



**Programming is fun;
Testing is needed;
Infra is ...**

JP Lehr

WHY TEST UPSTREAM LLVM



Support Upstream Developers



Guard Downstream ROCm™

LLVM TESTING LANDSCAPE

GitHub



- Used for GitHub actions
- Hosted on GitHub or self-hosted

Buildkite



- Used for pre-commit testing
- Hosted on GKE

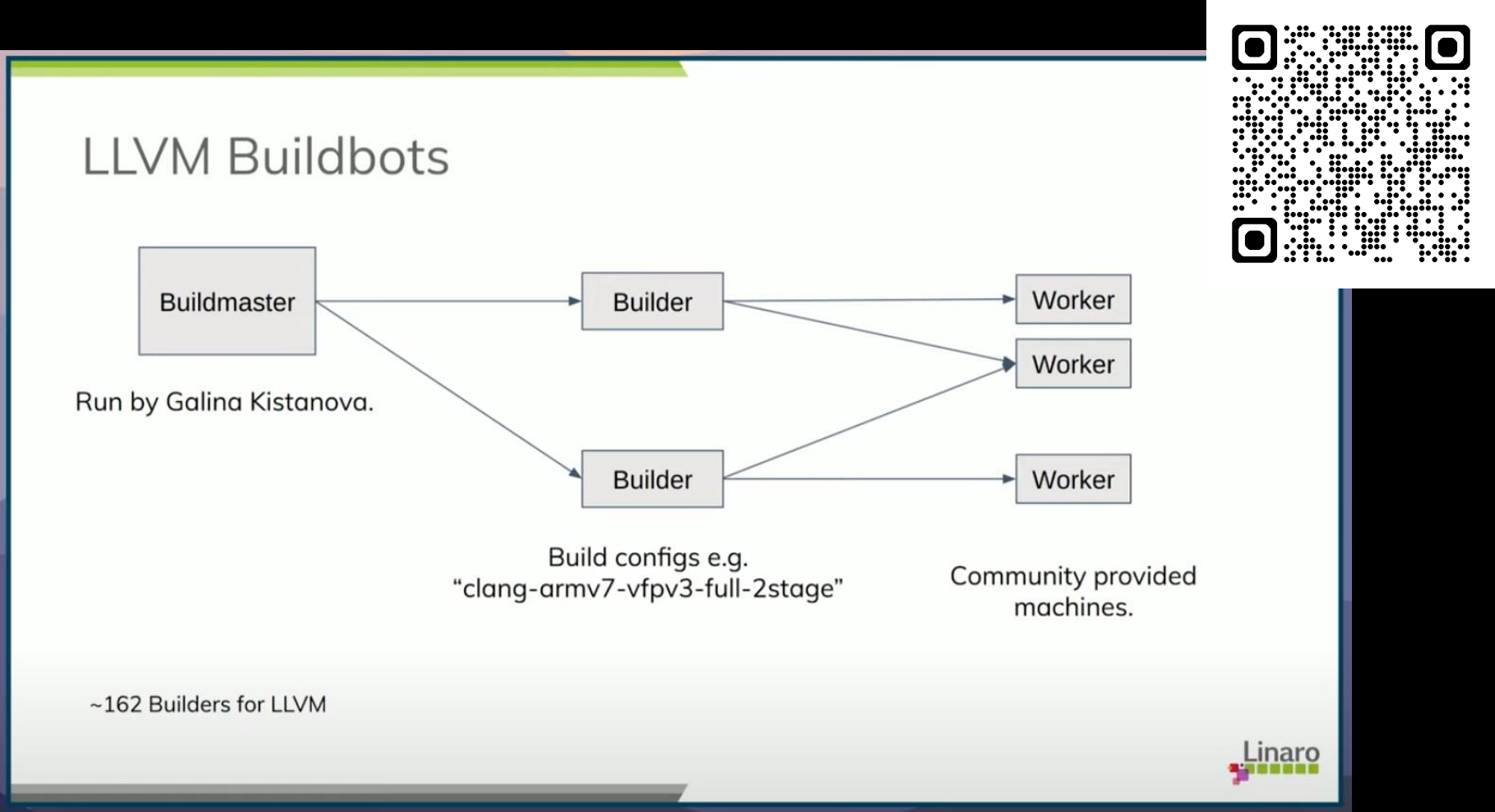
Buildbot



- Used for post-commit testing
- Hosted everywhere

In this talk: **Buildbot**

TERMINOLOGY



Talk by David Spickett: 2022 LLVM Dev Mtg: What does it take to run LLVM Buildbots?

TERMINOLOGY

AnnotatedBuilder

- Build-your-own builder
- Script defines what the builder is doing
- Not tailored for any particular purpose
- Examples: HIP, libc, ...

OpenMPBuilder

- Off-the-shelve builder
- OpenMPBuilder defines what builder is doing
- Tailored to building OpenMP®
- Always adds the check-openmp target

```
{'name' : "amdgpu-offload-ubuntu-22-cmake-build-only",  
'tags' : ["openmp"],  
'workernames' : ["rocm-docker-ubu-22"],  
'builddir': "amdgpu-offload-ubuntu-22-cmake-build-only",  
'factory' : AnnotatedBuilder.getAnnotatedBuildFactory(  
    depends_on_projects=["llvm", "clang", "lld", "compiler-rt", "libcxx", "libcxxabi", "openmp", "offload", "libunwind"],  
    script="amdgpu-offload-cmake.py",  
    checkout_llvm_sources=True,  
    script_interpreter=None  
)},
```

Maintained in llvm-zorg repository

CURRENT BUILDBOT FLEET

Builders / openmp-offload-amdgpu-runtime Build requests: None Builds: <table> <thead> <tr> <th>#</th> <th>Started At</th> <th>Duration</th> <th>Owners</th> </tr> </thead> <tbody> <tr> <td>11551</td> <td>an hour ago</td> <td>4 minutes</td> <td>Maksim Ivanov <emaxx@google.com></td> </tr> <tr> <td>11550</td> <td>an hour ago</td> <td>4 minutes</td> <td>Nathan Gauër <brioche@google.com></td> </tr> <tr> <td>11549</td> <td>an hour ago</td> <td>4 minutes</td> <td>Paul Walker <paul.walker@arm.com></td> </tr> </tbody> </table>	#	Started At	Duration	Owners	11551	an hour ago	4 minutes	Maksim Ivanov <emaxx@google.com>	11550	an hour ago	4 minutes	Nathan Gauër <brioche@google.com>	11549	an hour ago	4 minutes	Paul Walker <paul.walker@arm.com>	Builders / openmp-offload-amdgpu-runtime-2 Build requests: None Builds: <table> <thead> <tr> <th>#</th> <th>Started At</th> <th>Duration</th> <th>Owners</th> </tr> </thead> <tbody> <tr> <td>9783</td> <td>an hour ago</td> <td>6 minutes</td> <td>Maksim Ivanov <emaxx@google.com></td> </tr> <tr> <td>9782</td> <td>an hour ago</td> <td>6 minutes</td> <td>Nathan Gauër <brioche@google.com></td> </tr> <tr> <td>9781</td> <td>an hour ago</td> <td>6 minutes</td> <td>Paul Walker <paul.walker@arm.com></td> </tr> </tbody> </table>	#	Started At	Duration	Owners	9783	an hour ago	6 minutes	Maksim Ivanov <emaxx@google.com>	9782	an hour ago	6 minutes	Nathan Gauër <brioche@google.com>	9781	an hour ago	6 minutes	Paul Walker <paul.walker@arm.com>	Builders / clang-hip-vega20 Build requests: None Builds: <table> <thead> <tr> <th>#</th> <th>Started At</th> <th>Duration</th> <th>Owners</th> </tr> </thead> <tbody> <tr> <td>10585</td> <td>an hour ago</td> <td>8 minutes</td> <td>Maksim Ivanov <emaxx@google.com></td> </tr> <tr> <td>10584</td> <td>an hour ago</td> <td>8 minutes</td> <td>Paul Walker <paul.walker@arm.com></td> </tr> <tr> <td>10583</td> <td>2 hours ago</td> <td>8 minutes</td> <td>Simon Pilgrim <llvm-dev@redking.m></td> </tr> </tbody> </table>	#	Started At	Duration	Owners	10585	an hour ago	8 minutes	Maksim Ivanov <emaxx@google.com>	10584	an hour ago	8 minutes	Paul Walker <paul.walker@arm.com>	10583	2 hours ago	8 minutes	Simon Pilgrim <llvm-dev@redking.m>	Builders / openmp-offload-rhel-8_8 Build requests: None Builds: <table> <thead> <tr> <th>#</th> <th>Started At</th> <th>Duration</th> <th>Owners</th> </tr> </thead> <tbody> <tr> <td>9869</td> <td>an hour ago</td> <td>8 minutes</td> <td>Maksim Ivanov <emaxx@google.com></td> </tr> <tr> <td>9868</td> <td>an hour ago</td> <td>8 minutes</td> <td>Paul Walker <paul.walker@arm.com></td> </tr> </tbody> </table>	#	Started At	Duration	Owners	9869	an hour ago	8 minutes	Maksim Ivanov <emaxx@google.com>	9868	an hour ago	8 minutes	Paul Walker <paul.walker@arm.com>
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HISTORY



The inherited time

The intermediate time

The current time

The (bright) future

HISTORY



The inherited time

The intermediate time

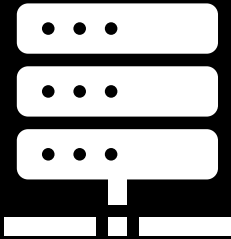
The current time

The (bright) future

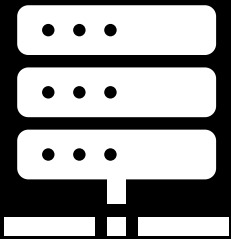
THE INHERITED TIME

- Three machines: all running bare metal
 - Three machines: all w/ different usernames and different systems
 - Partly unclear (and undocumented) setup steps
 - Existing documentation only available internally
-
- OpenMP® builder uses OpenMPBuilder
 - HIP builder uses AnnotatedBuilder
-
- Changes to llvm-zorg automatically pushed to staging area every 2 hours
 - ... unless there was a problem

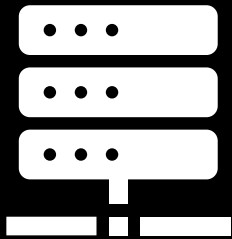
THE INHERITED TIME



clang-hip-vega20



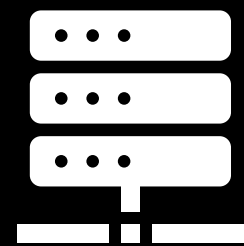
openmp-offload-amdgpu-runtime



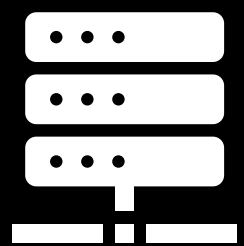
openmp-offload-amdgpu-
runtime-experimental

THE INHERITED TIME

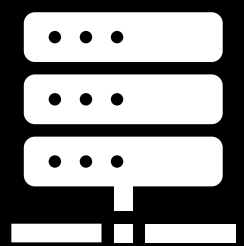
llvm-zorg



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openmp-offload-amdgpu-runtime



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THE INHERITED TIME



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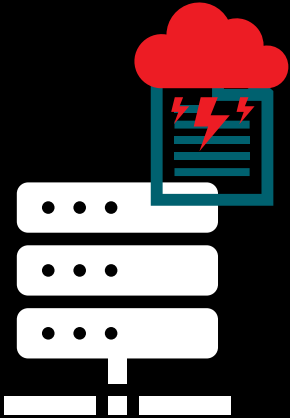


openmp-offload-amdgpu-runtime

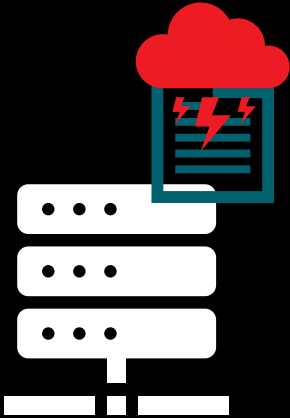


openmp-offload-amdgpu-
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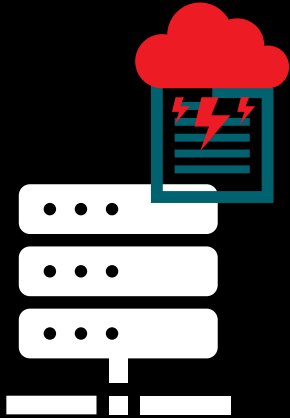
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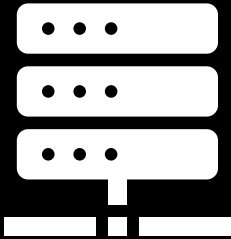


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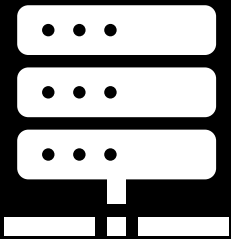


openmp-offload-amdgpu-
runtime-experimental

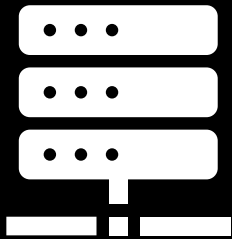
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openmp-offload-amdgpu-runtime



openmp-offload-amdgpu-
runtime-experimental

HISTORY



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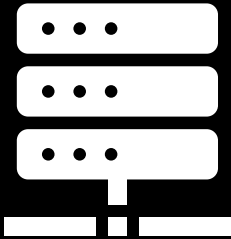
The (bright) future

THE INTERMEDIATE TIME

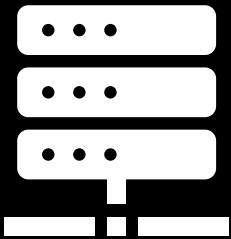
- Additional test-targets for one of two OpenMP® builders to cover libc on AMDGPU
- Patches to OpenMPBuilder to allow additional lit arguments
- Added containers for RHEL 8, RHEL 9 and SLES 15 builders
- Setting up new builders manual process (documentation only internally avail)

PDF only

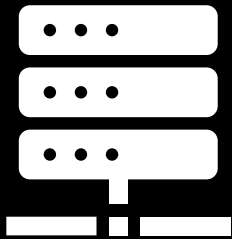
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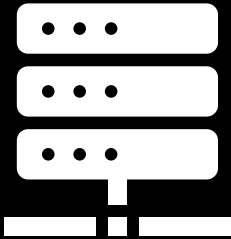


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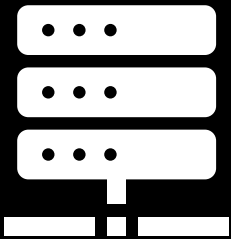


openmp-offload-amdgpu-
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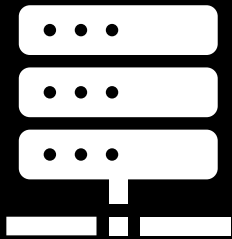
THE INTERMEDIATE TIME



clang-hip-vega20



openmp-offload-amdgpu-runtime



openmp-offload-libc-
amdgpu-runtime

THE INTERMEDIATE TIME



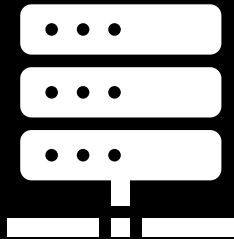
openmp-offload-sles-build-only



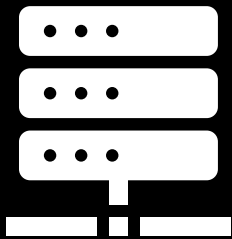
openmp-offload-rhel-8_8



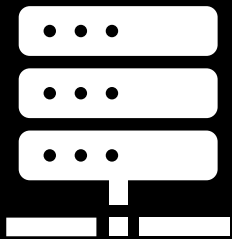
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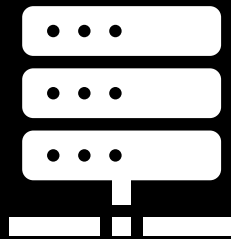
clang-hip-vega20



openmp-offload-
amdgpu-runtime

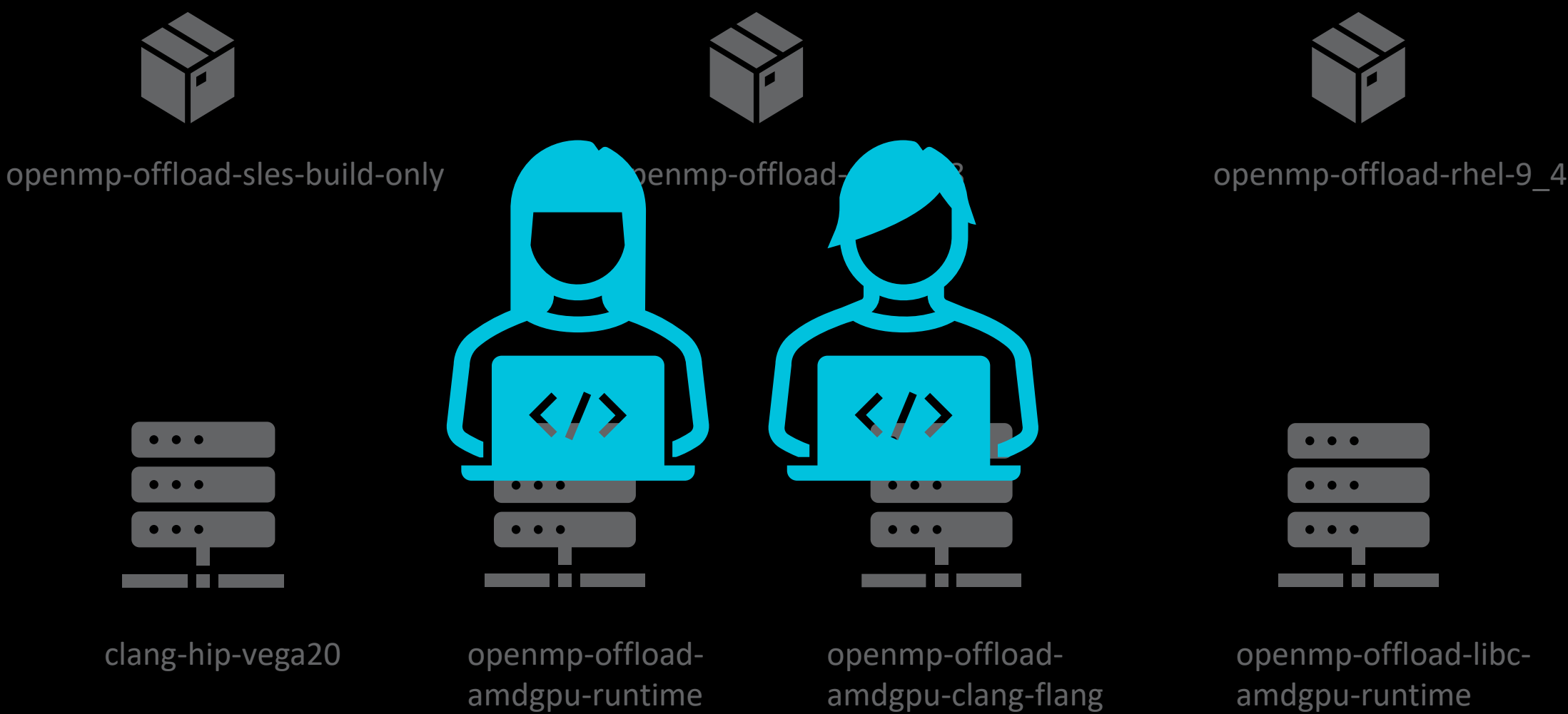


openmp-offload-
amdgpu-clang-flang



openmp-offload-libc-
amdgpu-runtime

THE INTERMEDIATE TIME



HISTORY



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The (bright) future

HISTORY



The inherited time

The intermediate time

The current time

The (bright) future

THE CURRENT TIME

- Still mix of bare metal and containerized builders
- Struggling with flakiness of some OpenMP®/GPU tests
- Most actual (not flaky) problems are during build

What it should be

- All builders containerized
- All machine setup and builder deployment automated via ansible
- Publicly available Dockerfiles for all builders
- Rely on CMake cache files in-tree for build configuration
- All builders based on AnnotatedBuilder

THE CURRENT TIME



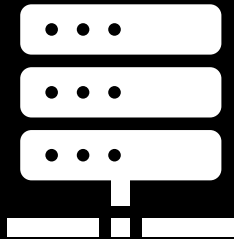
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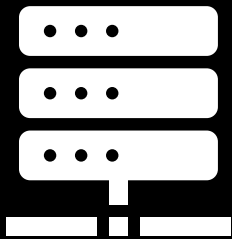
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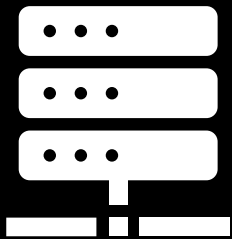
openmp-offload-rhel-9_4



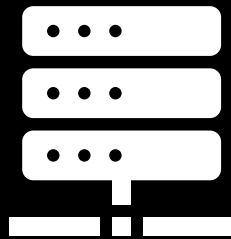
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openmp-offload-amdgpu-runtime



openmp-offload-amdgpu-clang-flang

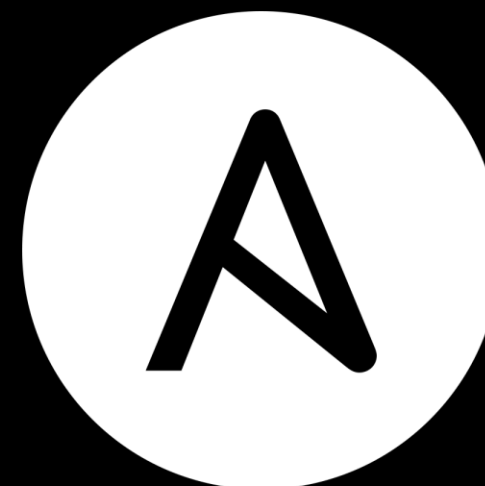


openmp-offload-libc-amdgpu-runtime

THE CURRENT TIME

```
amd-kcl.ko:  
Running module version sanity check.  
- Original module  
- This kernel never originally had a module by this name  
- Installation  
- Installing to /lib/modules/5.15.0-130-generic/updates/dkms/  
  
amd-sched.ko:  
Running module version sanity check.  
- Original module  
- This kernel never originally had a module by this name  
- Installation  
- Installing to /lib/modules/5.15.0-130-generic/updates/dkms/  
  
amddrm_ttm_helper.ko:  
Running module version sanity check.  
- Original module  
- This kernel never originally had a module by this name  
- Installation  
- Installing to /lib/modules/5.15.0-130-generic/updates/dkms/  
  
W: Possible missing firmware /lib/firmware/ast_dp501_fw.bin for module ast  
Scanning processes...  
  
amdrrm_bu...  
Running m...  
- Origin...  
- This...  
- Instal...  
- Inst...  
Scanning candidates...  
Scanning processor microcode...  
  
amdxcpc.ko  
Running m...  
- Origin...  
- This...  
- Instal...  
- Inst...  
Scanning linux images...  
  
Restarting services...  
/etc/needrestart/restart.d/systemd-manager  
systemctl restart cron.service irqbalance.service packagekit.service polkit.service rsyslog.service ssh.service systemd-journald.service systemd-networkd.service systemd-resolved.service systemd-timesyncd.service systemd-udevd.service udisks2.service upower.service  
depmod...  
update-in...  
janplehr@r15:~/git/apps/openmp-ci/buildbots$ ./connect_bot -d rack-178  
ssh: connect to host [REDACTED] port 22: Connection timed out  
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THE CURRENT TIME



THE CURRENT TIME



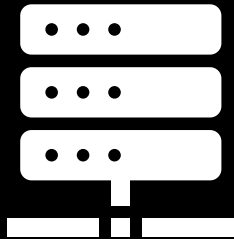
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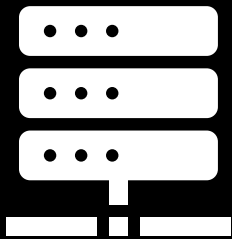
openmp-offload-rhel-8_8



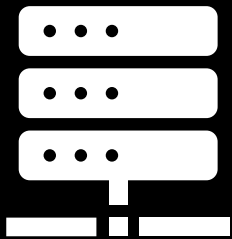
openmp-offload-rhel-9_4



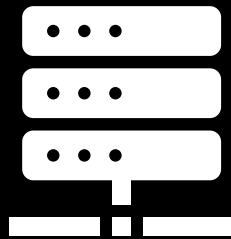
clang-hip-vega20



openmp-offload-
amdgpu-runtime



openmp-offload-
amdgpu-clang-flang



openmp-offload-libc-
amdgpu-runtime

THE CURRENT TIME



openmp-offload-sles-build-only



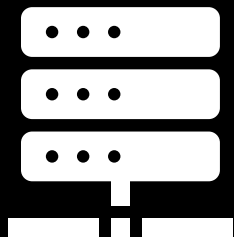
openmp-offload-rhel-8_8



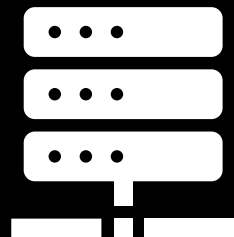
openmp-offload-rhel-9_4



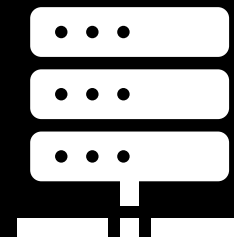
clang-hip-vega20



openmp-offload-amdgpu-runtime



openmp-offload-amdgpu-clang-flang



openmp-offload-libc-amdgpu-runtime

HISTORY



The inherited time

The intermediate time

The current time

The (bright) future

HISTORY



The inherited time

The intermediate time

The current time

The (bright) future

THE (BRIGHT) FUTURE



Ubuntu-22-fast



RHEL-8-fast



RHEL-9-fast



SLES-15-fast

Post Commit



Ubuntu-22-slow



RHEL-8-slow



RHEL-9-slow



SLES-15-slow

THE (BRIGHT) FUTURE



kubernetes

THE (BRIGHT) FUTURE

Pre Commit Build



kubernetes

THE (BRIGHT) FUTURE

Pre Commit Build

Pre Commit Test on GPU



kubernetes

THE BRIGHT FUTURE

Add pre-commit testing

- Add self-hosted runners to GitHub for pre-commit building and on-GPU testing
- Based on the same container as post-commit buildbots
- Plan is to use the same in-tree CMake config as in post-commit buildbots

Expand test coverage

- Add more compile targets (e.g., HIP programs or ROCm™ libraries) to post-commit testing
- Likely going to have fast and slow bots in post-commit

LESSONS LEARNED/BEST PRACTICES

- Running a single (inherited) buildbot is **easy enough** and well documented
- **Testing** a buildbot locally can now be easily done (Thank you!)
- Don't forget to **enable** mail-send on build-fail in
buildbot/osuosl/master/config/status.py

Builders should be easily reproducible locally

- Environment (e.g., via containers)
- Build config (e.g., via CMake cache file)



Running a fleet of buildbot is more complex. Because you are managing a fleet, not because of buildbot.

- Deployment should be automated: serves as documentation and eases re-deployment

LESSONS LEARNED/BEST PRACTICES

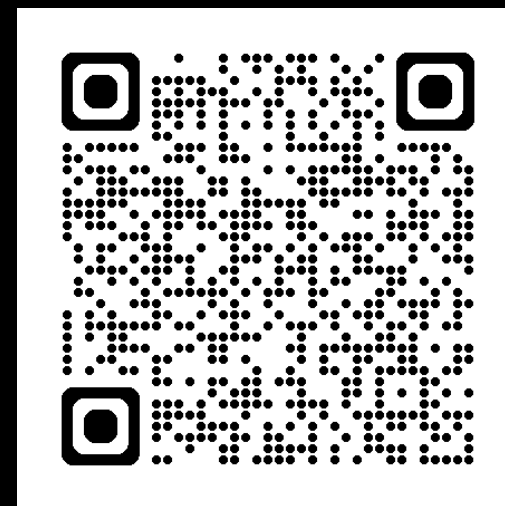
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We are hiring.

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