



# New & Improved LLVM

## Premerge Testing:

## Status Update

# Brief Intro & History

# What is this Premerge Testing?



## Review requested

Review has been requested on this pull request. It is not required to merge. [Learn more about requesting a pull request review.](#)



5 pending reviews >



## All checks have passed

2 skipped, 9 successful checks

9 successful checks ▾



buildkite/libcxx-ci — Build #89365 passed (2 seconds)



buildkite/libcxx-ci/pipeline — Passed (2 seconds)



Check code formatting / code\_formatter (pull\_request) Successful in 1m



CI Checks / Build and Test Linux (pull\_request) Successful in 4m

Required



CI Checks / Build and Test Linux AArch64 (pull\_request) Successful in 7m



CI Checks / Build and Test Windows (pull\_request) Successful in 2m

Required



Graphite / mergeability\_check



## No conflicts with base branch

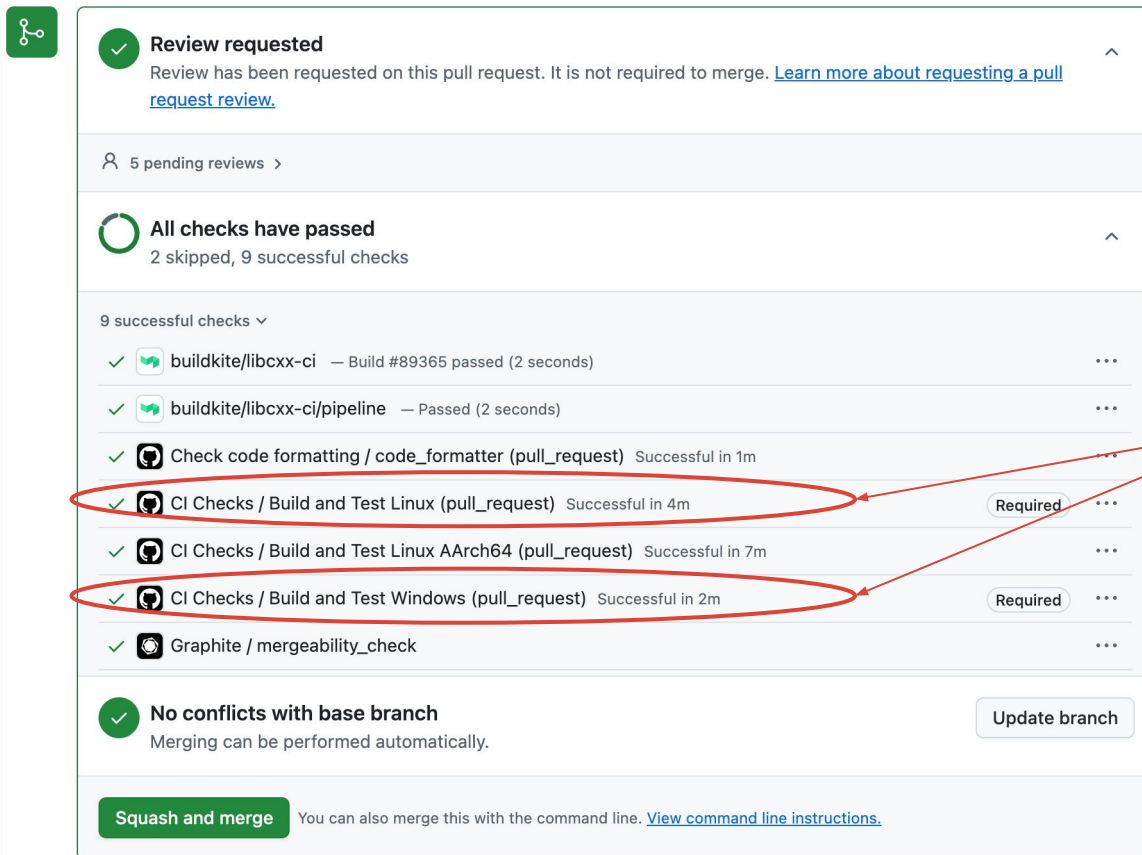
Merging can be performed automatically.

Update branch

Squash and merge

You can also merge this with the command line. [View command line instructions.](#)

# What is this Premerge Testing?



The screenshot displays a GitHub pull request interface. At the top, a green checkmark icon is followed by the text "Review requested" and a subtext "Review has been requested on this pull request. It is not required to merge. [Learn more about requesting a pull request review.](#)". Below this, a section indicates "5 pending reviews". The main section, titled "All checks have passed" with a green circle icon, states "2 skipped, 9 successful checks". A dropdown menu shows "9 successful checks". The list of checks includes:

- ✓ buildkite/libcxx-ci — Build #89365 passed (2 seconds) ...
- ✓ buildkite/libcxx-ci/pipeline — Passed (2 seconds) ...
- ✓ Check code formatting / code\_formatter (pull\_request) Successful in 1m ...
- ✓ CI Checks / Build and Test Linux (pull\_request) Successful in 4m ... Required
- ✓ CI Checks / Build and Test Linux AArch64 (pull\_request) Successful in 7m ...
- ✓ CI Checks / Build and Test Windows (pull\_request) Successful in 2m ... Required
- ✓ Graphite / mergeability\_check ...

At the bottom, a green checkmark icon is followed by the text "No conflicts with base branch" and a subtext "Merging can be performed automatically." A button labeled "Update branch" is visible. At the very bottom, a green button labeled "Squash and merge" is followed by the text "You can also merge this with the command line. [View command line instructions.](#)".

"Premerge  
Tests" for  
this talk.

# What is this Premerge Testing?



## Review requested

Review has been requested on this pull request. It is not required to merge. [Learn more about requesting a pull request review.](#)



5 pending reviews >



## All checks have passed

2 skipped, 9 successful checks

9 successful checks ▾



buildkite/libcxx-ci — Build #89365 passed (2 seconds)



buildkite/libcxx-ci/pipeline — Passed (2 seconds)



Check code formatting / code\_formatter (pull\_request) Successful in 1m



CI Checks / Build and Test Linux (pull\_request) Successful in 4m

Required



CI Checks / Build and Test Linux AArch64 (pull\_request) Successful in 7m



CI Checks / Build and Test Windows (pull\_request) Successful in 2m

Required



Graphite / mergeability\_check



## No conflicts with base branch

Merging can be performed automatically.

Update branch

Squash and merge

You can also merge this with the command line. [View command line instructions.](#)

Not  
covered in  
this talk.

# What is this Premerge Testing?



## Review requested

Review has been requested on this pull request. It is not required to merge. [Learn more about requesting a pull request review.](#)



5 pending reviews >



## All checks have passed

2 skipped, 9 successful checks

9 successful checks ▾



buildkite/libcxx-ci — Build #89365 passed (2 seconds)



buildkite/libcxx-ci/pipeline — Passed (2 seconds)



Check code formatting / code\_formatter (pull\_request) Successful in 1m



CI Checks / Build and Test Linux (pull\_request) Successful in 4m

Required



CI Checks / Build and Test Linux AArch64 (pull\_request) Successful in 7m



CI Checks / Build and Test Windows (pull\_request) Successful in 2m

Required



Graphite / mergeability\_check



## No conflicts with base branch

Merging can be performed automatically.

Update branch

Squash and merge

You can also merge this with the command line. [View command line instructions.](#)

## Brief History: Old System

### OLD Premerge System (2019 - May 2025)

- Ran on BuildKite.
- Slow, flaky, unreliable.
- Not well maintained.

## Brief History: New System

### NEW Premerge System (May 2025+)

- Autoscaling
- Oncall rotation support
- Metrics & performance tracking
- Added the libc++ testing, early July


Overall goals: Speed, Reliability & Ease of Use.


- < 30 mins, for 80+% of tests
- No false positive error reports.
- Make failures easy to find & understand.



# New Features

# Finding & Understanding Test Failures (failure summary)












## Some checks were not successful

2 failing, 1 in progress, 3 skipped, 5 successful checks




2 failing checks ▾






  CI Checks / Build and Test Linux (pull\_request) Failing after 4m Required 




  CI Checks / Build and Test Linux AArch64 (pull\_request) Failing after 10m 




1 in progress check ▾

  Test documentation build / Test documentation build (pull\_request) Started 33 minutes ago — This check has ... 


3 skipped checks ▾


  CI Checks / MacOS Premerge Checks (pull\_request) Skipped 33 minutes ago 


  Labelling new pull requests / automate-prs-labels (pull\_request\_target) Skipped 33 minutes ago 



  Labelling new pull requests / greater (pull\_request\_target) Skipped 33 minutes ago 

# Finding & Understanding Test Failures (failure summary)






**Some checks were not successful**  
2 failing, 1 in progress, 3 skipped, 5 successful checks

2 failing checks ▾




CI Checks / Build and Test Linux (pull\_request) Failing after 4m



Required 




CI Checks / Build and Test Linux AArch64 (pull\_request) Failing after 10m





1 in progress check ▾




Test documentation build / Test documentation build (pull\_request) Started 33 minutes ago — This check has ...





3 skipped checks ▾






CI Checks / MacOS Premerge Checks (pull\_request) Skipped 33 minutes ago






Labelling new pull requests / automate-prs-labels (pull\_request\_target) Skipped 33 minutes ago







Labelling new pull requests / greater (pull\_request\_target) Skipped 33 minutes ago



# Finding & Understanding Test Failures (failure summary)








## Some checks were not successful

2 failing, 1 in progress, 3 skipped, 5 successful checks



2 failing checks ▾



 CI Checks / Build and Test Linux (pull\_request) Failing after 4m

Required



⋮

 CI Checks / Build and Test Linux AArch64 (pull\_request) Failing after 10m

→ View details



⋮

1 in progress check ▾



 Test documentation build / Test documentation build (pull\_request) Started 33 minutes ago — This check has ...

⋮



3 skipped checks ▾

 CI Checks / MacOS Premerge Checks (pull\_request) Skipped 33 minutes ago

⋮


 Labelling new pull requests / automate-prs-labels (pull\_request\_target) Skipped 33 minutes ago


⋮

 Labelling new pull requests / greater (pull\_request\_target) Skipped 33 minutes ago

⋮

# Finding & Understanding Test Failures (failure summary)







## Some checks were not successful



2 failing, 1 in progress, 3 skipped, 5 successful checks

2 failing checks ▾

 CI Checks / Build and Test Linux (pull\_request) Failing after 4m

Required



⋮

 CI Checks / Build and Test Linux AArch64 (pull\_request) Failing after 10m

→ View details



⋮

1 in progress check ▾



 Test documentation build / Test documentation build (pull\_request) Started 33 minutes ago — This check has ...

⋮



3 skipped checks ▾

 CI Checks / MacOS Premerge Checks (pull\_request) Skipped 33 minutes ago

⋮

 Labelling new pull requests / automate-prs-labels (pull\_request\_target) Skipped 33 minutes ago


⋮

 Labelling new pull requests / greater (pull\_request\_target) Skipped 33 minutes ago

⋮

# Finding & Understanding Test Failures, Cont. (failure summary)

← Back to pull request #164291

 **[LLDB] Temporarily break dll test #142681**

 Summary

Jobs

 Build and Test Linux AArch64

 **Build and Test Linux**

 Build and Test Windows

 MacOS Premerge Checks

Run details

 Usage


 Workflow file

> **Annotations**

1 error

**Build and Test Linux**

failed 8 minutes ago in 4m 26s

>  Set up job

>  Checkout LLVM

▼  **Build and Test**

```
1 ▶ Run git config --global --add safe.directory '*'
41 Building projects: clang;lldb;llvm
42 Running project checks targets: check-lldb
43 Building runtimes: libcxx;libcxxabi;libunwind
44 Running runtimes checks targets:
45 Running runtimes checks requiring reconfiguring targets:
46 KUBERNETES_SERVICE_PORT_HTTPS=443
47 GITHUB_WORKSPACE=/home/gha/actions-runner/_work/llvm-project/llvm-project
48 KUBERNETES_SERVICE_PORT=443
49 HOSTNAME=llvm-premerge-linux-runners-ckfsp-runner-2pcpv
50 GITHUB_PATH=/home/gha/actions-runner/_work/_temp/_runner_file_commands/add_path_2aea957e-6bbd-458
51 GITHUB_ACTION=__run
52 GITHUB_RUN_NUMBER=142681
```

# Finding & Understanding Test Failures, Cont. (failure summary)

← Back to pull request #164291

❌ [LLDB] Temporarily break dll test #142681

🏠 Summary

Jobs

- ✅ Build and Test Linux AArch64
- ❌ Build and Test Linux
- ✅ Build and Test Windows
- 🔄 MacOS Premerge Checks

Run details

- 🕒 Usage
- 📄 Workflow file

> Annotations  
1 error

**Build and Test Linux**  
failed 8 minutes ago in 4m 26s

> ✅ Set up job

> ✅ Checkout LLVM

▼ ❌ Build and Test

```
1 ▶ Run git config --global --add safe.directory '*'
41 Building projects: clang;lldb;llvm
42 Running project checks targets: check-lldb
43 Building runtimes: libcxx;libcxxabi;libunwind
44 Running runtimes checks targets:
45 Running runtimes checks requiring reconfiguring targets:
46 KUBERNETES_SERVICE_PORT_HTTPS=443
47 GITHUB_WORKSPACE=/home/gha/actions-runner/_work/llvm-project/llvm-project
48 KUBERNETES_SERVICE_PORT=443
49 HOSTNAME=llvm-premerge-linux-runners-ckfsp-runner-2pcpv
50 GITHUB_PATH=/home/gha/actions-runner/_work/_temp/_runner_file_commands/add_path_2aea957e-6bbd-458
51 GITHUB_ACTION=__run
52 GITHUB_RUN_NUMBER=142681
```

# Finding & Understanding Test Failures, Cont. (failure summary)

## Jobs

✓ Build and Test Linux AArch64

✗ Build and Test Linux

✓ Build and Test Windows

🔄 MacOS Premerge Checks

## Run details

🕒 Usage

📄 Workflow file

## Build and Test Linux summary

### Linux x64 Test Results

- 33068 tests passed
- 478 tests skipped
- 3 tests failed

### Failed Tests

(click on a test name to see its output)

#### ~~lldb-api~~

- ▶ ~~lldb-api.commands/frame/var-dil/basics/ArraySubscript/TestFrameVarDILArraySubscript.py~~
- ▶ ~~lldb-api.commands/frame/var-dil/basics/LocalVars/TestFrameVarDILLocalVars.py~~
- ▶ ~~lldb-api.commands/frame/var-dil/basics/MemberOfInheritance/TestFrameVarDILMemberOfInheritance.py~~

If these failures are unrelated to your changes (for example tests are broken or flaky at HEAD), please open an issue at <https://github.com/llvm/llvm-project/issues> and add the `infrastructure` label.

Job summary generated at run-time

## Annotations



# Finding & Understanding Test Failures, Cont. (failure summary)

## Summary

### Jobs

- ✓ Build and Test Linux AArch64
- ✗ Build and Test Linux
- ✓ Build and Test Windows
- ⌚ MacOS Premerge Checks

### Run details

#### Usage

#### Workflow file

## lldb-api

► lldb-api.commands/frame/var-dil/basics/ArraySubscript/TestFrameVarDILArraySubscript.py

► lldb-api.commands/frame/var-dil/basics/LocalVars/TestFrameVarDILLocalVars.py

▼ lldb-api.commands/frame/var-dil/basics/MemberOfInheritance/TestFrameVarDILMemberOfInheritance.py

### Script:

```
---  
/usr/bin/python3 /home/gha/actions-runner/_work/llvm-project/llvm-project/lldb/test/API/dotest.py -u CXXFLAGS -u CFLAGS --env LLVM_LIBS  
---
```

Exit Code: 1

### Command Output (stdout):

```
---  
lldb version 22.0.0git (https://github.com/llvm/llvm-project revision 6164c521e1e9f82741911db872b2a44f1487966c)  
clang revision 6164c521e1e9f82741911db872b2a44f1487966c  
llvm revision 6164c521e1e9f82741911db872b2a44f1487966c  
Skipping the following test categories: ['msvcstl', 'dsym', 'gmodules', 'debugserver', 'objc']  
---
```

### Command Output (stderr):

```
---  
FAIL: LLDB (/home/gha/actions-runner/_work/llvm-project/llvm-project/build/bin/clang-x86_64) :: test_frame_var (TestFrameVarDILMemberOfInheritance.TestFrameVarDILMemberOfInheritance.test_frame_var)  
=====
```

### Traceback (most recent call last):

```
File "/home/gha/actions-runner/_work/llvm-project/llvm-project/lldb/test/API/commands/frame/var-dil/basics/MemberOfInheritance/TestFrameVarDILMemberOfInheritance.py", line 10, in test_frame_var  
self.expect_var_path("parent->z", value="5")  
File "/home/gha/actions-runner/_work/llvm-project/llvm-project/lldb/packages/Python/lldbsuite/test/lldbtest.py", line 2599, in expect_value_check  
value_check.check_value(self, eval_result, str(eval_result))  
File "/home/gha/actions-runner/_work/llvm-project/llvm-project/lldb/packages/Python/lldbsuite/test/lldbtest.py", line 313, in check_value  
test_base.assertEqual(self.expect_value, val.GetValue(), this_error_msg)
```

AssertionError: '5' != '3'

- 5

+ 3


: (int) z = 3


Checking SBValue: (int) z = 3

Config=x86\_64~home/gha/actions-runner/\_work/llvm-project/llvm-project/build/bin/clang

-----  
Ran 1 test in 0.457s


# Don't have to wait for tests to finish!





**Changes reviewed**  
1 approving review by reviewers with write access.



✓ 1 approval >



👤 1 pending review >

**Some checks haven't completed yet**  
3 in progress, 2 skipped, 5 successful checks



3 in progress checks ▾



  **CI Checks / Build and Test Linux (pull\_request)** Started 15 minutes ago — This check has started... **Required** ...

  **CI Checks / Build and Test Linux AArch64 (pull\_request)** Started 16 minutes ago — This check has started... ...


  **CI Checks / Build and Test Windows (pull\_request)** Started 15 minutes ago — This check has started... **Required** ...


2 skipped checks ▾

  **CI Checks / MacOS Premerge Checks (pull\_request)** Skipped 16 minutes ago ...

  **Labelling new pull requests / greeter (pull\_request\_target)** Skipped 16 minutes ago ...

5 successful checks ▾

 **buildkite/buildkite-ci** Build #00286 passed (3 seconds) ...

**This branch is out-of-date with the base branch**  
Merge the latest changes from main into this branch. This merge commit will be associated with boomanaiden154. **Update branch**

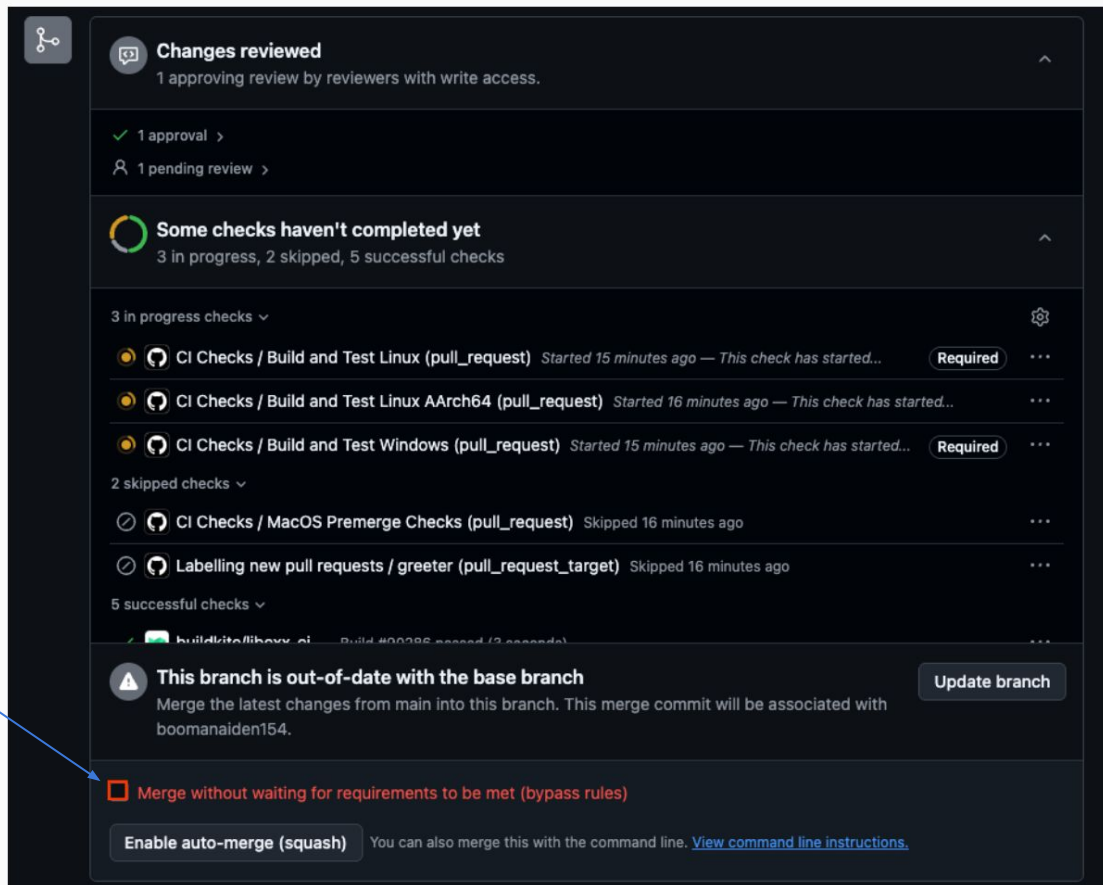
☐ Merge without waiting for requirements to be met (bypass rules)

**Enable auto-merge (squash)**

You can also merge this with the command line. [View command line instructions.](#)

# Don't have to wait for tests to finish!

Option 1:  
Merge  
before  
they're  
done.



**Changes reviewed**  
1 approving review by reviewers with write access.

✓ 1 approval >  
👤 1 pending review >

**Some checks haven't completed yet**  
3 in progress, 2 skipped, 5 successful checks

3 in progress checks ▾

- 🔴 CI Checks / Build and Test Linux (pull\_request) Started 15 minutes ago — This check has started... **Required** ⋮
- 🔴 CI Checks / Build and Test Linux AArch64 (pull\_request) Started 16 minutes ago — This check has started... ⋮
- 🔴 CI Checks / Build and Test Windows (pull\_request) Started 15 minutes ago — This check has started... **Required** ⋮

2 skipped checks ▾

- 🟢 CI Checks / MacOS Premerge Checks (pull\_request) Skipped 16 minutes ago ⋮
- 🟢 Labelling new pull requests / greeter (pull\_request\_target) Skipped 16 minutes ago ⋮

5 successful checks ▾

- 🟢 buildkite/buildkite ci Build #00286 passed (3 seconds) ⋮

**This branch is out-of-date with the base branch**  
Merge the latest changes from main into this branch. This merge commit will be associated with boomanaiden154. **Update branch**

☐ Merge without waiting for requirements to be met (bypass rules)

**Enable auto-merge (squash)** You can also merge this with the command line. [View command line instructions.](#)

# Don't have to wait for tests to finish!

Option 1:  
Merge  
before  
they're  
done.

**Changes reviewed**  
1 approving review by reviewers with write access.

✓ 1 approval >  
👤 1 pending review >

**Some checks haven't completed yet**  
3 in progress, 2 skipped, 5 successful checks

3 in progress checks ▾

- 🔴 CI Checks / Build and Test Linux (pull\_request) Started 15 minutes ago — This check has started... **Required** ⋮
- 🔴 CI Checks / Build and Test Linux AArch64 (pull\_request) Started 16 minutes ago — This check has started... ⋮
- 🔴 CI Checks / Build and Test Windows (pull\_request) Started 15 minutes ago — This check has started... **Required** ⋮

2 skipped checks ▾

- 🟢 CI Checks / MacOS Premerge Checks (pull\_request) Skipped 16 minutes ago ⋮
- 🟢 Labelling new pull requests / greeter (pull\_request\_target) Skipped 16 minutes ago ⋮

5 successful checks ▾

- 🟢 buildkite/buildkite-ci Build #00286 passed (3 seconds) ⋮

**This branch is out-of-date with the base branch**  
Merge the latest changes from main into this branch. This merge commit will be associated with boomanaiden154. **Update branch**

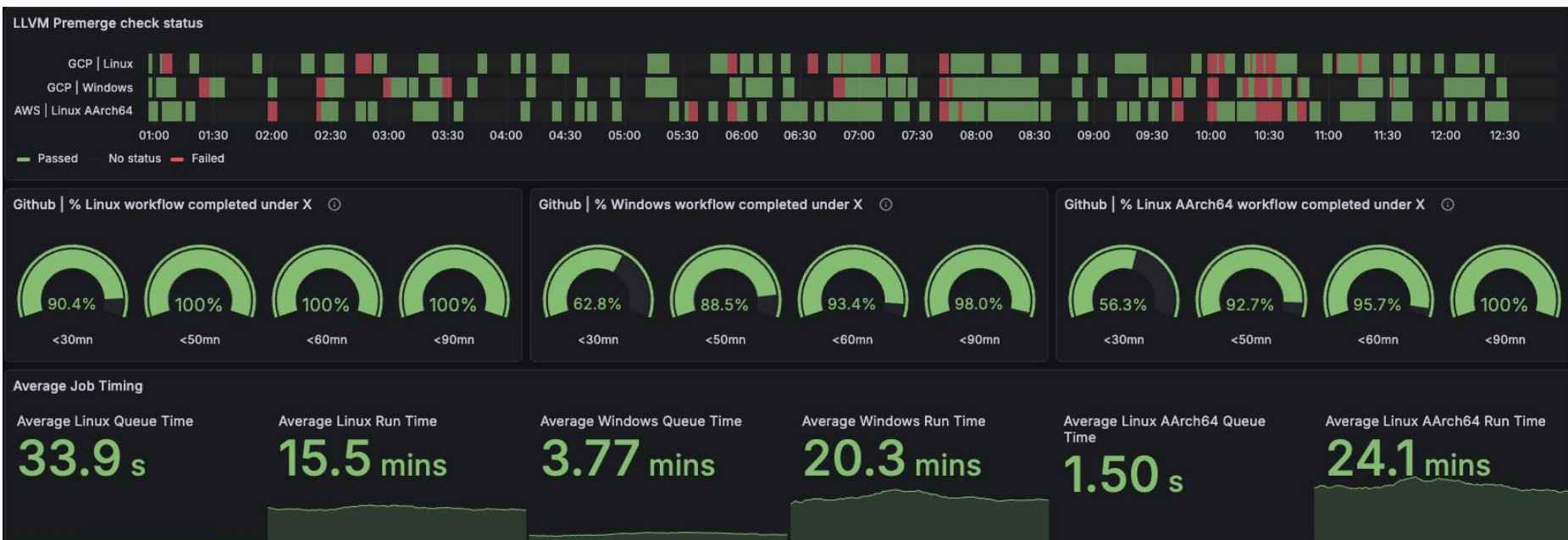
☒ Merge without waiting for requirements to be met (bypass rules)

**Enable auto-merge (squash)** You can also merge this with the command line. [View command line instructions.](#)

Option 2:  
Auto-merge  
when they  
finish.

# Performance Improvements

# Metrics & Performance Monitoring: Linux & Windows Current Performance



<https://llvm.grafana.net/public-dashboards/21c6e0a7cdd14651a90e118df46be4cc>

# Metrics & Performance Monitoring: Libc++ Current Performance



<https://llvm.grafana.net/public-dashboards/0bd453e8b3034733a1b0ff8c7728086d>

# Metrics & Performance Monitoring: Linux & Windows Performance Over Time



Shows performance improvements



## Performance Improvement: Caching objects.

- Updated testing to cache built objects.
- Re-uses cached objects whenever possible.
- Uses sccache in GCS (Google Cloud Storage)
- => 30-35% reduction in overall testing times!

# Performance Improvement (Linux): Migrating tests to lit internal shell

- What: Lit internal shell:
  - Limited functionality shell (compared to bash)
  - Avoids spawning test shell in another process
- Why?
  - => 10-15% performance improvement on Linux
  - (Windows already using it!)
- When?
  - Most tests already using it, including clang and LLVM.
  - In progress: compiler-rt tests.

## Performance Improvement (Windows): Switch to using Clang.

- Coming soon: Work-in-progress.
- Expect 40-50% reduction in compilation time...
  - (Preliminary results!)

# Flakiness Reduction

# Flakiness Reduction: Postsubmit Testing

- Need to know what's failing at head
  - => Don't want to report those as PR failures.
- Created a "postsubmit" test buildbot.
  - Runs same tests as premerge testing,.
  - Same configuration as premerge, but builds/tests all projects every run.
  - Results get uploaded for comparison.
  - Runs continuously.

Builder Name	Builds	Tags	Workers
premerge-monolithic-linux	8538 8537 8536 8535 8534 8533 8532 8531 8530 8529 8528 8527 8526 8525 8524		182 183 184 189 190 191
premerge-monolithic-windows	7061 7060 7059 7058 7057 7056 7055 7054 7053 7052 7051 7050 7049 7048 7047		180 181 185 186 187 188

## Flakiness Reduction: Premerge Advisor

- Checks failing premerge tests.
- Eliminates tests known to fail at head
  - (from postsubmit buildbot data)
- Eliminates known flaky tests.
- If any failures are left, reports tests as failing.
- Otherwise reports tests as passing.

GOAL: Eliminate false positive failure reports!

## Flakiness Reduction: Future Plans

- Expose flaky test information from the premerge advisor.
  - Gives accurate flake data for the common platforms.
  - Makes it easy to report issues upstream to test authors.

Ideally: eliminate all test flakiness on the most common platforms.

Thank you!