

Behind the Curtain

Lessons from running Remote Emulators

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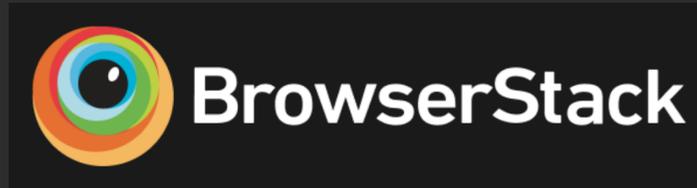
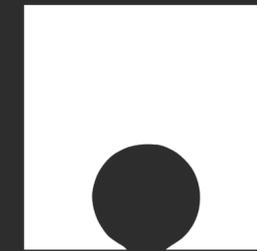
Why run remotely?

- PR, nightly or release E2E tests
- Different device configurations: Pixel XL, tablets, Android version 14, pt_BR

How to run on cloud?

Cloud Providers

Cloud Providers



headspin

Self Hosted

Self Hosted



Self Hosted



Self Hosted



```
- name: run tests
  uses: reactivecircus/android-emulator-runner@v2
  with:
    api-level: 34
    target: google_api
    arch: x86_64
    profile: pixel_7_pro
    script: ./gradlew connectedCheck
```



Criteria for Selection

Performance of Emulators

Criteria for Selection

Performance of Emulators = How fast you can execute without "*crawl*" ?

Criteria for Selection: Performance

Performance of Emulators: How fast you can execute without "*crawl*" ?

- ✓ Graphics Acceleration for screen rendering
- ✓ VM Acceleration

Criteria for Selection: Performance

Performance of Emulators: How fast you can execute without "*crawl*" ?

✓ Graphics Acceleration for screen rendering

✓ VM Acceleration

Hardware Acceleration



Criteria for Selection: Performance

Performance of Emulators: How fast you can execute without "crawl" ?

✓ Graphics Acceleration for screen rendering

✓ VM Acceleration

10x slower

Hardware Acceleration



Criteria for Selection: Graphics Acceleration

Criteria for Selection: Graphics Acceleration

Infrastructure	GPU support
Baremetal Macs (M1/M4)	
GCP VMs	
android-emulator-runner (Github runners)	

Criteria for Selection: Graphics Acceleration

Infrastructure	GPU support
Baremetal Macs (M1/M4)	✓
GCP VMs	✓ Attach GPU to VMs
android-emulator-runner (Github runners)	✓ GitHub Action Large Runners

What if I cannot have GPUs?

What if I cannot have GPUs?

- Using software acceleration – “Independence” from hardware



```
emulator -avd avd_name -gpu swiftshader_indirect
```

Criteria for Selection: VM Acceleration

Criteria for Selection: VM Acceleration

Infrastructure	VM Acceleration
Baremetal Macs (M1/M4)	
GCP VMs	
android-emulator-runner	

Criteria for Selection: VM Acceleration

Infrastructure	VM Acceleration
Baremetal Macs (M1/M4)	✔️ macOS >= 10.10
GCP VMs	✔️ <code>--enable-nested-virtualization</code>
android-emulator-runner	⚠️ Enable KVM on ubuntu-latest runner

Criteria for Selection

✓ Performance of Emulators

Criteria for Selection

✓ Performance of Emulators

Scalability = can I handle 30 PRs/day → 1000 tests?

Criteria for Selection: Scalability

Infrastructure	
Baremetal Macs (M1/M4)	
GCP VMs	
android-emulator-runner	

Criteria for Selection: Scalability

Infrastructure	Elasticity \Leftrightarrow Auto Scaling
Baremetal Macs (M1/M4)	
GCP VMs	
android-emulator-runner	

Criteria for Selection: Scalability

Infrastructure	Elasticity \Leftrightarrow Auto Scaling
Baremetal Macs (M1/M4)	 Non-Elastic
GCP VMs	 Auto-scale policy
android-emulator-runner	 max-concurrent-jobs,  price

Criteria for Selection

✓ Performance of Emulators

✓ Scalability of Emulators

Criteria for Selection

✓ Performance of Emulators

✓ Scalability of Emulators

Configurability

Configurability

How fast you can:

- add **OS versions**,
- new device models example **pixel_6, pixel_xl**
- **Play store** enabled/disabled
- More

Configurability: Let's add API 35

Configurability: Let's add API 35



```
sdkmanager --install "platform-tools" "emulator" "platforms;android-35" \  
"system-images;android-35;google_apis;x86_64"
```

Configurability: Let's add API 35



```
sdkmanager --install "platform-tools" "emulator" "platforms;android-35" \  
  "system-images;android-35;google_apis;x86_64"  
  
avdmanager create avd -n Pixel_XL_API35 \  
  -k "system-images;android-35;google_apis;x86_64" \  
  -d pixel_xl
```



Criteria for Selection: Configurability

Criteria for Selection: Configurability

Infrastructure	Ease of Automation
Baremetal Macs (M1/M4)	
GCP VMs	
android-emulator-runner (Github Runner)	

Criteria for Selection: Configurability

Infrastructure	Ease of Automation
Baremetal Macs (M1/M4)	<ul style="list-style-type: none">• Slower• Prone to state issues
GCP VMs	✅ Easy to make changes to boot disk
android-emulator-runner (Github Runner)	Less control 😓

Criteria for Selection

- ✓ Performance of Emulators
- ✓ Scalability of Emulators
- ✓ Configurability

Reliability

Reliability

- Reliability
 - "Ohh I keep seeing these system ANR dialogs"

Reliability

- Reliability
 - "Ohh I keep seeing these system ANR dialogs"
 - Why do I have apps from different teams on my phone?

Reliability

- Preparation of **stable** emulator for stable tests

Preparation for Stable Emulators

Criteria for Selection: Stable Emulators

Infrastructure	Isolation
Baremetal Macs (M1/M4)	
GCP VMs	
android-emulator-runner	

Criteria for Selection: Stable Emulators

Infrastructure	Isolation
Baremetal Macs (M1/M4)	⚠️ Stateful
GCP VMs	Stateless and Isolation (Delete and create for each test)
android-emulator-runner	✅ Stateless and Isolation

Preparation for Stable Emulators

✓ Isolation

Preparation for Stable Emulators

- Consistent configs →

Preparation for Stable Emulators

- Consistent configs →
 - Screen recording > 3 min

Preparation for Stable Emulators

- Consistent configs →
 - Screen recording > 3 min
 - Show taps

Preparation for Stable Emulators

- Consistent configs →
 - Screen recording > 3 min
 - Show taps
 - Disable animations

Preparation for Stable Emulators

- Consistent configs →
 - Screen recording > 3 min
 - Show taps
 - Disable animations
 - Disable system apps that interfere

Criteria for Selection

- ✓ Performance of Emulators
- ✓ Scalability of Emulators
- ✓ Configurability
- ✓ Reliability

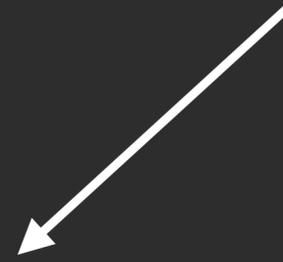
Closing Summary

Company

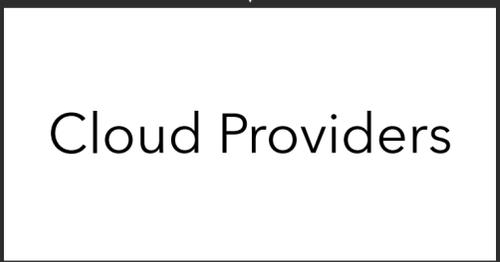
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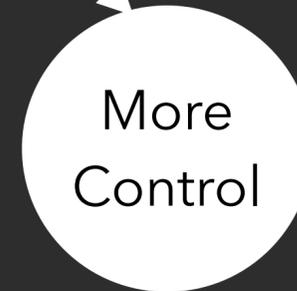


Ease?



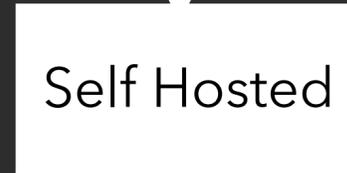
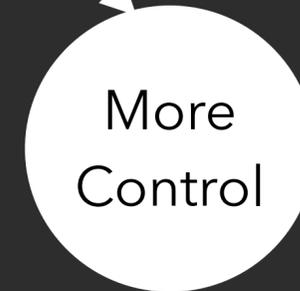
Cloud Providers

Company

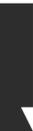
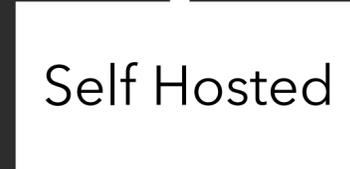


More
Control

Company



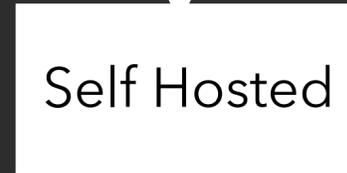
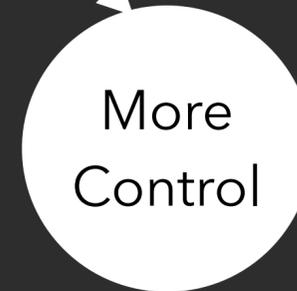
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Yes



Company



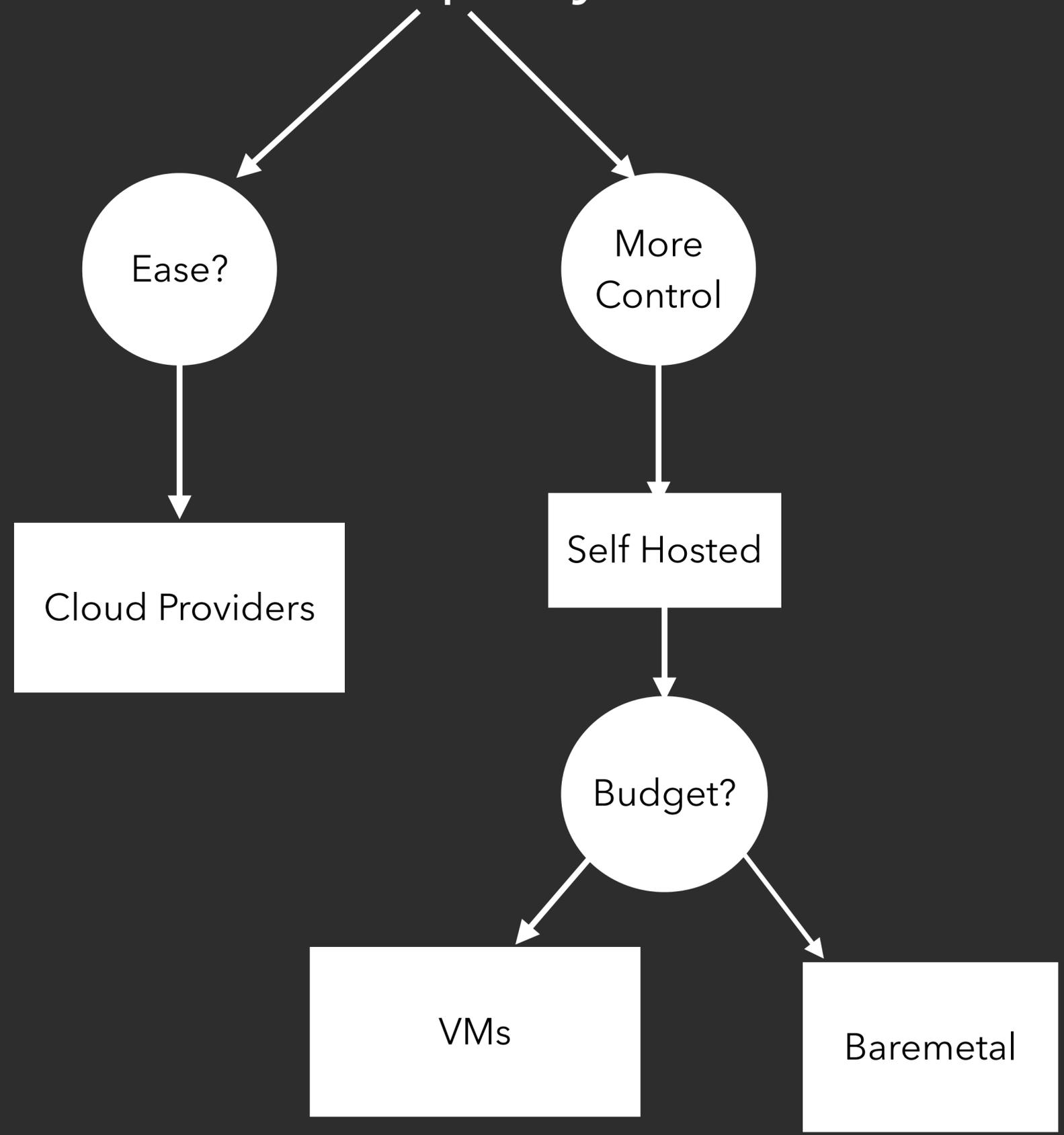
Yes



No



Company



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