Selenium Grid

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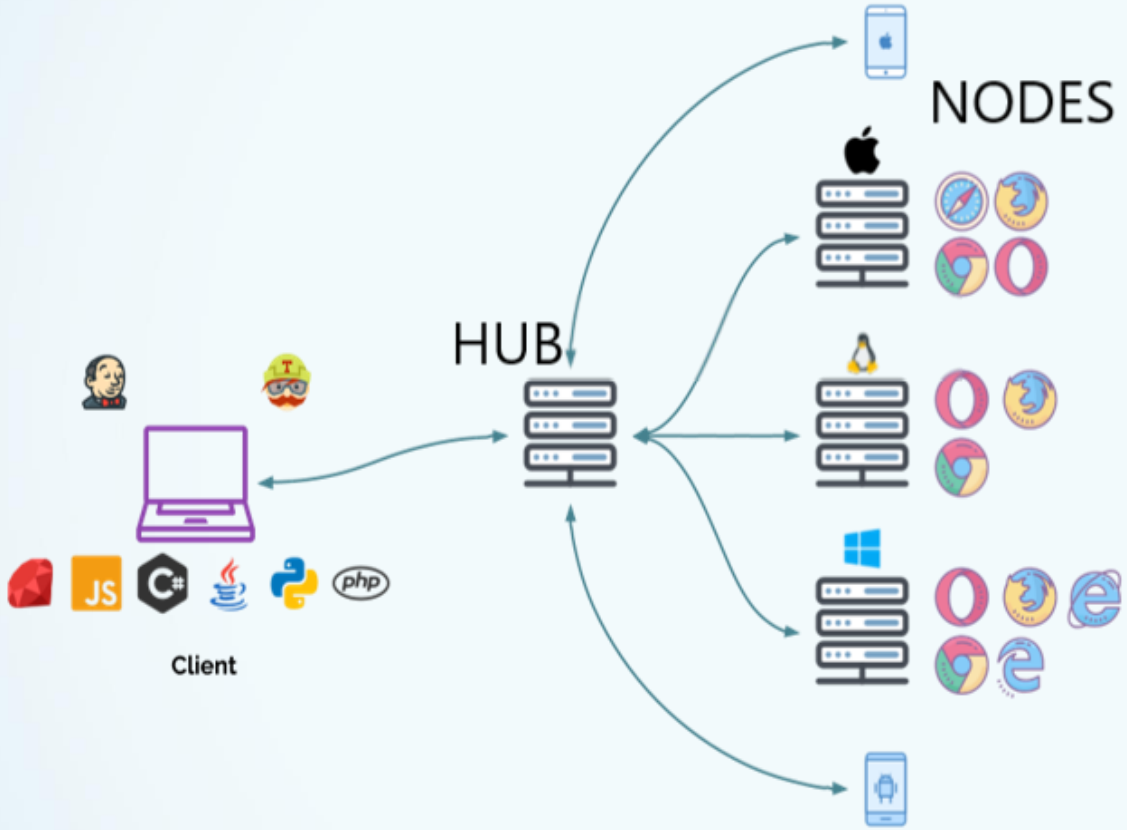
Introduction

Selenium Grid is a system that lets you run tests in parallel across multiple machines, browsers, and operating systems.

- Cross-browser compatibility tests
- Run tests on remote VM / cloud server
- Reduce execution time
- Parallel testing across multiple versions of Chrome
- Teams working with distributed environments

Architecture



Selenium Grid Modes

- Standalone - Local machine, single execution
- Hub–Node (Classic) - Medium-sized teams
- Fully Distributed - Large enterprise grade

Components in Selenium Grid

- Router - Traffic police
- Distributor - Assigns node like job scheduler
- Session Map - Maintains active sessions
- Session Queue - Maintains queued sessions
- Event Bus - Internal communicator between services
- Nodes - Machines

Starting Hub

- java -jar selenium-server-4.38.0.jar hub
- Hub - Start in Hub mode (central controller).

Optional Parameters

- --port 4444
- --config hub-config.toml

Starting Node

- java -jar selenium-server-4.21.0.jar node --port 5555 --hub http://localhost:4444
- Node - Start in Node mode.
- --port 5555 (Node Port, not server port)
- --hub http://localhost:4444 (Hub URL can be seen on hub console)
- --max-sessions 5

- If running on same machine only node argument required, everything else is optional

hub-config.toml

Syntax

[section]
key = value

Server

- Port = 4444
- host = "0.0.0.0" - accept from any IP
- bind-host = true
- allow-cors = true - Allows browser UIs to call the Grid API
- max-threads = 24 - Limits HTTP worker threads; default is roughly CPU * 3

hub-config.toml

```toml
# ---------- Server basic settings ----------
[server]
port = 4444
host = "0.0.0.0"
bind-host = true
allow-cors = true
max-threads = 24
```

hub-config.toml

router

- sub-path - reverse proxy
- disable-ui - enable Grid UI at /ui
- Username/password- enable basic authentication(Node URL http://admin:myStrongPassword@localhost:4444)

hub-config.toml

```toml
# ---------- Router / Hub behaviour ----------
[router]
sub-path = ""
disable-ui = false
username = "admin"
password = "myStrongPassword"
```

hub-config.toml

Sessions - The Session Map is an internal service tracking

- sessions - Full URL of the Session Map service. In simple setups, it usually runs in the same hub process and you point to http://localhost:<port>

- sessions-host, sessions-port - Host & port where Session Map listens, if you run it separately (more advanced distributed setups)

hub-config.toml

```
# ---------- Session Map & Queue ----------
[sessions]
sessions = "http://localhost:5556"
sessions-host = "localhost"
sessions-port = 5556
```

hub-config.toml

Sessionqueue- SessionQueue is like a waiting room for tests

- sessionqueue - URL of the Queue service – where new session requests are queued.
- session-request-timeout - If a new session request stays longer than 300 seconds in the queue, it times out.
- session-retry-interval - If all slots are busy, Grid will wait 5 seconds and retry assigning a Node.
- maximum-response-delay - How often (in seconds) queue responds even when there’s no data – helps reduce constant HTTP polling chatter.

hub-config.toml

```
[sessionqueue]
sessionqueue = "http://localhost:5559"
sessionqueue-host = "localhost"
sessionqueue-port = 5559
session-request-timeout = 300
session-retry-interval = 5
maximum-response-delay = 8
```

hub-config.toml

Distributor - brain that picks the Node

- distributor, distributor-host, distributor-port - URL of the Queue service – Where the Distributor service is reachable.
- healthcheck-interval - How often (seconds) to ping Nodes to see if they're alive.
- reject-unsupported-caps - reject or accept unsupported capability requests
- newsession-threadpool-size – size of threads the Distributor uses to create new sessions in parallel
- purge-nodes-interval - How often (seconds) to remove Nodes considered "dead" (no heartbeat for some time).
- slot-matcher - Java class that decides if a Node/slot can accept a given capability set.
- slot-selector - Java class that chooses *which slot* to use when multiple match.

hub-config.toml

```
# ---------- Distributor (assigns nodes) ----------
[distributor]
distributor = "http://localhost:5553"
distributor-host = "localhost"
distributor-port = 5553
healthcheck-interval = 60
reject-unsupported-caps = false
newsession-threadpool-size = 24
purge-nodes-interval = 30
slot-matcher = "org.openqa.selenium.grid.data.DefaultSlotMatcher"
slot-selector = "org.openqa.selenium.grid.distributor.selector.DefaultSlotSelector"
```