



Effectively Using Lustre's Development/CI Pipeline

Andreas Dilger <adilger@whamcloud.com>

Whamcloud Development Infrastructure

- ▶ JIRA Issue Tracking <https://jira.whamcloud.com/>
- ▶ Gerrit Change Review <https://review.whamcloud.com/>
- ▶ Git (really Gerrit) <https://git.whamcloud.com/>
- ▶ Jenkins Build Server <https://build.whamcloud.com/>
- ▶ Maloo Test Results Repo <https://testing.whamcloud.com/>

- ▶ Q & A

Multiple Components to Lustre Development

- ▶ JIRA for issue tracking (bugs, features, improvements) for code and docs
 - Gerrit posts patch submission and landing automatically to JIRA ticket in commit message
- ▶ Gerrit tracks patches and reviews for all Lustre projects
 - Whamcloud developers have an internal OpenID provider
 - Community developers use 3rd-party OAuth2/OpenID provider
 -
- ▶ Jenkins for automated builds
 - x86 servers: e18.9, e18.10, e19.3, e19.4
 - x86 clients: e18.9, e18.10, e19.3, e19.4, sles15sp5, sles15sp6, ubuntu2204, ubuntu2404
 - Other client arch: e19.3 aarch64, e18.9 ppcle64
- ▶ Multiple Autotest test sessions launched for successful patch build
 - *All enforced sessions* must pass
 - *Optional sessions* do not *need* to pass, but should still be reviewed
- ▶ Maloo tracks test results from Autotest
 - Posts into Gerrit when sessions are started
 - Posts into Gerrit when session is complete
 - Marks patch **Verified**: -1 if *any enforced session* fails

Autotest Test Sessions

Maloo

Patch Set 6:

The following sessions will be run for build 104168 patch 6

Enforced:

- review-ldisks on el8.9-x86_64/ldisks servers and clients
- review-zfs on el8.9-x86_64/zfs servers and clients
- review-dne-part-1 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-2 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-3 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-4 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-5 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-6 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-7 on el9.3-x86_64/ldisks servers and clients
- review-dne-part-8 on el9.3-x86_64/ldisks servers and clients
- review-ldisks on el9.2-x86_64/ldisks servers and clients
- review-ldisks on el9.2-x86_64/ldisks servers and el9.3-x86_64/ldisks clients
- review-ldisks on el9.3-x86_64/ldisks servers and clients
- review-ldisks-arm on el8.9-x86_64/ldisks servers and el8.8-aarch64/ldisks clients
- review-dne-selinux-ssk-part-1 on el8.9-x86_64/ldisks servers and clients
- review-dne-selinux-ssk-part-2 on el8.9-x86_64/ldisks servers and clients
- review-ldisks on el8.9-x86_64/ldisks servers and el9.2-x86_64/ldisks clients
- review-ldisks on el8.9-x86_64/ldisks servers and sles15sp4-x86_64/ldisks clients
- review-ldisks on el8.9-x86_64/ldisks servers and sles15sp5-x86_64/ldisks clients

Optional:

- review-dne-part-9 on el9.3-x86_64/ldisks servers and clients
- review-ldisks on el8.9-x86_64/ldisks servers and el9.3-x86_64/ldisks clients
- review-ldisks-ubuntu on el8.9-x86_64/ldisks servers and ubuntu2204-x86_64/ldisks clients

Maloo Test Queue: https://testing.whamcloud.com/test_queue?jobs=lustre-reviews&builds=104168&commit=Apply+Filter

Maloo Results: https://testing.whamcloud.com/test_sessions/related?jobs=lustre-reviews&builds=104168#redirect

- ▶ 25+ sessions **per patch version!** (45+ master)
 - Multiple sessions *enforced* for master patches
 - Multiple sessions *optional* for arches, distros
 - Automated *subtest-change* sessions for modified tests
- ▶ **Enforced** test sessions **must pass**
 - Custom Test-Parameters: runs are **Enforced**
- ▶ **Optional** sessions *are optional*
 - Run to test new distro/arch, or flakey tests (e.g. **racer**)
 - Run when test resources available (**aarch64**, **ppc64le**)
 - Working toward passing and enforcement
 - **Do not** resubmit optional sessions
- ▶ Janitor only -1 for failures in modified tests
- ▶ **Please use test resources wisely**
 - 260 test script runs, 13500 subtests, 230h+ *per patch*

Gerrit Patch Status

jenkins	Patch Set 1: Verified+1 Build Successful https://build.whamcloud.com/jo
Maloo	Patch Set 1: The following sessions will be run for build 108407 patch 1
Maloo	Patch Set 1: Failed enforced test custom-1001 on RHEL 9.3 / x86_64, R
Lustre G... Janitor	Patch Set 1: Initial testing succeeded. Succeeded: - runtests@ldiskfs+D
Maloo	Patch Set 1: Failed optional test review-dne-part-4 on RHEL 8.10 / x86_
Maloo	Patch Set 1: Failed optional test review-dne-part-9 on RHEL 9.4 / x86_6
Maloo	Patch Set 1: Failed enforced test review-dne-part-4 on RHEL 9.3 / x86_6
Lustre G... Janitor	Patch Set 1: Testing has completed with errors > racer@ldiskfs+DNE Ti
Maloo	Patch Set 1: Failed enforced test review-dne-part-1 on RHEL 9.3 / x86_6
Maloo	Patch Set 1: Failed optional test review-dne-zfs-part-1 on RHEL 8.10 / x
Maloo	Patch Set 1: Failed optional test review-dne-part-1 on RHEL 8.10 / x86_
Maloo	Patch Set 1: Failed optional test review-dne-part-9 on RHEL 8.10 / x86_
Maloo	Patch Set 1: Verified-1 Passed enforced test review-dne-part-3 on RHEL
Autotest	Patch Set 1: Onyx Autotest 2 retesting enforced review-dne-part-4 sessi
Autotest	Patch Set 1: Onyx Autotest 2 retesting enforced review-dne-part-1 sessi
Autotest	Patch Set 1: Travis Autotest 2 retesting enforced custom session on el9.
Maloo	Patch Set 1: Failed enforced test custom-1001 on RHEL 9.3 / x86_64, R
Maloo	Patch Set 1: Passed enforced test review-dne-part-4 on RHEL 9.3 / x86_
Maloo	Patch Set 1: Failed enforced test review-dne-part-1 on RHEL 9.3 / x86_6

- ▶ **Test-Parameters**: sessions start at **custom-1001**
- ▶ **Lustre Gerrit Janitor** is a separate test system that runs under loads that provoke race conditions
- ▶ Janitor test sessions often finish quickly and supply early feedback
- ▶ Janitor adds Verified -1 for **failures** on tests added or modified by patch, but failures should still be reviewed for correctness
- ▶ **Optional** test sessions are not required to pass for a test to land

Monitoring Test Results in Maloo

Maloo

Patch Set 2:

The following sessions will be run for build 104237 patch 2

Enforced:

- review-lldiskfs on el8.9-x86_64/lldiskfs servers and el9.3-x86_64/lldiskfs clients
- review-lldiskfs-ubuntu on el8.9-x86_64/lldiskfs servers and ubuntu2204-x86_64/lldiskfs clients

Maloo Test Queue: https://testing.whamcloud.com/test_queue?jobs=lustre-reviews&builds=104237&commit=Apply+Filter

Maloo Results: https://testing.whamcloud.com/test_sessions/related?jobs=lustre-reviews&builds=104237#redirect

- ▶ Permanently keeps *results* for all patches
- ▶ *Logs* are kept as long as possible (months), longer for test failures if space available
- ▶ Quickly see sessions still running
- ▶ Quickly see all session status

Job	Build/Patch	Idx	Test Group	Distros	Review	Suite/Test	Started	Time Remaining
lustre-reviews	104237:2	36	review-lldiskfs	s: el8.9-x86_64/lldiskfs c: sls15sp4-x86_64/lldiskfs	1ea8c49a5	sanity test_31d	2024-04-17 23:36 (~1 hr)	~5 hrs
lustre-reviews	104237:2	2	review-zfs	s: el8.9-x86_64/zfs c: el8.9-x86_64/zfs	1ea8c49a5	sanity-quota test_7a	2024-04-17 23:37 (~1 hr)	~5 hrs

<input type="checkbox"/>	Name	Test Sets	Index
	ENFORCED		
<input type="checkbox"/>	lustre-reviews_el8.9-x86_64_review-lldiskfs		1
	2024-04-17 14:54:02 UTC	5/5	
<input type="checkbox"/>	lustre-reviews_el8.9-x86_64_review-zfs		2
	2024-04-17 14:54:11 UTC	7/8	
	Testing for ~1 hr		

Control Autotest Sessions with Test-Parameters

```
Test-Parameters: testlist=sanity env=ONLY=16,HONOR_EXCEPT=y
Test-Parameters: serverversion=2.14 testlist=sanity env=ONLY=16,HONOR_EXCEPT=
Fixes: 7905359296 ("LU-15748 osc: fallocation interop for 2.14 clients")
Signed-off-by: Andreas Dilger <adilger@whamcloud.com>
Change-Id: I327183025a8de6fd814a7c2929365497153ebbe5
```

► Use the Test-Parameters: tag in a commit message:

- Test-Parameters: testlist=sanity,racer # run *additional* test scripts, *one session per line*
- ... env=ONLY=32,ONLY_REPEAT=50 # environment vars (run a subtest many times)
- ... clientversion=EXA5 # old client new server interop
- ... serverversion=EXA6.3.1 # new client old server interop
- ... mdscount=4 mdtcount=8 ostcount=8 # change server counts for DNE testing

► Use trivial keyword **only** for limited testing of test scripts, man pages, build, etc.

- ... trivial # runs **sanity**, **lnet-selftest**, x86 and arch64
- ... testlist=recovery-small,replay-single # add more sessions, config options as needed

<https://wiki.whamcloud.com/display/PUB/Changing+Test+Parameters+with+Gerrit+Commit+Messages>



Adding Extra Test Sessions to an Existing Patch (**New!**)

The following sessions will be run for build 104169 patch 1

Enforced:

- review-ldiskfs-dne on el9.3-x86_64/ldiskfs servers and clients
- custom on el8.9-x86_64/ldiskfs servers and el9.3-x86_64/ldiskfs clients

Maloo Test Queue: https://testing.whamcloud.com/test_queue?jobs=lustre-reviews&builds=104169&commit=Apply+Filter
Maloo Results: https://testing.whamcloud.com/test_sessions/related?jobs=lustre-reviews&builds=104169#redirect

- ▶ Maloo Results page can add new sessions
- ▶ Use Test-Parameters as needed
- ▶ Good to **add** test sessions to **existing** patches
- ▶ **Re-uses existing build!** Faster and less work
- ▶ Useful when patch already finished testing
- ▶ Tests are Enforced if testing is not finished
- ▶ Tests are Optional if Maloo +1 is already set
- ▶ **Merge Test-Parameters into patch if refreshed**

Job: lustre-reviews Build: 104169 Search

Filter sessions that match:

<input type="checkbox"/>	Name	Test Sets	Index
	ENFORCED		
<input type="checkbox"/>	lustre-reviews_el9.3-x86_64_review-ldiskfs-dne 2024-04-14 08:14:54 UTC	5/5	40
<input type="checkbox"/>	lustre-reviews_el8.9-x86_64_el9.3-x86_64_custom 2024-04-14 08:15:14 UTC	3/3	1001

Code review link: [54782](#)

Issue retests for selected sessions above

Quick select failures... Jira: Retest

Test-Parameter request

Request *additional* test sessions via 'Test-Parameter:' lines

```
Test-Parameters: testlist=sanity-sec env=ONLY=69,ONLY_REPEAT=100  
Test-Parameters: testlist=sanity-sec,sanity-sec,sanity-sec serverdistro=el9.3  
Test-Parameters: testlist=sanity-sec,sanity-sec,sanity-sec serverversion=2.15
```

Request

1. Requests are in *addition* to default sessions and 'Test-Parameters:' lines in git commit message
2. Each line should start with 'Test-Parameters:' and use same syntax as in commit message (see [wiki TP help page](#))
3. The following TP attributes are not allowed via this interface:
forjanitoronly, forbuidonly, fortetestonly, ignore, optional, trivial
4. TP requests are enforced (signofftest=true) unless Maloo has already sent +/- score or signofftest=false is specified
5. Request may take a few minutes to show up in the Maloo test queue, if there is an issue you will be notified via email

Automatic Subtest Change Test Sessions (**New!**)

Group	Distro (Arch)	Version	Branch	Change
review-dne-subtest-change	s: Rocky 8.8 (x86_64) c: Rocky 8.8 (x86_64)	s: 4.18.0-477.27.1.el8_lustre.ddn17.x86_64 c: 4.18.0-477.27.1.el8_8.x86_64	b_es6_0	56893
review-dne-subtest-change	s: Rocky 8.8 (x86_64) c: Rocky 8.8 (x86_64)	s: 4.18.0-477.27.1.el8_lustre.ddn17.x86_64 c: 4.18.0-477.27.1.el8_8.x86_64	b_es6_0	56893
review-dne-subtest-change	s: Rocky 8.8 (x86_64) c: Rocky 8.8 (x86_64)	s: 4.18.0-477.27.1.el8_lustre.ddn17.x86_64 c: 4.18.0-477.27.1.el8_8.x86_64	b_es6_0	56893

Name	Duration	Code
test_setup	19	0
test_2020a	19	0
test_2020a	17	0
test_2020a	17	0
test_2020a	18	0
test_2020a	18	0
test_2020a	16	0
test_2020a	20	0
test_2020a	16	0
test_2020a	19	0
test_2020a	17	0
test_cleanup	2	0

- ▶ New test sessions run for patches modifying or adding new subtests
 - Uses existing **ONLY_MINUTES** or **ONLY_REPEAT** infrastructure to repeat
 - Gerrit Janitor runs 40x extra iterations per modified subtest
 - Autotest runs subtest in a loop for 30 minutes/10 iterations
- ▶ Running many iterations help detect flakey/intermittent subtest issues
- ▶ New sessions are Enforced to ensure flakey patches do not land
- ▶ Subtest must leave system in original state for next iteration to run
 - `test-framework.sh::run_one()` automatically cleans up standard files (`$tdir*` and `$tfile*`)



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Tips for Effectively Reviewing Autotest Test Results in Maloo

Reviewing Test Failures in Maloo

test_64f

Error: 'buffered io, not write rpc: grants mismatch: 12656640, expected 4218880'
Failure Rate: 1.05% of most recent 95 runs, 5 skipped (all branches)
OST 1, OST 2, OST 3, OST 4, OST 5, OST 6, OST 7, OST 8 (trevis-100vm9)

- sanity.test_64f.debug.trevis-100vm9.log [[Download](#) | [Show](#) | [Preview 50](#)]
- sanity.test_64f.debug_log.trevis-100vm9.1664078772.log [[Download](#) | [Show](#) | [Preview 50](#)]

MDS 1, MDS 3 (trevis-100vm10)

- sanity.test_64f.debug.trevis-100vm10.log [[Download](#) | [Show](#) | [Preview 50](#)]
- sanity.test_64f.debug_log.trevis-100vm10.1664078772.log [[Download](#) | [Show](#) | [Preview 50](#)]
- sanity.test_64f.dmesg.trevis-100vm10.1664078772.log [[Download](#) | [Show](#) | [Preview 50](#)]
- sanity.test_64f.dmesg.trevis-100vm10.log [[Download](#) | [Show](#) | [Preview 50](#)]
- sanity.test_64f.journal.trevis-100vm10.log [[Download](#) | [Show](#) | [Preview 50](#)]
- sanity.test_64f.stack_trace.trevis-100vm10.log [[Download](#) | [Show](#) | [Preview 50](#)]

Bugs
No bugs

[Associate bug...](#) [Raise bug...](#) [Retest...](#)

- ▶ **Quick search link** for similar subtest failures with URL at failed subtest name
- ▶ Defaults to search past week
- ▶ **Review** test failures
- ▶ **Associate bug** to link subtest failures to pre-existing tickets
- ▶ **Raise bug** for new subtest failures **unrelated to patch**
- ▶ **Retest session** after issue Associated or Raised
- ▶ Tracks common error trends
- ▶ Contributions welcome to fix intermittent failures



Search Test Results in Maloo

LUSTRE Sessions Results Reports & Stats Queues Requests

Search Test sets | Subtests | Upload

Test set script: Trigger job(s):

Sub test script: Trigger build(s):

Status: Host(s):

Bug(s): Group(s):

Code review: User(s):

Code review: Within:

From: To:

Download results as CSV
16 records found

<input type="checkbox"/>	Name	Status	Date	Duration	Code	Error	Bugs	Links	Test log
<input type="checkbox"/>	test_64f	FAIL	2022-09-25	3604	1	buffered io, not write rpc: grants mi		gerrit:47131 , jira:LU-8151	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-20	3602	1	buffered io, not write rpc: grants mi		gerrit:47121 , jira:LU-15777	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-19	10	1	direct io with grant allocation: grant	LU-13847	gerrit:48579 , jira:LU-16165	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-13	14	1	direct io with grant allocation: grant		gerrit:43707 , jira:LU-14139	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-13	3602	1	buffered io, not write rpc: grants mi	LU-13847	gerrit:48278 , jira:LU-16087	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-07	3601	1	buffered io, not write rpc: grants mi	LU-13847	gerrit:48445 , jira:EX-5398	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-05	3601	1	buffered io, not write rpc: grants mi		gerrit:45890 , jira:LU-15058	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-02	3	1	mount failed		gerrit:46334 , jira:EX-4567	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-01	3	1	mount failed		gerrit:46334 , jira:EX-4567	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-08-29	3	1	mount failed		gerrit:46334 , jira:EX-4567	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-08-29	3603	1	buffered io, not write rpc: grants mi	LU-13847	gerrit:48278 , jira:LU-16087	Preview 50

- ▶ Start Search from Results menu
 - Select Test or Subtest search
- ▶ May need to increase date range to find occasional failures for subtest
- ▶ Check for other similar failures with associated LU ticket to speed up failure analysis
- ▶ Some failures are caused by patch issues (eg. 'mount failed' here)
- ▶ Repeated failures for same patch or ticket indicate patch regression



Associate Similar Failures with Multiple Patches

Search

Reset form

Associate bugs...

Disassociate bugs...

ID: LU-13847

Add

Cancel

► While reviewing patch failures, also associate the LU ticket for other similar subtest failures

- Helps other developers retest more easily
- Improves test failure analysis by grouping failures

[Download results as CSV](#)

16 records found

<input type="checkbox"/>	Name	Status	Date	Duration	Code	Error	Bugs	Links	Test log
<input checked="" type="checkbox"/>	test_64f	FAIL	2022-09-25	3604	1	buffered io, not write rpc: grants mi		gerrit:47131 , jira:LU-8151	Preview 50
<input checked="" type="checkbox"/>	test_64f	FAIL	2022-09-20	3602	1	buffered io, not write rpc: grants mi		gerrit:47121 , jira:LU-15777	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-19	10	1	direct io with grant allocation: grant	LU-13847	gerrit:48579 , jira:LU-16165	Preview 50
<input checked="" type="checkbox"/>	test_64f	FAIL	2022-09-13	14	1	direct io with grant allocation: grant		gerrit:43707 , jira:LU-14139	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-13	3602	1	buffered io, not write rpc: grants mi	LU-13847	gerrit:48278 , jira:LU-16087	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-07	3601	1	buffered io, not write rpc: grants mi	LU-13847	gerrit:48445 , jira:EX-5398	Preview 50
<input checked="" type="checkbox"/>	test_64f	FAIL	2022-09-05	3601	1	buffered io, not write rpc: grants mi		gerrit:45890 , jira:LU-15058	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-02	3	1	mount failed		gerrit:46334 , jira:EX-4567	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-09-01	3	1	mount failed		gerrit:46334 , jira:EX-4567	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-08-29	3	1	mount failed		gerrit:46334 , jira:EX-4567	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-08-29	3603	1	buffered io, not write rpc: grants mi	LU-13847	gerrit:48278 , jira:LU-16087	Preview 50
<input type="checkbox"/>	test_64f	FAIL	2022-08-29	2	1	mount failed		gerrit:45122 , jira:LU-14958	Preview 50

Limit Maloo Search Incrementally

- ▶ Very useful when looking for test regressions
- ▶ Limit or increase search dates to find when failure started
 - Broad searches with large date ranges/many results will timeout, limit searches to specific subtest and status
- ▶ Limit branch, architecture, filesystem to isolate effects
- ▶ "git log --oneline --after YYYY-MM-DD --before YYYY-MM-DD" to find related patch landings

LUSTRE	Sessions	Results	Reports & Stats	Queues	Andreas Dilger [settings logout] page loaded: Nov 12 05:38 UTC Maloo v5.25.0	
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Search [Test sets](#) | [Sub tests](#) | [Bug links](#)

Test set script	sanity	Trigger job(s)	All jobs	Server	not	Client	not
Sub test script	test_64f	Trigger build(s)	e.g. 123, 456	Distribution	<input type="checkbox"/>	Distribution	<input type="checkbox"/>
Status	FAIL	Host(s)	e.g. trevis*, onyx-33vm*	Architecture	<input type="checkbox"/>	Architecture	aarch64 <input checked="" type="checkbox"/>
Bug(s)	e.g. LU-1234, DCO-777	Group(s)	Any group	FileSystem	<input type="checkbox"/>	FileSystem	<input type="checkbox"/>
Code review	Commit id (SHA)	User(s)	All users	Branch	b_es5_2 <input checked="" type="checkbox"/>	Branch	b_es6_0 <input checked="" type="checkbox"/>
Code review	Change number (12345)	Within		Network	<input type="checkbox"/>	Network	<input type="checkbox"/>
Enforced type	All	or					
		From	2024-09-01	To	2024-12-01		

Search Reset form Associate bugs... Disassociate bugs...

Keep Patches Moving Forward!

- ▶ **Developers are responsible for their own patches**
 - Update patches to address inspection comments
 - Review, fix, and/or resubmit test session failures promptly (< 7 days) to avoid build expiry
 - Remind inspectors to review patches with friendly pings (~7 days is reasonable)
- ▶ **Provide inspection feedback for others in a timely manner**
 - Helps everyone benefit from effort put into development, testing resources
- ▶ **After inspection, help move patch (yours or others) to next state**
 - Two or more inspectors on the patch? If not, add another inspector, or ping existing
 - Tests have passed or triaged? If not, retests needed **within 7 days** before build expires
- ▶ **Good inspections avoid more effort finding defects later**
 - Chance to find and fix latent bugs before patch is landed
 - Cleanup nearby code while it is being modified

Autotest Failures Affect Everyone

- ▶ Need to identify all test failures on a patch before resubmitting
 - Don't just spam resubmit button
 - Patch may otherwise be adding new intermittent bugs
- ▶ **Associate** or **Raise** bugs in Maloo for all test failures
- ▶ Search for similar failures via Maloo, JIRA, associate with failure(s)
 - Can be done more efficiently in batches
- ▶ Data needed to prioritize bugs causing the most failures
 - This speeds up fixing the most frequent failures
 - This in turn speeds up every other patch testing and landing
- ▶ Don't assume others will fix test failures



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Tips for Effectively Using Git and Gerrit

Managing Branches

- Keep patches for independent changes on separate branches
- A git "branch" is just a pointer to some series of commits
- Each `commit` or `rebase` moves pointer to new tip of the branch
- All of the old commits/branches stay in repository, unreferenced
 - `git checkout branch` # check out specific branch
 - `git branch {new_branch}` # create new, **keep current branch**
 - `git checkout -b {new_branch} [old_branch]` # create new branch from current and move there
 - `git status` # show modified/staged/untracked

Finding Branches

► Show local branches

```
# git branch -lv
b_test5          5fefbd1078 LU-15548 tests: skip conf-sanity/131 for older servers
b_def_mask       5efdbeab24 LU-9859 libcfs: add "default" keyword for debug mask
b_comma_list     76cffe0f2c LU-12597 tests: remove need for comma_list
master           1b09fb2296 LU-16062 ldlm: improve bl_timeout for prolong
```

► Show all remote branches

```
# git branch -alv
[as above, plus]
remotes/origin/HEAD-> origin/master
remotes/prime/b2_13  a298f8c137 New release 2.13.0
remotes/prime/b2_14  e1635c6afb New release 2.14.0
```

Commit Message Should Describe Patch Well

- ▶ Patch summary line should be brief (≤ 60 chars), but useful by itself
 - Appears in many patch summaries ("`git log --oneline`", "`git reflog`", etc.)
- ▶ What should be in the commit message?
 - What problem/feature does this patch address? How critical is it?
 - Usage/test that triggered problem, with error messages/stack
 - Performance improvements resulting from patch
 - How it is being fixed, clear description of tricky code
- ▶ Fixes: label helps find related patches when searching by hash or JIRA ticket
 - Helps identify whether patch needs to be backported to maintenance branch
- ▶ Why is the commit message content important?
 - Helps inspectors to understand the patch more quickly
 - Gatekeeper understands importance of the patch
 - Anyone dealing with the patch later has some guidance

<https://wiki.whamcloud.com/display/PUB/Commit+Comments>

Committing Changes

- ▶ Install Git commit hooks for patch verification before push to Gerrit

```
# ln -sf ../../contrib/git-hooks/commit-msg .git/hooks
# ln -sf ../../contrib/git-hooks/prepare-commit-msg .git/hooks
```

- ▶ Read the comments provided by `prepare-commit-msg` hook and address them!

# git add [PATH ...]	# stage specified file(s) or dirs for commit
# git add [-u]	# stage all changes for commit
# git commit -av	# stage and commit all changes, show diff
# git commit -a --amend	# add current changes to previous commit
# git reset --hard {BRANCH HEAD~n}	# permanently revert to branch, or last <i>n</i> commits
# git cherry-pick {BRANCH COMMIT}	# copy specific patch to current branch

Committing Partial Changes

► Add individual patch hunks

```
# git add -p
diff --git a/obd_support.h b/obd_support.h
@@ -482,6 +482,8 @@ int obd_alloc_fail(const void *ptr,
    #define OBD_FAIL_LFSCK_NO_AUTO                0x160b
    #define OBD_FAIL_LFSCK_NO_DOUBLESCAN         0x160c

+#define OBD_FAIL_FID_MAPPING                    0x1500
+
    /* Assign references to moved code to reduce code changes */
    #define OBD_FAIL_PRECHECK(id)                CFS_FAIL_PRECHECK(id)
    #define OBD_FAIL_CHECK(id)                  CFS_FAIL_CHECK(id)
```

Stage this hunk [y,n,q,a,d,/,e,?]?


Rebasing Patches

- Patches should be kept up-to-date with master branch
- WC Checkpatch marks patches Verified: -1 if they no longer apply
- Multiple dependent patches in a single series
 - # `git rebase [-i] {master|b2_15}` # edit/reorder patches (interactively)
 - # `git add -u` # add updated file(s) to commit
 - # `git rebase {--continue|--abort}` # apply or discard changes
 - # `git rebase --skip` # drop current patch entirely
 - # `git rebase --onto BRANCH` # rebase onto a new branch

Rebasing a Patch or Series

► Rebase last two patches

```
# git rebase -i {master|HEAD~2}
pick    4043c3c3bd LU-12885 llite: add enum ll_file_flags for clarity
fixup    fc350ac3f4 LU-12885 mds: add enums for MDS_OPEN flags
reword  27723374a3 LU-16073 utils: double snapshot_mount fix
```



```
# Rebase fc350ac3f4.. 4043c3c3bd onto 27723374a3
```

```
# Commands:
```

```
# p, pick = use commit
```

```
# r, reword = use commit, but edit the commit message
```

```
# e, edit = use commit, but stop for amending
```

```
# s, squash = use commit, but meld into previous commit
```

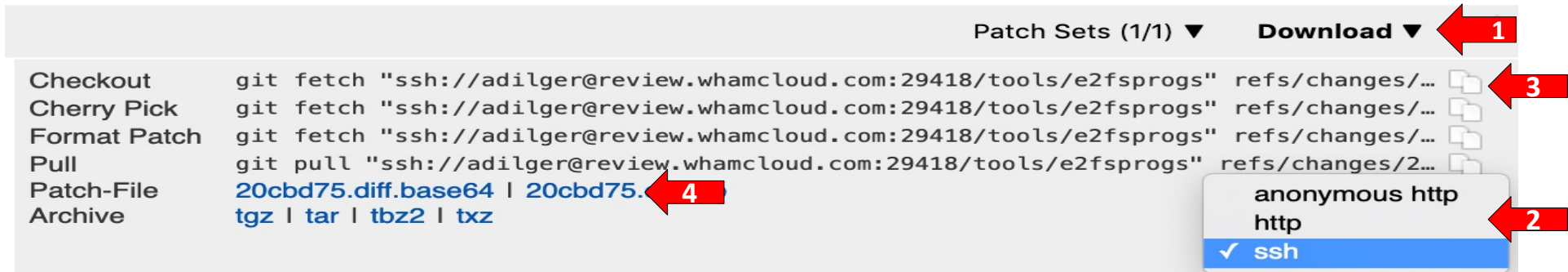
```
# f, fixup = like "squash", but discard this commit's log message
```

```
# x, exec = run command (the rest of the line) using shell
```

```
# These lines can be re-ordered; they are executed top to bottom.
```

► Can also change patch ordering in this way

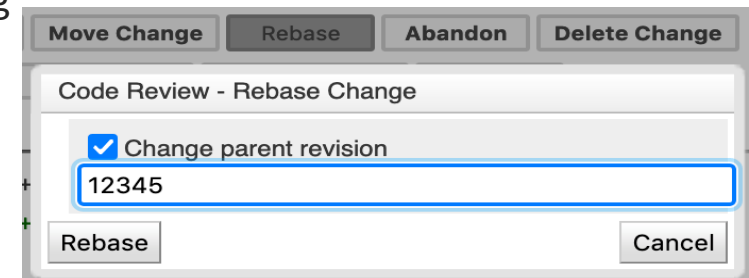
(Re)basing Another Patch onto an Existing Change



The screenshot shows the Gerrit web interface for a patch set. At the top right, there are buttons for 'Patch Sets (1/1)' and 'Download'. A red arrow labeled '1' points to the 'Download' button. Below the 'Download' button, a dropdown menu is open, showing options: 'anonymous http', 'http', and 'ssh'. A red arrow labeled '2' points to the 'ssh' option, which is selected. On the left side, there is a table of actions: 'Checkout', 'Cherry Pick', 'Format Patch', 'Pull', 'Patch-File', and 'Archive'. Each action has a corresponding git command and a 'refs/changes/...' link. A red arrow labeled '3' points to the 'refs/changes/...' link for the 'Checkout' action. A red arrow labeled '4' points to the '20cbd75' hash in the 'Patch-File' row.

```
# git fetch ... && git checkout -b b_new_patch FETCH_HEAD # checkout patch (#1, #2, #3)
# git cherry-pick {my patch} # apply new patch on top
# git log # verify old commit hash is same (#4)
# git push ... HEAD:refs/for/master # push new patch to Gerrit
```

- **Do not rebase** new branch onto latest parent before submitting
 - Original developer should rebase or land their patch first
- Can also do simple rebase in Gerrit with [Rebase] button
 - "Change parent revision" and specify patch number
 - Cannot resolve patch conflicts directly in Gerrit



The screenshot shows the 'Code Review - Rebase Change' dialog box. At the top, there are buttons: 'Move Change', 'Rebase', 'Abandon', and 'Delete Change'. The 'Rebase' button is selected. Below the buttons, there is a checkbox labeled 'Change parent revision' which is checked. Below the checkbox, there is a text input field containing the number '12345'. At the bottom, there are buttons for 'Rebase' and 'Cancel'.

Searching in Git

- `git diff [-w]` # show current change (no whitespace changes)
- `git diff --cached` # show "git add" changes already are staged for commit
- `git log [BRANCH|PATH]` # show commits (branch/dir/file)
- `git log -S STRING` # search changes in **patches** that add/remove specific string
- `git log -S STRING --patch` # show patch for each matching commit found
- `git log --grep REGEXP` # search **commit messages** with regular expression
- `git grep REGEXP` # show all **files in repository** with regular expression
- `git show [-w] [COMMIT]` # show latest (specific) commit (ignore whitespace differences)
- `git describe [COMMIT]` # name [of COMMIT] relative to tag (e.g. v2_14_57-26-g54d4cca6)

Finding Change History of Code

- Shows last commit that modified each line in a file

```
# git blame lustre/obdclass/class_obd.c
```

```
:
```

```
52257a67e4d (Liu Xuezhao      2012-07-10 21:13:26 +0800  96)
829dd8b39a8 (Nathan Rutman   2009-05-28 00:00:48 +0000  97)
7817e4c785d (John L. Hammond 2015-01-11 11:56:32 -0500  98)
5707f919e41 (James Simmons   2013-09-27 10:24:42 -0400  99)
5707f919e41 (James Simmons   2013-09-27 10:24:42 -0400 100)
54d4cca6cb0 (Arshad Hussain  2021-03-21 06:32:07 +0530 101)
```

- Show history of commits *before* a specific commit, ignore whitespace changes


```
# git blame -w lustre/obdclass/class_obd.c COMMIT~1
```

- Show patches landed between specific dates (with margin to account for time zones)

```
# git log --after 2022-09-10 --before 2022-09-13
```


Gerrit Searching Shortcut in Firefox

- ▶ Searching for patches is fairly flexible
 - A few basic keywords are useful to know
 - Many options available (state, content, age, reviews)
 - Default to search for word in commit message
- open change #12345
`review 12345`
- find commit messages for specific text
`review LU-12250`
- find merged patches owned by specific user
`review owner:bzzz is:merged`
- find open patches modifying specific file
`review file:lustre_idl.h is:open`

 **Edit bookmark**

Name

URL

Tags
 

Use tags to organize and search for bookmarks from the address bar

Keyword

Use a single keyword to open bookmarks directly from the address bar

<https://review.whamcloud.com/Documentation/user-search.html>

What To Do When Things Go Wrong

- ▶ Old commits/branches remain in the repository (until garbage collection)

```
# git reflog
```

```
3c96fb6 HEAD@{9}: rebase: LU-11721 tests: enable full debugging for sanity
da6cf33 HEAD@{1}: commit: LU-2468 libcfs: quiet debug messages
0b3e852 HEAD@{2}: checkout: moving from b_cleanup9 to b_cleanup7
5ea4d20 HEAD@{3}: rebase finished: returning to refs/heads/b_cleanup9
5ea4d20 HEAD@{4}: rebase: LU-1798 tests: don't set jobid if not changing
0b3e852 HEAD@{5}: checkout: moving from b_cleanup9 to 0b3e852a58^0
```

- ▶ If things go really badly, you can abort rebase/am and start again

```
# git rebase --abort
```

Extracting and Sharing Changes

- ▶ Default values from `$HOME/.gitconfig`
- ▶ Also from `.git/config` in local repos

```
[user]
    name = Andreas Dilger
    email = adilger@whamcloud.com
[sendemail]
    smtpserver = mail.shaw.ca
    smtpserverport = 25
    confirm = compose
[core]
    abbrev=10
[pretty]
    fixes=Fixes: %h ("%s")
[format]
    pretty=fuller
```



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Thank You