UPDATE OF THE LINEAR COLLIDER

Software Infrastructure

A Love Story between a Parrot and a Whale

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Outline

- AFS phaseout
- The Past
- Current status of Infrastructure
- Plans and open issues
- New hardware resources

Migration AFS → CVMFS and EOS

- Concern for the long term viability of the OpenAFS project
- Maintenance continues but little new investment
- Phase out AFS by LS2

AFS	CVMFS	EOS
Webpages		✓
iLCSoft releases	✓	
iLCSoft tar balls		✓
Test beam data		✓
DIRAC	✗	
Generic software	✓	

- DIRAC: establish everyone can access `/cvmfs/clicdp.cern.ch/`
- Some legacy activity still in AFS, but no write activity

The Past (1/2)

ABOUT

You can customize this short message in the index.tmpl of this template in order to tell your visitors what they find in your repositories.

Visit **www.websvn.info** for more information about WebSVN.

Learn more about Subversion at **subversion.tigris.org**.

SUBVERSION REPOSITORIES

EuXFEL		
Editing	Rev 0	
mtca4u_applications		
ad16	Rev 79	304d 09h
DOOCS_Adapter	Rev 145	284d 04h
matlab_tools	Rev 113	289d 07h
General		
afsadmin	Rev 337	275d 06h
afsbackup	Rev 31	372d 03h
aidasoft	Rev 2338	166d 06h
alfa_sw	Rev 27	627d 08h
alibavasoft	Rev 221	583d 00h
astrofit	Rev 207	1018d 03h
AtlasSiliconUpgrade	Rev 184	221d 07h
b2vxd_testbeam	Rev 238	3d 07h
Baskaran	Rev 10	1277d 06h
bbq	Rev 135	99d 08h
bbrtrack	Rev 8	3825d 05h
BCM1F	Rev 231	821d 02h
benchmark_yangsuli	Rev 86	3091d 11h
boojum	Rev 8	1151d 08h
brahms	Rev 91	4062d 22h

⋮

- All software hosted at DESY
- Distributed via SVN
- Was good solution for its time
- Lacking several modern attributes:
  - Uncontrolled committing
  - No review of code
  - No testing
  - No handle on regressions
  - No diagnostics

The Past (2/2)

- Testing via nightly builds
- Only detect errors after buggy code has been injected

CDash projects

Dashboards

Project	Description	Last activity
DD4hep	Detector Geometry Description for HEP	13 hours ago
DD4hepExamples	Examples shipped with DD4hep - built as a standalone project for testing.	11 hours ago
lcgeo	Lineaer Collider detector geometry description based on DD4hep	12 hours ago

Show all 23 projects

Kitware CDash 2.0.2 © Kitware | Report problems | 1.5Gb

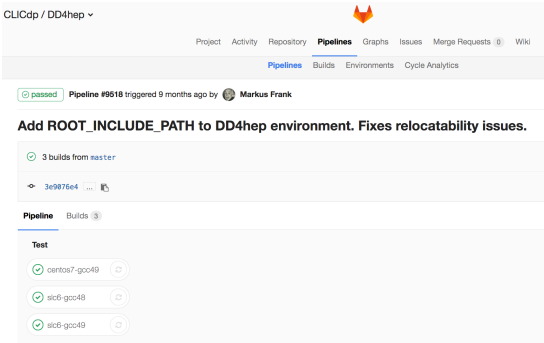
Nightly

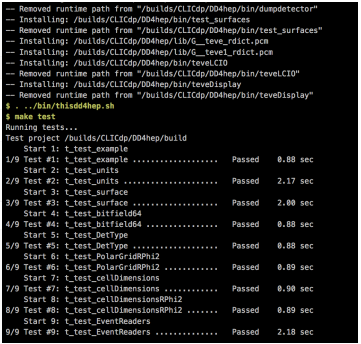
Site	Build Name	Update	Configure		Build		Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass	
ilcsoft_build_sl6.desy.de	Linux-2.6.32-573.12.1.el6.x86_64-/afs/cern.ch/sw/lcg/contrib/gcc/4.9.3/x86_64-slc6/bin/g++-Debug		0	0	0	50	0	0	10	14 hours ago

The DD4hep Showcase

Immediate testing is good

- New computing resources dedicated to testing
  - 12 × 4 code instances, 2 GB / core RAM
- Mirror DD4hep every few minutes to CERN/Gitlab and run tests





- Introduced “real time” testing on SLC6 and CC7 with gcc 4.8(9)

The DD4hep Migration (1/2)

Testing before is even better

- Move DD4hep repository from DESY to Github
- Use Pull Requests to put code into repository

Add deprecated attributes ✓ — 2
#117 by andresailer was merged 2 days ago

Fix problem with DetElement transformations. ✓ — 12
#115 by MarkusFrankATcernch was merged 3 days ago

Add GuineaPigReader from lcgeo ✓
#113 by andresailer was merged 4 days ago

cmake: set_compiler_flags: improve checking of variables ✓
#112 by andresailer was merged 4 days ago

Update to allow the externalization of the XML and the ComponentProp... ✓
#111 by MarkusFrankATcernch was merged 6 days ago

multiple vertices per interaction continued ✓ — 4
#110 by gaede was merged 5 days ago

The DD4hep Migration (2/2)

Testing before is even better

- Code review
- Utilise Travis-CI to run test
  - 2 Cores and 40 min available for free

```
-- Configuring done
-- Generating done
-- Build files have been written to: /DD4hep/build
[155/521] Building CXX object DDCore/C...ore.dir/src/VolumeManagerInterna.cpp.o
../DDCore/src/VolumeManagerInterna.cpp: In constructor
'DD4hep::Geometry::VolumeManagerContext::VolumeManagerContext()':
../DDCore/src/VolumeManagerInterna.cpp:26:32: warning: 'DD4hep::Geometry::VolumeManagerContext::mask' is
deprecated: This member variable might get axed if it is not used, please tell us if you do [-Wdeprecated-
declarations]
    : identifier(0), mask(~0x0ULL) {
                                   ^
In file included from ../DDCore/src/VolumeManagerInterna.cpp:17:0:
../DDCore/include/DD4hep/objects/VolumeManagerInterna.h:61:16: note: declared here
        VolumeID mask;
                 ^~~~
../DDCore/src/VolumeManagerInterna.cpp:26:32: warning: 'DD4hep::Geometry::VolumeManagerContext::mask' is
deprecated: This member variable might get axed if it is not used, please tell us if you do [-Wdeprecated-
declarations]
    : identifier(0), mask(~0x0ULL) {
                                   ^
In file included from ../DDCore/src/VolumeManagerInterna.cpp:17:0:
../DDCore/include/DD4hep/objects/VolumeManagerInterna.h:61:16: note: declared here
        VolumeID mask;
                 ^~~~
```

gaede commented 18 days ago — Member

@MarkusFrankATcernch please check logic in `c6a818f`.

petricm reviewed 18 days ago — View changes

DDG4/lcio/LCIOEventReader.cpp — Hide outdated

```
@@ -146,11 +146,10 @@ LCIOEventReader::readParticles(int event_number,
146  146        vtx->y = p->vsy ;
147  147        vtx->z = p->vsz ;
148  148        vtx->time = p->time ;
149     -      haveVertex = false ;
     149 +      haveVertex = true ;
```

petricm 18 days ago — Member

This does not change anything. In line 86 `bool haveVertex = true ;` subsequently if the `if( !haveVertex && genStatus == 1 ){` is always false as describes in CID 1402993. You have to change `if( !haveVertex && genStatus == 1 ){` to `if( haveVertex && genStatus == 1 ){` to address this.

- Due to time constrains from Travis run only type of build SLC6 with gcc 6.2

Implementation

- Travis-CI offers Ubuntu, but we don't want this
- Use Dockerized version of CernVM
  - Docker → additional layer of operating-system-level virtualization
  - CernVM + parrot connector to access CVMFS
  - All dependent software in CVMFS (quick migration)
- Due to time limit only try to build software in Travis-CI
- Post merging sync to Gitlab and run more tests
  - No time limit, use own 12 instances
  - Again use Docker for different systems SLC6 and CC7
  - Test different compilers GCC 6.2 and LLVM/Clang 3.9
  - Purchased Mac hardware to test on Mac
  - All dependencies centrally in CVMFS
- Successfully established continuous QA for DD4hep → iLCSoft

iLCSoft migration

iLCSoft	Build Status	Doxygen
CED	build unknown	
CEDViewer	build unknown	
CLICPerformance	build passing	
Clupatra	build passing	
CondDBMySQL	build unknown	
ConformalTracking	build unknown	
DDKalTest	build unknown	
DDMarlinPandora	build passing	
FastJetClustering	build unknown	
ForwardTracking	build unknown	
GEAR	build unknown	
iLCInstall	build unknown	
iLCUtil	build unknown	
ILDConfig	build unknown	
ILDPerformance	build unknown	
KalDet	build unknown	
KalTest	build unknown	
KiTrack	build unknown	
KiTrackMarlin	build unknown	
LCCD	build unknown	
LCFIPlus	build passing	
LCFIVertex	build unknown	
lcgeo	build passing	
LCIO	build passing	
LCTuple	build unknown	
Marlin	build passing	
MarlinDD4hep	build passing	
MarlinFastJet	build passing	
MarlinKinfit	build unknown	
MarlinKinfitProcessors	build unknown	
Overlay	build passing	
FCALSW	**Build Status**	**Doxygen**
FCalClusterer	build passing	

- After success of DD4hep do same to iLCSoft
- Identify all code authors for whole iLCSoft history
- Use GPL v3 to license code
- Packagevise migrate to https://github.com/iLCSoft/
- Migrated 13 of 34 packages
- To test package need “recent” version of iLCSoft due to dependencies
  - Nightly build of iLCSoft deployed to CVMFS
  - Use same Travis-CI mechanism as in DD4hep
- Elimination of all warnings from several packages
- Ensure better code quality
- Check status of migration at http://ilcsoft.github.io/

iLCSoft builds

- For rapid development enable snapshot build
- Not real releases, but status on date
- Available under `/cvmfs/clicdp.cern.ch/iLCSoft/builds/`

```
2016-02-02  2016-07-04  2016-09-27  2016-11-24  2017-02-17
2016-04-06  2016-08-22  2016-11-09  2016-12-15  current
2016-06-22  2016-09-12  2016-11-22  2017-02-02  nightly
```

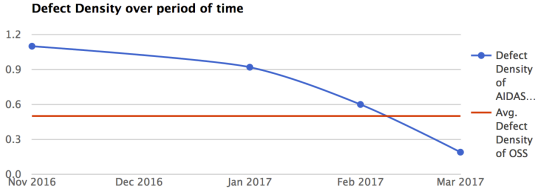
- All builds available in iLCDirac for mass production
- Access to nightly build for development

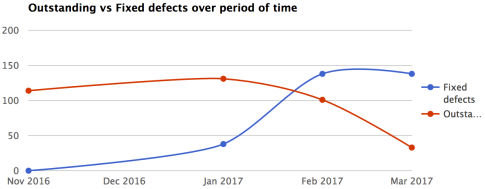
Code Analysis

- Open Source → free access to Coverity
- Coverity is a static code analysis and dynamic code analysis tool
- Pair all packages with Coverity and examine defects

```
4. overflow: Add operation overflows on operands 9UL and siz_nam . Example value for operand: siz_nam = 18446744073709551607.
CID 1398170 (#3-1 of 4): Overflowed array index write (INTEGER_OVERFLOW)
5. overflow_sink: Overflowed or truncated value (or a value computed from an overflowed or truncated value) 9UL + siz_nam used as array index.
159        text[8] = text[9+siz_nam] = text[10+siz_nam+siz_add] = 0;
```

- DD4hep: eliminated 138/171 code defects





- Due to new structure harder to introduce new defects
- Already deployed to some packages

Future Plans

- Transition all code to Github
- Equip all packages with CI and code analysis
- Integration builds testing on commit basis
- Memory consumption analytics
- Extension of the test suite

New Hardware resources

- Investment in Deep Learning system
- 2x Intel Xeon (40 Cores), 4× GeForce GTX 1080, 256GB RAM and 2 TB disk

- System in deployment, will be made accessible to collaboration members with appropriate projects (calorimetry, flavour tagging...)
- Procedures to be communicated once the system is in production

Summary

- Transitioned nearly all software to CVMFS (AFS deprecated)
- Transitioned DD4hep and iLCSoft to Github
- Imposed comprehensive testing system
  - Code review
  - Testing
- Improved code quality and minimized regressions
- Work to migrate all iLCSoft still ongoing
  - Scheduled to be finished in LC Hands On Week
- Testing infrastructure open to all members (used by allpix2)
  - Contact us if you want to take part
- New GPU hardware soon to be available to users for physics analysis