

Android Builds: Simple Recipes for Enhance Developer Productivity

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About me



Staff Software Engineer
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Agenda

01 Toast

02 POS App

03 Growth Pains

The problem

The results

04 Hardware

05 Gradle Properties

06 Dependencies

07 CI Scripts

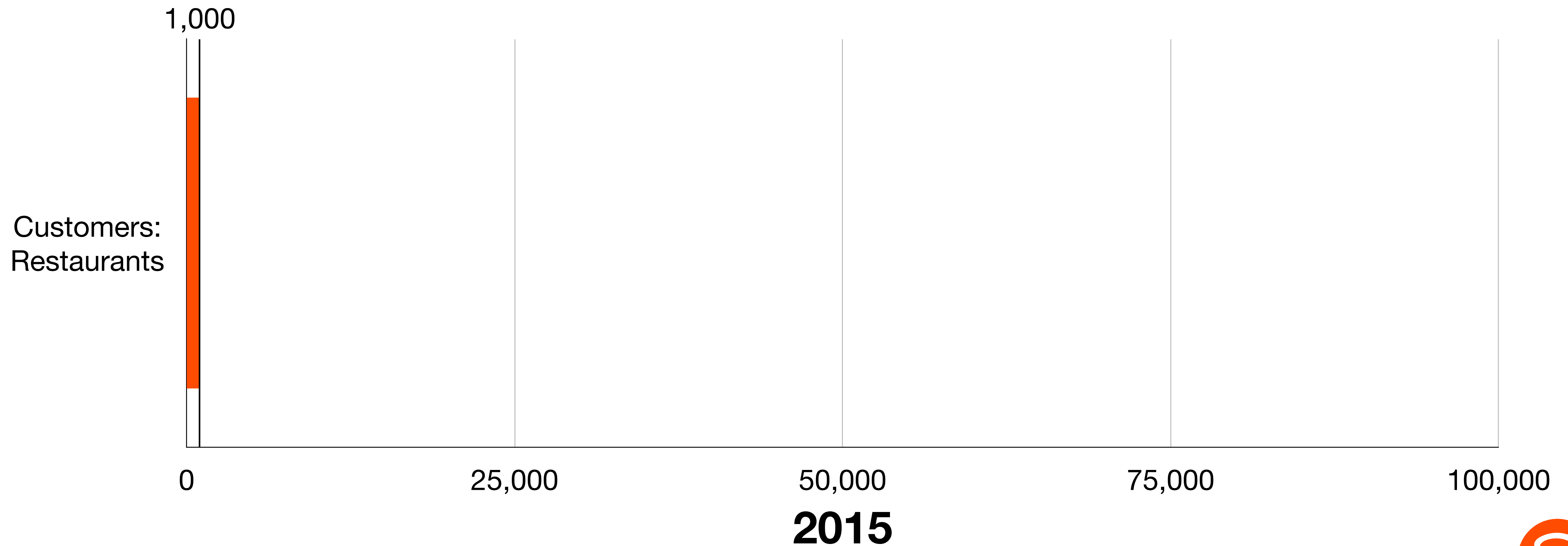
08 CI Container

Settings & Configuration

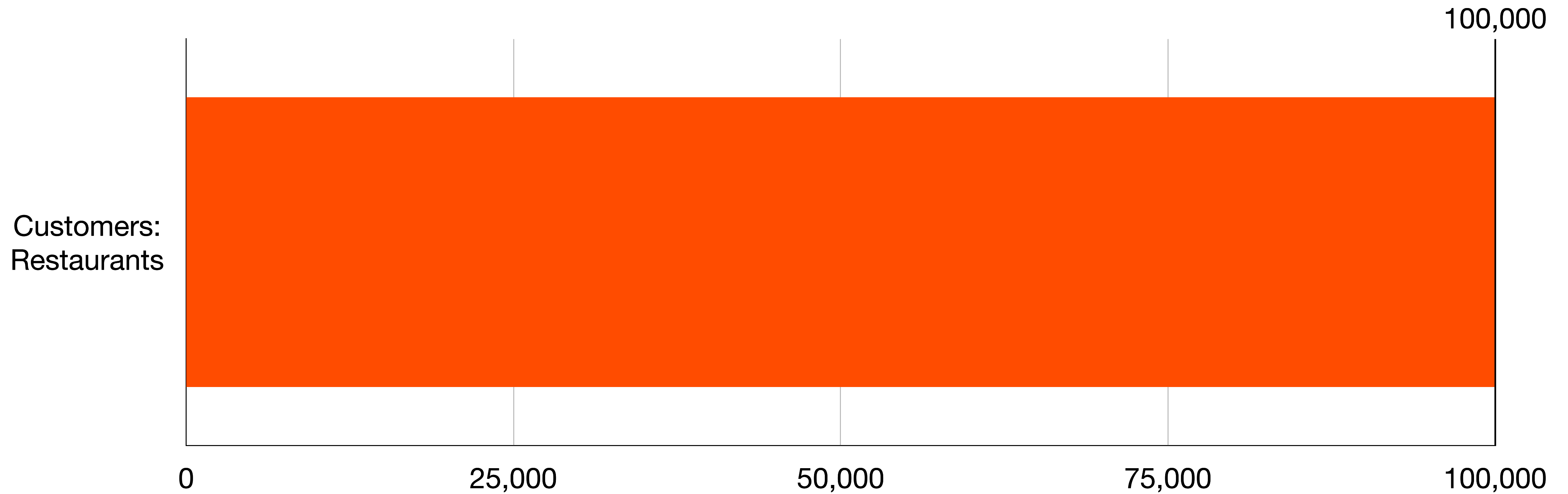
09 Recap



Toast's Growth



Toast's Growth



POS App's Current State



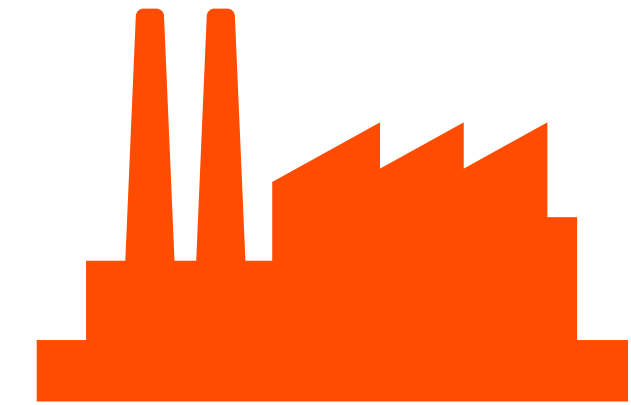
2M+
lines of code



326
modules



141
contributors



~150
avg remote builds/day



POS App's Build Tooling State



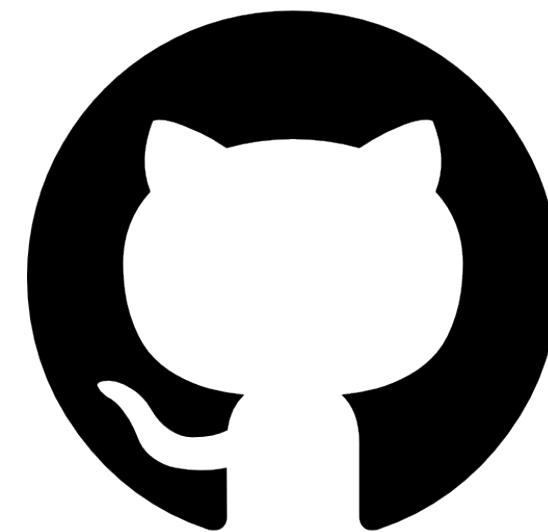
Gradle

Build System



Git

Version Control



Github

Git hosting platform

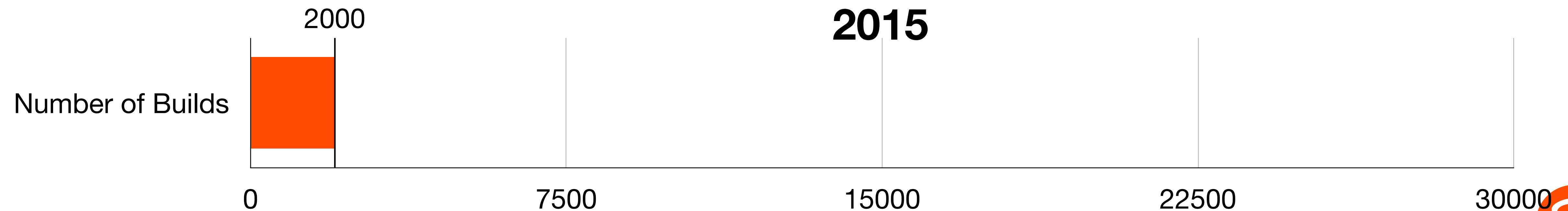
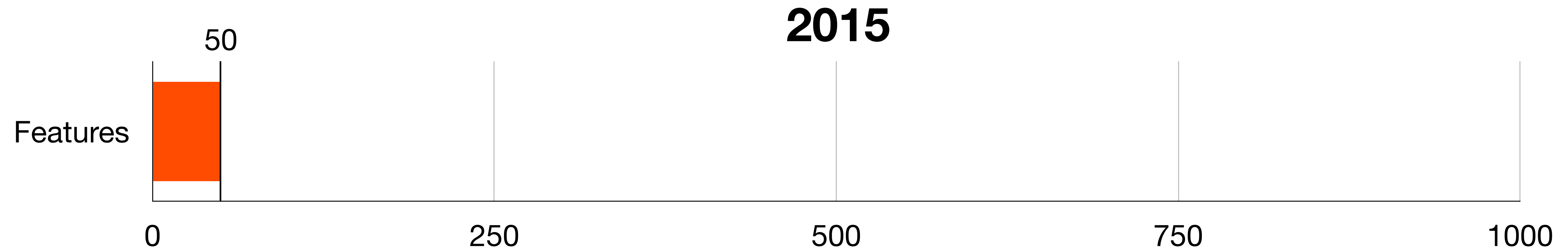
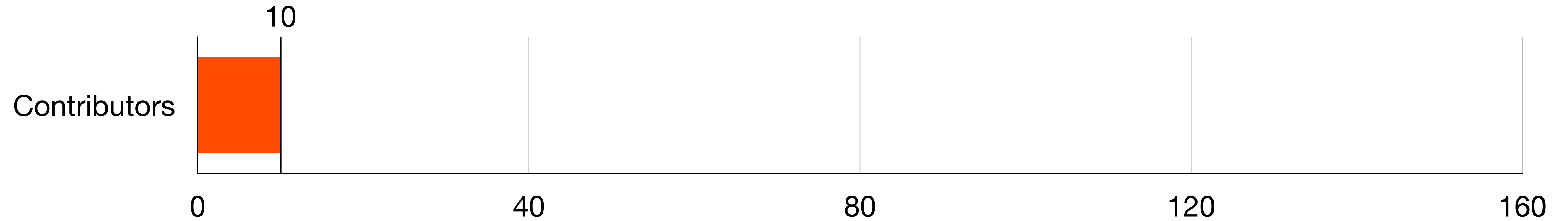


Jenkins

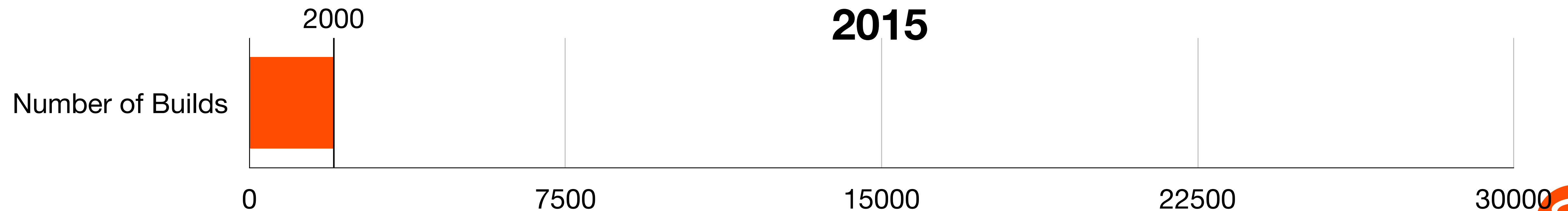
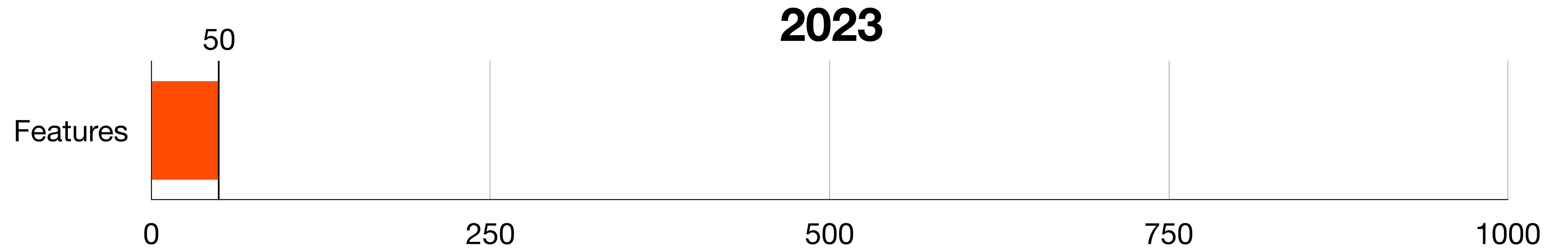
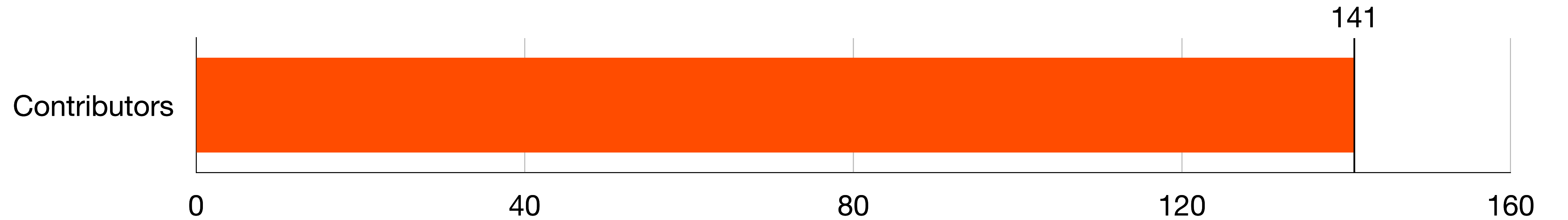
CI Server



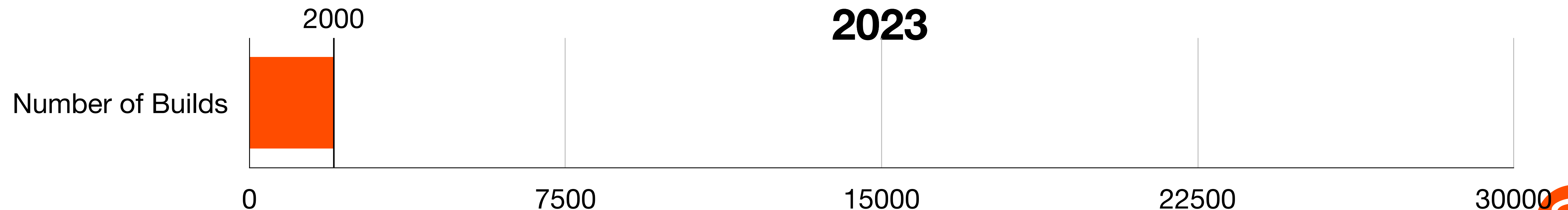
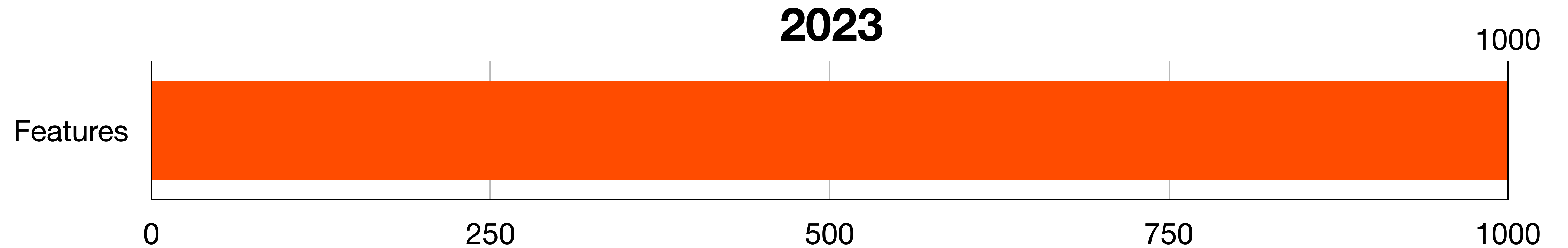
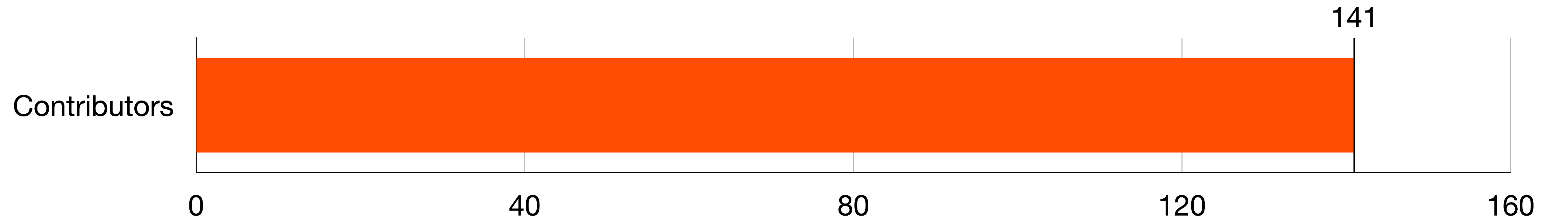
POS App's Growth



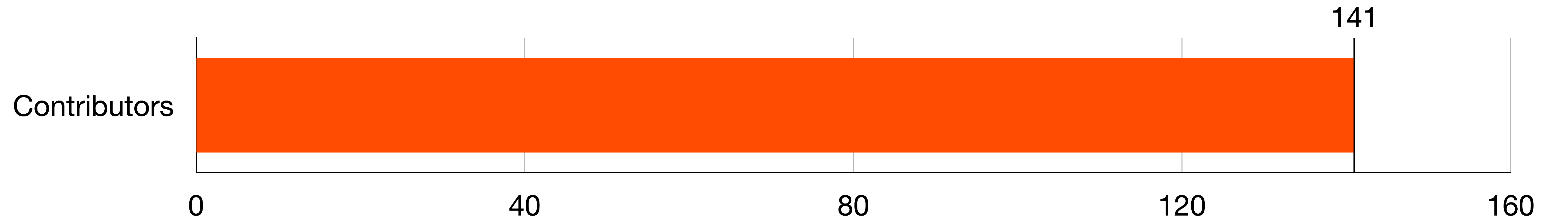
POS App's Growth



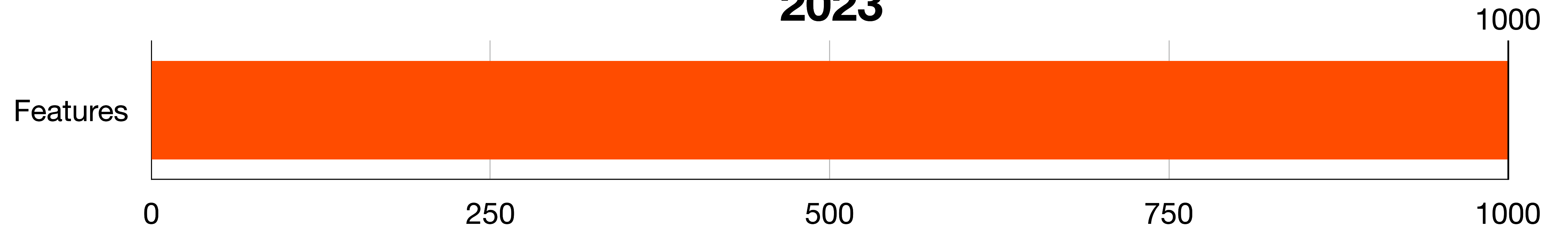
POS App's Growth



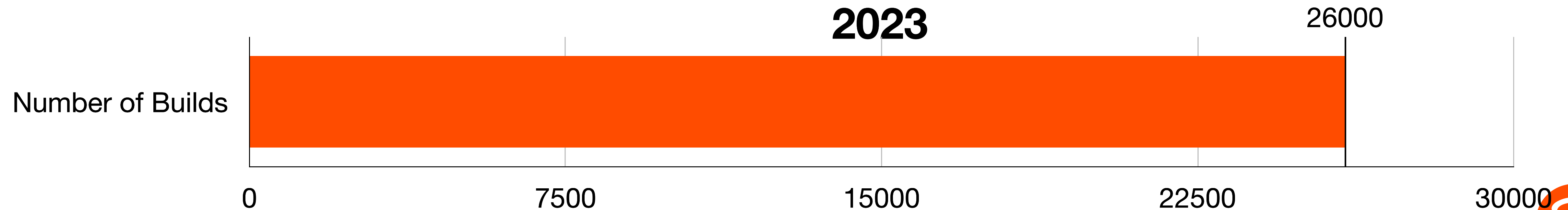
POS App's Growth



2023



2023

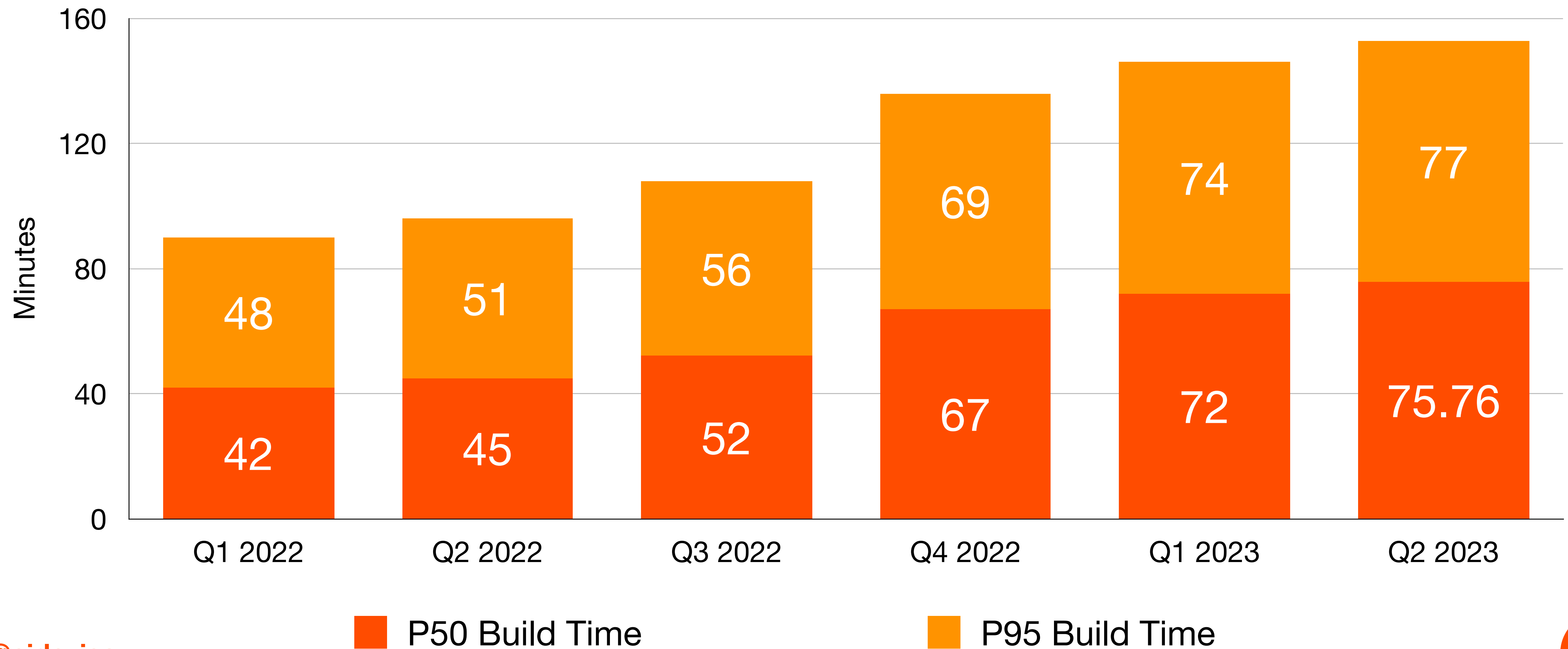


2023



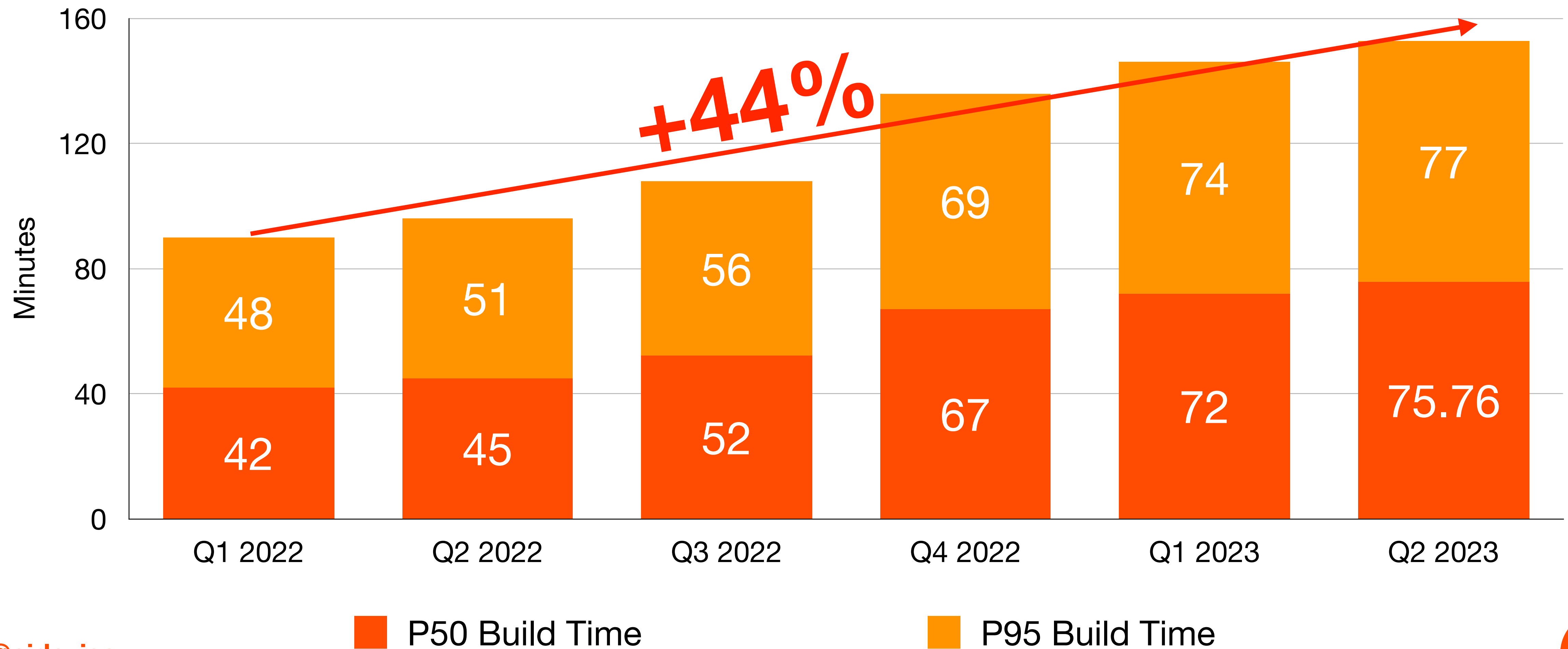
The problem

Build Time Uptick



The problem

Build Time Uptick



Why care about this problem?



Builds



Developers



Product



Why care about this problem?



Customers

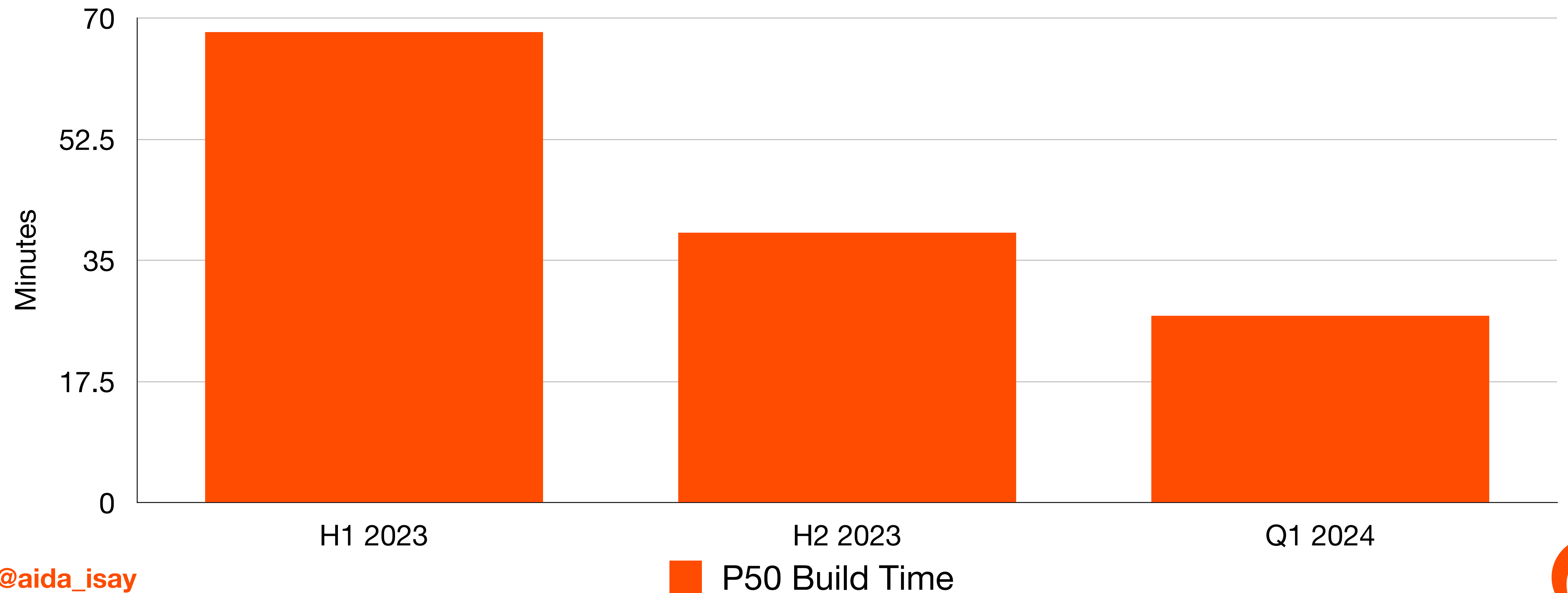


Business



Build Efficiency Project Results

Q3 2023 - Q1 2024



Build Efficiency Project Results

Q3 2023 - Q1 2024



How we did it?



How we did it?

By identifying and fixing low-hanging fruits



“You can’t fix what you can’t see”

–Someone on internet



Develocity

Gradle Enterprise

Build scans

Task inputs

Dependencies

Build dependencies

Custom values

Switches

Infrastructure

✓ gradle clean instantExecution:quickTest reporting:quickTest dia...

CACHED CI Check dirty FunctionalTest and 1 more

Started on Apr 29 2020 at 9:54:52 PM PDT, finished on Apr 29 2020 at 10:04:38 PM PDT

Gradle 6.4-rc-2, Gradle Enterprise plugin 3.2.1

Build Type Scans CI CompileAll Scan Git Commit Scans Source TeamCity Build

✓ gradle clean instantExecution:quickTest reporting:quickTest dia...

CACHED CI Check dirty FunctionalTest and 2 more

Started on Apr 30 2020 at 4:23:56 PM PDT, finished on Apr 30 2020 at 4:38:25 PM PDT

Gradle 6.4-rc-4, Gradle Enterprise plugin 3.3-rc-1

Build Type Scans CI CompileAll Scan Git Commit Scans Source TeamCity Build

Dependencies

Scripts and configurations

Comparing 669 dependencies in 44 scripts and configurations with differences

: settings.gradle.kts

com.gradle.enterprise:com.gradle.enterprise.gradle.plugin:3.2.1

com.gradle:gradle-enterprise-gradle-plugin: 3.2.1 3.3-rc-1

:buildSrc build.gradle.kts

net.swiftzer.semver:semver:1.1.1

org.gradle.kotlin-dsl.ktlint-convention:org.gradle.kotlin-dsl.ktlint-convention:0.4.1 0.5.0

org.jlleitschuh.gradle:ktlint-gradle: 8.2.0 9.2.1

:buildSrc runtimeClasspath

junit:junit: 4.12 4.13

net.swiftzer.semver:semver:1.1.1

org.gradle.kotlin:gradle-kotlin-dsl-conventions: 0.4.1 0.5.0

org.jlleitschuh.gradle:ktlint-gradle: 8.2.0 9.2.1

:buildSrc:binaryCompatibility ktlint

Comparing 4 custom values with differences

Build ID

34346977

34397787

Git Branch Name

master

Git Commit ID

6485d704a6dc6cabddc084f30efd611436f9bfb

8d447e9c031ff5e93e2c4351d115a503390aa7c1

Git Status

M buildSrc/gradle.properties
M gradle.properties
?? 11848-2020-04-29-10-49-18.filehandles.txt
?? 11848-2020-04-29-20-38-03.filehandles.txt
?? 18412-2020-04-29-10-49-17.filehandles.txt
?? gradle/shared-with-gradlebuild/
?? gradlebuild/
?? ports.txt

M buildSrc/gradle.properties
M gradle.properties
?? ports.txt

Comparing 12 infrastructure items, with 3 differences

Operating system

Windows 10 10.0

Windows 10 10.0

CPU cores

6 cores

6 cores

Max Gradle workers

4 workers

4 workers

Java runtime

AdoptOpenJDK OpenJDK Runtime Environment 11.0.4+11

AdoptOpenJDK OpenJDK Runtime Environment 11.0.4+11

Java VM

AdoptOpenJDK OpenJDK 64-Bit Server VM 11.0.4+11 (mixed mode)

AdoptOpenJDK OpenJDK 64-Bit Server VM 11.0.4+11 (mixed mode)

Max JVM memory heap size

2621 MB

2621 MB

Locale

English (United States)

English (United States)

Default charset

UTF-8

UTF-8

Username

tcagent1

tcagent1

Public hostname

windows27

windows13

Local hostname

WINDOWS27

WINDOWS13

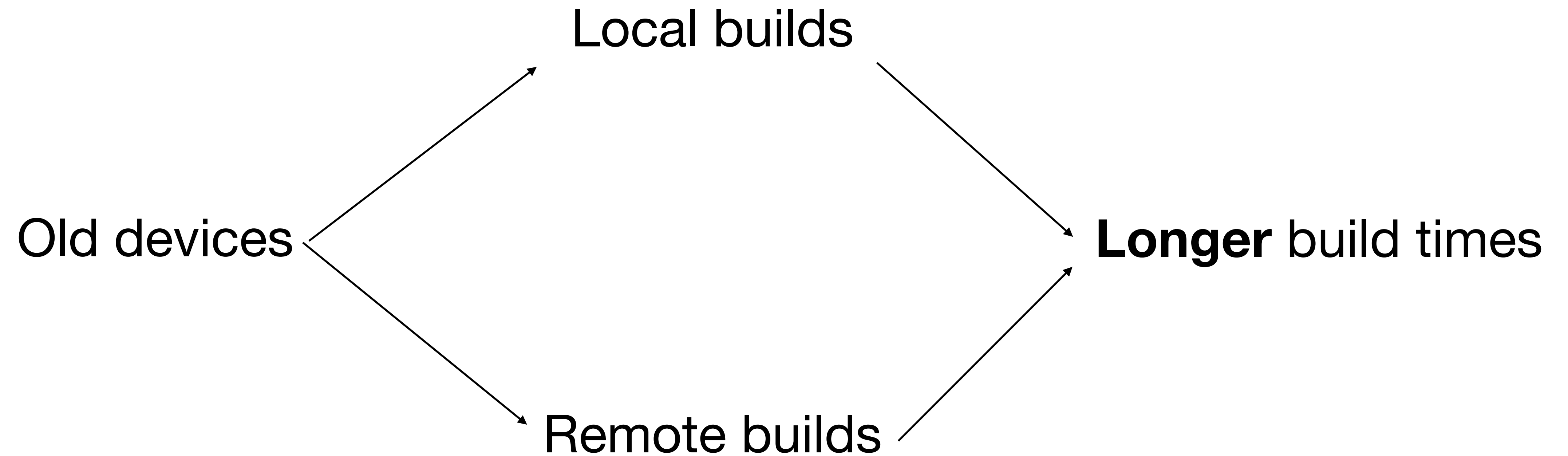
Local IP addresses

192.168.0.182

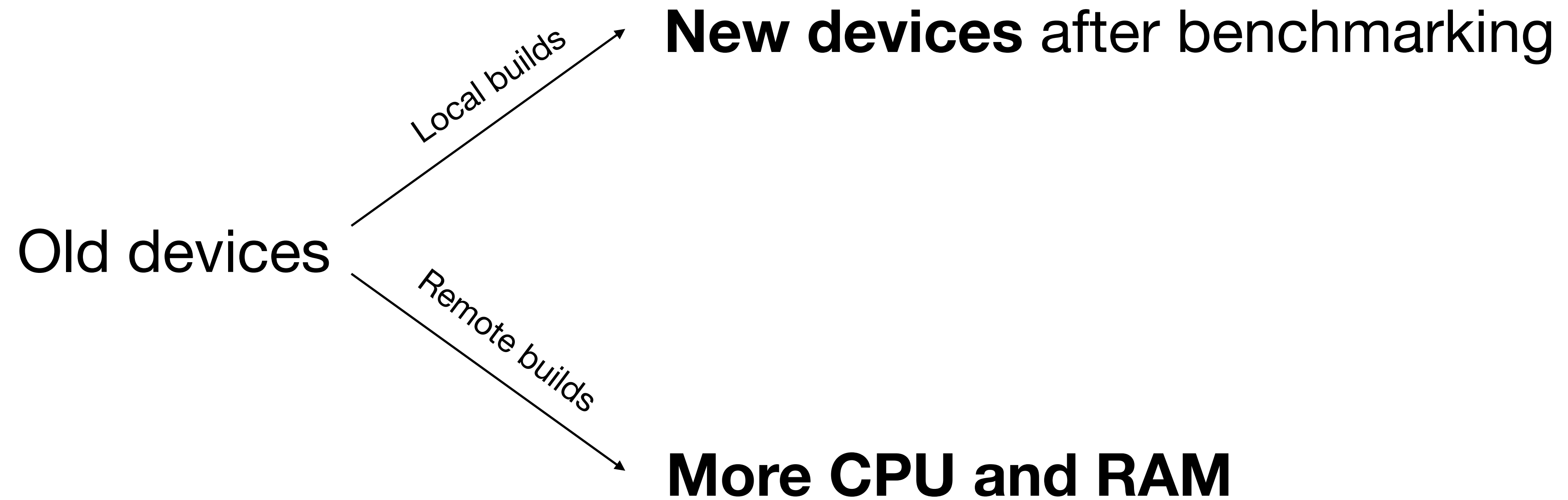
192.168.0.147



1. Hardware



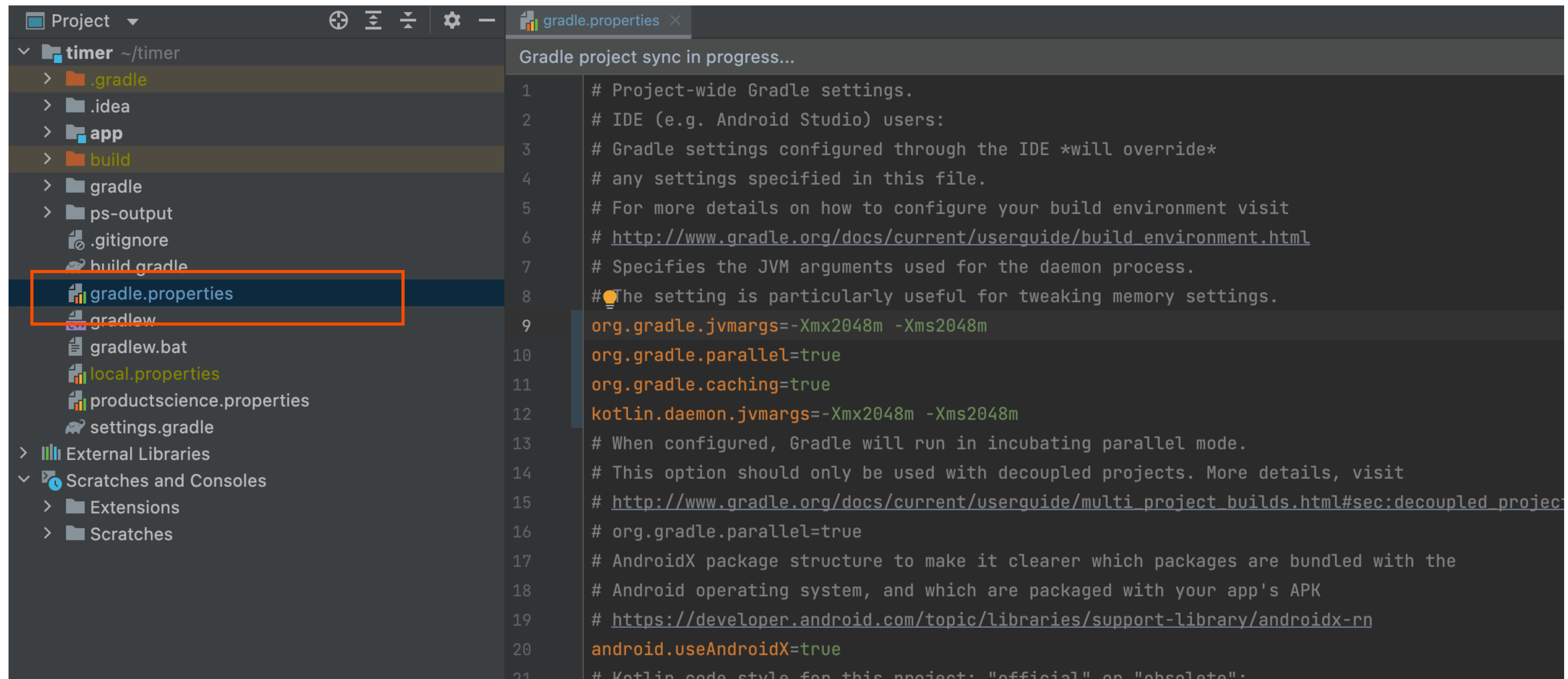
1. Hardware



1. Hardware



2. Gradle Properties



2a. Parallize Gradle Tasks

```
org.gradle.parallel=true
```



2b. Cache Gradle Tasks

```
org.gradle.caching=true
```



2c. Manage Gradle Workers

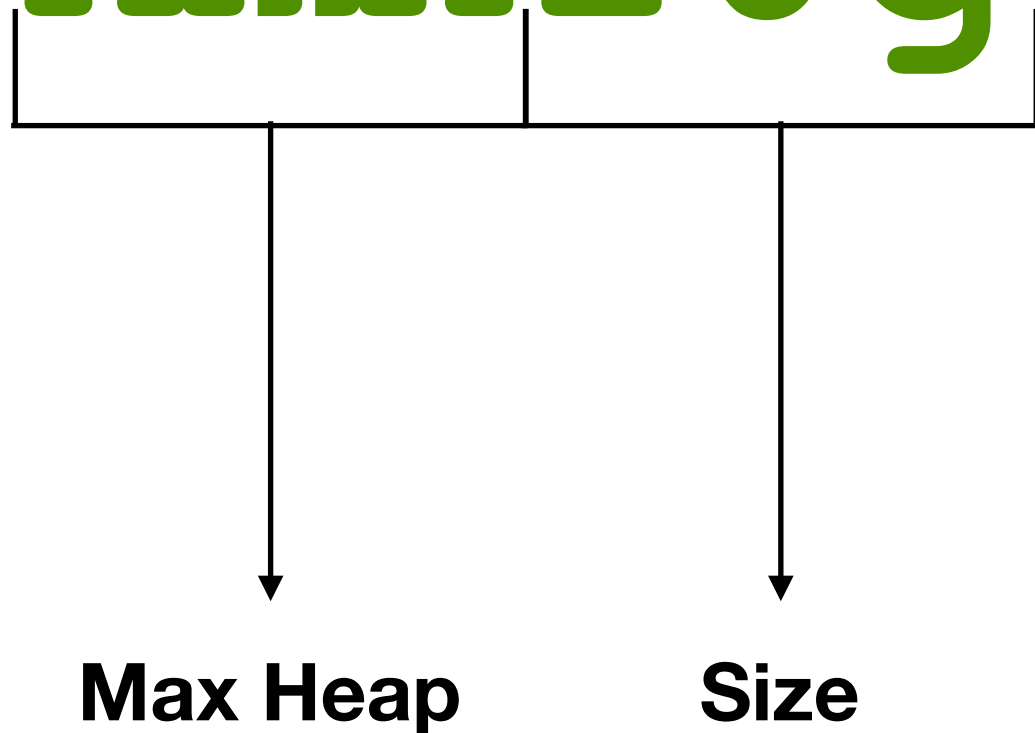
`org.gradle.workers.max=8*`

* Total Available CPU Cores / 1.5~2



2d. Manage Memory

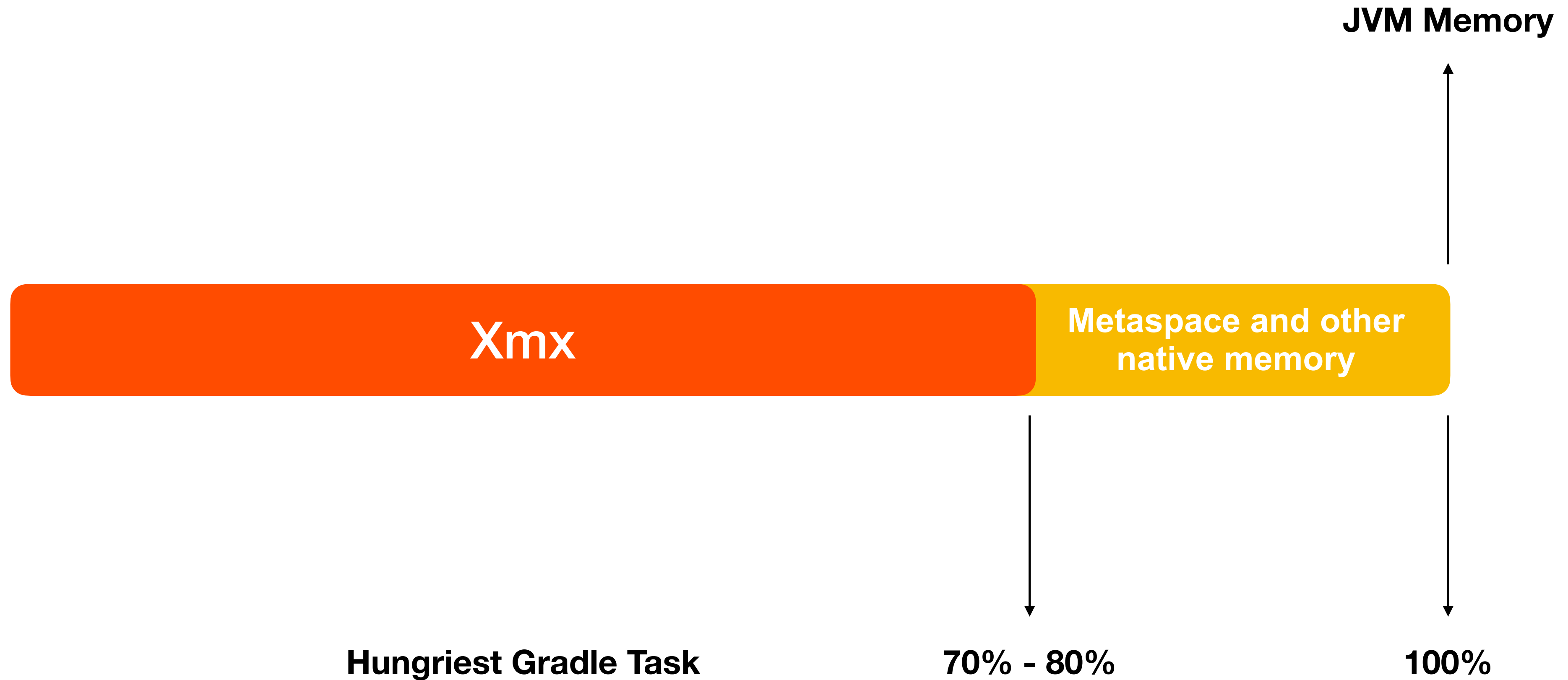
`org.gradle.jvmargs=-Xmx10g`



Max Heap Size



2d. Manage Memory



2d. Manage Memory

`org.gradle.jvmargs=-Xmx10g -Xms10g`

Max Heap

Initial Heap



2d. Manage Memory

`kotlin.daemon.jvmargs=-Xmx8g -Xms8g`



3. Dependencies



3. Dependencies

Unused Dependencies



3. Dependencies

Unused Dependencies

1. Time

- Dependency Resolution
- Configuration
- Download

2. Size

- Classpath



3. Dependencies

Unused Dependencies

Outdated Dependencies

1. Time

- Dependency Resolution
- Configuration
- Download

2. Size

- Classpath



3. Dependencies

Unused Dependencies

1. Time

- Dependency Resolution
- Configuration
- Download

2. Size

- Classpath

Outdated Dependencies

1. Time

- Dependency Resolution
- Inefficient build processes
- Deprecated Features

2. Compatibility Issues

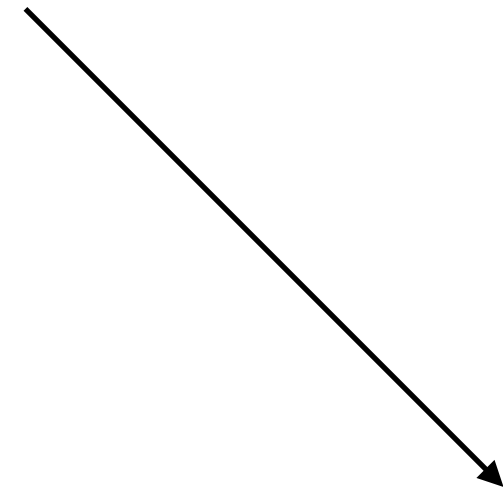
3. Security Patches

4. Maintainer Support

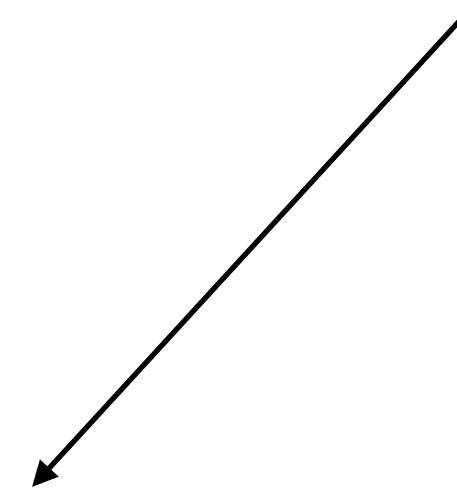


3. Dependencies

Unused Dependencies



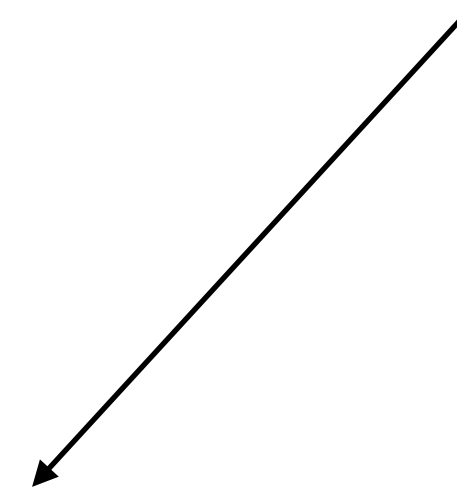
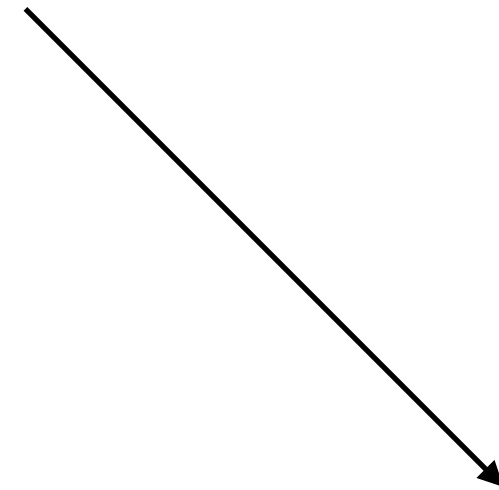
Outdated Dependencies



3. Dependencies

Unused Dependencies

Outdated Dependencies



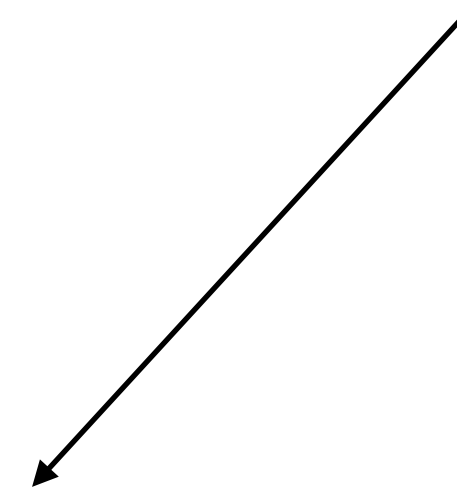
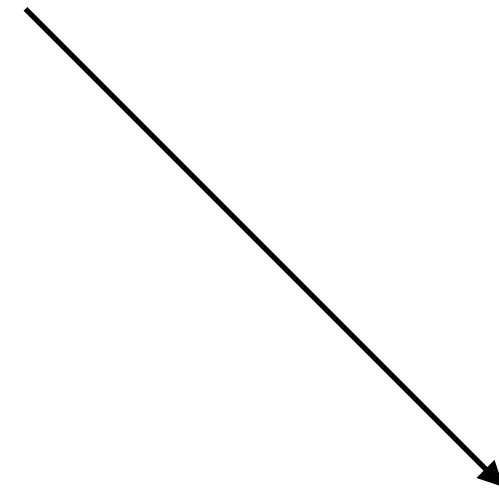
Use Plugins



3. Dependencies

Unused Dependencies

Outdated Dependencies

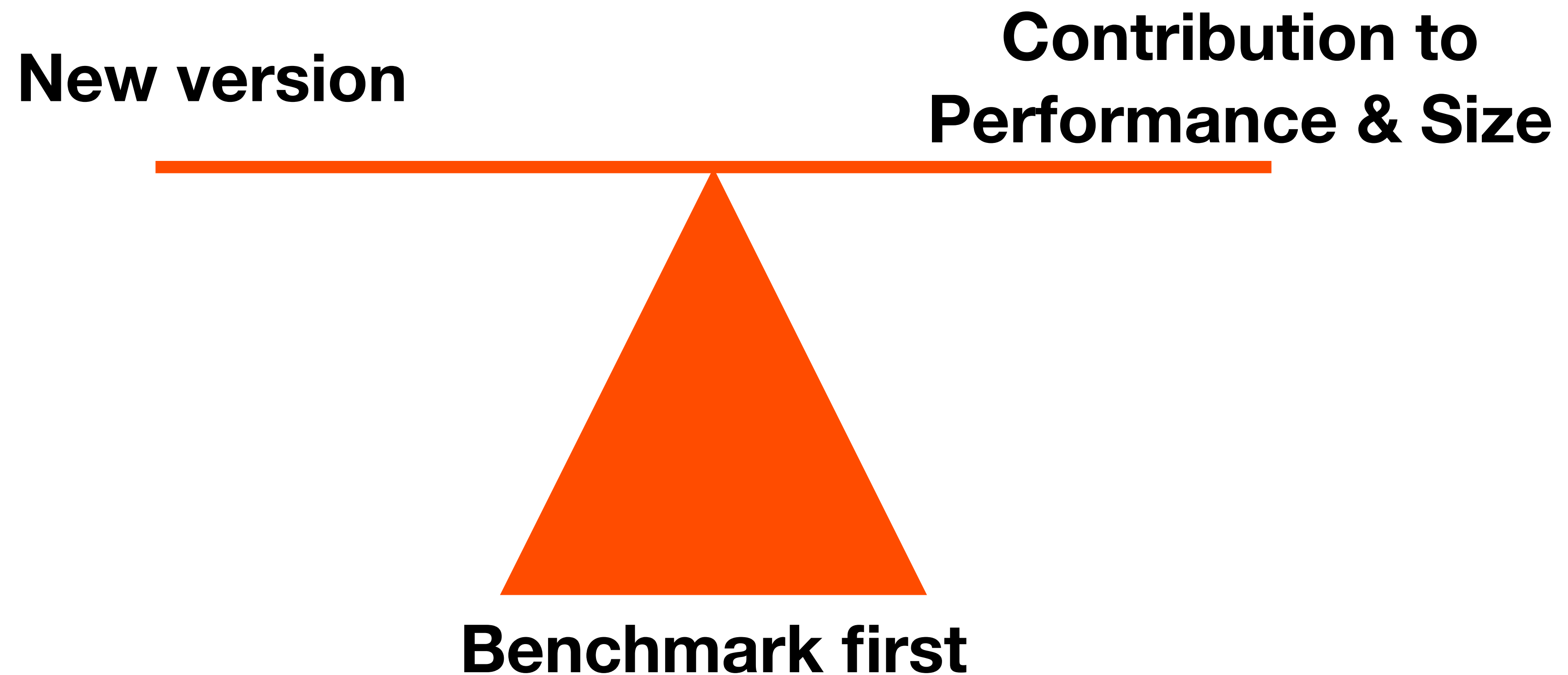


Use Plugins

1. [Dependency Analysis Gradle Plugin](#) - unused & transitive dependencies
2. [Dependabot](#) - automated dependency updates in Github
3. [RenovateBot](#) - automated dependency updates in Github



3. Dependencies



4. CI Scripts

- Serial Execution of CI Stages
- Staggered Gradle tasks across different stages
- Timeouts on different plugin responses

```
pipeline {  
  agent any  
  
  stages {  
    stage('Build') {  
      steps {  
        echo 'Building..'  
      }  
    }  
    stage('Test') {  
      steps {  
        echo 'Testing..'  
      }  
    }  
    stage('Deploy') {  
      steps {  
        echo 'Deploying....'  
      }  
    }  
  }  
}
```



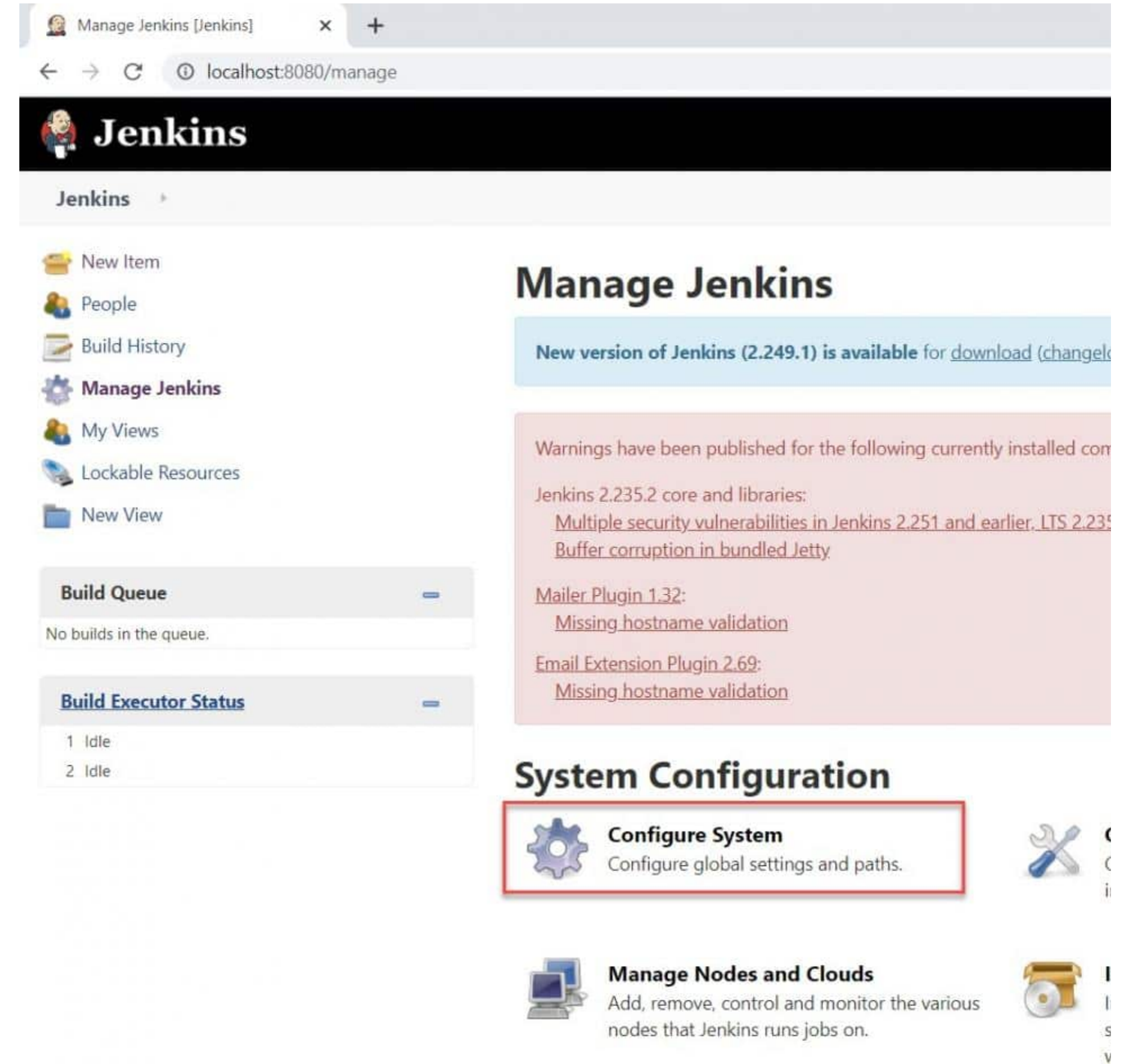
4. CI Scripts

- Parallelize CI Stages
- Combine Gradle tasks
- Investigate and reduce timeouts

```
pipeline {
  agent none
  stages {
    stage('Run Tests') {
      parallel {
        stage('Test On Windows') {
          agent {
            label "windows"
          }
          steps {
            bat "run-tests.bat"
          }
          post {
            always {
              junit "**/TEST-*.xml"
            }
          }
        }
        stage('Test On Linux') {
          agent {
            label "linux"
          }
          steps {
            sh "run-tests.sh"
          }
          post {
            always {
              junit "**/TEST-*.xml"
            }
          }
        }
      }
    }
  }
}
```



5. CI Container Settings & Config ❌

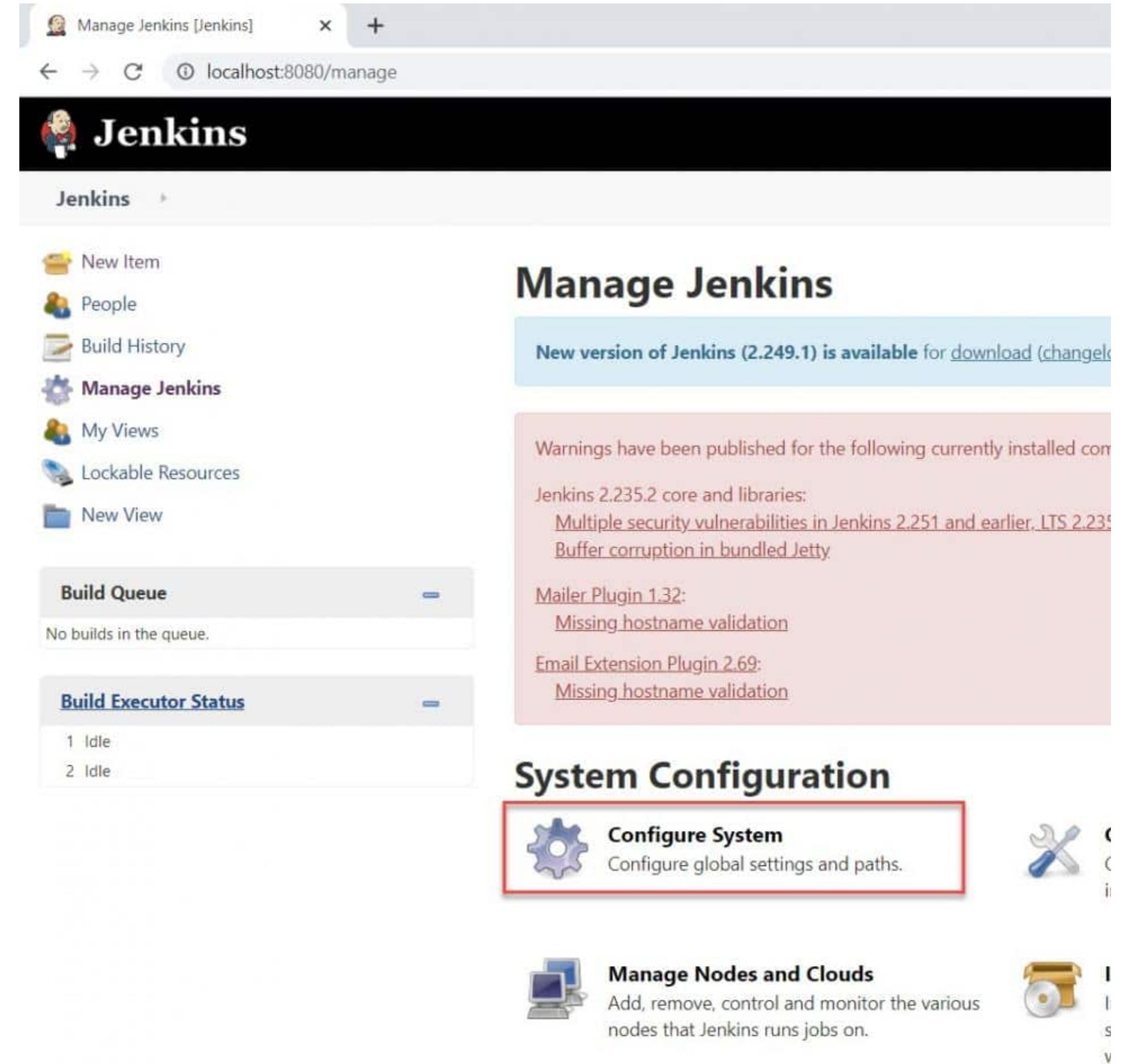


The screenshot shows the Jenkins 'Manage Jenkins' interface in a web browser. The browser tab is 'Manage Jenkins [Jenkins]' and the address bar shows 'localhost:8080/manage'. The Jenkins logo and name are at the top. A left sidebar contains navigation links: 'New Item', 'People', 'Build History', 'Manage Jenkins' (highlighted), 'My Views', 'Lockable Resources', and 'New View'. Below the sidebar, there are two expandable sections: 'Build Queue' (showing 'No builds in the queue.') and 'Build Executor Status' (showing two 'Idle' executors). The main content area is titled 'Manage Jenkins' and features a blue notification banner: 'New version of Jenkins (2.249.1) is available for download (change...)'. Below this is a red warning box stating: 'Warnings have been published for the following currently installed components: Jenkins 2.235.2 core and libraries: Multiple security vulnerabilities in Jenkins 2.251 and earlier. LTS 2.235 Buffer corruption in bundled Jetty. Mailer Plugin 1.32: Missing hostname validation. Email Extension Plugin 2.69: Missing hostname validation.' At the bottom, the 'System Configuration' section is visible, with 'Configure System' (described as 'Configure global settings and paths.') highlighted by a red rectangle, and 'Manage Nodes and Clouds' (described as 'Add, remove, control and monitor the various nodes that Jenkins runs jobs on.').



5. CI Container Settings & Config ❌

Instance Age



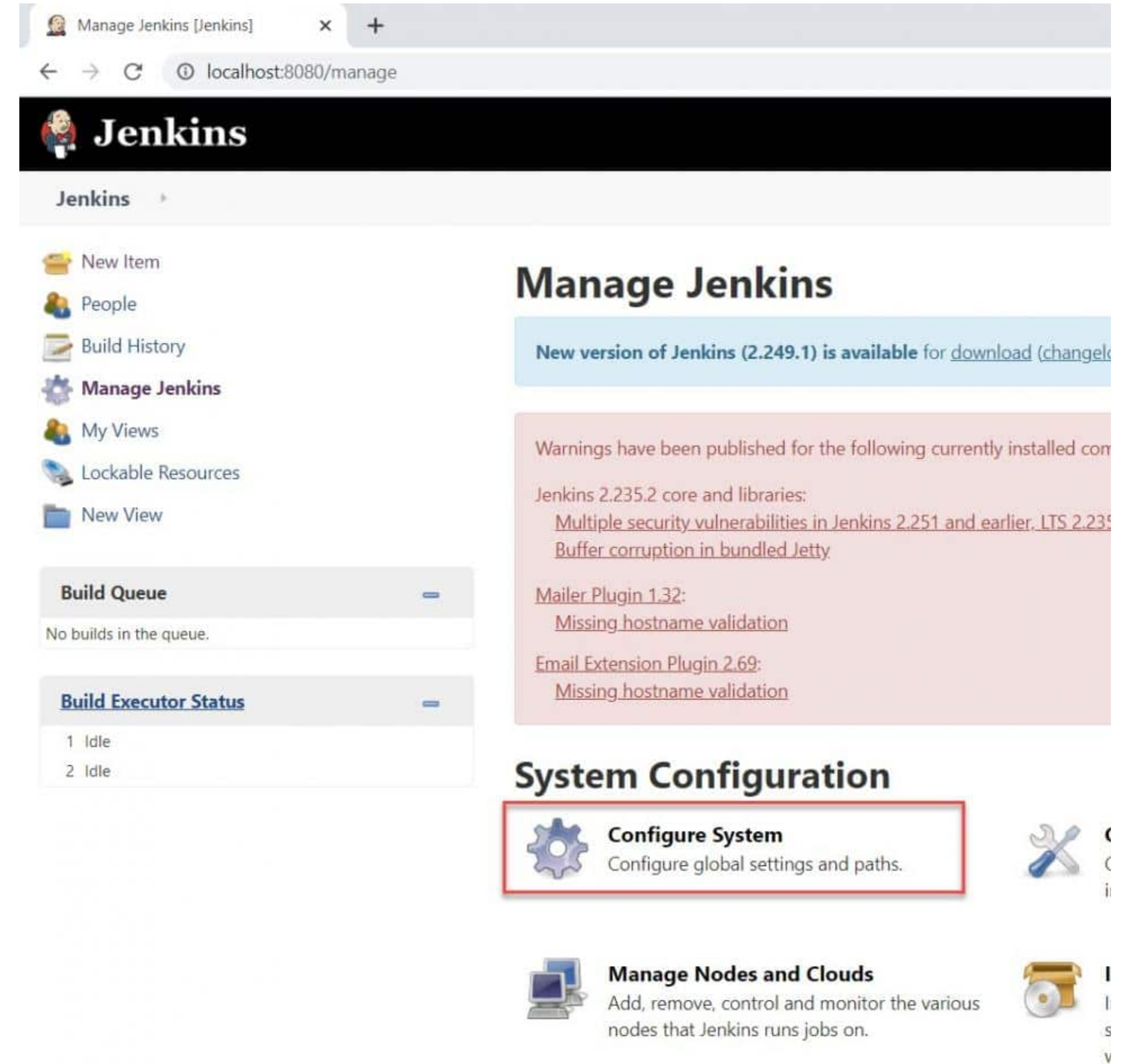
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5. CI Container Settings & Config ❌

Instance Age

Agents Count



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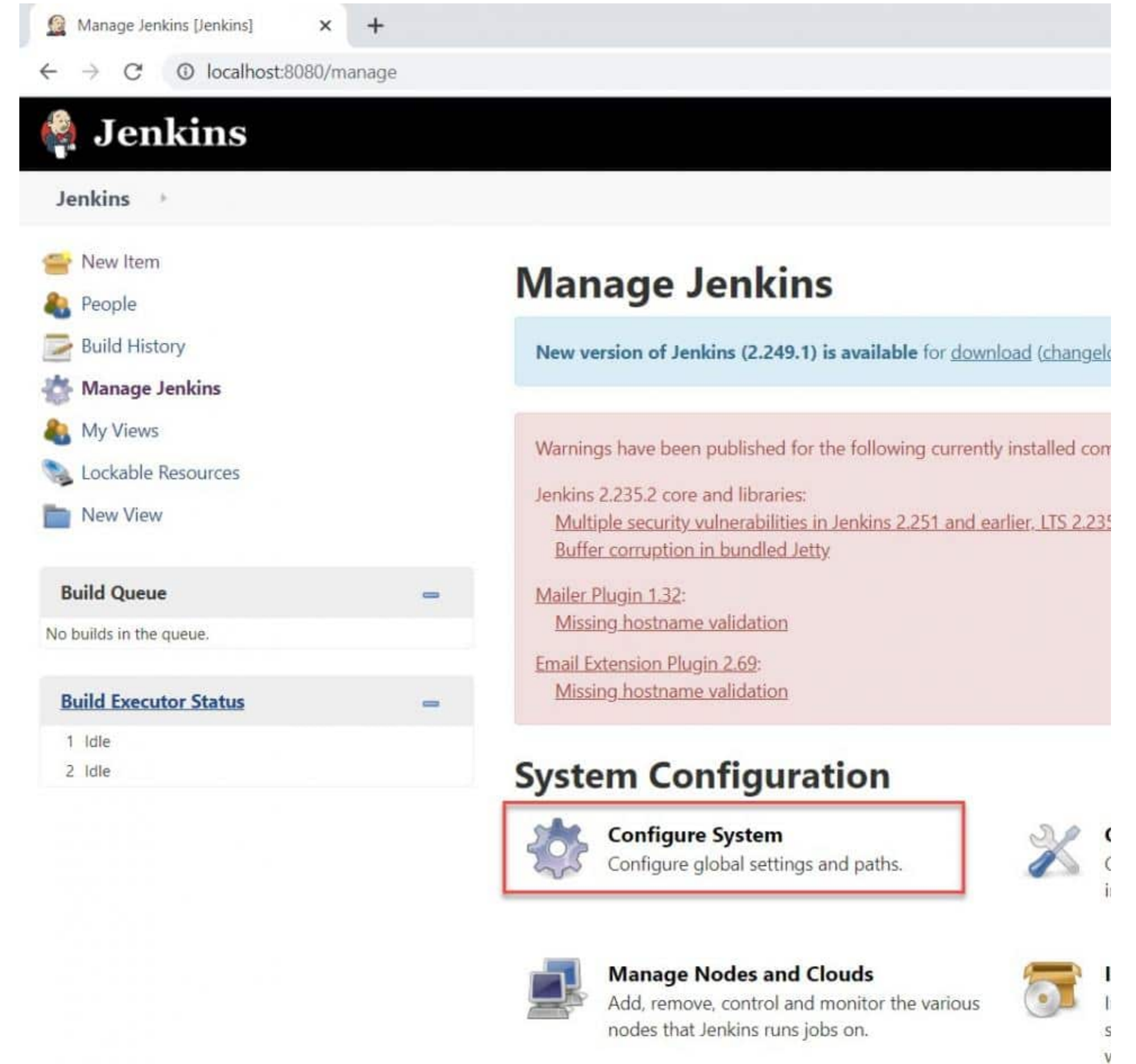


5. CI Container Settings & Config ❌

Instance Age

Agents Count

Agent Instantiation



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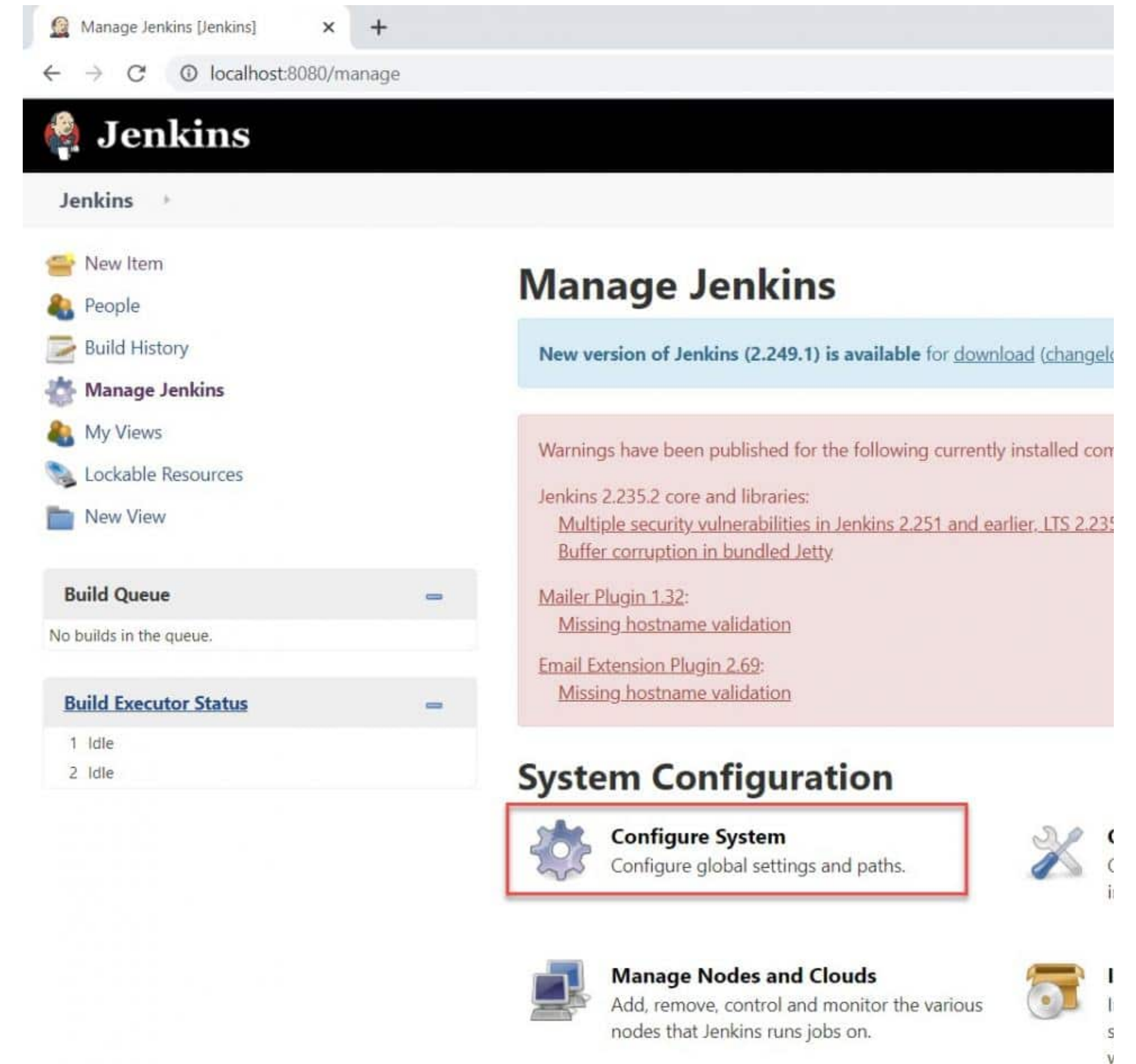
5. CI Container Settings & Config ❌

Instance Age

Agents Count

Agent Instantiation

Build Queue Congestion



5. CI Container Settings & Config ❌

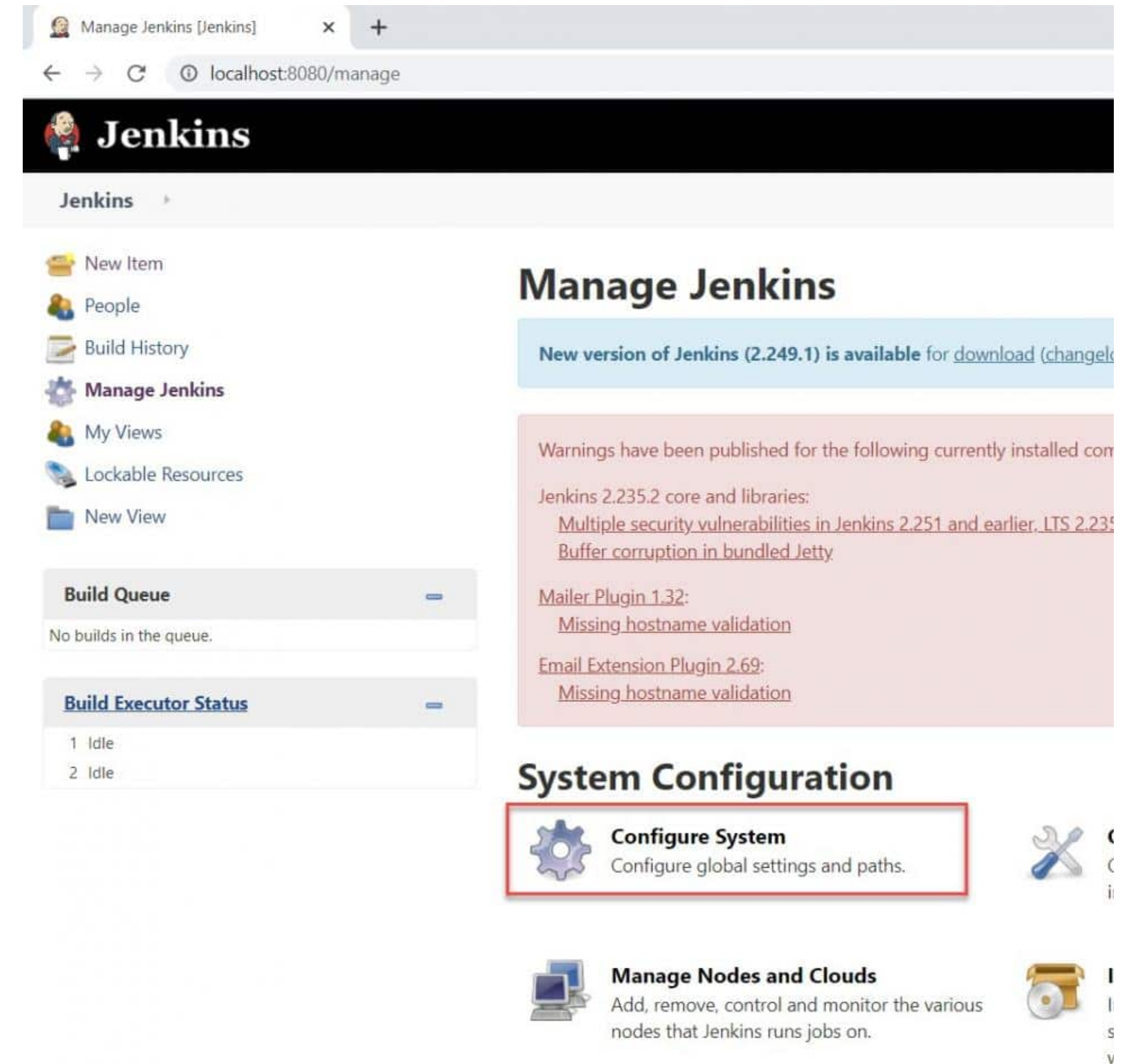
Instance Age

Agents Count

Agent Instantiation

Build Queue Congestion

Build Trigger on
Unnecessary Events



5. CI Container Settings & Config

Instance Age 

Agents Count 

Agent Instantiation 

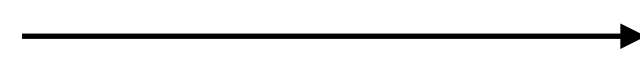
Build Queue Congestion 

Build Trigger on
Unnecessary Events 



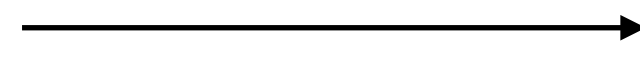
5. CI Container Settings & Config

Instance Age

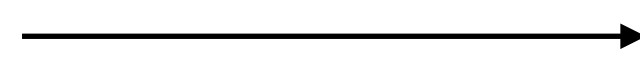


Migrate to newer instance

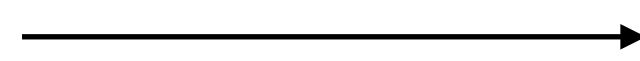
Agents Count



Agent Instantiation



Build Queue Congestion



Build Trigger on
Unnecessary Events



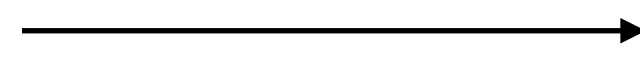
5. CI Container Settings & Config

Instance Age



Migrate to newer instance

Agents Count



Allocate high number of agents

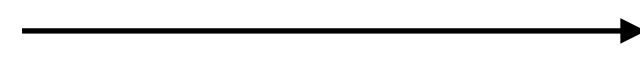
Agent Instantiation



Build Queue Congestion



Build Trigger on
Unnecessary Events



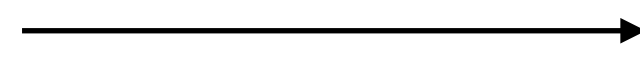
5. CI Container Settings & Config

Instance Age



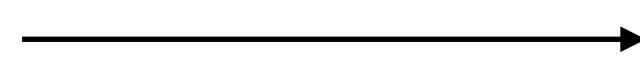
Migrate to newer instance

Agents Count



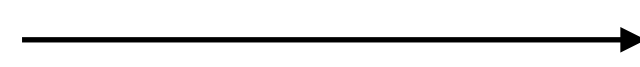
Allocate high number of agents

Agent Instantiation

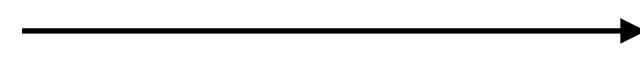


Keep agents warm

Build Queue Congestion

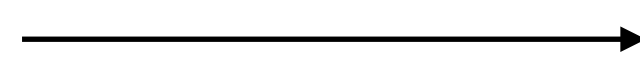


Build Trigger on
Unnecessary Events



5. CI Container Settings & Config

Instance Age



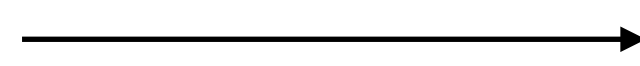
Migrate to newer instance

Agents Count



Allocate high number of agents

Agent Instantiation



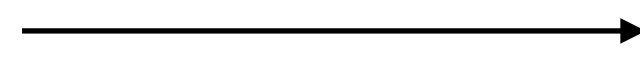
Keep agents warm

Build Queue Congestion



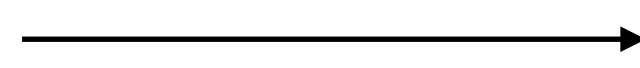
Cancel ongoing builds if
new one is pushed

Build Trigger on
Unnecessary Events



5. CI Container Settings & Config

Instance Age



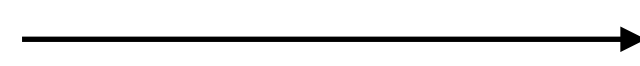
Migrate to newer instance

Agents Count



Allocate high number of agents

Agent Instantiation



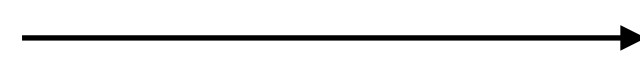
Keep agents warm

Build Queue Congestion



Cancel ongoing builds if new one is pushed

Build Trigger on Unnecessary Events



Revisit plugin events and don't trigger builds on PR metadata change

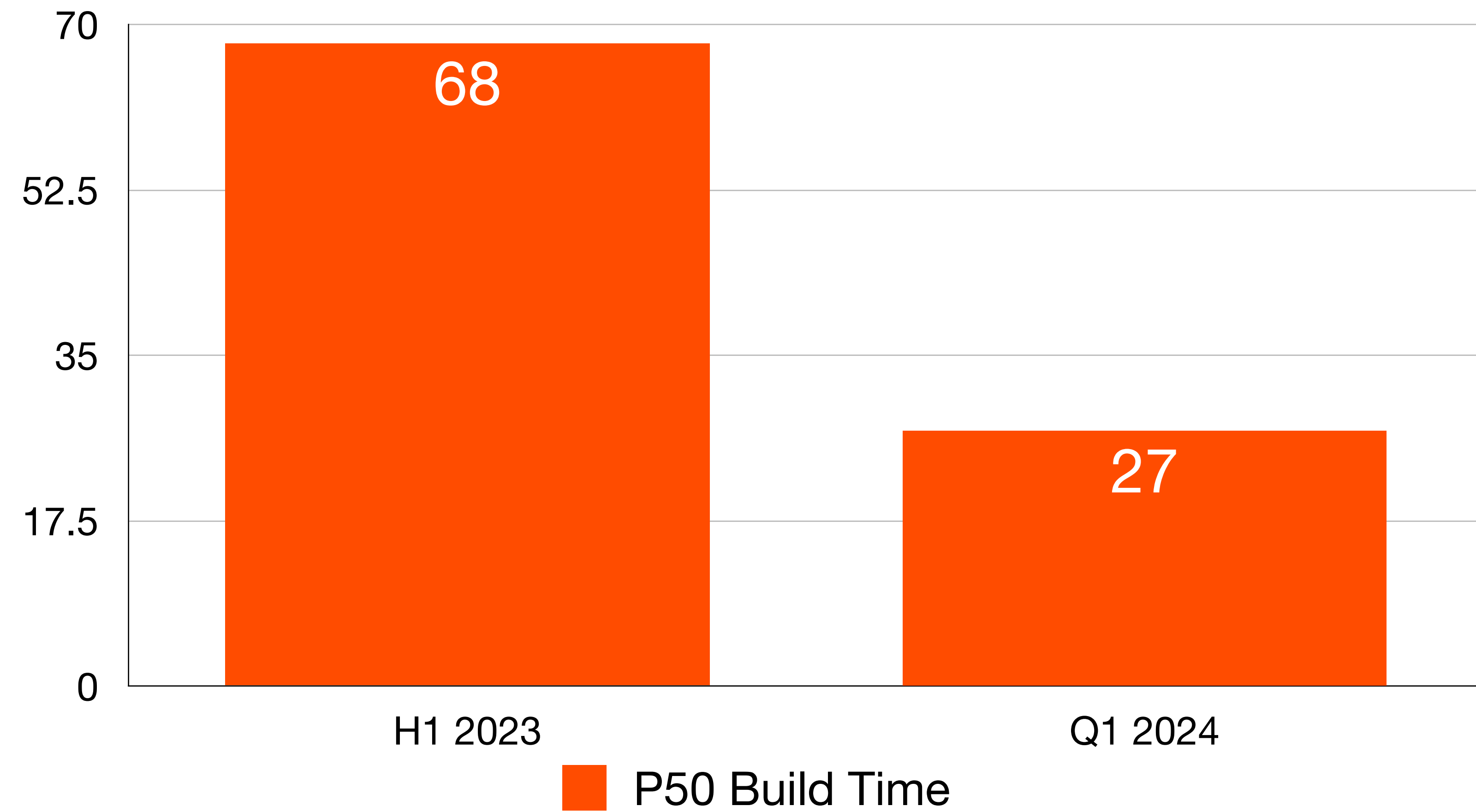


Recap

- enable parallel
- enable cache
- optimize memory config
- manage gradle workers
- upgrade hardware
- optimize container settings
- fine-tune plugin events
- improve CI scripts



Recap



Developers + Product



On the horizon

Modularization...true modularization



Thank you



Android Builds: Simple Recipes for Enhance Developer Productivity

Aida Issayeva



Resources

- [Setting Kotlin Daemon's JVM args](#)
- [Java Memory model specification](#)
- [Introduction to Java's Memory model](#)
- [Essential Tips to minimize Gradle Build Time](#)
- [From laptops to advanced CI](#)
- [Managing nodes in Jenkins](#)

