CernVM plans for 2017

G. Ganis for the CernVM Team
16 January 2017

Outline

- Human resources
- Summary of activities in 2016
- Plans for 2017

People

		2016	**2017**	2018
G. Ganis	Sf	50%	**50%**	50%
J. Blomer	Sf	100%	**100%**	100%
R. Popescu	Fw	33%	**100%**	66%
P. Jirout	TS	50%	**20%**	
N. Hardi	TS (KT)	25%	**75%**	
N. Kousi	Fw	15%	**15%**	
R. Meusel	Fw	40%		
J. Molina	TS	25%		
P. Buncic	St	5%	**5%**	5%
Total / FTE		3.43	**3.65**	2.15+

Summer Students in 2016

- Tim Schaffer (OpenLab)
  - *HEP Application delivery on HPC resources*
- Felix Scheffler
  - *CernVM porting to Arm64*

The CernVM ecosystem

- Main-stream
  - CernVM-FS   All usages
  - CernVM-Appliance   D, C, V , DP

- Side-stream
  - CernVM-Online   D, C, DP
  - (WebAPI)   D, V

- Discontinued
  - Copilot
    - Used in LHC@Home (T4T), now replaced by DataBridge

D = Desktop, C = Cloud, V = Volunteer, DP = Data Preservation

CernVM(-FS) reminder

- ● CernVM-FS
  - ○ Optimized for large scale software distribution
  - ○ Mission **critical** for WLCG
    - ■ Also used by ~45 non-LHC experiments, including EUCLID
- ● CernVM
  - ○ Designed to seamlessly setup computing environments for HEP experiments
  - ○ Using bootloader technology
    - ■ OS loaded from CernVM-FS, package management by RPM
  - ○ SL7, **SL6**, SL5, SL4 compatible
  - ○ Used by all 4 LHC experiments
    - ■ Laptops / desktops, Computing clouds, HLT farms, Data preservation, Open data, Master Classes

- > 350 million files under management
- > 50 repositories

Running jobs: 334639
Active CPU cores: 460014
Transfer rate: 13.29 GiB/sec
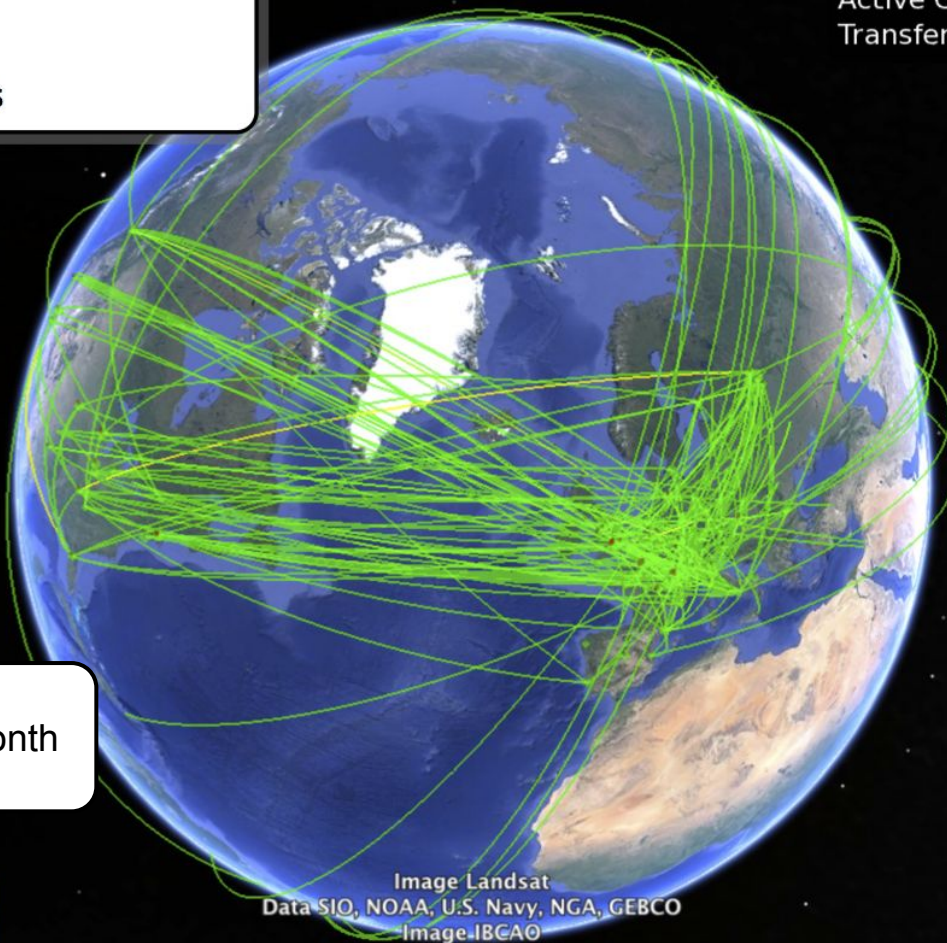
- 10 k new VMs / month

Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image IBCAO
Image U.S. Geological Survey

Google earth

eye alt 15825.12 km

WLCG ALICE ATLAS CMS LHCb PHCP

dashboard

Summary of 2016 activities

- CernVM-FS
- CernVM
- AoB

CernVM-FS in 2016 (1)

- 2.2.0 -> 2.2.3, Feb-May 2016
  - Move to semantic versioning
  - Support for OverlayFS (replacement for AUFS)
    - Requires kernel > 4.2: Fedora 23, Ubuntu 15.10, EL7.3
  - Support for extended attributes
  - Support for SHAKE-128 (SHA-3 derived) hash algorithm
  - Support for new platforms
    - Mac OS X El Capitan, AArch64, Power-8
  - Consolidation and bug-fixing

CernVM-FS in 2016 (2)

- ## 2.3.2, Oct 2016
  - ### Support for data distribution
    - #### Collaboration with Univ. of Nebraska (B. Bockelman)
  - ### Plug-in interface for client authorization helpers
  - ### Improved garbage collection
  - ### New platforms
    - #### Fedora 24, SLES12 on x86_64, CentOS 7 on AArch64
  - ### Reduced memory footprint
  - ### Further consolidation and bug fixing

CernVM-FS in 2016 (3)

Progress on new publishing interface

- Completed
  - Requirement analysis
    - Includes initial discussion with stakeholders (ALICE, SFT, IT)
  - Initial design of the new components
    - Including protocol, choice of technology
- In progress
  - Implementation of the new back-end components
  - Integration of new components with existing server-side tools

CernVM-FS in 2016 (4)

- Successful submission to the KT fund of a project to integrate CernVM-FS with Docker
  - Project approved in April
  - Request submitted at TSC 2016/1
  - Project started on 1 October
- Status
  - Understood Docker internals
    - Familiarity w/ Go language, OCI standard specs
  - Identified required modifications
  - Submitted a RFC on Docker GitHub to get in touch with the community
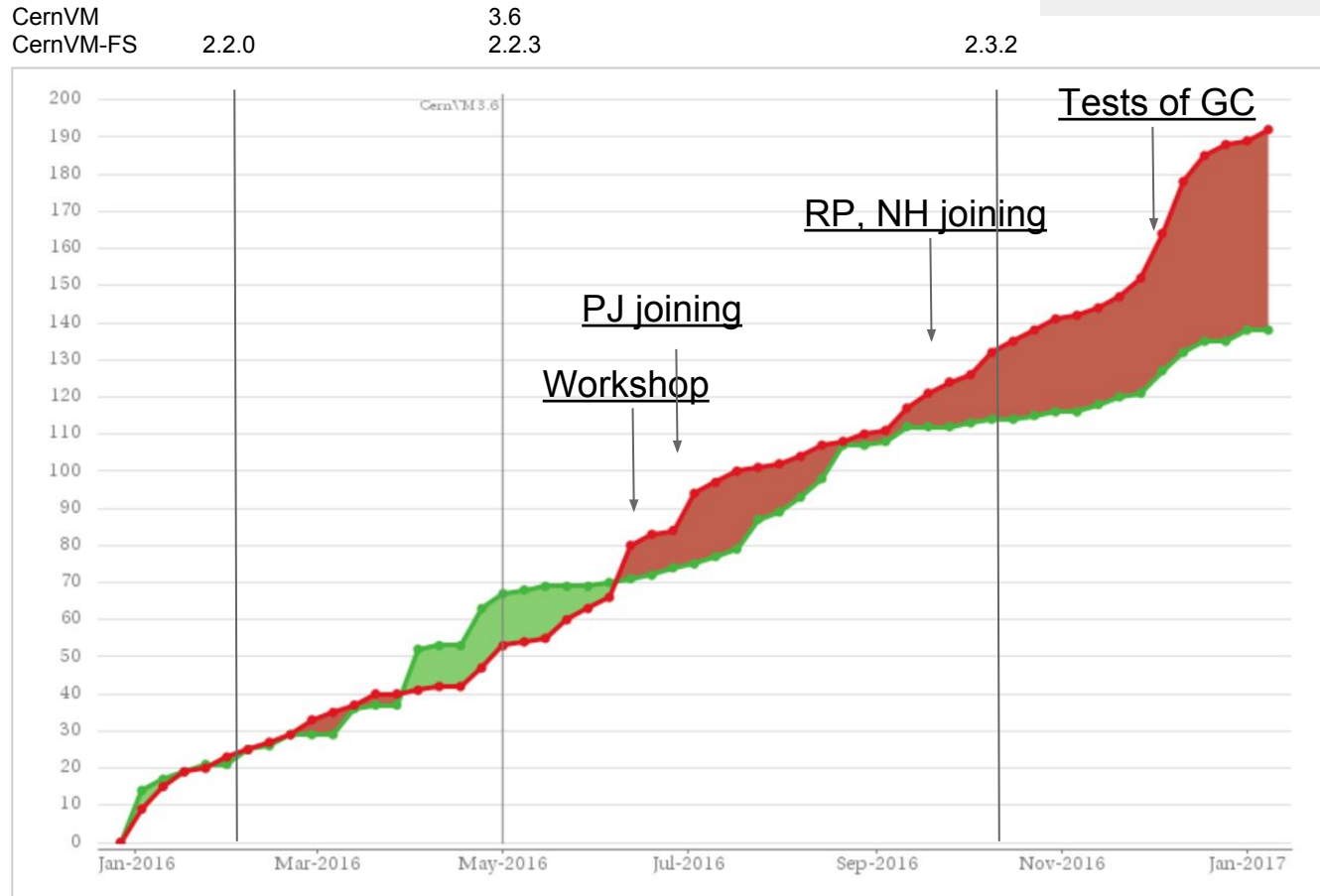
CernVM in 2016 (1)

- Bootloader (u-CernVM) upgrade
  - Kernel 4.1.23
    - Includes fix against 'dirty cow'
- Version 3, RHEL 6 based
  - Commissioning of v3.6 (SL 6.6), May 2016
    - Kernel 4.1.23
    - Support for Vagrant, glideinWMS
    - Improved boot time, use cvmfs proxy for contextualization
  - 14 security hotfixes (current version 3.6.5.14, Nov 25th)
- Version 4, RHEL 7 based
  - Consolidation of current preview state
    - Commissioning synchronized with lxplus/lxbatch
  - Boot time optimization (factor ~2 faster than v3)

CernVM in 2016 (2)

- New ports
  - ARM64 (F. Scheffler)
  - 32-bit for Volunteer Computing activities

- Support for Amazon EC2 HVM
  - Almost native performance
    - Direct access to NIC and GPU

- First release of launcher tool
  - À la Vagrant/Docker interface to control CernVMs
  - Preview at http://cernvm.cern.ch/portal/launch

JIRA activity in 2016

CernVM		3.6		
CernVM-FS	2.2.0	2.2.3		2.3.2

Tests of GC

RP, NH joining

PJ joining

Workshop

Since Jan 2016
    CernVM-FS: 143 new issues (43 bugs), 59 resolved (33 bugs)
    CernVM: 23 new issues (8 bugs), 8 resolved (4 bugs)

Other activities 2016

- Continued contacts with EUCLID
    - Technical meeting at CERN (April)
    - Official adoption of CernVM-FS for software distribution
- Established contacts with LIGO
    - CERN recognized experiment
    - Using CernVM-FS for data federation
- New expression of interest
    - MESOSPHERE, PIVOTAL
        - Demo of container distribution with CernVM-FS

Other activities 2016

- New website
  - Migrated to Drupal 7, same look and feel
- DPHEP
  - Update presented to February DPHEP workshop
  - Contributed to long paper to iPRES 2016, Bern, Oct 2016
    - "CERN Services for Long Term Data Preservation"
    - Presented by J Shiers
- CernVM Users Workshop, RAL/UK, June

CernVM Users Workshop in 2016

- [June 6-8, 2016, RAL/UK](#)
- Essential Input/Feedback from users, experiments and sites
- Technology session with invited speakers
    - Mesosphere, VMware, Linaro, IBM, Pivotal

- Main outcome
    - Development plans fit the needs of stakeholders
        - Improve publication process
        - Solutions for HPC
        - Flexibility in cache setups
    - CernVM appliance used by all LHC experiments
        - In a way or another

Other dissemination activity in 2016

- ## CHEP 2016 contributions involving team members
  - *New directions in the CernVM File System* (JB, PB, GG, RM, RP; poster)
  - *Accessing Data Federations with CernVM-FS* (JB, RM et al.)
  - *Web Proxy auto-discovery for WLCG (*JB et al.)
- ## Talks
  - GG, JB *Update on Software Environment Preservation with CernVM,* DPHEP, February
  - GG, JB, *CernVM ecosystem status,* LHCb workshop, June
  - GG, JB, CernVM-FS as Distribution Engine for containers, EP KT Innovation Day, October
  - JB, RP, *CernVM-FS devs*, ALICE (October) and IT (December)
  - JB et al., *A Novel Approach for Distributing and Managing Container Images*, MesosCon, Denver, US, June
  - JB, *Global Software Distribution with CernVM-FS*, CCL Workshop On Scalable Computing, Notre-Dame, US, October
  - JB, *Cloud Technologies in HEP data processing*, ICFDT, Frascati, Italy, March
  - JB et al., x32-ABI Re-evaluation, Technology meeting, January
- ## Papers
  - JB, GG et al., *CERN Services for Long Term Data Preservation,* iPRES 2016, Bern, Switzerland

CernVM 2017 Plan Of Work

- Guidelines
  - Support for running services
  - Developments driven by unique needs of main stakeholders

CernVM-FS devs guidelines

- Address requirements of Run3 and AFS replacement
  - Reduction of publishing time to address more demanding use-cases
    - E.g. ATLAS nightlies, ALICE conditions data
  - Fully exploit version tracking capabilities of the file system
    - Required, e.g., for ALICE conditions data @ Run 3
- Improve flexibility for client deployments
  - Diskless server farms
  - HPC special storage systems (e.g. NERSC @ LBNL/US)
- Improvement of the HTTP distribution chain
  - Improved monitoring, coherent network to push the data around
- Commissioning Docker integration

CernVM-FS (1)

Improving publishing phase (v2.4)

- Complete the implementation of a working prototype
- Commissioning of the new prototype w/ ALICE
  - During the shutdown period
- Deployment for ALICE conditions data
- Further work to reduce propagation delay
  - To Stratum 1, clients
- Performance measurements and improvements
  - Scalability, …

CernVM-FS (2)

Improve flexibility for client deployments (v2.4)

● Commission version & snapshot support (*)
● Support for client cache plug-ins
● Cache plug-in managers for different backends
  ○ Ceph, shared RAM cache, ...

Docker integration

● Realize full read/write Docker workflow
  ○ Effective Replace Docker registry with CernVM-FS
● Extend to generic container service

(*) See backup

CernVM devs guidelines

- Facilitate the creation of on-demand turn-key clusters of VMs
  - E.g. batch clusters (HTCondor), BigData clusters
- Performance studies, measurements and improvements

CernVM-Appliance

- Consolidation/Maintenance of v 3.6
  - Follow-up security hotfixes for v3.6
  - Preparing for commissioning v4 when lxplus moves to CC7
- Consolidate cernvm-launch
  - Support creation of cluster
  - Common repository of context files
  - Deprecate cernvm-online and webapi
- Performance benchmarking
  - Prepare context for benchmarking
    - Following benchmark working group (B Panzer)
  - Define set of representative cases
    - CERN Openstack, various configurations
    - Commercial clouds (Amazon, Google, Azure)
      - Coordinate with IT

CernVM-Appliance (2)

- ## Analytics (Piwik)
  - Better understanding of usage
- ## AoB
  - CernVM images available of CERN OpenStack
  - Inclusion in LCG builds

Miscellanea

- CernVM-Online and WebAPI
  - Identify and extract components that can be managed by the group
- Infrastructure
  - Migration of test HW in bld 157 to IT
- Follow up DPHEP evolution
  - Workshop in March
- Follow-up contacts with potential external users
- Prepare for next workshop
  - Tentative period: Dec 2017 or Jan 2018

Conference targets

- Linaro Connect (Budapest, March)
  - CernVM port on ARM64
- ACAT 2017 (end August)
  - CernVM port on ARM64
  - Status of CernVM-FS devs
- Codemesh (London, November)
  - C++ and Erlang in CernVM-FS

Summary

- Main effort goes to support running services
- Developments driven by
  - Forthcoming needs
    - Run 3, AFS replacement, ...
  - Improved flexibility for clients deployments
    - Diverse cache backends, ...
  - Exploitation of products potential
    - Docker integration, VM cluster handling, ...

Feedback is welcome and may influence our priorities

Backup

CernVM-FS: snapshots & branching

- Branches allow non-linear workflows on file system snapshots
  - Can describe relation between derived and parent container
  - Allow fixes to conditions data of a given, past run
- Instant access to snapshots
  - New virtual directory provides access to all named snapshots within a single mount point, .cvmfs_snapshots (à la zfs)