ATLAS software installation from source on HPC and PowerPC

BigPanDA Technical Interchange Meeting
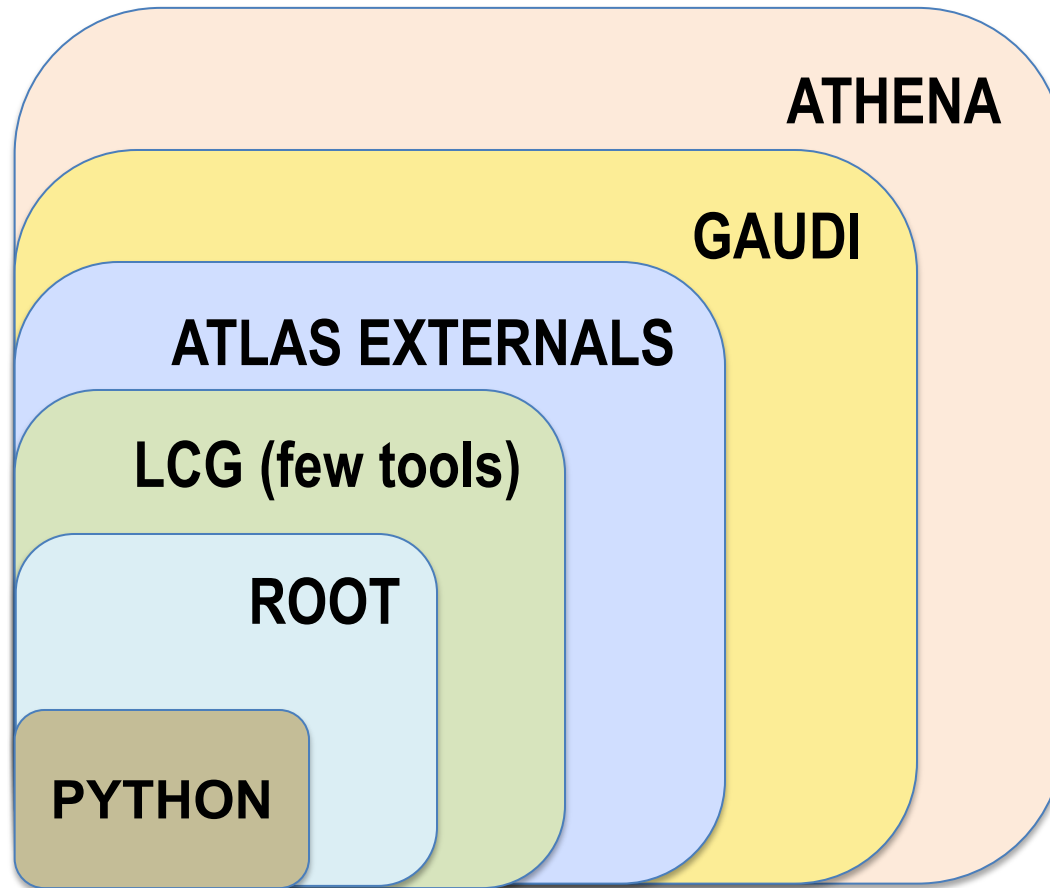
April 25, 2018

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Idea

Install ATLAS Software on HPC and PowerPC from sources taking the nesting structure of components into account

ATHENA

GAUDI

ATLAS EXTERNALS

LCG (few tools)

ROOT

PYTHON

Motivation

- HPC computers are important participants in ATLAS production campaigns

- PowerPC architectures will offer significant computing resource soon

- PowerPC architecture has a different set of instructions, emulating a different chipset can result in a huge performance loss

- CVMFS is not available on HPC and PowerPC and therefore installation from sources

- SFT, ROOT, Gaudi provide multiplatform releases, looking forward to use PowerPC

- ➢ **Installation from sources could be a good solution**

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- Software/libraries adaptation and validation [is needed] for wide variety of processor types:

  - Many/multi core; multi-threading, vector units, GPUs, all common CPU types

  - Need capability to rapidly port to and validate on new architectures, even processor generations (new instruction sets)

Ian Bird, "WLG Evolution", ATLAS SW Week, Mar 7, 2018
https://indico.cern.ch/event/692124/contributions/2903109/attachments/1612631/2561342/WLCG-ATLAS-290218.pdf

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ATLAS Comprehensive Supercomputer Compilation ACSC Project

Attempt to compile ATLAS software (with all externals) on:

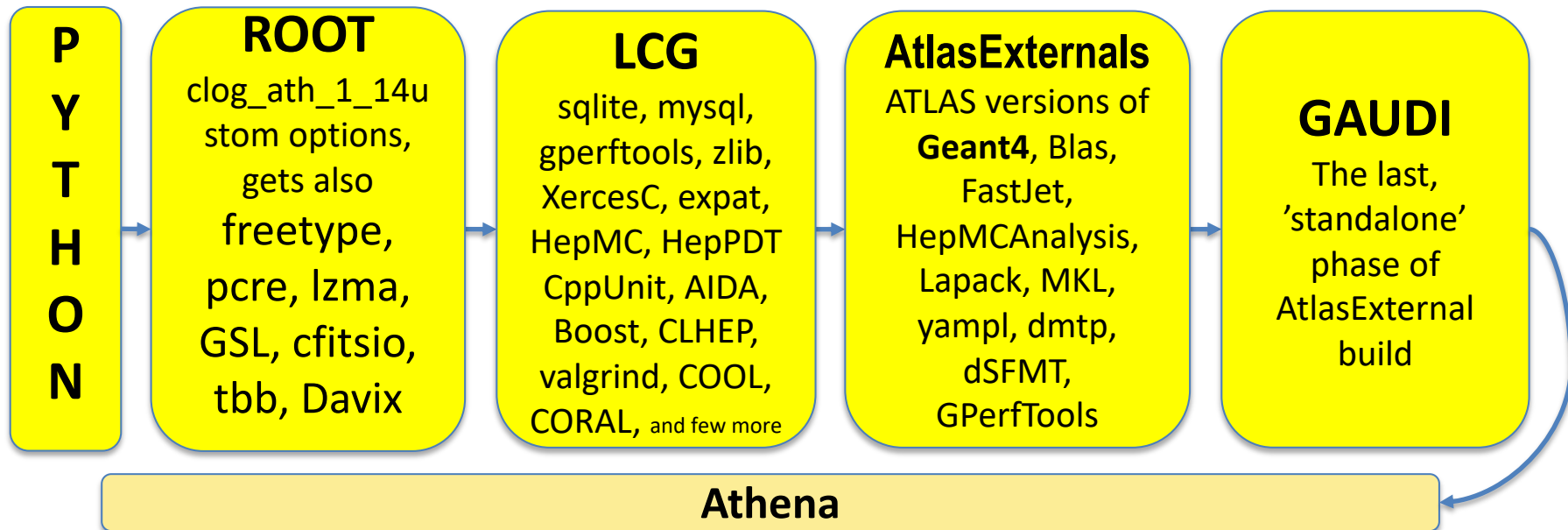**Friendly Linux kernel and AMD CPUs (ATLAS kits binaries work)**

**PowerPC, 10X of Titan
IBM CPUs, GNU Linux
(ATLAS kits binaries do not work)**

This Talk

- ACSC method
- Status of ACSC
- Plans

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ACSC Method

- Use **documented procedures** for external components
- Code is getting via **HTTP** (git, wget), **it works on supercomputers**
- **Preinstalled on OS**: standard gcc version 6.2 or 6.3, cmake
- **Python** is installed from LCG collection as the first step
- Component builds automatically get necessary externals installed
- **ROOT build is customized** to drop unnecessary features (e.g. image processing)
- **Only 40 LCG packages** needed (out of 242 packages of LCG_88)
- **Validation** must follow installation

PYTHON → **ROOT** clog_ath_1_14u stom options, gets also freetype, pcre, lzma, GSL, cfitsio, tbb, Davix → **LCG** sqlite, mysql, gperftools, zlib, XercesC, expat, HepMC, HepPDT CppUnit, AIDA, Boost, CLHEP, valgrind, COOL, CORAL, and few more → **AtlasExternals** ATLAS versions of **Geant4**, Blas, FastJet, HepMCAnalysis, Lapack, MKL, yampl, dmtp, dSFMT, GPerfTools → **GAUDI** The last, 'standalone' phase of AtlasExternal build

Athena

Project Timeline

I. ACSC tools developed and tested on ATLAS CERN Farm in December 2017

➢ Code: AthSimulation 21.0.34

II. ACSC on Titan

➢ Compilation completed, validated

III. ACSC on Summit[dev]

➢ In progress

❖ *Effort ~0.15 FTE of Alex Undrus, help with validation from Sergey Panitkin (DOE ASCR BigPanDA project), help with debugging problems from Atlas Core Team (Charles Leggett, Scott Snyder, Vakho Tsulaia)*

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Compilation Results

- Compilation chain *ROOT-LCG-Externals-Gaudi-Athena(AthSimulation 21.0.34)*

- Set of shell scripts is developed for automation

- Compilation successful and unit test results look good

  - On ATLAS SLC6 build machines at CERN (gcc 6.2)

  - On Titan HPC at Oak Ridge National Lab (gcc 6.2)

  - On Summit PowerPC at Oak Ridge National Lab (gcc 6.3)

COMPONENT	COMPILATION TIME X86_64	COMPILATION TIME Titan	COMPILATION TIME Summit
ROOT	20 min	34 min	27 min
LCG tools (~20)	73 min	100 min	90 min
AtlasExternals (Geant 4, etc.)	28 min	46 min	40 min
Gaudi	25 min	44 min	38 min
AthSimulation	4 hours	6 hours	6 hours

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Source Corrections

- ■ On Titan no corrections were needed (except few python sub–packages in *AtlasPyFwdBwdPorts* failed to compile and were removed)

- ■ On Summitdev:

    - ■ Replacement of __linux compiler macro with __linux__ (particularly in Gaudi)

    - ■ Replacement of linker option -Wl,-z,max-page-size=0x1000 with -Wl,-z,common-page-size=0x1000 (as *virtual addresses and file offsets for the 64-bit PowerPC processor family segments are congruent modulo 64 Kbytes (0x10000)*

    - ■ Removal of checkpointing package dmtcp (checkpointing tool, uses assembly commands that do not exist on PowerPC)

    - ■ Few minor tweaks (e.g. adding an include statement for of a system header file in a package code)

Build Product

- Two tar files for easy installation anywhere on the machine

- Includes simple runtime environment setup without asetup (ATLAS universal environment setup tool) use

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Test Results

	Titan	Summit
ROOT histograms		
PROOF test (from S. Panitkin)		
ROOT genreflex test (from S. Snyder)		
GAUDI examples tests		
Athena Unit tests		
Simple Athena jobs		
ATLAS Simulation job (by S. Panitkin)		

Problem on Summit:
Athena executable crashes with segmentation fault, debugging in progress (in cooperation with ATLAS Core team)

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Summitdev User Experience

- Good support: fast response to questions, issues

- Slow file system (lustre) was chosen (because plenty of space available)

  - Move to NFS file system is recommended

- Restarts are quite frequent, on daily basis

- Three long shutdowns in April (0.5 – 3 days)

- Accidents with frozen shell commands (e.g. ls)

➢ **Hiccups are unavoidable at the start of operations. However they noticeably delay the ACSC project**

Conclusion

- **Methodology** of simulation releases installation from source is developed

    - Simplified runtime environment setup

- Procedure on Titan works practically 'from A to Z'

- Test ATLAS Simulation jobs ran OK on Titan

- Compilations on Summit were completed OK

- There are runtime problems on Summit, they are investigated

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