The State of ROOT

http://root.cern
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Stats since Okinawa

- v6.04: June, 2015; v6.06: Dec, 2015; v6.08: Oct, 2016; ROOT 5 frozen
- 1150 new bugs, 850 resolved
- Forum: 14k posts in 18 months, now 10k users
Stats since Okinawa (2)

- >5k commits
- About 90 authors
- >200 pull requests @ github.com/root-mirror
  - with 34 open ones

Word cloud of commit logs
News

- New-style interfaces: `#include "ROOT/TFoo.hxx", ROOT::TFoo`
- Started to deprecate interfaces
- New web site
Core

- Pulling in std::string_view, std::array_view, std::apply from the future

- Support for builds with C++ modules (clang only) - thanks, US-CMS!

- ROOT::TSeq: integer range a la python xrange;
  ROOT::TThreadedObject: one object per thread, merge on demand

- **Still coming**: thread safe ROOT memory management ("list of cleanups"), const == thread safe
I/O, Dictionaries

• New C++ types for I/O: unique_ptr, array, tuple (already had unordered_* , forward_list)

• Memory reduction; more thread safety

• Still coming: zero-copy I/O, byte swapping, atomic<T>, shared_ptr, parallel write, schema evolution write rules, improved type system, use JIT, I/O for interpreted classes, improve compression of branch of unsplit collections, reduce overhead for deep hierarchy, thread safe (slower) version of TFile
Tree

- **MakeSelector** uses TTreeReader (thank you, summer student Akos!)

- **Still coming**: parallel basket compression, compression of individual entries, production quality Parallel Tree Merger, faster + smarter TTreeFormula (using JIT), TTree::SetBranchAddress matching input type and branch content, vectorization in TTree::Draw and TTree interfaces
Parallel ROOT

• Multi-threaded TTree::GetEntry(), lambda-on-a-tree
  • enable with -Dimt=ON and ROOT::EnableImplicitMT()

• MultiProc tree analysis

• Still coming: parallel analysis with functional programming, focusing on Python
Math

• TMVA: deep learning in TMVA, RMVA, PyMVA (scikit-learn), JsMVA 20/90 authors! First time on GPU! Thank you, summer students + GSOCs: Omar + Simon + Attila!

• MixMax random number generator, see Computer Physics Communications 196 (2015) 161 / http://arxiv.org/abs/1403.5355

• Still coming: vectorization + parallelization of fitting; TMVA + Keras / Theano

id321
Here @ 15:15
Sergei Gleyzer
Interpreter

- Exception support, GCC5 ABI, *pointer validity check, more value printing
- Python 3 support

- **Still coming**: unloading, Windows, even lazier compilation (a la Julia), modules for dictionaries
Graphics

- TRatioPlot (thank you, summer student Paul!)

- **Still coming**: auto-coloring of multiple histograms, auto-placement of legend, fixed size fonts by default; switching to a web-based UI
Net

• THttpServer: bi-directional communication enabling interactive use of ROOT from the browser
Geometry

- VecGeom adaptor / conversion
- GDML expression parsing (JITted), treatment of global constants

Speedup of adapter to VecGeom shape compared to the original ROOT shape

Shape complexity (overall navigation time normalized to box)
Usability

• Doxygen documentation

• Jupyter-ized tutorials (thank you, summer student Pau!)

• rootdrawtree -i *.root -o out.root -hs ‘histphi=jets.phi’ / TSimpleAnalysis (thank you, summer student Luca!)
CMake

• Many “built-in” external packages
  • downloaded + built with a simple -Dvc=ON etc
• configure/make now deprecated
  • about 1000 changes to CMake files since Okinawa
• Still coming: cross-build
• New interfaces in ROOT::Experimental
Extensions / Context

- JSROOT: can now draw simple TTree branches; geometry, tracks & hits ("JS-Eve")
- Jupyter notebooks
- SWAN
Summary

- Ongoing development in many areas
- Keep the contributions coming!
  - feedback: root.cern/forum
  - bugs: root.cern/bugs
  - PRs: github.com/root-mirror/root
- Are we addressing your needs?
Backup
VecGeom adapter/converter

• New VecGeom solids adapter to TGeoShape
  • Providing only navigation functionality
  • Original ROOT shape pointer kept for other functionality (e.g. visualization)
• Converter for any transient TGeo geometry
  • Replacing shapes with the adapted matched in VecGeom
• New library built on demand
• One line usage: TVirtualGeoConverter::Instance()::ConvertGeometry()