                                  |
| Empty<br>Disable                      | Caches<br>Caches  | ~C ℋΕ                            |
|                                       |   |                                  |

### Colloquy base.html base.html base.html base.html JSPong

Pong Context

Automatically Show Web Inspector for JSContexts Automatically Pause Connecting to JSContexts



Key

### Entitlemen

### com.app

|                       | Туре       | Value    |
|-----------------------|------------|----------|
| nts File              | Dictionary | (1 item) |
| le.webinspector.allow | Boolean    | YES      |

|                         | Web Inspec         | ctor — MacBook Pro — JSPong -                              | – Pong Context |           |   |
|-------------------------|--------------------|--|----------------|-----------|---|
|                         |                    | Debugger Paused V  |                | Q~ Search |   |
| Resources               | (J) Timelines      | Debugger   | > Console      | Q Search  | + |
|                         |                    | PongAl.js  |                |           |   |
| Pause Reason            | o 1 var last       | BallY = 0;   |                |           |   |
| Triggered Breakpoint    | 3 function         | <pre>nextMove(paddle, ball)</pre>                          |                |           |   |
| ▼ Call Stack            | 5 var b            | <pre>ballY = ball.middleY;</pre>                           |                |           |   |
| nextMove — PongAl.js:5  | 6 var b<br>7 ? kUr | <pre>ballDirection = ballY &gt; lastBa<br/>Direction</pre> | ILY            |           |   |
| Breakpoints             | 8 : kDo            | ownDirection;  |                |           |   |
| All Exceptions          | 10                 | batti – batti,   |                |           |   |
| All Uncaught Exceptions | 11 if (t           | <pre>pallY &gt; paddle.top) pature klipDirection;</pre>    |                |           |   |
| V js PongAl.js          | 13                 | eturn kopullettion;  |                |           |   |
| Line 5                  | 14 if (t           | pallY < paddle.bottom)                                     |                |           |   |
| Sources                 | 16                 | ecurin Koowindineccion,                                    |                |           |   |
|                         | 17 retur           | rn ballDirection;  |                |           |   |
|                         | 19                 |  |                |           |   |

| .middleY;                 |           |  |  |  |
|---------------------------|-----------|--|--|--|
| on = ballY >              | lastBallY |  |  |  |
| ;<br>Y;                   |           |  |  |  |
| lle.top)<br>rection;      |           |  |  |  |
| lle.bottom)<br>Direction; |           |  |  |  |
| tion;                     |           |  |  |  |



## Profiling Javascript

Analyzing Memory

Analyzing Memory

Profiling Javascript

Profiling JavaScript

NEW

# Sampling Profiler



Where is the time being spent?

Where is the time being spent? Samples the stack every millisecond

Where is the time being spent? Samples the stack every millisecond Runs with all four tiers of the JIT compiler

Where is the time being spent? Samples the stack every millisecond Runs with all four tiers of the JIT compiler Breakpoints and debugger statements are ignored



## JavaScript Profiling Speed Improvement
Profiling JavaScript Events view

|                             | Web Inspector — localhost — demo          |                  |                  |          |            |             |                |  |  |  |
|-----------------------------|---|------------------|------------------|----------|------------|-------------|----------------|--|--|--|
|                             |   | 🗋 11 🗋 682       | .5 KB 🕔 36.6ms 🏮 | 0 0 0    | <u>∧</u> o |             | ર્~ Search     |  |  |  |
| 日 Elements                  | Detwork Resources                         | J Tim            | elines 🕅         | Debugger | Storage    | >= Console  | Q Search +     |  |  |  |
| 🛑 Events Frames 🗸           | > 🖄 Timeline Recording 1 > 🚫 JavaScript & | Events > (1) Oms | - 15.00s         |          |            |             | 団              |  |  |  |
| E                           | dit 1.00s 2.00s                           | 3.00s            | 4.00s            | 5.00s    | 6.00s      | 7.00s 8.00s | 9.00s 10.00s   |  |  |  |
| JavaScript & Events         |   |                  |                  |          |            |             |                |  |  |  |
| 🚫 Details 👌 📃 Events 🗘      |   |                  |                  |          |            |             | Filter Records |  |  |  |
| Name                        | Location                                  | Samples          | Start 7          | Time ^   | Total Time | Self Time   | Average Time   |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 7                | 7.0              | 687ms    | 10.11ms    | 10.11ms     | 10.11ms        |  |  |  |
| Animation Frame Req         | f d3_timer_step — d3.js:2156              | 0                | 17               | 7.76ms   | Oms        | Oms         | Oms            |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 5                | 24               | l.19ms   | 6.605ms    | 6.605ms     | 6.605ms        |  |  |  |
| Animation Frame Req         | 🕜 d3_timer_step — d3.js:2156              | 0                | 30               | ).77ms   | Oms        | Oms         | Oms            |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 2                | 40               | ).94ms   | 3.101ms    | 3.101ms     | 3.101ms        |  |  |  |
| \Lambda Animation Frame Req | 🕜 d3_timer_step — d3.js:2156              | 0                | 44               | 1.01ms   | Oms        | Oms         | Oms            |  |  |  |
| Garbage Collection          | _   | 0                | 45               | 5.74ms   | 0.738ms    | 0.738ms     | 0.738ms        |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 2                | 57               | 7.50ms   | 2.785ms    | 2.785ms     | 2.785ms        |  |  |  |
| Animation Frame Req         | 🕜 d3_timer_step — d3.js:2156              | 0                | 60               | ).25ms   | Oms        | Oms         | Oms            |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 2                | 74               | 1.95ms   | 3.528ms    | 3.528ms     | 3.528ms        |  |  |  |
| \Lambda Animation Frame Req | f d3_timer_step — d3.js:2156              | 0                | 78               | 8.44ms   | Oms        | Oms         | Oms            |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 2                | 91               | .56ms    | 3.179ms    | 3.179ms     | 3.179ms        |  |  |  |
| \Lambda Animation Frame Req | f d3_timer_step — d3.js:2156              | 0                | 94               | l.71ms   | Oms        | Oms         | Oms            |  |  |  |
| Animation Frame Fired       | js d3.js:2146                             | 2                | 10               | 7.7ms    | 2.989ms    | 2.989ms     | 2.989ms        |  |  |  |
| \Lambda Animation Frame Req | f d3_timer_step — d3.js:2156              | 0                | 11               | 0.6ms    | Oms        | Oms         | Oms            |  |  |  |
| Script Evaluated            | js d3.js:1                                | 4                | 12               | 9.0ms    | 12.78ms    | 12.78ms     | 12.78ms        |  |  |  |
| Script Evaluated            | js d3.geo.projection.js:1                 | 1                | 14               | 2.1ms    | 3.852ms    | 3.852ms     | 3.852ms        |  |  |  |
| Script Evaluated            | js d3.promise.js:1                        | 1                | 14               | 6.1ms    | 0.315ms    | 0.315ms     | 0.315ms        |  |  |  |
| Script Evaluated            | js topojson.js:1                          | 0                | 14               | 16.5ms   | 0.513ms    | 0.513ms     | 0.513ms        |  |  |  |
| Script Evaluated            | js satellite.js:1                         | 1                | 14               | 17.3ms   | 3.617ms    | 3.617ms     | 3.617ms        |  |  |  |
| Script Evaluated            | js global-map.js:1                        | 0                | 15               | 51.3ms   | 0.211ms    | 0.211ms     | 0.211ms        |  |  |  |
| Script Evaluated            | js interface.js:1                         | 0                | 15               | 51.6ms   | 0.203ms    | 0.203ms     | 0.203ms        |  |  |  |
| Script Evaluated            | odemo:16                                  | 0                | 15               | 51.9ms   | 0.118ms    | 0.118ms     | 0.118ms        |  |  |  |
| ▶ 🖪 DOM Content Loaded      | odemo:88                                  | 4                | 15               | 52.1ms   | 3.776ms    | 3.776ms     | 3.776ms        |  |  |  |
| Script Evaluated            | _   | 0                | 15               | 58.2ms   | 0.201ms    | 0.201ms     | 0.201ms        |  |  |  |
| 🗉 Progress Event Dispat     | js d3.js:1954                             | 0                | 16               | 64.1ms   | 0.087ms    | 0.087ms     | 0.087ms        |  |  |  |
| E Load Event Dispatched     | js d3.js:1940                             | 1                | 16               | 64.2ms   | 50.68ms    | 50.68ms     | 50.68ms        |  |  |  |
| E Microtask Dispatched      | _   | 39               | 16               | 6.3ms    | 48.63ms    | 48.63ms     | 48.63ms        |  |  |  |
| Script Evaluated            | _   | 0                | 21               | 6.5ms    | 0.165ms    | 0.165ms     | 0.165ms        |  |  |  |
| E Progress Event Dispat     | js d3.js:1954                             | 0                | 22               | 27.4ms   | 0.178ms    | 0.178ms     | 0.178ms        |  |  |  |
| E Microtask Dispatched      | _   | 0                | 22               | 27.5ms   | 0.085ms    | 0.085ms     | 0.085ms        |  |  |  |
| E Load Event Dispatched     | js d3.js:1940                             | 1                | 22               | 27.6ms   | 0.707ms    | 0.707ms     | 0.707ms        |  |  |  |
| E Microtask Dispatched      | _   | 0                | 22               | 27.8ms   | 0.475ms    | 0.475ms     | 0.475ms        |  |  |  |
| <b>—</b>                    |   |                  |                  | -        |            |             |                |  |  |  |

|                        |       |                  |            |       |       | · · · · |       |              |       |            |    |
|------------------------|-------|------------------|------------|-------|-------|---------|-------|--------------|-------|------------|----|
|                        | Edit  | 1.00s            |            | 2.00s | 3.00s |         | 4.00s | 5.00s        | 6.00s |            | 7. |
| JavaScript & Events    | ×     |                  |            |       |       |         |       |              |       |            |    |
| 🚫 Details 🔪 📃 Events 🗘 |       |                  |            |       |       |         |       |              |       |            |    |
| Name                   | Loca  | tion             |            |       | Samp  | oles    |       | Start Time ^ |       | Total Time |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 7       |       | 7.687ms      |       | 10.11ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 17.76ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 5       |       | 24.19ms      |       | 6.605ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 30.77ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 40.94ms      |       | 3.101ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 44.01ms      |       | Oms        |    |
| Garbage Collection     | -     | _                |            |       |       | 0       |       | 45.74ms      |       | 0.738ms    |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 57.50ms      |       | 2.785ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 60.25ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 74.95ms      |       | 3.528ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 78.44ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 91.56ms      |       | 3.179ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 94.71ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 107.7ms      |       | 2.989ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 110.6ms      |       | Oms        |    |
| Script Evaluated       | js d  | 3.js:1           |            |       |       | 4       |       | 129.0ms      |       | 12.78ms    |    |
| Script Evaluated       | js d  | 3.geo.projection | .js:1      |       |       | 1       |       | 142.1ms      |       | 3.852ms    |    |
| Script Evaluated       | js d  | 3.promise.js:1   |            |       |       | 1       |       | 146.1ms      |       | 0.315ms    |    |
| Script Evaluated       | js to | pojson.js:1      |            |       |       | 0       |       | 146.5ms      |       | 0.513ms    |    |
| Script Evaluated       | js Si | atellite.js:1    |            |       |       | 1       |       | 147.3ms      |       | 3.617ms    |    |
| Script Evaluated       | js g  | lobal-map.js:1   |            |       |       | 0       |       | 151.3ms      |       | 0.211ms    |    |
| Script Evaluated       | js in | nterface.js:1    |            |       |       | 0       |       | 151.6ms      |       | 0.203ms    |    |
| Script Evaluated       | <> d  | emo:16           |            |       |       | 0       |       | 151.9ms      |       | 0.118ms    |    |
| ▶ 🖪 DOM Content Loaded | <> d  | emo:88           |            |       |       | 4       |       | 152.1ms      |       | 3.776ms    |    |



|                        | Edit     | 1.00s                | 2.00s | 3.00s   | 4.00s | 5.00s        | 6.00s | 7         |
|------------------------|----------|----------------------|-------|---------|-------|--------------|-------|-----------|
| JavaScript & Events    | ×        |                      |       |         |       |              |       |           |
| 🚫 Details 🔪 📃 Events 🗘 |          |                      |       |         |       |              |       |           |
| Name                   | Location | l                    |       | Samples |       | Start Time ^ | Ţ     | otal Time |
| Animation Frame Fired  | js d3.js | s:2146               |       | 7       |       | 7.687ms      |       | 10.11ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 17.76ms      |       | Oms       |
| Animation Frame Fired  | js d3.js | s:2146               |       | 5       |       | 24.19ms      |       | 6.605ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 30.77ms      |       | Oms       |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 40.94ms      |       | 3.101ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 44.01ms      |       | Oms       |
| Garbage Collection     | _        |                      |       | 0       |       | 45.74ms      |       | 0.738ms   |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 57.50ms      |       | 2.785ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 60.25ms      |       | Oms       |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 74.95ms      |       | 3.528ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 78.44ms      |       | Oms       |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 91.56ms      |       | 3.179ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 94.71ms      |       | Oms       |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 107.7ms      |       | 2.989ms   |
| Animation Frame Req    | 🜈 d3_t   | imer_step — d3.js:21 | 156   | 0       |       | 110.6ms      |       | Oms       |
| Script Evaluated       | js d3.js | s:1                  |       | 4       |       | 129.0ms      |       | 12.78ms   |
| Script Evaluated       | js d3.g  | eo.projection.js:1   |       | 1       |       | 142.1ms      |       | 3.852ms   |
| Script Evaluated       | js d3.p  | romise.js:1          |       | 1       |       | 146.1ms      |       | 0.315ms   |
| Script Evaluated       | js topo  | json.js:1            |       | 0       |       | 146.5ms      |       | 0.513ms   |
| Script Evaluated       | js sate  | llite.js:1           |       | 1       |       | 147.3ms      |       | 3.617ms   |
| Script Evaluated       | js glob  | al-map.js:1          |       | 0       |       | 151.3ms      |       | 0.211ms   |
| Script Evaluated       | js inter | face.js:1            |       | 0       |       | 151.6ms      |       | 0.203ms   |
| Script Evaluated       | adem 🕹   | o:16                 |       | 0       |       | 151.9ms      |       | 0.118ms   |
| ▶ 🔲 DOM Content Loaded | . 😽 dem  | 0:88                 |       | 4       |       | 152.1ms      |       | 3.776ms   |



|                        | Edit     | 1.00s                | 2.00s | 3.00s   | 4.00s | 5.00s        | 6.00s |            | 7. |
|------------------------|----------|----------------------|-------|---------|-------|--------------|-------|------------|----|
| JavaScript & Events    |          |                      |       |         |       |              |       |            |    |
| 🚫 Details 🗦 📃 Events 🗘 |          |                      |       |         |       |              |       |            |    |
| Name                   | Location | n                    |       | Samples | S     | Start Time ^ | 7     | Total Time |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 7       |       | 7.687ms      |       | 10.11ms    |    |
| Animation Frame Req    | . 🜈 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 17.76ms      |       | Oms        |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 5       |       | 24.19ms      |       | 6.605ms    |    |
| Animation Frame Req    | . 🕜 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 30.77ms      |       | Oms        |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 40.94ms      |       | 3.101ms    |    |
| Animation Frame Req    | . 🕜 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 44.01ms      |       | Oms        |    |
| Garbage Collection     | _        |                      |       | 0       |       | 45.74ms      |       | 0.738ms    |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 57.50ms      |       | 2.785ms    |    |
| Animation Frame Req    | . 🜈 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 60.25ms      |       | Oms        |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 74.95ms      |       | 3.528ms    |    |
| Animation Frame Req    | . 🜈 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 78.44ms      |       | Oms        |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 91.56ms      |       | 3.179ms    |    |
| Animation Frame Req    | . 🜈 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 94.71ms      |       | Oms        |    |
| Animation Frame Fired  | js d3.js | s:2146               |       | 2       |       | 107.7ms      |       | 2.989ms    |    |
| Animation Frame Req    | . 🜈 d3_t | timer_step — d3.js:2 | 156   | 0       |       | 110.6ms      |       | Oms        |    |
| Script Evaluated       | js d3.js | s:1                  |       | 4       |       | 129.0ms      |       | 12.78ms    |    |
| Script Evaluated       | js d3.g  | jeo.projection.js:1  |       | 1       |       | 142.1ms      |       | 3.852ms    |    |
| Script Evaluated       | js d3.p  | promise.js:1         |       | 1       |       | 146.1ms      |       | 0.315ms    |    |
| Script Evaluated       | js topo  | ojson.js:1           |       | 0       |       | 146.5ms      |       | 0.513ms    |    |
| Script Evaluated       | js sate  | llite.js:1           |       | 1       |       | 147.3ms      |       | 3.617ms    |    |
| Script Evaluated       | js glob  | al-map.js:1          |       | 0       |       | 151.3ms      |       | 0.211ms    |    |
| Script Evaluated       | js inter | rface.js:1           |       | 0       |       | 151.6ms      |       | 0.203ms    |    |
| Script Evaluated       | odem 🕹   | 10:16                |       | 0       |       | 151.9ms      |       | 0.118ms    |    |
| DOM Content Loaded .   | 😽 dem    | 10:88                |       | 4       |       | 152.1ms      |       | 3.776ms    |    |



|                                 | Edit 1.00s            | 2.00s     | 3.00s   | 4.00s   | 5.00s | 6.00s |            | 7 |
|---------------------------------|-----------------------|-----------|---------|---------|-------|-------|------------|---|
| JavaScript & Events             |                       |           |         |         |       |       |            |   |
| 🚫 Details 🔪 📃 Events 🗘          |                       |           |         |         |       |       |            |   |
| Name                            | Location              |           | Samples | Start T | ime ^ | 7     | Total Time |   |
| ► \Lambda Animation Frame Fired | js d3.js:2146         |           | 7       | 7.6     | 87ms  |       | 10.11ms    |   |
| Animation Frame Req             | d3_timer_step — d     | 3.js:2156 | 0       | 17.     | .76ms |       | Oms        |   |
| Animation Frame Fired           | js d3.js:2146         |           | 5       | 24.     | .19ms |       | 6.605ms    |   |
| Animation Frame Req             | d3_timer_step — d     | 3.js:2156 | 0       | 30.     | .77ms |       | Oms        |   |
| Animation Frame Fired           | js d3.js:2146         |           | 2       | 40.     | .94ms |       | 3.101ms    |   |
| Animation Frame Req             | d3_timer_step — d     | 3.js:2156 | 0       | 44.     | .01ms |       | Oms        |   |
| Garbage Collection              | _                     |           | 0       | 45.     | .74ms |       | 0.738ms    |   |
| Animation Frame Fired           | js d3.js:2146         |           | 2       | 57.     | .50ms |       | 2.785ms    |   |
| Animation Frame Req             | 🕜 d3_timer_step — d   | 3.js:2156 | 0       | 60.     | .25ms |       | Oms        |   |
| ► 🔼 Animation Frame Fired       | js d3.js:2146         |           | 2       | 74.     | .95ms |       | 3.528ms    |   |
| Animation Frame Req             | 🕜 d3_timer_step — d   | 3.js:2156 | 0       | 78.     | .44ms |       | Oms        |   |
| ► 🔼 Animation Frame Fired       | js d3.js:2146         |           | 2       | 91.     | .56ms |       | 3.179ms    |   |
| Animation Frame Req             | 🕜 d3_timer_step — d   | 3.js:2156 | 0       | 94.     | .71ms |       | Oms        |   |
| ► 🔝 Animation Frame Fired       | js d3.js:2146         |           | 2       | 10      | 7.7ms |       | 2.989ms    |   |
| Animation Frame Req             | 🕜 d3_timer_step — d   | 3.js:2156 | 0       | 110     | 0.6ms |       | Oms        |   |
| Script Evaluated                | js d3.js:1            |           | 4       | 12      | 9.0ms |       | 12.78ms    |   |
| Script Evaluated                | js d3.geo.projection. | js:1      | 1       | 14      | 2.1ms |       | 3.852ms    |   |
| Script Evaluated                | js d3.promise.js:1    |           | 1       | 14      | 6.1ms |       | 0.315ms    |   |
| Script Evaluated                | js topojson.js:1      |           | 0       | 14      | 6.5ms |       | 0.513ms    |   |
| Script Evaluated                | js satellite.js:1     |           | 1       | 14      | 7.3ms |       | 3.617ms    |   |
| Script Evaluated                | js global-map.js:1    |           | 0       | 15      | 1.3ms |       | 0.211ms    |   |
| Script Evaluated                | js interface.js:1     |           | 0       | 15      | 1.6ms |       | 0.203ms    |   |
| Script Evaluated                | odemo:16              |           | 0       | 15      | 1.9ms |       | 0.118ms    |   |
| DOM Content Loaded .            | 😽 demo:88             |           | 4       | 15:     | 2.1ms |       | 3.776ms    |   |
|                                 |                       |           |         |         |       |       |            |   |



|                        |       |                  |            |       |       | · · · · |       |              |       |            |    |
|------------------------|-------|------------------|------------|-------|-------|---------|-------|--------------|-------|------------|----|
|                        | Edit  | 1.00s            |            | 2.00s | 3.00s |         | 4.00s | 5.00s        | 6.00s |            | 7. |
| JavaScript & Events    | ×     |                  |            |       |       |         |       |              |       |            |    |
| 🚫 Details 🔪 📃 Events 🗘 |       |                  |            |       |       |         |       |              |       |            |    |
| Name                   | Loca  | tion             |            |       | Samp  | oles    |       | Start Time ^ |       | Total Time |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 7       |       | 7.687ms      |       | 10.11ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 17.76ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 5       |       | 24.19ms      |       | 6.605ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 30.77ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 40.94ms      |       | 3.101ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 44.01ms      |       | Oms        |    |
| Garbage Collection     | -     | _                |            |       |       | 0       |       | 45.74ms      |       | 0.738ms    |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 57.50ms      |       | 2.785ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 60.25ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 74.95ms      |       | 3.528ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 78.44ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 91.56ms      |       | 3.179ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 94.71ms      |       | Oms        |    |
| Animation Frame Fired  | js d  | 3.js:2146        |            |       |       | 2       |       | 107.7ms      |       | 2.989ms    |    |
| Animation Frame Req    | f d   | 3_timer_step —   | d3.js:2156 |       |       | 0       |       | 110.6ms      |       | Oms        |    |
| Script Evaluated       | js d  | 3.js:1           |            |       |       | 4       |       | 129.0ms      |       | 12.78ms    |    |
| Script Evaluated       | js d  | 3.geo.projection | .js:1      |       |       | 1       |       | 142.1ms      |       | 3.852ms    |    |
| Script Evaluated       | js d  | 3.promise.js:1   |            |       |       | 1       |       | 146.1ms      |       | 0.315ms    |    |
| Script Evaluated       | js to | pojson.js:1      |            |       |       | 0       |       | 146.5ms      |       | 0.513ms    |    |
| Script Evaluated       | js Si | atellite.js:1    |            |       |       | 1       |       | 147.3ms      |       | 3.617ms    |    |
| Script Evaluated       | js g  | lobal-map.js:1   |            |       |       | 0       |       | 151.3ms      |       | 0.211ms    |    |
| Script Evaluated       | js in | nterface.js:1    |            |       |       | 0       |       | 151.6ms      |       | 0.203ms    |    |
| Script Evaluated       | <> d  | emo:16           |            |       |       | 0       |       | 151.9ms      |       | 0.118ms    |    |
| ▶ 🖪 DOM Content Loaded | <> d  | emo:88           |            |       |       | 4       |       | 152.1ms      |       | 3.776ms    |    |



### 

# 1.00s 2.00s 3.00s 4.00s 5.00s

|                | Samples | Start Time ^ | Total Time | Self Time | Average      |
|----------------|---------|--------------|------------|-----------|--------------|
|                | 7       | 7.687ms      | 10.11ms    | 10.11ms   | 10.1         |
| o — d3.js:2156 | 0       | 17.76ms      | Oms        | Oms       |              |
|                | 5       | 24.19ms      | 6.605ms    | 6.605ms   | 6.60         |
| o — d3.js:2156 | 0       | 30.77ms      | Oms        | Oms       |              |
|                | 2       | 40.94ms      | 3.101ms    | 3.101ms   | 3.10         |
| o — d3.js:2156 | 0       | 44.01ms      | Oms        | Oms       |              |
|                | 0       | 45.74ms      | 0.738ms    | 0.738ms   | 0.73         |
|                | 2       | 57.50ms      | 2.785ms    | 2.785ms   | 2.78         |
| o — d3.js:2156 | 0       | 60.25ms      | Oms        | Oms       |              |
|                | 2       | 74.95ms      | 3.528ms    | 3.528ms   | 3.52         |
| o — d3.js:2156 | 0       | 78.44ms      | Oms        | Oms       |              |
|                | 2       | 91.56ms      | 3.179ms    | 3.179ms   | <b>3.1</b> 7 |
| o — d3.js:2156 | 0       | 94.71ms      | Oms        | Oms       |              |
|                | 2       | 107.7ms      | 2.989ms    | 2.989ms   | 2.98         |
| o — d3.js:2156 | 0       | 110.6ms      | Oms        | Oms       |              |
|                | 4       | 129.0ms      | 12.78ms    | 12.78ms   | 12.7         |
| ction.js:1     | 1       | 142.1ms      | 3.852ms    | 3.852ms   | 3.85         |
| 5: <b>1</b>    | 1       | 146.1ms      | 0.315ms    | 0.315ms   | 0.31         |
|                | 0       | 146.5ms      | 0.513ms    | 0.513ms   | 0.51         |
|                | 1       | 147.3ms      | 3.617ms    | 3.617ms   | 3.61         |
| s:1            | 0       | 151.3ms      | 0.211ms    | 0.211ms   | 0.21         |
|                | 0       | 151.6ms      | 0.203ms    | 0.203ms   | 0.20         |
|                | 0       | 151.9ms      | 0.118ms    | 0.118ms   | 0.11         |
|                | 4       | 152.1ms      | 3.776ms    | 3.776ms   | 3.77         |
|                |         |              |            |           |              |



Filter Records



## 1.00s 2.00s 3.00s 4.00s 5.00s

|                | Samples | Start Time ^ |   |
|----------------|---------|--------------|---|
|                | 7       | 7.687ms      |   |
| o — d3.js:2156 | 0       | 17.76ms      |   |
|                | 5       | 24.19ms      |   |
| o — d3.js:2156 | 0       | 30.77ms      |   |
|                | 2       | 40.94ms      |   |
| o — d3.js:2156 | 0       | 44.01ms      |   |
|                | 0       | 45.74ms      |   |
|                | 2       | 57.50ms      |   |
| o — d3.js:2156 | 0       | 60.25ms      |   |
|                | 2       | 74.95ms      |   |
| o — d3.js:2156 | 0       | 78.44ms      |   |
|                | 2       | 91.56ms      |   |
| o — d3.js:2156 | 0       | 94.71ms      |   |
|                | 2       | 107.7ms      |   |
| o — d3.js:2156 | 0       | 110.6ms      |   |
|                | 4       | 129.0ms      |   |
| ction.js:1     | 1       | 142.1ms      |   |
| s:1            | 1       | 146.1ms      |   |
|                | 0       | 146.5ms      |   |
|                | 1       | 147.3ms      |   |
| s:1            | 0       | 151.3ms      |   |
|                | 0       | 151.6ms      |   |
|                | 0       | 151.9ms      |   |
|                | 4       | 152.1ms      |   |
|                |         |              | - |



| 5   | Constant of the |     |    |    |     |
|-----|-----------------|-----|----|----|-----|
| ( ) | Eil             | tor | Do | 00 | roc |
|     | 1.11            | LCI | ne | 60 | 103 |

| Average           | Self Time | Total Time |
|-------------------|-----------|------------|
| 10.1              | 10.11ms   | 10.11ms    |
|                   | Oms       | Oms        |
| 6.60              | 6.605ms   | 6.605ms    |
|                   | Oms       | Oms        |
| 3.10              | 3.101ms   | 3.101ms    |
|                   | Oms       | Oms        |
| 0.73              | 0.738ms   | 0.738ms    |
| 2.78              | 2.785ms   | 2.785ms    |
|                   | Oms       | Oms        |
| 3.52              | 3.528ms   | 3.528ms    |
|                   | Oms       | Oms        |
| 3.17              | 3.179ms   | 3.179ms    |
|                   | Oms       | Oms        |
| 2.98              | 2.989ms   | 2.989ms    |
|                   | Oms       | Oms        |
| 12.7              | 12.78ms   | 12.78ms    |
| 3.85              | 3.852ms   | 3.852ms    |
| 0.31              | 0.315ms   | 0.315ms    |
| 0.51              | 0.513ms   | 0.513ms    |
| <mark>3.61</mark> | 3.617ms   | 3.617ms    |
| 0.21              | 0.211ms   | 0.211ms    |
| 0.20              | 0.203ms   | 0.203ms    |
| 0.11              | 0.118ms   | 0.118ms    |
| 3.77              | 3.776ms   | 3.776ms    |



Profiling JavaScript Events view

# Profiling JavaScript Call Trees view

NEW



|                        |                              | 12    |
|------------------------|------------------------------|-------|
| J Timelines            | 귬 Elements                   | G     |
| Events Frames          | < > 🖄 Timeline Recording 1 🛇 | JavaS |
|                        | Edit 200.0ms 400.0ms         | 6     |
| JavaScript & Events    |                              |       |
| 🚫 Details 👌 📃 Events 🗘 |                              |       |
| Name                   | Location                     | Sa    |
| Animation Frame        | js d3.js:2146                |       |
| Animation Frame        | d3_timer_step — d3.js:2156   |       |
| Garbage Collection     |                              |       |
| Script Evaluated       | js d3.js:1                   |       |
| Script Evaluated       | js d3.geo.projection.js:1    |       |
| Script Evaluated       | js d3.promise.js:1           |       |
| Script Evaluated       | js topojson.js:1             |       |
| Script Evaluated       | js satellite.js:1            |       |
| Script Evaluated       | js flat-map.js:1             |       |
| Script Evaluated       | js globe-map.js:1            |       |
| Script Evaluated       | js interface.js:1            |       |
| S Script Evaluated     | demo:17                      |       |
| DOM Content Lo         | ademo:95                     |       |
| Animation Frame        | 13_d3_timer — d3.js:2142     |       |
| S Script Evaluated     |                              |       |
| Progress Event D       | js d3.js:1954                |       |
|                        |                              |       |

| Web Inspector — localhost — demo |                         |            |             |  |  |
|----------------------------------|-------------------------|------------|-------------|--|--|
| <u> </u>                         | .3 KB 🕔 69.2ms 🗐 0      |            | $\bigcirc$  |  |  |
| ) Netwo                          | ork                     | sources    | ) Debugger  |  |  |
| cript & E                        | Events > 🕘 0ms – 15.00s |            |             |  |  |
| 600.0ms                          | 800.0ms 1.00            | s 1.20s    | 1.40s 1.60s |  |  |
|                                  |                         |            |             |  |  |
|                                  |                         |            |             |  |  |
| amples                           | Start Time ^            | Total Time | Self        |  |  |
| 14                               | 0.804ms                 | 18.77ms    | 18.7        |  |  |
| 0                                | 19.55ms                 | Oms        |             |  |  |
| 0                                | 21.41ms                 | 0.866ms    | 0.86        |  |  |
| 4                                | 34.40ms                 | 15.18ms    | 15.1        |  |  |
| 2                                | 50.13ms                 | 4.164ms    | 4.16        |  |  |
| 0                                | 54.36ms                 | 0.251ms    | 0.25        |  |  |
| 1                                | 54.78ms                 | 0.551ms    | 0.55        |  |  |
| 1                                | 55.46ms                 | 3.436ms    | 3.43        |  |  |
| 0                                | 59.10ms                 | 0.346ms    | 0.34        |  |  |
| 0                                | 59.70ms                 | 0.445ms    | 0.44        |  |  |
| 0                                | 60.18ms                 | 0.252ms    | 0.25        |  |  |
| 0                                | 60.46ms                 | 0.131ms    | 0.13        |  |  |
| 6                                | 60.72ms                 | 7.666ms    | 7.66        |  |  |
| 0                                | 67.07ms                 | Oms        |             |  |  |
| 0                                | 71.89ms                 | 0.171ms    | 0.17        |  |  |
| 0                                | 77.51ms                 | 0.080ms    | 0.08        |  |  |
|                                  |                         |            |             |  |  |



|                     |                                 | 12    |  |  |
|---------------------|---------------------------------|-------|--|--|
| J Timelines         | 귬 Elements                      | I     |  |  |
| Events Frames       | < > 🖄 Timeline Recording 1 🖉    | JavaS |  |  |
|                     | Edit 200.0ms 400.0ms            | 6     |  |  |
| JavaScript & Events |                                 |       |  |  |
| Oetails Events      |                                 |       |  |  |
| Name Call Trees     |                                 | Sa    |  |  |
| Animation Frame     | js d3.js:2146                   |       |  |  |
| Animation Frame     | 🚰 d3_timer_step — d3.js:2156    |       |  |  |
| Garbage Collection  |                                 |       |  |  |
| Script Evaluated    | js d3.js:1                      |       |  |  |
| Script Evaluated    | js d3.geo.projection.js:1       |       |  |  |
| Script Evaluated    | js d3.promise.js:1              |       |  |  |
| Script Evaluated    | js topojson.js:1                |       |  |  |
| Script Evaluated    | js satellite.js:1               |       |  |  |
| Script Evaluated    | js flat-map.js:1                |       |  |  |
| Script Evaluated    | js globe-map.js:1               |       |  |  |
| Script Evaluated    | js interface.js:1               |       |  |  |
| S Script Evaluated  | demo:17                         |       |  |  |
| DOM Content Lo      | odemo:95                        |       |  |  |
| Animation Frame     | <b>13_d3_timer</b> — d3.js:2142 |       |  |  |
| Script Evaluated    |                                 |       |  |  |
| Progress Event D    | js d3.js:1954                   |       |  |  |
|                     |                                 |       |  |  |

| Web Inspector — localhost — demo |                         |            |             |  |  |
|----------------------------------|-------------------------|------------|-------------|--|--|
| <u> </u>                         | .3 KB 🕔 69.2ms 🗐 0      |            | $\bigcirc$  |  |  |
| ) Netwo                          | ork                     | sources    | ) Debugger  |  |  |
| cript & E                        | Events > 🕘 0ms – 15.00s |            |             |  |  |
| 600.0ms                          | 800.0ms 1.00            | s 1.20s    | 1.40s 1.60s |  |  |
|                                  |                         |            |             |  |  |
|                                  |                         |            |             |  |  |
| amples                           | Start Time ^            | Total Time | Self        |  |  |
| 14                               | 0.804ms                 | 18.77ms    | 18.7        |  |  |
| 0                                | 19.55ms                 | Oms        |             |  |  |
| 0                                | 21.41ms                 | 0.866ms    | 0.86        |  |  |
| 4                                | 34.40ms                 | 15.18ms    | 15.1        |  |  |
| 2                                | 50.13ms                 | 4.164ms    | 4.16        |  |  |
| 0                                | 54.36ms                 | 0.251ms    | 0.25        |  |  |
| 1                                | 54.78ms                 | 0.551ms    | 0.55        |  |  |
| 1                                | 55.46ms                 | 3.436ms    | 3.43        |  |  |
| 0                                | 59.10ms                 | 0.346ms    | 0.34        |  |  |
| 0                                | 59.70ms                 | 0.445ms    | 0.44        |  |  |
| 0                                | 60.18ms                 | 0.252ms    | 0.25        |  |  |
| 0                                | 60.46ms                 | 0.131ms    | 0.13        |  |  |
| 6                                | 60.72ms                 | 7.666ms    | 7.66        |  |  |
| 0                                | 67.07ms                 | Oms        |             |  |  |
| 0                                | 71.89ms                 | 0.171ms    | 0.17        |  |  |
| 0                                | 77.51ms                 | 0.080ms    | 0.08        |  |  |
|                                  |                         |            |             |  |  |



|                         |                     | Ċ         |                      | 12             |  |  |
|-------------------------|---------------------|-----------|----------------------|----------------|--|--|
|                         | Timelines           |           | 귬 Elements           | F              |  |  |
| Events                  | Fram                | es < >    | Timeline Recording   | 1 > 🚫 JavaS    |  |  |
|                         |                     | Edit      | 200.0ms 400          | .0ms 6         |  |  |
| S JavaScript & Events X |                     |           |                      |                |  |  |
| 🚫 Details 👌             | Call T              | rees ¢    |                      |                |  |  |
| Total                   | Time ~              | Self Time | Function             |                |  |  |
| 450.2ms                 | 82.3%               | 0.0ms     | ▼ 🚰 d3_timer_step d3 | 3.js           |  |  |
| 449.0ms                 | 82.1%               | 1.2ms     | ▼ 🚰 d3_timer_mark    | d3.js          |  |  |
| 446.7ms                 | <mark>81.6</mark> % | 0.0ms     | 🔻 📝 (anonymou        | is function) f |  |  |
| 446.7ms                 | 81.6%               | 2.7ms     | ▼ 🚰 _drawF           | oregroundSc    |  |  |
| 221.6ms                 | 40.5%               | 15.2ms    | ▼ 🚰 _dr              | awSatellites   |  |  |
| 141.3ms                 | 25.8%               | 22.7ms    | ▼ 7                  | _drawUnless    |  |  |
| 94.8ms                  | 17.3%               | 0.0ms     |                      | 🖌 🚰 stream     |  |  |
| 93.5ms                  | 17.1%               | 1.3ms     |                      | ▼ 🚰 d3_g       |  |  |
| 92.2ms                  | 16.8%               | 1.2ms     |                      | ▼ 🚰 F          |  |  |
| 91.0ms                  | 16.6%               | 1.4ms     |                      | ▼[             |  |  |
| 89.6ms                  | 16.4%               | 0.0ms     |                      |                |  |  |
| 89.6ms                  | 16.4%               | 1.6ms     |                      |                |  |  |
| 88.0ms                  | 16.1%               | 0.0ms     |                      |                |  |  |
| 78.6ms                  | 14.4%               | 78.6ms    |                      |                |  |  |
| 9.4ms                   | 1.7%                | 2.8ms     |                      |                |  |  |
| 1.3ms                   | 0.2%                | 1.3ms     |                      | N has C        |  |  |
| 23.8ms                  | 4.4%                | 0.0ms     |                      | stream         |  |  |
|                         |                     |           |                      |                |  |  |

| Web Inspector —       | localhost — de    | mo       |          |            |   |
|-----------------------|-------------------|----------|----------|------------|---|
| 🛆 709.3 КВ 🕕 69.      | .2ms 🗐 0 🛛 🗍      |          |          | $\bigcirc$ |   |
| ) Network             | 🗋 Resour          | rces     | Deb      | ougger     |   |
| cript & Events > 🕘 On | ns – 15.00s       |          |          |            |   |
| 00.0ms 800.0ms        | 1.00s             | 1.20s    | 1.40s    | 1.60s      |   |
|                       |                   |          |          |            |   |
|                       |                   | $\times$ | Top Down | Bottom Up  | ( |
|                       |                   |          |          |            |   |
|                       |                   |          |          |            |   |
| lat-man is            |                   |          |          |            |   |
| ene flat-man is       |                   |          |          |            |   |
| flat-map.is           |                   |          |          |            |   |
| Clipped flat-map.is   |                   |          |          |            |   |
| d3.js                 |                   |          |          |            |   |
| eo_streamGeometry     | d3.js             |          |          |            |   |
| Point d3.js           |                   |          |          |            |   |
| (anonymous function   | on) d3.js         |          |          |            |   |
| ▼ f point d3.js       |                   |          |          |            |   |
| 🔻 🜈 point d3.js       |                   |          |          |            |   |
| 🔻 🚮 drawLa            | belAtPoint flat-m | ap.js    |          |            |   |
| N fillT               | ext               |          |          |            |   |
| ► f sca               | le d3.js          |          |          |            |   |
| wnProperty            |                   |          |          |            |   |
|                       |                   |          |          |            |   |



|       | Tota | l Time ~            | Self Time | Function  |
|-------|------|---------------------|-----------|---|
| 450.  | 2ms  | 82.3%               | 0.0ms     | ▼ G d3_timer_step d3.js   |
| 449.0 | Oms  | 82.1%               | 1.2ms     | ▼ 🚰 d3_timer_mark d3.js   |
| 446.  | 7ms  | 81. <mark>6%</mark> | 0.0ms     | (anonymous function) fl   |
| 446.  | 7ms  | 81.6%               | 2.7ms     | Image: Comparison of the second se |
| 221.  | 6ms  | 40.5%               | 15.2ms    | ▼ 🚰 _drawSatellites f   |
| 141.3 | 3ms  | 25.8%               | 22.7ms    | ▼ 🚰 _drawUnless   |
| 94.   | 8ms  | 17.3%               | 0.0ms     | 🔻 🚰 stream d  |
| 93.   | 5ms  | 17.1%               | 1.3ms     | ▼ 🚰 d3_g  |
| 92.   | 2ms  | 16.8%               | 1.2ms     | ▼ 🚰 P   |
| 91.0  | Oms  | 16.6%               | 1.4ms     |   |
| 89.   | 6ms  | 16.4%               | 0.0ms     |   |
| 89.   | 6ms  | 16.4%               | 1.6ms     |   |
| 88.   | Oms  | 16.1%               | 0.0ms     |   |
| 78.   | 6ms  | 14.4%               | 78.6ms    |   |
| 9.4   | 4ms  | 1.7%                | 2.8ms     |   |
| 1.3   | 3ms  | 0.2%                | 1.3ms     | 🔝 hasO  |
| 23.   | 8ms  | 4.4%                | 0.0ms     | ► 🚰 stream d  |
| 50.   | 9ms  | 9.3%                | 0.0ms     | ▶ 🚰 path d3.js  |
| 8.    | 9ms  | 1.6%                | 3.2ms     | 🕨 🔝 map   |
| 3.    | 7ms  | 0.7%                | 3.7ms     | N fill  |
| 1.    | 7ms  | 0.3%                | 1.7ms     | N beginPath   |
| 167.  | 7ms  | 30.6%               | 76.5ms    | plotSatellites fl   |
| 44.   | 8ms  | 8.2%                | 2.5ms     | plotSolarTermin   |
| 5.3   | 3ms  | 1.0%                | 2.7ms     | drawTime flat-r   |
| 3.3   | 3ms  | 0.6%                | 3.3ms     | N clearRect   |
| 1.    | 2ms  | 0.2%                | 1.2ms     | N Date  |
| 1.    | 2ms  | 0.2%                | 0.0ms     | ► 🚰 tick d3.js  |
| 1.    | 1ms  | 0.2%                | 1.1ms     | <b>requestAnimationFrame</b>  |
|       |      |                     |           |   |



flat-map.js inator flat-map.js O -map.js



| Function  | Self Time    | Time ~ | Tota    |
|---|--------------|--------|---------|
| ▼  d3_timer_step d3.js  | 0.0ms        | 82.3%  | 450.2ms |
| ▼ 🜈 d3_timer_mark d3.js   | 1.2ms        | 82.1%  | 449.0ms |
| (anonymous function) f  | 0.0ms        | 81.6%  | 446.7ms |
| Image: Comparison of the second se | 2.7ms        | 81.6%  | 446.7ms |
| Image: Contract of the second seco | 15.2ms       | 40.5%  | 221.6ms |
| ▼ 🚰 _drawUnless   | 22.7ms       | 25.8%  | 141.3ms |
| 🔻 📝 stream  | 0.0ms        | 17.3%  | 94.8ms  |
| ▼ 🚰 d3_c  | 1.3ms        | 17.1%  | 93.5ms  |
|   | 1.2ms        | 16.8%  | 92.2ms  |
| $\mathbf{\nabla}$   | 1.4ms        | 16.6%  | 91.0ms  |
|   | 0.0ms        | 16.4%  | 89.6ms  |
|   | 1.6ms        | 16.4%  | 89.6ms  |
|   | 0.0ms        | 16.1%  | 88.0ms  |
|   | 78.6ms       | 14.4%  | 78.6ms  |
|   | 2.8ms        | 1.7%   | 9.4ms   |
| N has   | <b>1.3ms</b> | 0.2%   | 1.3ms   |
| 🕨 🌈 stream  | 0.0ms        | 4.4%   | 23.8ms  |
| ▶ 🚰 path d3.js  | 0.0ms        | 9.3%   | 50.9ms  |
| 🕨 🔝 map   | 3.2ms        | 1.6%   | 8.9ms   |
| N fill  | 3.7ms        | 0.7%   | 3.7ms   |
| N beginPath   | 1.7ms        | 0.3%   | 1.7ms   |
| plotSatellites f  | 76.5ms       | 30.6%  | 167.7ms |
| plotSolarTermin   | 2.5ms        | 8.2%   | 44.8ms  |
| drawTime flat-  | 2.7ms        | 1.0%   | 5.3ms   |
| N clearRect   | 3.3ms        | 0.6%   | 3.3ms   |
| N Date  | 1.2ms        | 0.2%   | 1.2ms   |
| ► 🗗 tick d3.js  | 0.0ms        | 0.2%   | 1.2ms   |
| R requestAnimationFrame   | 1.1ms        | 0.2%   | 1.1ms   |
|   |              |        |         |



flat-map.js

nator flat-map.js

map.js

| Frame                | es < 🕽   | > 🖄 Timeline    | Recording 1 > 🚫  | JavaScript & Eve             | ents > 🕘 0ms – 1 |
|----------------------|----------|-----------------|------------------|------------------------------|------------------|
|                      | Edi      | t 200.0ms       | 400.0ms          | 600.0ms                      | 800.0ms          |
| t & Eve              | nts      |                 |                  |                              |                  |
| Call Tr              | ees 🗘    |                 |                  |                              |                  |
| me ~                 | Self Tim | e Function      |                  |                              |                  |
| 2. <mark>3%</mark>   | 0.0m     | ns 🛛 🐨 🚰 d3_tim | ner_step d3.js   |                              |                  |
| 2.1%                 | 1.2m     | ns 🛛 🔻 🌠 d3_    | timer_mark d3.js |                              |                  |
| 8 <mark>1.6</mark> % | 0.0m     | ns 🛛 🕶 🚰        | (anonymous func  | tion) flat-map.js            |                  |
| 1.6%                 | 2.7m     | ns 🔻            | drawForegro      | undScene flat-m              | nap.js           |
| 0.5%                 | 15.2m    | IS              | V 🕜 _drawSate    | ellites flat-map.js          | 5                |
| 5.8%                 | 22.7m    | IS              | 🔻 🜠 _draw        | UnlessClipped fl             | at-map.js        |
| 7.3%                 | 0.0m     | IS              | 🔻 🛃 st           | ream d3.js                   |                  |
| 7.1%                 | 1.3m     | IS              |                  | d3_geo_stream                | Geometry d3.js   |
| 6.8%                 | 1.2m     | IS              |                  | 🛡 🚰 Point d3.js              |                  |
| 6.6%                 | 1.4m     | IS              |                  | 🔻 🛐 (anonyr                  | nous function) d |
| <mark>6.4%</mark>    | 0.0m     | IS              |                  | 🔻 🚮 poir                     | nt d3.js         |
| 6.4%                 | 1.6m     | IS              |                  | $\mathbf{\nabla} \mathbf{f}$ | point d3.js      |
| 6.1%                 | 0.0m     | IS              |                  |                              | 🕤 🚰 drawLabelAtl |
| 4.4%                 | 78.6m    | IS              |                  |                              | N fillText       |
| 1.7%                 | 2.8m     | IS              |                  |                              | F scale d3       |
| 0.2%                 | 1.3m     | IS              |                  | hasOwnProper                 | ty               |
| 4.4%                 | 0.0m     | IS              | ► 🚰 st           | ream d3.js O                 |                  |
| 9.3%                 | 0.0m     | IS              | 🕨 🚰 path         | d3.js                        |                  |
| 1.6%                 | 3.2m     | IS              | 🕨                |                              |                  |
| 0.7%                 | 3.7m     | IS              | N fill           |                              |                  |
| 0.3%                 | 1.7m     | IS              | N begin          | Path                         |                  |
| 0.6%                 | 76.5m    | IS              | ▶ 🚰 _plotSate    | llites flat-map.js           |                  |
|                      |          |                 |                  |                              |                  |

| 17               |            |          |           |            |       |
|------------------|------------|----------|-----------|------------|-------|
| 5.00s            |            |          |           |            | 一一一   |
| 1.00s            | 1.20s      | 1.40s    | 1.60s     | 1.80s      | 2.00s |
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| 3 ic             |            |          |           |            |       |
| 0.j5             |            |          |           |            |       |
|                  |            |          |           |            |       |
| Point flat-map.j | js         |          |           |            |       |
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| .js              |            |          |           |            |       |
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| Frame                | es < 🕽   | > 🖄 Timeline    | Recording 1 > 🚫  | JavaScript & Eve             | ents > 🕘 0ms – 1 |
|----------------------|----------|-----------------|------------------|------------------------------|------------------|
|                      | Edi      | t 200.0ms       | 400.0ms          | 600.0ms                      | 800.0ms          |
| t & Eve              | nts      |                 |                  |                              |                  |
| Call Tr              | ees 🗘    |                 |                  |                              |                  |
| me ~                 | Self Tim | e Function      |                  |                              |                  |
| 2. <mark>3%</mark>   | 0.0m     | ns 🛛 🐨 🚰 d3_tim | ner_step d3.js   |                              |                  |
| 2.1%                 | 1.2m     | ns 🛛 🔻 🌠 d3_    | timer_mark d3.js |                              |                  |
| 8 <mark>1.6</mark> % | 0.0m     | ns 🛛 🕶 🚰        | (anonymous func  | tion) flat-map.js            |                  |
| 1.6%                 | 2.7m     | ns 🔻            | drawForegro      | undScene flat-m              | nap.js           |
| 0.5%                 | 15.2m    | IS              | V 🕜 _drawSate    | ellites flat-map.js          | 5                |
| 5.8%                 | 22.7m    | IS              | 🔻 🜠 _draw        | UnlessClipped fl             | at-map.js        |
| 7.3%                 | 0.0m     | IS              | 🔻 🛃 st           | ream d3.js                   |                  |
| 7.1%                 | 1.3m     | IS              |                  | d3_geo_stream                | Geometry d3.js   |
| 6.8%                 | 1.2m     | IS              |                  | 🛡 🚰 Point d3.js              |                  |
| 6.6%                 | 1.4m     | IS              |                  | 🔻 🛐 (anonyr                  | nous function) d |
| 6.4%                 | 0.0m     | IS              |                  | 🔻 🚮 poir                     | nt d3.js         |
| 6.4%                 | 1.6m     | IS              |                  | $\mathbf{\nabla} \mathbf{f}$ | point d3.js      |
| 6.1%                 | 0.0m     | IS              |                  |                              | 🕤 🚰 drawLabelAtl |
| 4.4%                 | 78.6m    | IS              |                  |                              | N fillText       |
| 1.7%                 | 2.8m     | IS              |                  |                              | F scale d3       |
| 0.2%                 | 1.3m     | IS              |                  | hasOwnProper                 | ty               |
| 4.4%                 | 0.0m     | IS              | ► 🚰 st           | ream d3.js O                 |                  |
| 9.3%                 | 0.0m     | IS              | 🕨 🚰 path         | d3.js                        |                  |
| 1.6%                 | 3.2m     | IS              | 🕨                |                              |                  |
| 0.7%                 | 3.7m     | IS              | N fill           |                              |                  |
| 0.3%                 | 1.7m     | IS              | N begin          | Path                         |                  |
| 0.6%                 | 76.5m    | IS              | ▶ 🚰 _plotSate    | llites flat-map.js           |                  |
|                      |          |                 |                  |                              |                  |

| 17               |            |          |           |            |       |
|------------------|------------|----------|-----------|------------|-------|
| 5.00s            |            |          |           |            | 一一一   |
| 1.00s            | 1.20s      | 1.40s    | 1.60s     | 1.80s      | 2.00s |
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| 3 ic             |            |          |           |            |       |
| 0.j5             |            |          |           |            |       |
|                  |            |          |           |            |       |
| Point flat-map.j | js         |          |           |            |       |
|                  |            |          |           |            |       |
| .js              |            |          |           |            |       |
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|                  |            |          |           |            |       |



| Frame                | es < 🕽   | > 🖄 Timeline    | Recording 1 > 🚫  | JavaScript & Eve             | ents > 🕘 0ms – 1 |
|----------------------|----------|-----------------|------------------|------------------------------|------------------|
|                      | Edi      | t 200.0ms       | 400.0ms          | 600.0ms                      | 800.0ms          |
| t & Eve              | nts      |                 |                  |                              |                  |
| Call Tr              | ees 🗘    |                 |                  |                              |                  |
| me ~                 | Self Tim | e Function      |                  |                              |                  |
| 2. <mark>3%</mark>   | 0.0m     | ns 🛛 🐨 🚰 d3_tim | ner_step d3.js   |                              |                  |
| 2.1%                 | 1.2m     | ns 🛛 🔻 🌠 d3_    | timer_mark d3.js |                              |                  |
| 8 <mark>1.6</mark> % | 0.0m     | ns 🛛 🕶 🚰        | (anonymous func  | tion) flat-map.js            |                  |
| 1.6%                 | 2.7m     | ns 🔻            | drawForegro      | undScene flat-m              | nap.js           |
| 0.5%                 | 15.2m    | IS              | V 🕜 _drawSate    | ellites flat-map.js          | 5                |
| 5.8%                 | 22.7m    | IS              | 🔻 🜠 _draw        | UnlessClipped fl             | at-map.js        |
| 7.3%                 | 0.0m     | IS              | 🔻 🛃 st           | ream d3.js                   |                  |
| 7.1%                 | 1.3m     | IS              |                  | d3_geo_stream                | Geometry d3.js   |
| 6.8%                 | 1.2m     | IS              |                  | 🛡 🚰 Point d3.js              |                  |
| 6.6%                 | 1.4m     | IS              |                  | 🔻 🛐 (anonyr                  | nous function) d |
| 6.4%                 | 0.0m     | IS              |                  | 🔻 🚮 poir                     | nt d3.js         |
| 6.4%                 | 1.6m     | IS              |                  | $\mathbf{\nabla} \mathbf{f}$ | point d3.js      |
| 6.1%                 | 0.0m     | IS              |                  |                              | 🕤 🚰 drawLabelAtl |
| 4.4%                 | 78.6m    | IS              |                  |                              | N fillText       |
| 1.7%                 | 2.8m     | IS              |                  |                              | F scale d3       |
| 0.2%                 | 1.3m     | IS              |                  | hasOwnProper                 | ty               |
| 4.4%                 | 0.0m     | IS              | ► 🚰 st           | ream d3.js O                 |                  |
| 9.3%                 | 0.0m     | IS              | 🕨 🚰 path         | d3.js                        |                  |
| 1.6%                 | 3.2m     | IS              | 🕨                |                              |                  |
| 0.7%                 | 3.7m     | IS              | N fill           |                              |                  |
| 0.3%                 | 1.7m     | IS              | N begin          | Path                         |                  |
| 0.6%                 | 76.5m    | IS              | ▶ 🚰 _plotSate    | llites flat-map.js           |                  |
|                      |          |                 |                  |                              |                  |

| 1 <del>7</del>                 |       |          |           | -          |       |
|--------------------------------|-------|----------|-----------|------------|-------|
| 5.00s                          |       |          |           |            | 団     |
| 1.00s                          | 1.20s | 1.40s    | 1.60s     | 1.80s      | 2.00s |
|                                |       |          |           |            |       |
|                                |       | Top Down | Bottom Up | Filter Rec | ords  |
|                                |       |          |           |            |       |
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|                                |       |          |           |            |       |
|                                |       |          |           |            |       |
|                                |       |          |           |            |       |
|                                |       |          |           |            |       |
|                                |       |          |           |            |       |
|                                |       |          |           |            |       |
| 3.js                           |       |          |           |            |       |
|                                |       |          |           |            |       |
| P <mark>oint</mark> flat-map.j | s     |          |           |            |       |
|                                |       |          |           |            |       |
| .js                            |       |          |           |            |       |
|                                |       |          |           |            |       |
|                                |       |          |           |            |       |
|                                |       |          |           |            |       |



| Frames            | - < >      | 🖄 Timeline Re   | cording 1 > 🚫     | JavaScript & Ev  | ents > 🕘 0ms – | 15.00s |          |          |           |                | 1     |
|-------------------|------------|---|-------------------|------------------|----------------|--------|----------|----------|-----------|----------------|-------|
|                   | Edit       | 200.0ms   | 400.0ms           | 600.0ms          | 800.0ms        | 1.00s  | 1.20s    | 1.40s    | 1.60s     | 1.80s          | 2.00s |
| ot & Even         | ts $	imes$ |   |                   |                  |                |        |          |          |           |                |       |
| Call Tre          | es 🗘       |   |                   |                  |                |        | $\times$ | Top Down | Bottom Up | Filter Records |       |
| ime ~             | Self Time  | Function  |                   |                  |                |        |          |          |           |                |       |
| 4.4%              | 78.6ms     | FillText  |                   |                  |                |        |          |          |           |                |       |
| 4.0%              | 76.5ms     | ► 🚰 _plotSate   | ellites flat-map. | js               |                |        |          |          |           |                |       |
| 7.3%              | 39.7ms     | N atan2   |                   |                  |                |        |          |          |           |                |       |
| 6.3%              | 34.3ms     | ▶ 🚺 moveTo  |                   |                  |                |        |          |          |           |                |       |
| 4.1%              | 22.7ms     | ▶ 🚰 _drawUn   | essClipped flat   | t-map.js         |                |        |          |          |           |                |       |
| <mark>3.1%</mark> | 16.8ms     | drawSat   | ellites flat-map  | o.js             |                |        |          |          |           |                |       |
| 2.9%              | 16.1ms     | 🕨 🚰 (anonym   | ous function) d   | space.js         |                |        |          |          |           |                |       |
| 2.1%              | 11.5ms     | Image: A start and a start and a start a st |                   |                  |                |        |          |          |           |                |       |
| 2.0%              | 11.2ms     | Image: Image: Image: Amage: | atorValueNext     |                  |                |        |          |          |           |                |       |
| 2.0%              | 11.0ms     | 🕨 🌠 (anonym   | ous function) e   | ci-to-geodetic.j | S              |        |          |          |           |                |       |
| 1.8%              | 10.0ms     | 🕨 🚰 (anonym   | ous function) s   | gp4.js           |                |        |          |          |           |                |       |
| 1.6%              | 8.6ms      | resample  | Recursive d3.j    | S                |                |        |          |          |           |                |       |
| 1.4%              | 7.4ms      | 🕨 🚰 (anonym   | ous function) d   | 3.js             |                |        |          |          |           |                |       |
| 1.2%              | 6.5ms      | ▶ 🚰 d3_geo_o  | lipAntimeridian   | Line d3.js       |                |        |          |          |           |                |       |
| 1.1%              | 5.9ms      | N values  |                   |                  |                |        |          |          |           |                |       |
| 1.0%              | 5.4ms      | d3_map_   | escape d3.js      |                  |                |        |          |          |           |                |       |
| 0.8%              | 4.4ms      | N push  |                   |                  |                |        |          |          |           |                |       |
| 0.7%              | 4.0ms      | N asin  |                   |                  |                |        |          |          |           |                |       |
| 0.7%              | 3.9ms      | ► 🚰 resample  | LineTo d3.js      |                  |                |        |          |          |           |                |       |
| 0.7%              | 3.8ms      | S (program  | ) d3.js           |                  |                |        |          |          |           |                |       |
| 0.7%              | 3.8ms      | ▶ 🕅 setPrope  | rty               |                  |                |        |          |          |           |                |       |
| 0.7%              | 3.8ms      | ► 🚰 (anonym   | ous function) d   |                  |                |        |          |          |           |                |       |
|                   |            |   |                   |                  |                |        |          |          |           |                |       |



| Events      | Fram              | es < >                | Timeline Recording 1 Solution Solution  |
|-------------|-------------------|-----------------------|---|
|             |                   | Edit                  | 200.0ms 400.0ms 6   |
| S JavaSc    | ript & Eve        | ents X                |   |
| 🚫 Details > | Call T            | rees 🗘                |   |
| Total       | Time ~            | Self Time             | Function  |
| 78.6ms      | 14.4%             | 78.6ms                | ▶ 🔝 fillText  |
| 76.5ms      | 14.0%             | 76.5ms                | [7] _plotSatellites flat-map.js   |
| 39.7ms      | 7.3%              | 39.7ms                | Matan2  |
| 34.3ms      | <mark>6.3%</mark> | 34.3ms                | ▶ 🚺 moveTo  |
| 22.7ms      | 4.1%              | 22.7ms                | _drawUnlessClipped flat-map.  |
| 16.8ms      | 3.1%              | 1 <mark>6.8</mark> ms | _drawSatellites flat-map.js   |
| 16.1ms      | <mark>2.9%</mark> | 16.1ms                | (anonymous function) dspace   |
| 11.5ms      | 2.1%              | 11.5ms                | arc   |
| 11.2ms      | 2.0%              | 11.2ms                | Image: |
| 11.0ms      | 2.0%              | 11.0ms                | (anonymous function) eci-to-  |
| 10.0ms      | 1.8%              | 10.0ms                | (anonymous function) sgp4.js  |
| 8.6ms       | <mark>1.6%</mark> | 8.6ms                 | resampleRecursive d3.js   |
| 7.4ms       | <mark>1.4%</mark> | 7.4ms                 | (anonymous function) d3.js  |
| 6.5ms       | <mark>1.2%</mark> | 6.5ms                 | d3_geo_clipAntimeridianLine   |
| 5.9ms       | 1.1%              | 5.9ms                 | Values  |
| 5.4ms       | 1.0%              | 5.4ms                 | d3_map_escape d3.js   |
| 4.4ms       | 0.8%              | 4.4ms                 | ▶ 🕅 push  |
| 4.0ms       | 0.7%              | 4.0ms                 | Asin  |
| 3.9ms       | 0.7%              | 3.9ms                 | resampleLineTo d3.js  |
| 3.8ms       | 0.7%              | 3.8ms                 | S (program) d3.js   |
| 3.8ms       | 0.7%              | 3.8ms                 | SetProperty   |
| 3.8ms       | 0.7%              | 3.8ms                 | ► 🚰 (anonymous function) d3.js  |
|             |                   |                       |   |

| 754          |                  | (a     |       |         | area and  |   |
|--------------|------------------|--------|-------|---------|-----------|---|
| Script & Eve | ents > 🕘 0ms – 1 | 15.00s |       |         |           |   |
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# Demo JavaScript profiling

Brian Burg Safari and WebKit Engineer

Profiling so fast it's accurate

Profiling so fast it's accurate Find slow handlers with the Events view

Profiling so fast it's accurate Find slow handlers with the Events view See time costs pile up in the Call Trees view

Profiling so fast it's accurate Find slow handlers with the Events view See time costs pile up in the Call Trees view Bottom Up view shows the best places to start optimizing

## Connecting Web Inspector

Analyzing Memory

Profiling Javascript

## Connecting Web Inspector

### Profiling Javascript

Analyzing Memory

Analyzing Memory Memory timeline

NEW



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#### Categories

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Analyzing Memory Memory timeline

Analyzing Memory JavaScript Allocations timeline





## JavaScript Allocation Snapshots



## JavaScript Allocation Snapshots



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| Snapshot 4                 |                   |                      |                          |                       |             | 30.06s  |         | 14.0           | 5 MB |
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| Snapshot 10                |                   |                      |                          |                       |             | 90.06s  |         | 18.1           | 1 MB |
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| Snapshot 13                |                   |                      |                          |                       |             | 120.15s |         | 18.1           | 9 MB |
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| Snapshot 10               |          |                    |                    |
| Snapshot 11               |          |                    |                    |
| Snapshot 12               |          |                    |                    |
| Snapshot 13               |          |                    |                    |
| Snapshot 14               |          |                    |                    |
|                           |          |                    |                    |

| Web Inspec        | ctor — loc         | alhost —   | - demo  |   |                    |       |           |    |              |
|-------------------|--------------------|------------|---------|---|--------------------|-------|-----------|----|--------------|
| <u> 1856.7 КВ</u> | ( <b>\)</b> 134m   | s 🗐 6      | 0 []    | 0 |                    |       | $\ominus$ |    | Q~ Searc     |
| D Network         |                    | 🗋 Re       | sources |   | Đ I                | Debug | ger       |    | ∑ Cor        |
| vaScript Allocati | ons $ angle$ () Er | ntire Reco | rding   |   |                    |       |           |    |              |
| 20.00s            | 30.00s             |            | 40.00s  |   | 50.00s             |       | 60.0      | 0s | 7            |
| S                 | 8                  |            |         | S |                    | S     |           | S  |              |
|                   |                    |            |         | 1 |                    |       | ⊚ ₹       | 0  | Filter Recor |
|                   |                    |            |         |   | Time               | • ^   |           |    |              |
|                   |                    |            |         |   | <mark>23.21</mark> | ms    |           |    |              |
|                   |                    |            |         |   | 10.0               | )5s   |           |    |              |
|                   |                    |            |         |   | 20.1               | 3s    |           |    |              |
|                   |                    |            |         |   | 30.0               | 6s    |           |    |              |
|                   |                    |            |         |   | 40.0               | )6s   |           |    |              |
|                   |                    |            |         |   | 50.1               | 8s    |           |    |              |
|                   |                    |            |         |   | 60.0               | 8s    |           |    |              |
|                   |                    |            |         |   | 70.0               | )5s   |           |    |              |
|                   |                    |            |         |   | 80.0               | 9s    |           |    |              |
|                   |                    |            |         |   | 90.0               | )6s   |           |    |              |
|                   |                    |            |         |   | 100.0              | 8s    |           |    |              |
|                   |                    |            |         |   | 110.0              | )6s   |           |    |              |
|                   |                    |            |         |   | 120.1              | 5s    |           |    |              |
|                   |                    |            |         |   | 126.9              | 1s    |           |    |              |
|                   |                    |            |         |   |                    |       |           |    |              |
|                   |                    |            |         |   |                    |       |           |    |              |
|                   |                    |            |         |   |                    |       |           |    |              |
|                   |                    |            |         |   |                    |       |           |    |              |

|                             |          |                    | ١            |
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|                             | C        |                    | 17 [         |
| Timelines                   |          | 뮴 Elements         | Ð            |
| Events Frames 🗸             | >        | Timeline Recording | 1 ) 🕜 JavaSo |
|                             | Edit     | 10.00s             | 20.00        |
| JavaScript Allocations      | $\times$ | S                  |              |
| 🕜 Details 👌 📃 Snapshot List |          |                    |              |
| Name                        |          |                    |              |
| Snapshot 1                  |          |                    |              |
| Snapshot 2                  |          |                    |              |
| Snapshot 3                  |          |                    |              |
| Snapshot 4                  |          |                    |              |
| Snapshot 5                  |          |                    |              |
| Snapshot 6                  |          |                    |              |
| Snapshot 7                  |          |                    |              |
| Snapshot 8                  |          |                    |              |
| Snapshot 9                  |          |                    |              |
| Snapshot 10                 |          |                    |              |
| Snapshot 11                 |          |                    |              |
| Snapshot 12                 |          |                    |              |
| Snapshot 13                 |          |                    |              |
| Snapshot 14                 |          |                    |              |
|                             |          |                    |              |

| Ne   | b Inspector -           | — local | host — dem  | 0            |        |           |       |              |
|------|-------------------------|---------|-------------|--------------|--------|-----------|-------|--------------|
| 8 [  | 56.7 KB 🕓 1             | 134ms   | ₽6 ()(      | o <u>∧</u> o |        | $\ominus$ |       | Q~ Searc     |
| Ne   | etwork                  |         | Resource    | es           | Đ c    | Debugger  |       | ∑ Cor        |
| crip | ot Allocations $ angle$ | Entir   | e Recording |              |        |           |       |              |
| )s   | 30                      | 0.00s   | 40.0        | Os           | 50.00s | 60        | ).00s | 7            |
|      |                         | S       |             | S            |        | 3         | S     |              |
|      |                         |         |             |              | -      | © 2       |       | Filter Recor |
|      |                         |         |             |              | Time   | ~         |       |              |
|      |                         |         |             |              | 23.21r | ns        |       |              |
|      |                         |         |             |              | 10.0   | 5s        |       |              |
|      |                         |         |             |              | 20.13  | 3s        |       |              |
|      |                         |         |             |              | 30.00  | 6s        |       |              |
|      |                         |         |             |              | 40.00  | 6s        |       |              |
|      |                         |         |             |              | 50.18  | 8s        |       |              |
|      |                         |         |             |              | 60.08  | 8s        |       |              |
|      |                         |         |             |              | 70.0   | 5s        |       |              |
|      |                         |         |             |              | 80.09  | 9s        |       |              |
|      |                         |         |             |              | 90.00  | 6s        |       |              |
|      |                         |         |             |              | 100.08 | 8s        |       |              |
|      |                         |         |             |              | 110.00 | 6s        |       |              |
|      |                         |         |             |              | 120.1  | 5s        |       |              |
|      |                         |         |             |              | 126.9  | 1s        |       |              |
|      |                         |         |             |              |        |           |       |              |
|      |                         |         |             |              |        |           |       |              |
|      |                         |         |             |              |        |           |       |              |



|                             | Ċ    |                | 17 [             |
|-----------------------------|------|----------------|------------------|
| Timelines                   |      | 뮴 Elements     | Ð                |
| Events Frames <             | >    | Timeline Recor | ding 1 > 🕜 JavaS |
|                             | Edit | 10.00s         | 20.0             |
| JavaScript Allocations      | >    | S              | S                |
| 🕜 Details 👌 📃 Snapshot List |      |                |                  |
| Name                        |      |                |                  |
| Snapshot 1                  |      |                |                  |
| Snapshot 2                  |      |                |                  |
| Snapshot 3                  |      |                |                  |
| Snapshot 4                  |      |                |                  |
| Snapshot 5                  |      |                |                  |
| Snapshot 6                  |      |                |                  |
| Snapshot 7                  |      |                |                  |
| Snapshot 8                  |      |                |                  |
| Snapshot 9                  |      |                |                  |
| Snapshot 10                 |      |                |                  |
| Snapshot 11                 |      |                |                  |
| Snapshot 12                 |      |                |                  |
| Snapshot 13                 |      |                |                  |
| Snapshot 14                 |      |                |                  |
|                             |      |                |                  |

| Web Inspector      | — localhost - | – demo   |         |           |   |
|--------------------|---------------|----------|---------|-----------|---|
| 🗅 856.7 КВ 🕓       | 134ms 🗐 6     | 0        | 0       | $\ominus$ |   |
| ) Network          | R             | esources | Deb     | ugger     |   |
| Script Allocations | Dentire Reco  | ording   |         |           |   |
| 00s 3              | 0.00s         | 40.00s   | 50.00s  | 60.00s    |   |
| S                  | S             | S        | S       |           | S |
|                    |               |          |         | 62        |   |
|                    |               |          | Time ^  |           |   |
|                    |               |          | 23.21ms |           |   |
|                    |               |          | 10.05s  |           |   |
|                    |               |          | 20.13s  |           |   |
|                    |               |          | 30.06s  |           |   |
|                    |               |          | 40.06s  |           |   |
|                    |               |          | 50.18s  |           |   |
|                    |               |          | 60.08s  |           |   |
|                    |               |          | 70.05s  |           |   |
|                    |               |          | 80.09s  |           |   |
|                    |               |          | 90.06s  |           |   |
|                    |               |          | 100.08s |           |   |
|                    |               |          | 110.06s |           |   |
|                    |               |          | 120.15s |           |   |
|                    |               |          | 126.91s |           |   |
|                    |               |          |         |           |   |
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|                           | 0        |               |           |               | 356.7 KB     | ()134ms      | <b>₽0 0</b> 0 | <u>Vi</u> <u>X</u> 0 | T       |    |
|---------------------------|----------|---------------|-----------|---------------|--------------|--------------|---------------|----------------------|---------|----|
| Timelines                 |          | 묘 Elements    |           | D N           | etwork       |              | Resources     | De De                | ebugger |    |
| Events Frames             | >        | 🖄 Timeline Re | cording 1 | > 🕜 JavaScrip | ot Allocatio | ns > 🕘 Entii | re Recording  |                      |         |    |
|                           | Edit     | 10.           | .00s      | 20.00s        |              | 30.00s       | 40.00s        | 50.00s               | 60.00   | Is |
| JavaScript Allocations    | $\times$ | S             | S         |               | 3            | S            |               | 3                    |         | S  |
| Details > 📃 Snapshot List | t        |               |           |               |              |              |               |                      | 6 2     | 0  |
| Name                      |          |               |           |               |              |              |               | Time /               | <       |    |
| Snapshot 1                |          |               |           |               |              |              |               | 23.21m               | s       |    |
| Snapshot 2                |          |               |           |               |              |              |               | 10.05                | s       |    |
| Snapshot 3                |          |               |           |               |              |              |               | 20.13                | s       |    |
| Snapshot 4                |          |               |           |               |              |              |               | 30.06                | S       |    |
| Snapshot 5                |          |               |           |               |              |              |               | 40.06                | s       |    |
| Snapshot 6                |          |               |           |               |              |              |               | 50.18                | s       |    |
| Snapshot 7                |          |               |           |               |              |              |               | 60.08                | s       |    |
| Snapshot 8                |          |               |           |               |              |              |               | 70.05                | S       |    |
| Snapshot 9                |          |               |           |               |              |              |               | 80.09                | S       |    |
| Snapshot 10               |          |               |           |               |              |              |               | 90.06                | S       |    |
| Snapshot 11               |          |               |           |               |              |              |               | 100.08               | S       |    |
| Snapshot 12               |          |               |           |               |              |              |               | 110.06               | S       |    |
| Snapshot 13               |          |               |           |               |              |              |               | 120.15               | S       |    |
| Snapshot 14               |          |               |           |               |              |              |               | 126.91               | S       |    |
|                           |          |               |           |               |              |              |               |                      |         |    |
|                           |          |               |           |               |              |              |               |                      |         |    |
|                           |          |               |           |               |              |              |               |                      |         |    |
|                           |          |               |           |               |              |              |               |                      |         |    |
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|                           | 0        |                   |                    | 56.7 KB ()134ms                          | s (⊒ 6 ()0     |                       | U U    |
|---------------------------|----------|-------------------|--------------------|--|----------------|-----------------------|--------|
| Timelines                 |          | 日 Elements        | D Ne               | twork                                    | Resources      | Debu                  | ugger  |
| Events Frames 🗸           | >        | Timeline Recordir | ng 1 > 🕜 JavaScrip | t Allocations $ angle$ ) $ ightarrow$ En | tire Recording |                       |        |
|                           | Edit     | 10.00s            | 20.00s             | 30.00s                                   | 40.00s         | 50.00s                | 60.00s |
| JavaScript Allocations    | $\times$ | SS                | 3                  | 3]                                       | ]              | S                     | S      |
| O Details > Snapshot List |          |                   |                    |  |                |                       | (@) ₹  |
| Name                      |          |                   |                    |  |                | Time ^                |        |
| Snapshot 1                |          |                   |                    |  |                | 23.21ms               |        |
| Snapshot 2                |          |                   |                    |  |                | 10.05s                |        |
| Snapshot 3                |          |                   |                    |  |                | 20.13s                |        |
| Snapshot 4                |          |                   |                    |  |                | 30.06s                |        |
| Snapshot 5                |          |                   |                    |  |                | 40.06s                |        |
| Snapshot 6                |          |                   |                    |  |                | 50.18s                |        |
| Snapshot 7                |          |                   |                    |  |                | 60.08s                |        |
| Snapshot 8                |          |                   |                    |  |                | 70.05s                |        |
| Snapshot 9                |          |                   |                    |  |                | 80.09s                |        |
| Snapshot 10               |          |                   |                    |  |                | 90.06s                |        |
| Snapshot 11               |          |                   |                    |  |                | 100.08s               |        |
| Snapshot 12               |          |                   |                    |  |                | <mark>110.06</mark> s |        |
| Snapshot 13               |          |                   |                    |  |                | 120.15s               |        |
| Snapshot 14               |          |                   |                    |  |                | <mark>126.91s</mark>  |        |
|                           |          |                   |                    |  |                |                       |        |
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|                             | 0        |                |                      | 356.7 KB () 134m              | s (≓)6 (_)0 Z   | <u>I</u> 0           | U U U  |
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| J Timelines                 |          | 귬 Elements     | D N                  | etwork                        | Resources       | Debu                 | ugger  |
| Events Frames 🗸             | >        | Timeline Recor | ding 1 > 🕜 JavaScrip | pt Allocations $ angle$ () Er | ntire Recording |                      |        |
|                             | Edit     | 10.00s         | 20.00s               | 30.00s                        | 40.00s          | 50.00s               | 60.00s |
| JavaScript Allocations      | $\times$ | S              | S                    | 3                             | S               | S                    | S      |
| O Details > 📃 Snapshot List |          |                |                      |                               |                 |                      | @ Z () |
| Name                        |          |                |                      |                               |                 | Time 🔨               |        |
| Snapshot 1                  |          |                |                      |                               |                 | 23.21ms              |        |
| Snapshot 2                  |          |                |                      |                               |                 | 10.05s               |        |
| Snapshot 3                  |          |                |                      |                               |                 | 20.13s               |        |
| Snapshot 4                  |          |                |                      |                               |                 | 30.06s               |        |
| Snapshot 5                  |          |                |                      |                               |                 | 40.06s               |        |
| Snapshot 6                  |          |                |                      |                               |                 | 50.18s               |        |
| Snapshot 7                  |          |                |                      |                               |                 | 60.08s               |        |
| Snapshot 8                  |          |                |                      |                               |                 | 70.05s               |        |
| Snapshot 9                  |          |                |                      |                               |                 | 80.09s               |        |
| Snapshot 10                 |          |                |                      |                               |                 | 90.06s               |        |
| Snapshot 11                 |          |                |                      |                               |                 | 100.08s              |        |
| Snapshot 12                 |          |                |                      |                               |                 | <mark>110.06s</mark> |        |
| Snapshot 13                 |          |                |                      |                               |                 | 120.15s              |        |
| Snapshot 14                 |          |                |                      |                               |                 | <mark>126.91s</mark> |        |
|                             |          |                |                      |                               |                 |                      |        |
|                             |          |                |                      |                               |                 |                      |        |
|                             |          |                |                      |                               |                 |                      |        |
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|                             |          |                |                      |                               |                 |                      |        |
|                             |          |                |                      |                               |                 |                      |        |
|                             |          |                |                      |                               |                 |                      |        |



#### console.takeHeapSnapshot("Before login");

- // Do some work

#### console.takeHeapSnapshot("After login");



## console.takeHeapSnapshot("Before login"); // Do some work ...

console.takeHeapSnapshot("After login");



# for (let entry of list) { console.takeHeapSnapshot(entry.name); // Do some more work ...

}

NEW



#### for (let entry of list) {

#### console.takeHeapSnapshot(entry.name);

// Do some more work

. . .





## Analyzing Memory console.takeHeapSnapshot()

Snapshots can impact performance



## Analyzing Memory console.takeHeapSnapshot()

Snapshots can impact performance Use in pairs around code doing work



## Analyzing Memory console.takeHeapSnapshot()

Snapshots can impact performance Use in pairs around code doing work Don't leave in console.takeHeapSnapshot()


|                           |          | Web Inspector — localhost — demo |                       |              |               |               |                 |        |           |        |
|---------------------------|----------|----------------------------------|-----------------------|--------------|---------------|---------------|-----------------|--------|-----------|--------|
|                           | Ċ        |                                  |                       | 17 🛆 8       | 56.7 КВ 🕓     | 42.4ms 🗐      | 6 () 0 <u>∧</u> |        | $\ominus$ |        |
| Timelines                 |          | 뮲 Elemer                         | nts                   | D Ne         | twork         |               | Resources       | D D    | ebugger   |        |
| 🛑 Events Frames 🗸         | >        | 🖄 Timeline                       | Recording 1 $\rangle$ | G JavaScript | t Allocations | () Entire Red | cording         |        |           |        |
|                           | Edit     | 10.00s                           | 20.00s                | 30.00s       | 40.00s        | 50.00s        | 60.00s          | 70.00s | 80.00s    | 90.00s |
| JavaScript Allocations    | $\times$ | S                                | 3                     | S            | 3             | 3             | 5 5             | S      | S         |        |
| O Details > Snapshot List | ť        |                                  |                       |              |               |               |                 |        | 6         | 20     |
| Name                      |          |                                  |                       |              |               |               |                 | Time   | ^         |        |
| Snapshot 1                |          |                                  |                       |              |               |               |                 | 12.24m | าร        |        |
| S Snapshot 2              |          |                                  |                       |              | •             |               |                 | 10.02  | 2s        |        |
| Snapshot 3                |          |                                  |                       |              |               |               |                 | 20.08  | Bs        |        |
| Snapshot 4                |          |                                  |                       |              |               |               |                 | 30.04  | ls        |        |
| Snapshot 5                |          |                                  |                       |              |               |               |                 | 40.10  | Ds        |        |
| Snapshot 6                |          |                                  |                       |              |               |               |                 | 50.07  | 7s        |        |
| Snapshot 7                |          |                                  |                       |              |               |               |                 | 60.09  | )s        |        |
| Snapshot 8                |          |                                  |                       |              |               |               |                 | 70.09  | 9s        |        |
| Snapshot 9                |          |                                  |                       |              |               |               |                 | 80.20  | Ds        |        |
| Snapshot 10               |          |                                  |                       |              |               |               |                 | 90.11  | s         |        |
| Snapshot 11               |          |                                  |                       |              |               |               |                 | 100.13 | Bs        |        |
| Snapshot 12               |          |                                  |                       |              |               |               |                 | 110.10 | )s        |        |
| Snapshot 13               |          |                                  |                       |              |               |               |                 | 116.93 | Bs        |        |
|                           |          |                                  |                       |              |               |               |                 |        |           |        |
|                           |          |                                  |                       |              |               |               |                 |        |           |        |
|                           |          |                                  |                       |              |               |               |                 |        |           |        |
|                           |          |                                  |                       |              |               |               |                 |        |           |        |
|                           |          |                                  |                       |              |               |               |                 |        |           |        |



|                           |      | Web Inspector — localhost — demo |              |                  |                |                 |         |         |           |        |
|---------------------------|------|----------------------------------|--------------|------------------|----------------|-----------------|---------|---------|-----------|--------|
|                           | C    |                                  |              | 17 <u> 856</u> . | 7 КВ 🕓 42      | 2.4ms 🗐 6       | ① 0 ▲ 0 |         | $\ominus$ |        |
| Timelines                 | 동    | 금 Elements                       |              | D Netwo          | ork            | Res             | sources | Del     | ougger    |        |
| Events Frames             | > 🖄  | Timeline Reco                    | ording 1 🖓 🕜 | JavaScript Al    | locations > (- | D Entire Record | ding    |         |           |        |
|                           | Edit | 10.00s                           | 20.00s       | 30.00s           | 40.00s         | 50.00s          | 60.00s  | 70.00s  | 80.00s    | 90.00s |
| JavaScript Allocations    | ×S   | S                                | S            | S                | S              | S               | S       | S       | S         |        |
| O Details > Snapshot List | Ë    |                                  |              |                  |                |                 |         |         | 0         | 2      |
| Name                      |      |                                  |              |                  |                |                 |         | Time ^  |           |        |
| Snapshot 1                |      |                                  |              |                  |                |                 |         | 12.24ms |           |        |
| S Snapshot 2              |      |                                  |              |                  | •              |                 |         | 10.02s  |           |        |
| Snapshot 3                |      |                                  |              |                  |                |                 |         | 20.08s  |           |        |
| Snapshot 4                |      |                                  |              |                  |                |                 |         | 30.04s  |           |        |
| Snapshot 5                |      |                                  |              |                  |                |                 |         | 40.10s  |           |        |
| Snapshot 6                |      |                                  |              |                  |                |                 |         | 50.07s  |           |        |
| Snapshot 7                |      |                                  |              |                  |                |                 |         | 60.09s  |           |        |
| Snapshot 8                |      |                                  |              |                  |                |                 |         | 70.09s  |           |        |
| Snapshot 9                |      |                                  |              |                  |                |                 |         | 80.20s  |           |        |
| Snapshot 10               |      |                                  |              |                  |                |                 |         | 90.11s  |           |        |
| Snapshot 11               |      |                                  |              |                  |                |                 |         | 100.13s |           |        |
| Snapshot 12               |      |                                  |              |                  |                |                 |         | 110.10s |           |        |
| Snapshot 13               |      |                                  |              |                  |                |                 |         | 116.93s |           |        |
|                           |      |                                  |              |                  |                |                 |         |         |           |        |
|                           |      |                                  |              |                  |                |                 |         |         |           |        |
|                           |      |                                  |              |                  |                |                 |         |         |           |        |
|                           |      |                                  |              |                  |                |                 |         |         |           |        |
|                           |      |                                  |              |                  |                |                 |         |         |           |        |



|  |                 |           |                | Web Inspector — localhost — demo |                 |         |            |          |     |       |       |        |         |   |
|--|-----------------|-----------|----------------|----------------------------------|-----------------|---------|------------|----------|-----|-------|-------|--------|---------|---|
|  |                 | Ċ         |                |                                  |                 | 10      |            |          |     |       |       |        |         |   |
| 귬 Element  | ts              | D Netw    | ork            | Res                              | ources          | (       | J Timeline | es       |     | Debu  | igger |        | Storage |   |
| Events F   | rames           | < > 🖄 Ti  | meline Recordi | ing 1 > 🕜 .                      | JavaScript Allo | ocation | s > 🕘 0ms  | - 122.86 | ðs  |       |       |        |         |   |
|  |                 | Edit      | 10.00s         | 20.00s                           | 30.00s          |         | 40.00s     | 50.0     | 00s | 60.00 | )s    | 70.00s | 80.00s  |   |
| JavaScript A   | llocatior       | ns 🗙 S    | S              | S                                |                 | 3       | S          |          | S   |       | S     | S      | S       | 3 |
| 🖸 Details > 📃 Snapshot List > 🛐 Snapshot 1 > 💽 Instances 🗘 |                 |           |                |                                  |                 |         |            |          |     |       |       |        |         |   |
| Retained   | Size ~          | Self Size | Count          | Class Nar                        | ne              |         |            |          |     |       |       |        |         |   |
| 1.16 MB  |                 | 34.66 KB  | 864            | 🕨 🚺 Obj                          | ect             |         |            |          |     |       |       |        |         |   |
| 1019.27 KB   | —               | 144.74 KB | 3019           | 🕨 🚰 Fun                          | ction           |         |            |          |     |       |       |        |         |   |
| 765.05 KB  | () <u> </u>     | 2.71 KB   | 2              | 🕨 🚺 Win                          | dow             |         |            |          |     |       |       |        |         |   |
| 683.21 KB  | <u> </u>        | 87.12 KB  | 5568           | Array                            |                 |         |            |          |     |       |       |        |         |   |
| 448.49 KB  | 3 <b></b> 7     | 17.33 KB  | 206            | ▶ 🕅 JSL                          | exicalEnvironn  | nent    |            |          |     |       |       |        |         |   |
| 261.78 KB  | —               | 246.84 KB | 4477           | 🕨 🛐 stri                         | ng              |         |            |          |     |       |       |        |         |   |
| 130.17 KB  | · <u>····</u> · | 100 B     | 5              | 🕨 🚺 Proi                         | mise            |         |            |          |     |       |       |        |         |   |
| 24.99 KB   |                 | 452 B     | 1              | 🕨 🚺 Web                          | GLRendering     | Contex  | tBaseProto | type     |     |       |       |        |         |   |
| 11.98 KB   | _               | 81 B      | 1              | Stri                             | ng              |         |            |          |     |       |       |        |         |   |
| 11.64 KB   | —               | 181 B     | 1              | Doc                              | umentPrototy    | ре      |            |          |     |       |       |        |         |   |
| 10.96 KB   |                 | 179 B     | 1              | ▶ 0 Eler                         | nentPrototype   | •       |            |          |     |       |       |        |         |   |
| 10.25 KB   |                 | 92 B      | 1              | Can                              | vasRendering    | Contex  | t2DPrototy | pe       |     |       |       |        |         |   |
| 9.60 KB  | -               | 800 B     | 25             | ► 🚺 Get                          | terSetter       |         |            |          |     |       |       |        |         |   |
| 9.31 KB  | _               | 47 B      | 1              | Prot                             | totype          |         |            |          |     |       |       |        |         |   |
| 5.93 KB  |                 | 60 B      | 1              | Mat                              | h               |         |            |          |     |       |       |        |         |   |
| 5.27 KB  | _               | 60 B      | 2              | ▶ 🛛 Inje                         | ctedScriptHos   | st      |            |          |     |       |       |        |         |   |
| 5.13 KB  | _               | 51 B      | 1              | > O web                          | kitAudioConte   | extProt | otype      |          |     |       |       |        |         |   |
| 5.05 KB  | _               | 57 B      | 1              | Ran                              | gePrototype     |         |            |          |     |       |       |        |         |   |
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9 Promise {Symbol(Symbol.toStringTag): "Promise"}



| JavaScrip     | ot Allocations |                 |             |                                     |
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| 1.16 MB       |                | 34.66 KB        | 864         | Object                              |
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| 765.05 KB     |                | 2.71 KB         | 2           | ▶ O Window                          |
| 683.21 KB     | · - ·          | 87.12 KB        | 5568        | Array                               |
| 448.49 KB     |                | 17.33 KB        | 206         | ► IN JSLexicalEnvironment           |
| 261.78 KB     | · - ·          | 246.84 KB       | 4477        | ▶ String                            |
| 130.17 KB     |                | 100 B           | 5           | Promise                             |
| 24.99 KB      | · - ·          | 452 B           | 1           | WebGLRenderingContextBasePrototype  |
| 11.98 KB      |                | 81 B            | 1           | S String                            |
| 11.64 KB      | · - ·          | 181 B           | 1           | ODcumentPrototype                   |
| 10.96 KB      |                | 179 B           | 1           | ElementPrototype                    |
| 10.25 KB      | · - ·          | 92 B            | 1           | O CanvasRenderingContext2DPrototype |
| 9.60 KB       |                | 800 B           | 25          | GetterSetter                        |
| 9.31 KB       | · - ·          | 47 B            | 1           | Prototype                           |
| 5.93 KB       |                | 60 B            | 1           | Math                                |
| 5.27 KB       | · - ·          | 60 B            | 2           | InjectedScriptHost                  |
| 5.13 KB       |                | 51 B            | 1           | WebkitAudioContextPrototype         |
| 5.05 KB       | · - ·          | 57 B            | 1           | RangePrototype                      |
| 4.94 KB       | ·              | 62 B            | 1           | SVGSVGElementPrototype              |
| 4.43 KB       | ·              | 45 B            | 1           | SVGPathElementPrototype             |
| 3.95 KB       | ·              | 37 B            | 1           | Console                             |
| 3.73 KB       | · - ·          | 2.36 KB         | 27          | RegExp                              |
| 3.61 KB       |                | 72 B            | 1           | O HTMLMediaElementPrototype         |
| 3.25 KB       | ·              | 65 B            | 1           | NodePrototype                       |
| 3.24 KB       |                | 43 B            | 1           | SelectionPrototype                  |
| 3.08 KB       |                | 23 B            | 1           | ► O WritableStreamPrototype         |
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JavaScript Allocations

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| 192 B     |       | ▶ 🔘 @207420 <b>{\$: fun</b> |
| 176 B     |       | @215695 {getDate            |
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| 32 B      |       | ▶ 💽 @212314 d3_Map 🛉        |
| 206 B     |       | @214804 {alicebi            |
| 71 B      |       | [0] @221630 {linear.        |
| 70 B      |       | @221632 {bundle.            |
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"MultiPolygon", coordinates: Array}

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| Sel <mark>f</mark> Size | Count          | Class Name        |                             |                      |                           |
| 4.66 KB                 | 864            | 🔻 <u> O</u> bject |                             |                      |                           |
| 114 B                   |                | ▶ 🔘 @2035         | 46 {version:                | " <b>3.5.17</b> ", a | scendina: func            |
| 33 B                    |                | ▶ 🔘 @2225         | 2! {name: "Ir               | idium-33 De          | bris", url: "d            |
| 48 B                    |                | ▶ 0 @2136         | 15 {type: "Fe               | ature", pro          | <pre>perties: {}, g</pre> |
| 32 B                    |                | ▶ 🧕 @2136         | 19 type: "Mu                | ltiPolygon"          | , coordinates:            |
| 163 B                   |                | ▶ 🚺 @2216         | 40 <mark>{stream:</mark> f  | unction, ar          | ea: function,             |
| 83 B                    |                | ▶ 🚺 @2027         | 24 <b>{_lastBoun</b>        | dObjectId:           | 141, _idToWrap            |
| 97 B                    |                | ▶ 🔘 @2135         | 80 GlobalMap                | {_width: 96          | 0, _height: 60            |
| 432 B                   |                | ▶ 🚺 @2081         | 76 <mark>{isPrimit</mark> i | veValue: fu          | nction, previe            |
| 144 B                   |                | ▶ 💽 @2035         | 44 {version:                | "1.2.0", co          | onstants: Objec           |
| 65 B                    |                | ▶ 🔘 @2300         | 81 <b>{point: fu</b>        | nction, sph          | ere: function,            |
| 64 B                    |                | ▶ 🔘 @2302         | 36 <mark>{point: fu</mark>  | nction, lin          | eStart: functi            |
| 97 B                    |                | ▶ 🔘 @2123         | 59 <b>{year:</b> fun        | ction, year          | s: function, d            |
| 64 B                    |                | ▶ 🔘 @2073         | 23 <b>{\$:</b> functi       | on, \$\$: fun        | ction, _canQue            |
| 192 B                   |                | ▶ 🔘 @2074         | 20 <b>{\$:</b> functi       | on, \$\$: fun        | ction, _canQue            |
| 176 B                   |                | ▶ 0 @2156         | 95 <b>{getDate:</b>         | function, g          | etDay: functio            |
| 33 B                    |                | ▶ [0] @2225       | 27 {name: "Sc               | ience Exper          | iments", url:             |
| 66 B                    |                | ▶ [0] @2035       | 45 {version:                | "1.6.26", "          | esh: function,            |
| 64 B                    |                | ▶ [0] @2303       | 28 <mark>{point: fu</mark>  | nction, lin          | eStart: functi            |
| 208 B                   |                | ▶ [0] @2143       | 20 <b>{a: funct</b> i       | on, A: func          | tion, b: funct            |
| 33 B                    |                | ▶ [0] @2225       | 26 {name: "Sp               | y Satellite          | es", url: "data           |
| 32 B                    |                | ▶ [0] @2123       | 14 d3_Map {_:               | Object}              |                           |
| 206 B                   |                | ▶ 0 @2148         | 04 <mark>{aliceblue</mark>  | : d3_color,          | antiquewhite:             |
| 71 B                    |                | ▶ 🙆 @2216         | 30 <b>{linear:</b> f        | unction, lo          | g: function, p            |
| 70 B                    |                | ▶ [0] @2216       | 32 <b>{bundle:</b> f        | unction, ch          | ord: function,            |
| 80 B                    |                | ▶ 0 @2242         | 82 {Point: Ob               | ject, Multi          | Point: Object,            |
| 32 B                    |                |                   | 38 d3 Map { :               | Object}              |                           |

tion, descending: function, min: function, max: function, ...}
ata/iridium-33-debris.txt", satellites: Promise}

eometry: Object}

#### Array}

bounds: function, centroid: function, clipExtent: function, ...} pedObject: Object, \_idToObjectGroupName: {}, \_objectGroups: {}, \_modules: {Co... 0, \_takeHeapSnapshots: false, element: <div>, \_foregroundContext: CanvasRenderii wValue: function, functionDetails: function, wrapObject: function, setExcepti... t, degreesLat: function, degreesLong: function, eciToEcf: function, ...} lineStart: function, lineEnd: function, polygonStart: function, ...} on, lineEnd: function, polygonStart: function, polygonEnd: function, ...} ay: function, days: function, dayOfYear: function, ...} rySelectorOnNode: function, \$x: function, dir: function, ...} rySelectorOnNode: function, \$x: function, dir: function, ...} n, getFullYear: function, getHours: function, getMilliseconds: function, ...} 'data/science.txt", satellites: Promise} meshArcs: function, merge: function, mergeArcs: function, ...} on, lineEnd: function, polygonStart: function, polygonEnd: function} ion, B: function, c: function, ...} /intelsat.txt", satellites: Promise}



| X         |                |                         |                      |                 |                                |
|-----------|----------------|-------------------------|----------------------|-----------------|--------------------------------|
| S Snapsho | ot 1 > 🚺 Insta | ances 0                 |                      |                 |                                |
| Self Size | Count          | Class Name              |                      |                 |                                |
| 4.66 KB   | 864            | 🔻 🧿 Object              |                      |                 |                                |
| 114 B     |                | ▶ 0 @2035               | 46 {version:         | "3.5.17", as    | scending: funct                |
| 33 B      |                | ▶ 🔘 @2225               | 25 {name: "I         | ridium–33 Del   | oris", url: "da                |
| 48 B      |                | ▶ 0 @2136               | 15 {type: "F         | eature", prop   | perties: {}, ge                |
| 32 B      |                | ► <u>0</u> <u>@2136</u> | 19 {type: "M         | ultiPolygon"    | , coordinates:                 |
| 163 B     |                |                         | 10 Catnaam.          | function, are   | ea: function, b                |
| 83 B      | Shor           | test property pa        | ath to @213619       | jectId:         | 141, _idToWrapp                |
| 97 B      |                | window 🧕 V              | Window @2027         | 70 idth: 96     | 0, _height: 600                |
| 432 B     | _user          | Interface 00 C          | Object @20354        | 3 alue: fui     | nction, preview                |
| 144 B     | _ian           |                         | Diect @213610        | 2.0", col       | n <mark>stants: Obj</mark> ect |
| 65 B      |                |                         |                      | ion, sphe       | ere: function,                 |
| 64 B      |                | ▶ 0 @2302               | 36 <b>{point: f</b>  | unction, line   | e <mark>Start:</mark> functio  |
| 97 B      |                |                         | 59 {year: fu         | nction, years   | s: function, da                |
| 64 B      |                | ▶ 0 @2073               | 23 <b>{\$:</b> funct | ion, \$\$: fund | ction, <u>_canQue</u> r        |
| 192 B     |                | ▶ 🔘 @2074               | 20 <b>{\$:</b> funct | ion, \$\$: fund | ction, _canQuer                |
| 176 B     |                | 0 @2156                 | 95 <b>{getDate:</b>  | function, ge    | etDay: functior                |
| 33 B      |                | ▶ 🔘 @2225               | 27 {name: "S         | cience Experi   | <mark>iments",</mark> url: "   |
| 66 B      |                | ▶ <mark>()</mark> @2035 | 45 {version:         | "1.6.26", me    | esh: function,                 |
| 64 B      |                | ▶ [0] @2303             | 28 <b>{point:</b> f  | unction, line   | e <mark>Start: functio</mark>  |
| 208 B     |                |                         | 20 {a: funct         | ion, A: func    | tion, <mark>b:</mark> functi   |
| 33 B      |                | ▶ 🔘 @2225               | 26 {name: "S         | py Satellites   | s", url: "data/                |
| 32 B      |                |                         | 14 d3_Map {_         | : Object}       |                                |
| 206 B     |                | ▶ 🙆 @2148               | 04 <b>{aliceblu</b>  | e: d3_color,    | antiquewhite:                  |
| 71 B      |                | ▶ 🙆 @2216               | 30 <b>{linear:</b>   | function, log   | g: function, po                |
| 70 B      |                | ▶ 🙆 @2216               | 32 {bundle:          | function, cho   | ord: function,                 |
| 80 B      |                | ▶ 💽 @2242               | 82 {Point: 0         | bject, Multil   | Point: Object,                 |
| 32 B      |                |                         | 38 d3 Map {          | : Object}       |                                |

tion, descending: function, min: function, max: function, ...}
ata/iridium-33-debris.txt", satellites: Promise}
eometry: Object}

#### Array}

bounds: function, centroid: function, clipExtent: function, ...} pedObject: Object, \_idToObjectGroupName: {}, \_objectGroups: {}, \_modules: {Co... \_\_takeHeapSnapshots: false, element: <div>, \_foregroundContext: CanvasRenderin wValue: function, functionDetails: function, wrapObject: function, setExcepti... t, degreesLat: function, degreesLong: function, eciToEcf: function, ...} lineStart: function, lineEnd: function, polygonStart: function, ...} on, lineEnd: function, polygonStart: function, polygonEnd: function, ...} ay: function, days: function, dayOfYear: function, ...} rySelectorOnNode: function, \$x: function, dir: function, ...} rySelectorOnNode: function, \$x: function, dir: function, ...} n, getFullYear: function, getHours: function, getMilliseconds: function, ...} 'data/science.txt", satellites: Promise} meshArcs: function, merge: function, mergeArcs: function, ...} on, lineEnd: function, polygonStart: function, polygonEnd: function} ion, B: function, c: function, ...} intelsat.txt", satellites: Promise}



| S Snapsh  | not 1 > 🚺 Inst | ances 🗘               |                        |                               |                       |
|-----------|----------------|-----------------------|------------------------|-------------------------------|-----------------------|
| Self Size | Count          | Class Name            |                        |                               |                       |
| 4.66 KB   | 864            | V 🚺 Object            |                        |                               |                       |
| 114 B     |                | ▶ 🚺 @203              | 546 {version           | "3.5.17", as                  | cending: funct        |
| 33 B      |                | ▶ 🚺 @222              | 525 {name: "1          | Tridium—33 Deb                | ris", url: "da        |
| 48 B      |                | ► <b>(</b> @@213      | 615 <b>{tvpe:</b> "    | F <mark>eature</mark> ", prop | erties: {}, ge        |
| 32 B      |                | ► <mark>0</mark> @213 | 619 {type: "/          | MultiPalygon",                | coordinates:          |
| 163 B     |                |                       | 240 Laturame           | funntion, are                 | a: function, b        |
| 83 B      | Sho            | rtest property        | path to @213619        | 9je <mark>ctId: 1</mark>      | <b>41,</b> _idToWrapp |
| 97 B      |                | window 🧕 🧕            | Window @2027           | 770 icth: 960                 | , _height: 600        |
| 432 B     | _use           | rinterface            | Object @20354          | 43 alue: fun                  | ction, preview        |
| 144 B     | _la            |                       | Object @21361          | 2.0", con                     | stants: Object        |
| 65 B      |                |                       | 00/001 @21001          | icn, sphe                     | re: function,         |
| 64 B      |                | ► 🔘 @230              | 236 <b>{ point :</b> 1 | runction, line                | Start: functio        |
| 97 B      |                | ▶ 🚺 @212              | 359 {year: fu          | unction, years                | : function, da        |
| 64 B      |                | ▶ 🚺 @207              | 323 {\$: funct         | tion, \$\$: fund              | tion, _canQuer        |
| 192 B     |                | ▶ 🚺 @207              | 420 {\$: funct         | tion, \$\$: fund              | tion, _canQuer        |
| 176 B     |                | ▶ 🚺 @215              | 695 <b>{getDate</b>    | : function, ge                | tDay: function        |
| 33 B      |                | ▶ 🚺 @222              | 527 {name: "S          | Science Experi                | .ments", url: "       |
| 66 B      |                | ▶ 🚺 @203              | 545 {version:          | : "1.6.26", me                | sh: function,         |
| 64 B      |                | ▶ 🚺 @230              | 328 <b>{point:</b> 1   | function, line                | Start: functio        |
| 208 B     |                | ▶ 🚺 @214              | 320 {a: funct          | tion, A: funct                | ion, b: functi        |
| 33 B      |                | ▶ 🚺 @222              | 526 {name: "5          | Spy Satellites                | ", url: "data/        |
| 32 B      |                | ▶ 🚺 @212              | 314 d3_Map {_          | _: Object}                    |                       |
| 206 B     |                | ▶ 🚺 @214              | 804 <b>{alicebl</b>    | ue: d3_color,                 | antiquewhite:         |
| 71 B      |                | ▶ 🚺 @221              | 630 {linear:           | function, log                 | : function, po        |
| 70 B      |                | ▶ 🙆 @221              | 632 {bundle:           | function, cho                 | rd: function,         |
| 80 B      |                | ▶ 🖸 @224              | 282 <b>{Point:</b> (   | Object, MultiP                | oint: Object,         |
|           |                |                       |                        |                               |                       |

tion, descending: function, min: function, max: function, ...}
ata/iridium-33-debris.txt", satellites: Promise}

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pounds: function, centroid: function, clipExtent: function, ...} pedObject: Object, \_idToObjectGroupName: {}, \_objectGroups: {}, \_modules: {Co... , \_takeHeapSnapshots: false, element: <div>, \_foregroundContext: CanvasRenderi Walue: function, functionDetails: function, wrapObject: function, setExcepti... degreesLat: function, degreesLong: function, eciToEcf: function, ...} lineStart: function, lineEnd: function, polygonStart: function, ...} on, lineEnd: function, polygonStart: function, polygonEnd: function, ...} ay: function, days: function, dayOfYear: function, ...} rySelectorOnNode: function, \$x: function, dir: function, ...} rySelectorOnNode: function, \$x: function, dir: function, ...} , getFullYear: function, getHours: function, getMilliseconds: function, ...} 'data/science.txt", satellites: Promise} meshArcs: function, merge: function, mergeArcs: function, ...} on, lineEnd: function, polygonStart: function, polygonEnd: function} ion, B: function, c: function, ...} intelsat.txt", satellites: Promise}



|                          | Ċ        |              |                       | 17    | <u> </u> 856. | 7 КВ 🕓    | 42.4m  | s 🗐 6       | 0 ()    | <u>∧</u> o |        | $\ominus$ |        |
|--------------------------|----------|--------------|-----------------------|-------|---------------|-----------|--------|-------------|---------|------------|--------|-----------|--------|
| () Timelines             |          | 뮮 Elemer     | its                   | (     | D Netwo       | rk        |        | 🗋 Res       | sources |            | ٦<br>آ | Debugger  |        |
| Events Frames            | < >      | 🖄 Timeline I | Recording 1 $\rangle$ | 🕜 Jav | aScript Al    | locations | ) 🕘 En | tire Record | ding    |            |        |           |        |
|                          | Edit     | 10.00s       | 20.00s                |       | 30.00s        | 40.00s    |        | 50.00s      | 60.00s  | 70.        | .00s   | 80.00s    | 90.00s |
| JavaScript Allocations   | $\times$ | 3            | 3                     | S     | S             | (         | 3      | S           |         | 3)         | S      | S         |        |
| O Details > Snapshot Lis | st       |              |                       |       |               |           |        |             |         |            |        | 6         | 20     |
| Name                     |          |              |                       |       |               |           |        |             |         |            | Time   | e ^       |        |
| Snapshot 1               |          |              |                       |       |               |           |        |             |         |            | 12.24  | ms        |        |
| Snapshot 2               |          |              |                       |       |               |           |        |             |         |            | 10.0   | )2s       |        |
| Snapshot 3               |          |              |                       |       |               |           |        |             |         |            | 20.0   | )8s       |        |
| Snapshot 4               |          |              |                       |       |               |           |        |             |         |            | 30.0   | )4s       |        |
| Snapshot 5               |          |              |                       |       |               |           |        |             |         |            | 40.1   | Os        |        |
| Snapshot 6               |          |              |                       |       |               |           |        |             |         |            | 50.0   | )7s       |        |
| Snapshot 7               |          |              |                       |       |               |           |        |             |         |            | 60.0   | 9s        |        |
| Snapshot 8               |          |              |                       |       |               |           |        |             |         |            | 70.0   | )9s       |        |
| Snapshot 9               |          |              |                       |       |               |           |        |             |         |            | 80.2   | Os        |        |
| Snapshot 10              |          |              |                       |       |               |           |        |             |         |            | 90.1   | 1s        |        |
| Snapshot 11              |          |              |                       |       |               |           |        |             |         |            | 100.1  | 3s        |        |
| Snapshot 12              |          |              |                       |       |               |           |        |             |         |            | 110.1  | Os        |        |
| Snapshot 13              |          |              |                       |       |               |           |        |             |         |            | 116.9  | )3s       |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |
|                          |          |              |                       |       |               |           |        |             |         |            |        |           |        |



|                            | C        |            |                       | 17    | <u> </u>     | кв 🕔     | 42.4ms     | ₽ 6        | ① 0 △  | 0      |        | $\ominus$ |        |
|----------------------------|----------|------------|-----------------------|-------|--------------|----------|------------|------------|--------|--------|--------|-----------|--------|
| J Timelines                |          | 귬 Elemer   | its                   | (     | D Networ     | k        |            | 🗋 Res      | ources | }      | D Debu | gger      |        |
| Events Frames              | < >      | 🖄 Timeline | Recording 1 $\rangle$ | 🕜 Jav | aScript Allo | ocations | 🕘 Ent      | ire Record | ling   |        |        |           |        |
|                            | Edit     | 10.00s     | 20.00s                |       | 30.00s       | 40.00s   | ŧ          | 50.00s     | 60.00s | 70.00s | 80     | .00s      | 90.00s |
| JavaScript Allocations     | $\times$ | S          | 3                     | S     | S            |          | <u>S</u> ] | S          | S      | 8      | 3      | S         | (      |
| 🕜 Details 👌 📃 Snapshot Lis | t        |            |                       |       |              |          |            |            |        |        |        | 6         | 20     |
| Name                       |          |            |                       |       |              |          |            |            |        | 1      | Time ^ |           |        |
| Snapshot 1                 |          |            |                       |       |              |          |            |            |        | 12     | .24ms  |           |        |
| Snapshot 2                 |          |            |                       |       |              |          |            |            |        | 1      | 10.02s |           |        |
| Snapshot 3                 |          |            |                       |       |              |          |            |            |        | 2      | 20.08s |           |        |
| Snapshot 4                 |          |            |                       |       |              |          |            |            |        | 3      | 30.04s |           |        |
| Snapshot 5                 |          |            |                       |       |              |          |            |            |        | 2      | 40.10s |           |        |
| Snapshot 6                 |          |            |                       |       |              |          |            |            |        | Ę      | 50.07s |           |        |
| Snapshot 7                 |          |            |                       |       |              |          |            |            |        | E      | 60.09s |           |        |
| Snapshot 8                 |          |            |                       |       |              |          |            |            |        |        | 70.09s |           |        |
| Snapshot 9                 |          |            |                       |       |              |          |            |            |        | 8      | 30.20s |           |        |
| Snapshot 10                |          |            |                       |       |              |          |            |            |        | S      | 90.11s |           |        |
| Snapshot 11                |          |            |                       |       |              |          |            |            |        | 10     | 00.13s |           |        |
| Snapshot 12                |          |            |                       |       |              |          |            |            |        | 11     | 10.10s |           |        |
| Snapshot 13                |          |            |                       |       |              |          |            |            |        | 11     | 16.93s |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |
|                            |          |            |                       |       |              |          |            |            |        |        |        |           |        |



|                          | Ċ    |              |                       | 17    | <u> </u>     | кв 🕔     | 42.4m  | s 🗐 6       | ① 0 △ 0 |            | $\bigcirc$     |        |
|--------------------------|------|--------------|-----------------------|-------|--------------|----------|--------|-------------|---------|------------|----------------|--------|
| J Timelines              |      | 뮮 Elemen     | ts                    | (     | D Networ     | k        |        | Reso        | ources  | ٦<br>آ     | Debugger       |        |
| Events Frames            | >    | 🖄 Timeline F | Recording 1 $\rangle$ | 🕜 Jav | aScript Allo | ocations | D 🕘 En | tire Record | ing     |            |                |        |
|                          | Edit | 10.00s       | 20.00s                |       | 30.00s       | 40.00s   |        | 50.00s      | 60.00s  | 70.00s     | 80.00s         | 90.00s |
| JavaScript Allocations   | ×    | S            | 3                     | S     | 3            |          | S      | S           | S       | S          | S              | (      |
| ODetails > Snapshot List | t    |              |                       |       |              |          |        |             | 6       | Select bas | seline snapsho | ot 💿   |
| Name                     |      |              |                       |       |              |          |        |             |         | Time       | e ^            |        |
| Snapshot 1               |      |              |                       |       |              |          |        |             |         | 12.24      | ms             |        |
| Snapshot 2               |      |              |                       |       |              |          |        |             |         | 10.0       | 2s             |        |
| Snapshot 3               |      |              |                       |       |              |          |        |             |         | 20.0       | 8s             |        |
| Snapshot 4               |      |              |                       |       |              |          |        |             |         | 30.0       | 4s             |        |
| Snapshot 5               |      |              |                       |       |              |          |        |             |         | 40.1       | Os             |        |
| Snapshot 6               |      |              |                       |       |              |          |        |             |         | 50.0       | 7s             |        |
| Snapshot 7               |      |              |                       |       |              |          |        |             |         | 60.0       | 9s             |        |
| Snapshot 8               |      |              |                       |       |              |          |        |             |         | 70.0       | 9s             |        |
| Snapshot 9               |      |              |                       |       |              |          |        |             |         | 80.2       | Os             |        |
| Snapshot 10              |      |              |                       |       |              |          |        |             |         | 90.1       | 1s             |        |
| Snapshot 11              |      |              |                       |       |              |          |        |             |         | 100.1      | 3s             |        |
| Snapshot 12              |      |              |                       |       |              |          |        |             |         | 110.1      | Os             |        |
| Snapshot 13              |      |              |                       |       |              |          |        |             |         | 116.9      | 3s             |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |
|                          |      |              |                       |       |              |          |        |             |         |            |                |        |



|                          | C                 |      | $\mathbb{D}$ |              | 17 🛆 856.7     | 7 КВ 🕓 42    | .4ms 🗐 6       | ① 0 ▲   |                 | $\bigcirc$   |        | Q~ Sear     |
|--------------------------|-------------------|------|--------------|--------------|----------------|--------------|----------------|---------|-----------------|--------------|--------|-------------|
| Timelines                |                   | 뮵    | Elements     |              | D Netwo        | rk           | 🗅 Re           | sources | Del             | bugger       |        | ∑ Co        |
| Events Frames            | $\langle \rangle$ | 🖄 Ti | meline Rec   | ording 1 > 🕜 | JavaScript All | ocations > ( | ) Entire Recor | ding    |                 |              |        |             |
|                          | Edit              |      | 10.00s       | 20.00s       | 30.00s         | 40.00s       | 50.00s         | 60.00s  | 70.00s          | 80.00s       | 90.00s | 100.0       |
| JavaScript Allocations   | $\times$          | S    | S            | S            | S              | S            | S              | S       | S               | S            |        | 3           |
| O Details > Snapshot Lis | st                |      |              |              |                |              |                | 6 2     | Select comparis | son snapshot | ۲      | Filter Reco |
| Name                     |                   |      |              |              |                |              |                |         | Time ^          |              |        |             |
| Snapshot 1               |                   |      |              |              |                |              |                |         | 12.24ms         | 5            |        |             |
| Snapshot 2               |                   |      |              |              |                | 0            |                |         | 10.02s          |              |        |             |
| Snapshot 3               |                   |      |              |              |                |              |                |         | 20.08s          |              |        |             |
| Snapshot 4               |                   |      |              |              |                |              |                |         | 30.04s          |              |        |             |
| Snapshot 5               |                   |      |              |              |                |              |                |         | 40.10s          | į            |        |             |
| Snapshot 6               |                   |      |              |              |                |              |                |         | 50.07s          | i l          |        |             |
| Snapshot 7               |                   |      |              |              |                |              |                |         | 60.09s          | i .          |        |             |
| Snapshot 8               |                   |      |              |              |                |              |                |         | 70.09s          |              |        |             |
| Snapshot 9               |                   |      |              |              |                |              |                |         | 80.20s          |              |        |             |
| Snapshot 10              |                   |      |              |              |                |              |                |         | 90.11s          |              |        |             |
| Snapshot 11              |                   |      |              |              |                |              |                |         | 100.13s         |              |        |             |
| Snapshot 12              |                   |      |              |              |                |              |                |         | 110.10s         |              |        |             |
| Snapshot 13              |                   | _    |              |              |                |              |                |         | 116.93s         | į.           |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |
|                          |                   |      |              |              |                |              |                |         |                 |              |        |             |

|                          | C    |      | $\mathbb{D}$ |              | ) 17 🛆 856   | 6.7 КВ 🕔    | 42.4ms 🗐  | 6 🕕 0     | C  |            |            | $\ominus$ |        | Q~ Sear     |
|--------------------------|------|------|--------------|--------------|--------------|-------------|-----------|-----------|----|------------|------------|-----------|--------|-------------|
| Timelines                |      | 뮮    | Elements     |              | D Netw       | /ork        |           | Resources |    | Ĵ          | )<br>Debug | ger       |        | ∑ Co        |
| Events Frames            | < >  | 🖄 Ті | imeline Rec  | ording 1 > 🔀 | JavaScript A | Allocations | Entire Re | cording   |    |            |            |           |        |             |
|                          | Edit |      | 10.00s       | 20.00s       | 30.00s       | 40.00s      | 50.00s    | 60.0      | Os | 70.00s     | 80.0       | )Os       | 90.00s | 100.0       |
| JavaScript Allocations   | ×    | S    | S            | S            | S            |             | 3] (      | S         | S  | S          |            | S         |        | 3)          |
| O Details > Snapshot Lis | t    |      |              |              |              |             |           | 0         | ₹  | Select com | nparison   | snapshot  | 0      | Filter Reco |
| Name                     |      |      |              |              |              |             |           |           |    | Ti         | me ^       |           |        |             |
| Snapshot 1               |      |      |              |              |              |             |           |           |    | 12.2       | 24ms       |           |        |             |
| Snapshot 2               |      |      |              |              |              |             |           |           |    | 10         | 0.02s      |           |        |             |
| Snapshot 3               |      |      |              |              |              | •           |           |           |    | 20         | 0.08s      |           |        |             |
| Snapshot 4               |      |      |              |              |              |             |           |           |    | 30         | 0.04s      |           |        |             |
| Snapshot 5               |      |      |              |              |              |             |           |           |    | 40         | 0.10s      |           |        |             |
| Snapshot 6               |      |      |              |              |              |             |           |           |    | 50         | 0.07s      |           |        |             |
| Snapshot 7               |      |      |              |              |              |             |           |           |    | 60         | 0.09s      |           |        |             |
| Snapshot 8               |      |      |              |              |              |             |           |           |    | 70         | 0.09s      |           |        |             |
| Snapshot 9               |      |      |              |              |              |             |           |           |    | 80         | 0.20s      |           |        |             |
| Snapshot 10              |      |      |              |              |              |             |           |           |    | 90         | 0.11s      |           |        |             |
| Snapshot 11              |      |      |              |              |              |             |           |           |    | 100        | 0.13s      |           |        |             |
| Snapshot 12              |      |      |              |              |              |             |           |           |    | 110        | 0.10s      |           |        |             |
| Snapshot 13              |      | _    |              |              |              |             |           |           |    | 116        | 6.93s      |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |
|                          |      |      |              |              |              |             |           |           |    |            |            |           |        |             |

|   |            |           | $   \mathbf{D} $ | 17             | <u> 1856.7 кв</u> | () 42.4          |               | $\bigcirc$ |        |          |        |       |
|---|------------|-----------|------------------|----------------|-------------------|------------------|---------------|------------|--------|----------|--------|-------|
| J Time  | lines      | 뮮         | Elements         |                | D Network         |                  | 🗋 Res         | sources    | Ð      | Debugger |        | ∑ Co  |
| Events  | Frames     | < > 🖄 ті  | imeline Record   | ing 1 👌 🕜 Java | Script Allocat    | ions $ angle$ () | Entire Record | ding       |        |          |        |       |
|   |            | Edit      | 10.00s           | 20.00s 3       | 0.00s 4           | 0.00s            | 50.00s        | 60.00s     | 70.00s | 80.00s   | 90.00s | 100.0 |
| JavaScript /  | Allocation | ns 🗙 🖸    | S                | S              | S                 | S                | S             | S          | S      | S        | S      |       |
| Details 🕽 📃 Snapshot List 👌 💽 Snapshot Comparison (2 and 3) 🤇 🢽 Instances 🗘 |            |           |                  |                |                   |                  |               |            |        |          |        |       |
| Retained  | Size ~     | Self Size | Count            | Class Name     |                   |                  |               |            |        |          |        |       |
| 312.76 KB   |            | 116.72 KB | 855              | Object         |                   |                  |               |            |        |          |        |       |
| 175.83 KB   | · <u> </u> | 80 B      | 1                | Array          |                   |                  |               |            |        |          |        |       |
| 108.70 KB   |            | 108.70 KB | 1709             | String         |                   |                  |               |            |        |          |        |       |
| 6.33 KB   | —          | 1.53 KB   | 1                | JSLexic        | alEnvironment     | t                |               |            |        |          |        |       |
| 3.89 KB   |            | 3.61 KB   | 1                | Functio        | n                 |                  |               |            |        |          |        |       |
| 20 B  |            | 20 B      | 1                | Promise        | )                 |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |
|   |            |           |                  |                |                   |                  |               |            |        |          |        |       |

|                 |            |                 | $\mathbb{D}$  | 17              | <u> </u>         | кв 🕓 4    | 2.4ms                  | € 6     | ① 0      | <u>∧</u> 0 |        | $\bigcirc$ |           |
|-----------------|------------|-----------------|---------------|-----------------|------------------|-----------|------------------------|---------|----------|------------|--------|------------|-----------|
| 🕘 Time          | lines      | 品               | Elements      |                 | ) Network        | 5         | [                      | Res     | ources   |            | Ŵ      | Debugger   |           |
| Events          | Frames     | < > 🖄 ті        | meline Record | ing 1 > 🕜 Java  | Script Allo      | cations > | Entire                 | Record  | ing      |            |        |            |           |
|                 |            | Edit            | 10.00s        | 20.00s 3        | 0.00s            | 40.00s    | 50.0                   | 00s     | 60.00s   | 70.0       | 00s    | 80.00s     | 90.00s    |
| JavaScript      | Allocation | s × S           | S             | S               | S                | S         |                        | S       | (        | <u>S</u> ) | S      | S          |           |
| 🕜 Details 🔪 📃 🤅 | Snapshot I | List 👌 🝺 Snapsł | not Compariso | n (2 and 3) 👌 🤇 | Instances        | s ()      |                        |         |          |            |        |            |           |
| Retained        | I Size 🗸   | Self Size       | Count         | Class Name      |                  |           |                        |         |          |            |        |            |           |
| 312.76 KB       | ·          | 116.72 KB       | 855           | 🔻 🚺 Object      |                  |           |                        |         |          |            |        |            |           |
| 622 B           | 0.1%       | 34 B            |               | ▶ 💽 @416        | 61 <b>{name:</b> | "SDO",    | tle1: "                | 1 3639  | 950 1000 | 5A 161.    | 34.592 | 2882470    | 0000048   |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 47 {name:        | "AZERSI   | PACE 1",               | tlel    | "1 390   | 790 1300   | 6B 1   | 16135.2266 | 6819 .000 |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 46 <b>{name:</b> | "AMAZOI   | VAS 3",                | tle1:   | "1 3907  | 80 13006   | A 16   | 6134.52583 | 721000    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 45 {name:        | "TDRS     | <mark>11",</mark> tle  | e1: "1  | 39070U   | 13004A     | 16135  | 5.74191650 | .000000   |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 44 <b>{name:</b> | "MEXSAT   | <mark>T 3",</mark> tl  | le1: "1 | 1 390350 | 12075B     | 1613   | 34.6749317 | 100000    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 43 {name:        | "SKYNET   | T 5D", t               | lel: '  | '1 39034 | U 12075A   | 161    | 135,930726 | 97 .0000  |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 42 <b>{name:</b> | "YAMAL    | 402", t                | lel: '  | 1 39022  | U 12070A   | 161    | 134.657026 | 22 .0000  |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 41 {name:        | "EUTELS   | SAT 70B"               | , tlei  | l: "1 39 | 0200 120   | 69A    | 16135.158  | 895900    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 40 <b>{name:</b> | "CHINAS   | SAT 12 (               | (ZX 12) | ", tle1  | : "1 390   | 170 12 | 2067A 16   | 136.04648 |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 39 <b>{name:</b> | "ECHOST   | TAR 16",               | tlel    | "1 390   | 08U 1206.  | 5A 1   | 16134.5272 | 979600    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 💽 @417        | 38 {name:        | "EUTELS   | SAT 218"               | , tlei  | l: "1 38 | 9920 120   | 62B    | 16134.297  | 01339 .0  |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🙆 @417        | 37 {name:        | "STAR (   | ONE C3",               | tlel    | "1 389   | 910 1206   | 2A 1   | 16135.0658 | 954700    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🚺 @417        | 36 {name:        | "YAMAL    | 300K",                 | tle1:   | "1 3897  | 80 12061   | B 16   | 6134.74172 | 091 .000  |
| 422 B           | 0.1%       | 34 B            |               | ▶ 💽 @417        | 35 {name:        | "LUCH !   | 5 <mark>8",</mark> tle | e1: "1  | 38977U   | 12061A     | 16134  | 4.78825772 | 000001    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🙆 @417        | 34 <b>{name:</b> | "BEIDOL   | U G6", t               | :le1: ' | '1 38953 | U 12059A   | 161    | 136.094882 | 880000    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🙆 @417        | 33 {name:        | "INTELS   | SAT 23 (               | (IS-23) | ", tle1  | : "1 388   | 670 12 | 2057A 16   | 134.47898 |
| 422 B           | 0.1%       | 34 B            |               | ▶ 🙆 @417        | 32 {name:        | "GSAT-3   | 10", tle               | e1: "1  | 38779U   | 12051B     | 16135  | 5.12418773 | 000001    |
| 422 B           | 0.1%       | 34 B            |               | ▶ 💽 @417        | 31 {name:        | "ASTRA    | 2F", tl                | le1: "1 | 1 387780 | 12051A     | 1613   | 34.2786816 | 8 .00000. |
|                 |            |                 |               |                 |                  |           |                        |         |          |            |        |            |           |



|               |            |                 |                | 17                    | <u></u> 856.7 | кв 🕔     | 42.4ms 🖟   | 6       | ① 0 ①    | <u>∧</u> o |          | $\ominus$ |        |
|---------------|------------|-----------------|----------------|-----------------------|---------------|----------|------------|---------|----------|------------|----------|-----------|--------|
| 🕘 Tim         | elines     | 뮮               | Elements       |                       |               | ¢        |            | ) Resc  | ources   |            | Debu     | ugger     |        |
| Events        | Frames     | < > 🖄 Ti        | neline Recordi | ng 1 ) 🕜 Jav          | vaScript Allo | cations  | Entire F   | Recordi | ng       |            |          |           |        |
|               |            | Edit            | 10.00s         | 20.00s                | 30.00s        | 40.00s   | 50.00      | )s      | 60.00s   | 70.00      | 8        | 0.00s     | 90.00s |
| JavaScript    | Allocation | ns 🗙 🖸          | S              | S                     | S             |          | 3          | S       | S        | 9          | S        | S         | (      |
| 🕜 Details 🔪 📃 | Snapshot   | List 🔰 D Snapsh | ot Comparisor  | n (2 and 3) 👌         | 0 Instance    | s ¢      |            |         |          |            |          |           |        |
| Retaine       | d Size 🗸   | Self Size       | Count          | Class Name            |               |          |            |         |          |            |          |           |        |
| 312.76 KB     |            | 116.72 KB       | 855            | 🔻 🚺 Object            | t             |          |            |         |          |            |          |           |        |
| 622 B         | 0.1%       | 34 B            |                | ► <u>0</u> <u>@41</u> | 661 {name:    | "SDO",   | tle1: "1   | 3639    | 50 10005 | A 16134    | .5928824 | 70000     | 0048   |
| 422 B         | 0.1%       | 34 B            |                |                       | AT Comme      | 11.47000 | PACE 1",   | tle1:   | "1 3907  | 9U 13006B  | 16135    | .2266681  | 9.00   |
| 422 B         | 0.1%       | 34 B            | Shor           | test property         | path to @4    | 1661     | VAS 3", t  | le1:    | "1 39078 | U 13006A   | 16134.   | 52583721  | 000    |
| 422 B         | 0.1%       | 34 B            |                | window                | Window @      | 19793    | 11", tle1  | : "1    | 39070U 1 | .3004A 1   | 6135.741 | 91650 .   | 000000 |
| 422 B         | 0.1%       | 34 B            | _user          | Interface             | Object @1     | 9980     | T 3", tle  | el: "1  | 39035U   | 12075B     | 16134.67 | 493171 -  | .00000 |
| 422 B         | 0.1%       | 34 B            | _9             |                       | Object @2     | 401      | T 5D", tl  | el: "   | 1 390340 | 12075A     | 16135.9  | 3072697   | .0000  |
| 422 B         | 0.1%       | 34 B            | -              | [253]                 | Object @4     | 1661     | 402", tl   | el: "   | 1 390220 | 12070A     | 16134.6  | 5702622   | .0000  |
| 422 B         | 0.1%       | 34 B            |                |                       |               |          | .5AT 70B", | tlel    | : "1 390 | 200 12069  | A 1613   | 5.158895  | 9000   |
| 422 B         | 0.1%       | 34 B            |                | ▶ 💽 @41               | 740 {name:    | "CHINA   | SAT 12 (2  | X 12)   | ", tle1: | "1 39017   | U 12067A | 16136     | .04648 |
| 422 B         | 0.1%       | 34 B            |                | ▶ 💽 @41               | 739 {name:    | "ECHOS   | TAR 16",   | tle1:   | "1 3900  | 8U 12065A  | 16134    | .5272979  | 600    |
| 422 B         | 0.1%       | 34 B            |                | ▶ 💽 @41               | 738 {name:    | "EUTEL   | SAT 218",  | tle1    | : "1 389 | 920 12062  | B 1613   | 4.297013  | 39 .0  |
| 422 B         | 0.1%       | 34 B            |                | ▶ 💽 @41               | 737 {name:    | "STAR    | ONE C3",   | tle1:   | "1 3899  | 1U 12062A  | 16135    | .0658954  | 700    |
| 422 B         | 0.1%       | 34 B            |                | ▶ 💽 @41               | 736 {name:    | "YAMAL   | . 300K", t | le1:    | "1 38978 | U 12061B   | 16134.   | 74172091  | .000   |
| 422 B         | 0.1%       | 34 B            |                | ▶ 💽 @41               | 735 {name:    | "LUCH    | 5B", tle1  | "1      | 38977U 1 | 2061A 1    | 6134.788 | 25772     | 000001 |
| 422 B         | 0.1%       | 34 B            |                | ▶ 0 @41               | 734 {name:    | "BEIDO   | 0U G6", tl | .el: "  | 1 389530 | 12059A     | 16136.0  | 9488288   | 0000   |
| 422 B         | 0.1%       | 34 B            |                | ▶ 0 @41               | 733 {name:    | "INTEL   | .SAT 23 (1 | (S-23)  | ", tle1: | "1 38867   | U 12057A | 16134     | .47898 |
| 422 B         | 0.1%       | 34 B            |                | ▶ 0 @41               | 732 {name:    | "GSAT-   | -10", tle1 | : "1    | 387790 1 | 2051B 1    | 6135.124 | 18773     | 000001 |
| 422 B         | 0.1%       | 34 B            |                | ▶                     | 731 {name:    | "ASTRA   | 2F", tle   | 1: "1   | 38778U   | 12051A     | 16134.27 | 868168    | .00000 |
|               |            |                 |                |                       |               |          |            |         |          |            |          |           |        |



## Demo Memory and JavaScript Allocations timelines

Brian Burg Safari and WebKit Engineer

Quickly see memory spikes to investigate

Quickly see memory spikes to investigate Take heap snapshots to explore what keeps objects alive

Quickly see memory spikes to investigate Take heap snapshots to explore what keeps objects alive Don't leave in console.takeHeapSnapshot()

Quickly see memory spikes to investigate Take heap snapshots to explore what keeps objects alive Don't leave in console.takeHeapSnapshot() Snapshots can have a performance impact

### Connecting Web Inspector

#### Profiling Javascript

Analyzing Memory

#### Consider upgrading to WKWebView



#### Consider upgrading to WKWebView Connect Web Inspector to your app



Consider upgrading to WKWebView Connect Web Inspector to your app Save time and deliver great performance



Consider upgrading to WKWebView Connect Web Inspector to your app Save time and deliver great performance Stay updated on feature development









## Web Inspector





### Visual Styles Sidebar

Quick Open

takeHeapSnapshot

Tail Call Stacks

Pseudo Elements in DOM Tree



### Compare Heap Snapshots



Sampling Profiler

## Memory Timeline

JavaScript Call Trees

JavaScript Heap Objects







## WebKit




# WebKit





#### CSP 2.0

### WOFF 2.0

#### International API

#### Proper Tail Calls

#### **CSS Variables**



#### WebDriver

#### Improved IndexedDB

### Unprefixed CSS Filters

<picture>

Shadow DOM









# WebKit





# WebKit.org



# Safari



# Safari Technology Preview

# More Information https://developer.apple.com/wwdc16/420

# Related Sessions

Extending Your App with Safari App Exter

Web Inspector and Modern JavaScript

Introducing the Modern WebKit API

What's New in Web Development in Web

Introducing Safari View Controller

Using Safari to Deliver and Debug a Respo Web Design

| isions         | Nob Hill | Wednesday 4:00PM |
|----------------|----------|------------------|
|                |          | WWDC 2014        |
|                |          | WWDC 2014        |
| Kit and Safari |          | WWDC 2014        |
|                |          | WWDC 2015        |
| onsive         |          | WWDC 2015        |



#### Safari and WebKit Lab

#### Frameworks Lab C

Friday 4:30 PM

