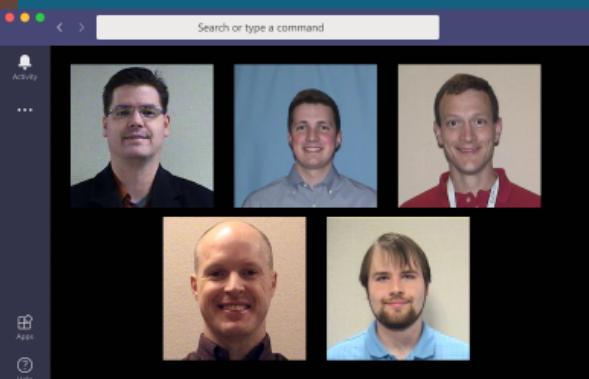
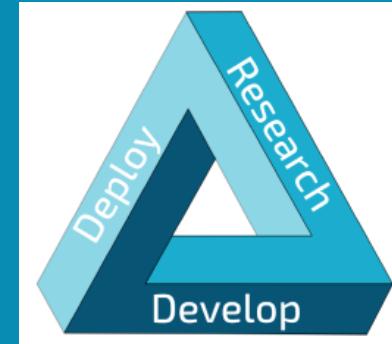




A Common Tool for Building Trilinos: Introduction to GenConfig



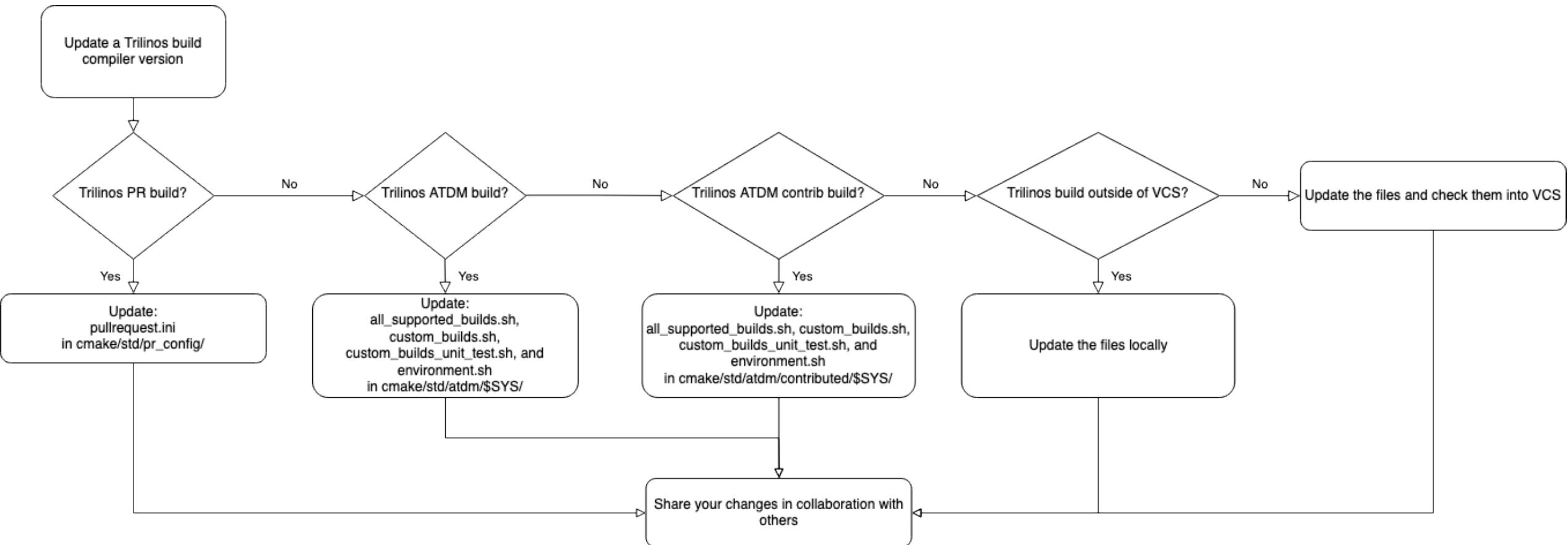
PRESENTED BY

Evan Harvey, Joshua Braun, James Willenbring



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Current approach to configuring Trilinos



This is complicated... I'll just send an email asking someone to update the compiler version.

Introduction to GenConfig



- Environment and cmake script tied to string
 - Complete configuration: *complete_config*
- Written in Python and unit-tested via pytest
 - 99% line coverage
- Offers two interfaces: CLI and API
 - CLI: *gen-config.sh*
 - API: class *gen_config.GenConfig*

How GenConfig uses LoadEnv



- LoadEnv also written in Python and unit-tested via pytest
 - 98% line coverage
- Environment tied to a
 - Complete environment name: *complete_env*
 - Note: *complete_config* begins with *complete_env*
- GenConfig loads environment via *class load_env.LoadEnv*
 - CLI: *gen-config.sh* modifies user's subshell
 - API: *gen_config.py* modifies python process



Developer use-case (gen-config.sh)

```
[josbrau@weaver11 build]$ source ~/GenConfig/gen-config.sh --list-configs
Using system 'rhel7' based on matching hostname 'weaver11'.

=====
| INFO: Please select one of the following complete configurations from
| /home/josbrau/GenConfig/examples/trilinos/config-specs.ini

- rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_no-uvm_pr-framework
- rhel7_sems-gnu-7.2.0-openmpi-1.10.1-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-gnu-7.2.0-serial_release-debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-gnu-7.2.0-openmpi-1.10.1-serial_release-debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_pr
- rhel7_sems-gnu-7.2.0-openmpi-1.10.1-serial_release-debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-gnu-8.3.0-openmpi-1.10.1-openmp_release-debug_static_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_pr
- rhel7_sems-gnu-8.3.0-openmpi-1.10.1-openmp_release-debug_static_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-clang-7.0.1-openmpi-1.10.1-serial_release-debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-clang-9.0.0-openmpi-1.10.1-serial_release-debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-clang-10.0.0-openmpi-1.10.1-serial_release-debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling_release_static_Volta70_Power9_no-asan_complex_fpic_mpi_pt_no-rdc_no-uvm_no-package-enables
- rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling_release_static_Volta70_Power9_no-asan_complex_fpic_mpi_pt_no-rdc_uvm_no-package-enables
- rhel7_sems-intel-17.0.1-mpich-3.2-serial_release-debug_static_no-kokkos-arch_no-asan_no-complex_fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
- rhel7_sems-intel-19.0.5-mpich-3.2-serial_release-debug_static_no-kokkos-arch_no-asan_no-complex_fpic_mpi_no-pt_no-rdc_no-uvm_no-package-enables
| -----
+=====
```

-----[Examples]-----

NOTE: In each of the following examples, GenConfig first runs LoadEnv to load the correct environment.

Run CMake Using Configure Flags from GenConfig:

```
source /path/to/gen-config.sh \
<build-name> \
/path/to/src
```

NOTE: /path/to/src must always be specified as the last command line argument UNLESS the --cmake-fragment flag is used.

Save CMake Fragment File to Use with CMake:

```
source /path/to/gen-config.sh \
--cmake-fragment foo.cmake \
<build-name>

cmake -C foo.cmake /path/to/src
```



Developer use-case (gen-config.sh)

```
[josbrau@weaver11 build]$ source ~/GenConfig/gen-config.sh --cmake-fragment cuda_10_1_105.cmake \
>   rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling_release_static_Volta70_Power9_no-asan_complex_fpic_mpi_pt_no-rdc_uvm_no-package-enables
```

```
-----[ Examples ]-----  
NOTE: In each of the following examples, GenConfig first runs  
LoadEnv to load the correct environment.
```

```
Run CMake Using Configure Flags from GenConfig:
```

```
source /path/to/gen-config.sh \  
<build-name> \  
>/path/to/src
```

```
NOTE: /path/to/src must always be specified as the last command  
line argument UNLESS the --cmake-fragment flag is used.
```

```
Save CMake Fragment File to Use with CMake:
```

```
source /path/to/gen-config.sh \  
--cmake-fragment foo.cmake \  
<build-name>  
  
cmake -C foo.cmake /path/to/src
```

Developer use-case (gen-config.sh)

```
[josbrau@weaver11 build]$ source ~/GenConfig/gen-config.sh --cmake-fragment cuda_10_1_105.cmake \
>   rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling_release_static_Volta70_Power9_no-asan_complex_fpic_mpi_pt_no-rdc_uvm_no-package-enables
```

```
*****
ENVIRONMENT LOADED SUCCESSFULLY
*****
*****  
TYPE exit TO LEAVE THE ENVIRONMENT
*****  
*****  
BEGIN CONFIGURATION
*****  
  
Please run:  
$ cmake -C /path/to/fragment.cmake /path/to/src  
  
where "/path/to/fragment.cmake" is replaced with your generated cmake fragment file  
and "/path/to/src" is replaced with your build source.  
  
(rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling) $ ls  
cuda_10_1_105.cmake  
(rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling) $ cmake -C cuda_10_1_105.cmake ~/Trilinos/
```

```
-----[ Examples ]-----  
  
NOTE: In each of the following examples, GenConfig first runs  
LoadEnv to load the correct environment.  
  
Run CMake Using Configure Flags from GenConfig:  
  
source /path/to/gen-config.sh \  
<build-name> \  
>/path/to/src  
  
NOTE: /path/to/src must always be specified as the last command  
line argument UNLESS the --cmake-fragment flag is used.  
  
Save CMake Fragment File to Use with CMake:  
  
source /path/to/gen-config.sh \  
--cmake-fragment foo.cmake \  
<build-name>  
  
cmake -C foo.cmake /path/to/src
```

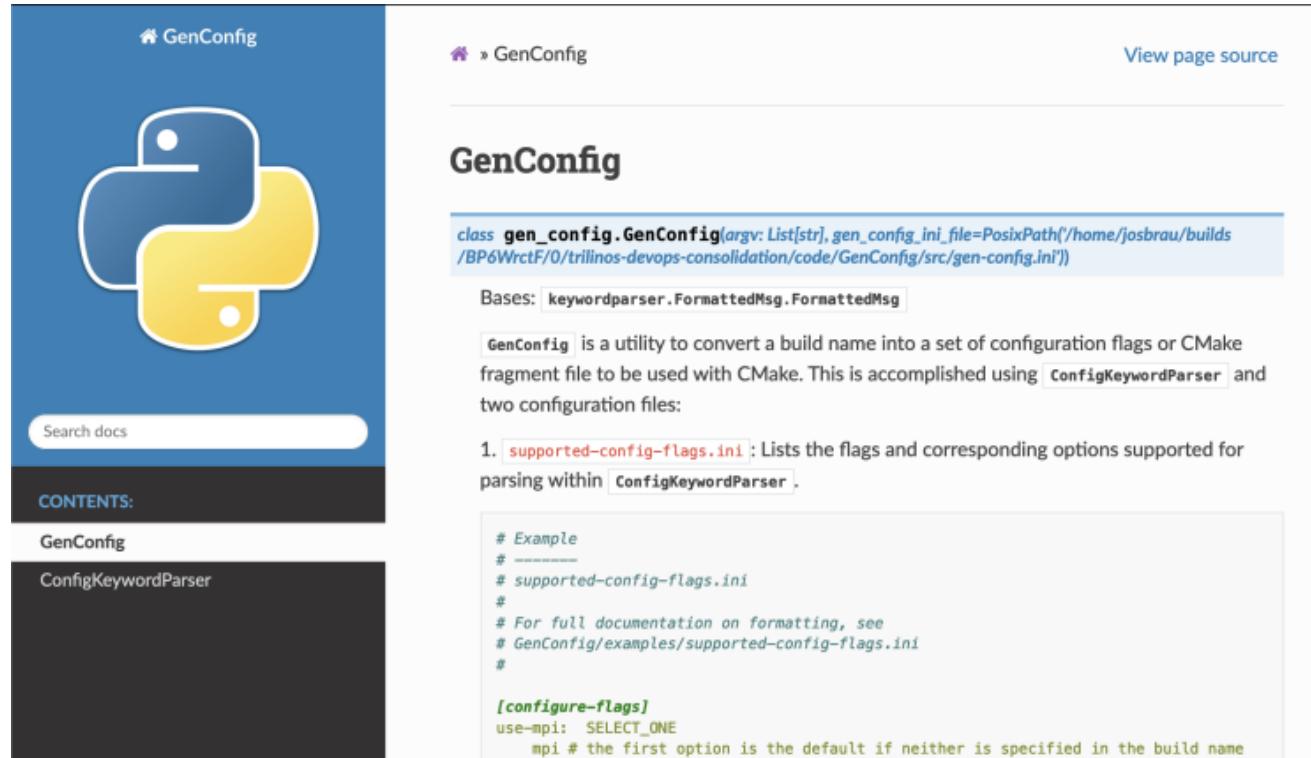
- GenConfig uses LoadEnv to put the user into a subshell with the right environment loaded.

8 PR testing use-case (class gen_config.GenConfig)

```
# example.py
from gen_config import GenConfig

build_name = "rhel7_cuda-10.1.105-gnu-7.2.0-spmipi-rolling_release_static_Volta70_Power9_no-asan_complex_fpic_mpi_pt_no-rdc_uvm_no-package-enables"
gc = GenConfig(["--cmake-fragment", "cuda_10_1_105.cmake", build_name])
gc.write_cmake_fragment()
```

More information in the GenConfig class documentation:



GenConfig

View page source

GenConfig

```
class gen_config.GenConfig(argv: List[str], gen_config_ini_file=PosixPath('/home/josbrau/builds/BP6WrctF/0/trilinos-devops-consolidation/code/GenConfig/src/gen-config.ini'))
```

Bases: `keywordparser.FormattedMsg.FormattedMsg`

`GenConfig` is a utility to convert a build name into a set of configuration flags or CMake fragment file to be used with CMake. This is accomplished using `ConfigKeywordParser` and two configuration files:

1. `supported-config-flags.ini`: Lists the flags and corresponding options supported for parsing within `ConfigKeywordParser`.

```
# Example
# -----
# supported-config-flags.ini
#
# For full documentation on formatting, see
# GenConfig/examples/supported-config-flags.ini
#
[configure-flags]
use-mpi: SELECT_ONE
mpi # the first option is the default if neither is specified in the build name
```

Introduction to config-specs.ini



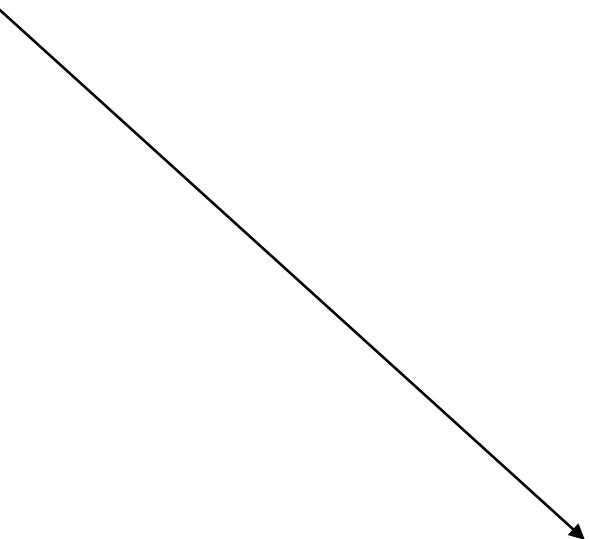
- Single file where every *complete_config* is defined
- Focuses on:
 - human readability
 - reusability
- For example, this is the config for the *python-3* PR job:

```
1139 [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140 use RHEL7_SEMS_COMPILER|GNU_
1141 use NODE-TYPE|SERIAL_
1142 use BUILD-TYPE|DEBUG_
1143 use RHEL7_SEMS_LIB-TYPE|SHARED_
1144 use KOKKOS-ARCH|NO-KOKKOS-ARCH_
1145 use RHEL7_SEMS_USE-ASAN|NO_USE-FPIC|NO_USE-MPI|NO_USE-PT|NO_PACKAGE-ENABLES|PR-FRAMEWORK_
1146 use USE-COMPLEX|NO_
1147 use USE-RDC|NO_
1148
1149 use COMMON_
```

Introduction to config-specs.ini



- *complete_config*



```
1139 [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140 use RHEL7_SEMS_COMPILER|GNU_
1141 use NODE-TYPE|SERIAL_
1142 use BUILD-TYPE|DEBUG_
1143 use RHEL7_SEMS_LIB-TYPE|SHARED_
1144 use KOKKOS-ARCH|NO-KOKKOS-ARCH_
1145 use RHEL7_SEMS_USE-ASAN|NO_USE-FPIC|NO_USE-MPI|NO_USE-PT|NO_PACKAGE-ENABLES|PR-FRAMEWORK_
1146 use USE-COMPLEX|NO_
1147 use USE-RDC|NO_
1148
1149 use COMMON_
```

Introduction to config-specs.ini



- *complete_env*

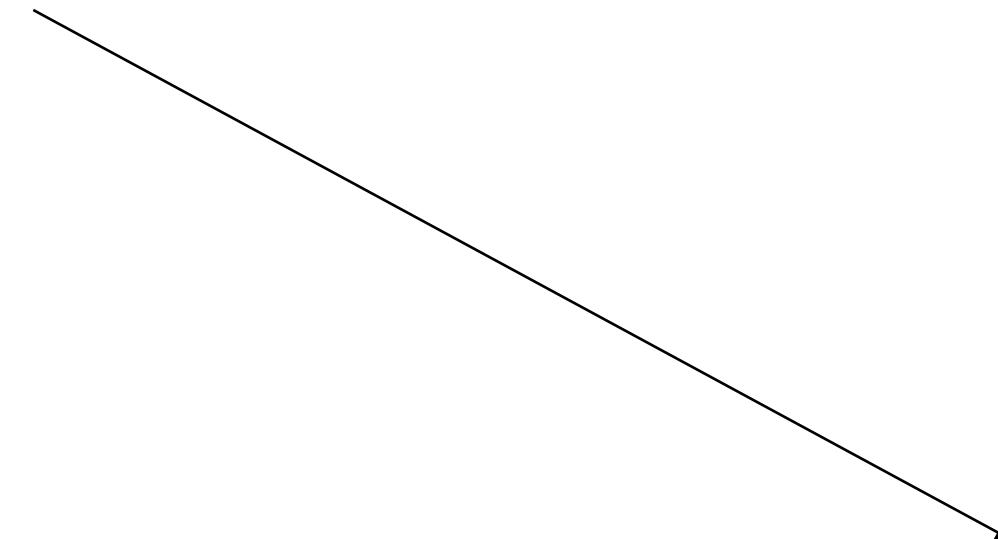


```
1139 [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140 use RHEL7_SEMS_COMPILER|GNU_
1141 use NODE-TYPE|SERIAL_
1142 use BUILD-TYPE|DEBUG_
1143 use RHEL7_SEMS_LIB-TYPE|SHARED_
1144 use KOKKOS-ARCH|NO-KOKKOS-ARCH_
1145 use RHEL7_SEMS_USE-ASAN|NO_USE-FPIC|NO_USE-MPI|NO_USE-PT|NO_PACKAGE-ENABLES|PR-FRAMEWORK_
1146 use USE-COMPLEX|NO_
1147 use USE-RDC|NO_
1148
1149 use COMMON_
```

Introduction to config-specs.ini



- Configure flags



```
1139 [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140 use RHEL7_SEMS_COMPILER|GNU_
1141 use NODE-TYPE|SERIAL_
1142 use BUILD-TYPE|DEBUG_
1143 use RHEL7_SEMS_LIB-TYPE|SHARED_
1144 use KOKKOS-ARCH|NO-KOKKOS-ARCH_
1145 use RHEL7_SEMS_USE-ASAN|NO_USE-FPIC|NO_USE-MPI|NO_USE-PT|NO_PACKAGE-ENABLES|PR-FRAMEWORK_
1146 use USE-COMPLEX|NO_
1147 use USE-RDC|NO_
1148
1149 use COMMON_
```

Introduction to config-specs.ini



- Common code for ‘debug’ build type:

```
409 [BUILD-TYPE|DEBUG]
410 opt-set-cmake-var CMAKE_BUILD_TYPE           STRING : DEBUG
411 opt-set-cmake-var Trilinos_ENABLE_DEBUG      BOOL   : ON
412 # Intrepid2 will not build with bounds check enabled:
413 # coreKokkos_Array.hpp:152:57: error: array subscript is below array bounds [-Werror=array-bounds]
414 opt-set-cmake-var Kokkos_ENABLE_DEBUG_BOUNDS_CHECK BOOL : OFF
415 opt-set-cmake-var Kokkos_ENABLE_DEBUG          BOOL : ON
```

- Build type flag

```
1139 [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140 use RHEL7_SEMS_COMPILER|GNU_
1141 use NODE-TYPE|SERIAL_
1142 use BUILD-TYPE|DEBUG_
1143 use RHEL7_SEMS_LIB-TYPE|SHARED_
1144 use KOKKOS-ARCH|NO-KOKKOS-ARCH_
1145 use RHEL7_SEMS_USE-ASAN|NO_USE-FPIC|NO_USE-MPI|NO_USE-PT|NO_PACKAGE-ENABLES|PR-FRAMEWORK_
1146 use USE-COMPLEX|NO_
1147 use USE-RDC|NO_
1148
1149 use COMMON_
```

Changing config-specs.ini to use a new build type



Draft: Tug16 config spec demo

Overview 0 Commits 1 Pipelines 1 Changes 1



Compare

master

and

latest version



1 file

+2

-2



examples/trilinos/config-specs.ini



+2 -2

[Show all unchanged lines](#) [Show 20 lines](#)

1136	1136	
1137	1137	# Full configurations intended to be loaded.
1138	1138	
1139		- [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
	1139	+ [rhel7_sems-gnu-7.2.0-anaconda3-serial_release_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140	1140	use RHEL7_SEMS_COMPILER GNU
1141	1141	use NODE-TYPE SERIAL
1142		- use BUILD-TYPE DEBUG
	1142	+ use BUILD-TYPE RELEASE
1143	1143	use RHEL7_SEMS_LIB-TYPE SHARED
1144	1144	use KOKKOS-ARCH NO-KOKKOS-ARCH
1145	1145	use RHEL7_SEMS_USE-ASAN NO_USE-FPIC NO_USE-MPI NO_USE-PT NO_PACKAGE-ENABLES PR-FRAMEWORK

[Show 20 lines](#) [Show all unchanged lines](#)

Changing config-specs.ini to use a new build type



Draft: Tug16 config spec demo

Overview 0 Commits 1 Pipelines 1 Changes 1



Compare

master

and

latest version



1 file +2 -2



examples/trilinos/config-specs.ini

+2 -2



[↓ Show all unchanged lines](#) [↑ Show 20 lines](#)

1136	1136	
1137	1137	# Full configurations intended to be loaded.
1138	1138	
1139		- [rhel7_sems-gnu-7.2.0-anaconda3-serial_debug_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
	1139	+ [rhel7_sems-gnu-7.2.0-anaconda3-serial_release_shared_no-kokkos-arch_no-asan_no-complex_no-fpic_no-mpi_no-pt_no-rdc_pr-framework]
1140	1140	use RHEL7_SEMS_COMPILER GNU
1141	1141	use NODE-TYPE SERIAL
1142		- use BUILD-TYPE DEBUG
	1142	+ use BUILD-TYPE RELEASE
1143	1143	use RHEL7_SEMS_LIB-TYPE SHARED
1144	1144	use KOKKOS-ARCH NO-KOKKOS-ARCH
1145	1145	use RHEL7_SEMS_USE-ASAN NO_USE-FPIC NO_USE-MPI NO_USE-PT NO_PACKAGE-ENABLES PR-FRAMEWORK

[↓ Show 20 lines](#) [↑ Show all unchanged lines](#)

Changing config-specs.ini causes test failures



Draft: Tug16 config spec demo

Overview 0 Commits 1 Pipelines 1 Changes 1

Request to merge [tug16_config_spec_d...](#) into [master](#)

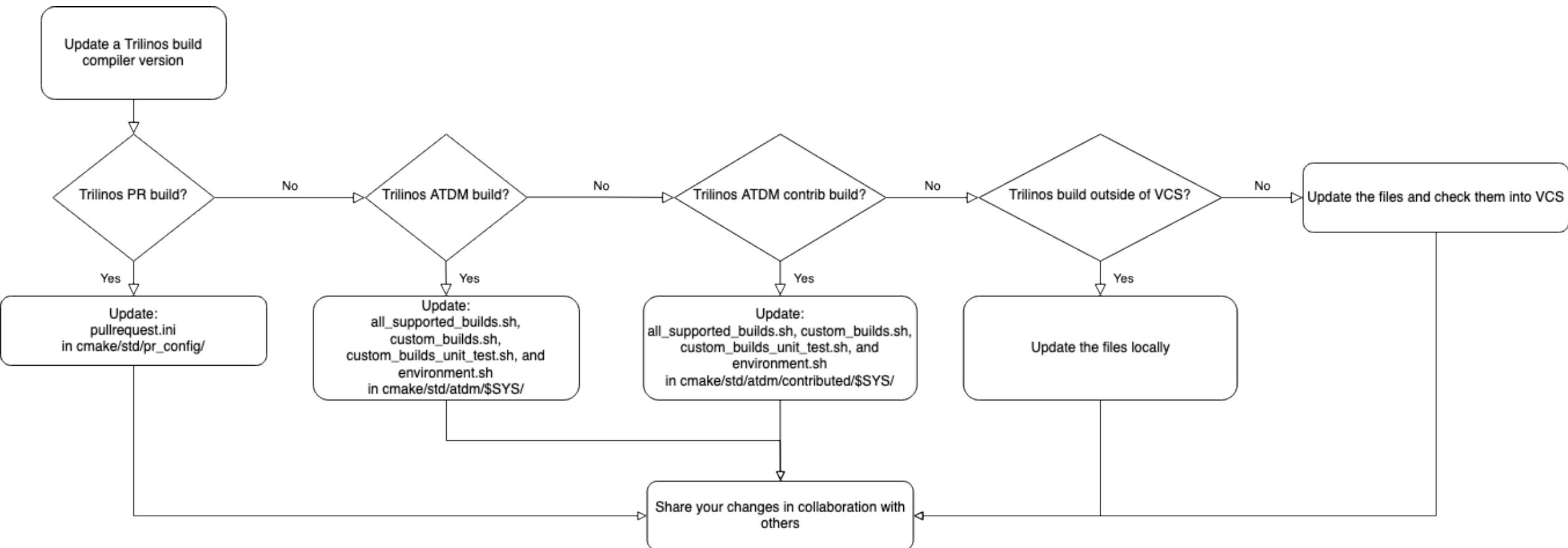
[Open in Web IDE](#) [Check out branch](#) [Download](#)

✖ Pipeline #13882 failed for [edad408c](#) on [tug16_config_spec_d...](#)

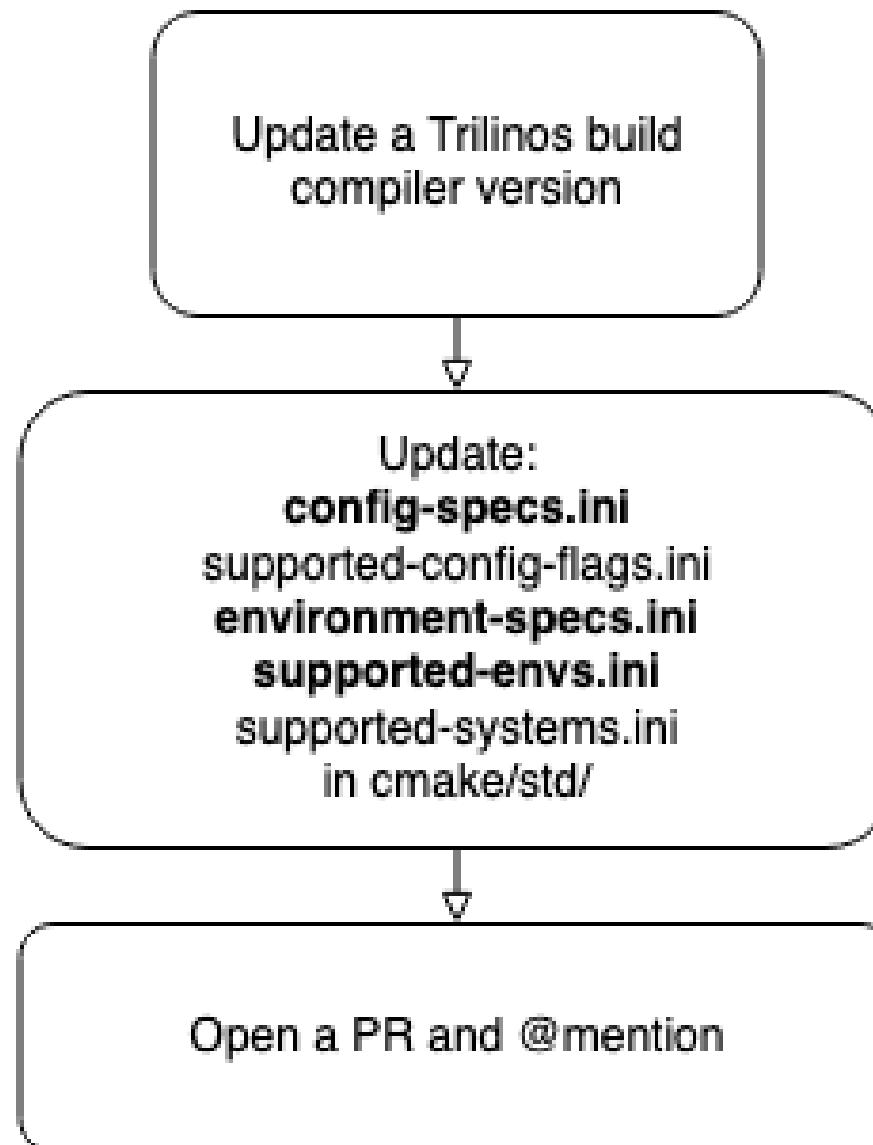
Since config-specs.ini is verified via pytest, the change causes this test failure:

```
154 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_all_configs_are_in_map FAILED [ 87%]
155 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_clang_10_0_0_openmpi_1_10_1_serial_release_debug_shared_no_kokkos_arch_no_asan_no_complex_no_fpic_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 88%]
156 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_gnu_7_2_0_anaconda3_serial_debug_shared_no_kokkos_arch_no_asan_no_complex_no_fpic_no_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 90%]
157 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_gnu_7_2_0_openmpi_1_10_1_serial_release_debug_shared_no_kokkos_arch_no_asan_no_complex_no_fpic_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 91%]
158 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_gnu_7_2_0_serial_release_debug_shared_no_kokkos_arch_no_asan_no_complex_no_fpic_no_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 92%]
159 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_gnu_8_3_0_openmpi_1_10_1_openmp_release_debug_static_no_kokkos_arch_no_asan_no_complex_no_fpic_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 93%]
160 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_intel_17_0_1_mpich_3_2_serial_release_debug_static_no_kokkos_arch_no_asan_no_complex_fpic_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 95%]
161 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_rhel7_configs::test_rhel7_sems_intel_19_0_5_mpich_3_2_serial_release_debug_static_no_kokkos_arch_no_asan_no_complex_fpic_mpi_no_pt_no_rdc_no_package_enables SKIPPED [ 96%]
162 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_ats2_configs::test_all_configs_are_in_map PASSED [ 97%]
163 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_ats2_configs::test_ats2_cuda_10_1_243_gnu_8_3_1_spmi_rolling_release_static_Volta70_Power9_no_asan_no_complex_no_fpic_mpi_pt_no_rdc_no_package_enables SKIPPED [ 98%]
164 tests/verification_tests/test_verify_trilinos_configs.py::Test_verify_ats2_configs::test_ats2_cuda_10_1_243_gnu_8_3_1_spmi_rolling_release_static_Volta70_Power9_no_asan_no_complex_no_fpic_mpi_pt_rdc_no_package_enables SKIPPED [100%]
165 ===== FAILURES =====
166 Test_verify_rhel7_configs.test_all_configs_are_in_map
```

Old use-case



New use-case: ini files as a common language



How GenConfig supports collaboration via ini files



- Parses single file: config-specs.ini
- Documentation resides in config-specs.ini
- Supports developer use-case:
 - Dev gets something working locally
 - Copy and paste into ini files under VCS
 - GenConfig takes care of translation
 - No need to translate from a cmake command line or cmake fragment file
- Rather than a potentially ambiguous email, config-specs.ini provides a testable common language

Special thanks to

- Dena Vigil
- Roscoe Bartlett
- Jason Gates
- David Collins
- Trilinos Framework Team

