CernVM, Systems & Services Plan Of Work for 2023

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On behalf of the CSS team

13 February 2023

Outline

- Team members
- System & Services
  - Last year's activities
  - A plan of work for 2023

The key4hep plan of work was presented on 16 January 2023

The CernVM plan of work will be presented in a separated talk today

For reference: System & Services Plans for 2022

CSS Workforce evolution

		2022	2023	2024	
G Ganis	STAF	20%	10%	10%	S
J Blomer	STAF	25%	45%	25%	C
R Popescu + V Volkl	STAF	66%	100%	100%	C
A Sailer (1)	STAF	66%	66%	66%	S, K
I Goulas	STAF	100%	100%	100%	S
S M Muzaffar	STAF	10%	10%	10%	S
L Promberger (2)	FELL	40%	100%	100%	C
P Fernandez Declara -> S. Sasikumar	FELL	66%	83%	100%	K
V Volkl -> J M Canceller	FELL	100%	92%	100%	K
H Hansen + O Morud	TECH	100%	66%		S
J Eberhardt	TECH	75%			C
D Konstantinov (1)	PJAS	50%	50%	25%	S
Total (FTE)		7.2	**7.2**	5.8+	

S: 2.75 C: 2.45 K: 2.0

C: CernVM
S: Systems & Services
K: Key4hep

CMS librarian
EP-R&D

TECHs who left in 2022
- H Hansen (S)
- J Eberhardt (C)

Summer Students
- …

Contributions from
P Mato, G Amadio

(1) LIM chairs
(2) Jumptrading funds

Related activity reports in 2022

CernVM

- J Eberhardt, Progress in CernVM5, 14 Feb
- L Promberger, Highlights from CernVM Workshop, 3 Oct
- J Eberhardt, Technical Studentship report, 10 Oct

SPI

- H Hansen, Technical Studentship report, 26 Sep

Key4hep

- G Ganis, Summary of ECFA reconstruction workshop, 9 May
- P Fernandez Declara, Summary of the Key4hep meeting, 9 May
- P. Fernandez Declara, Fellowship report, 26 Sep

AoB

- J Blomer, Summary of the ITUM meeting, 27 Jun

Summer Student reports

- K Stomeinova, Extending GUINEA-PIG with EDM4hep output, 15 Aug
- R Virtan, CernVM-FS profiling, 29 Aug
- V Cantero, Converting algorithms from iLCSoft to Gaudi, 29 Aug

System & Services
(aka SPI)

S&S deliverables

- Software stack of about 500 packages
- Large number of combinations
  - {x86, ARM} x {OS1, OS2, …} x {Comp1, Comp2, …} x {opt, dbg}
- Nightlies
  - C: /cvmfs/sft-nightlies.cern.ch

- Releases
  - C: /cvmfs/sft.cern.ch
  - R: RPMs
  - T: Tarballs
  - S: Spack (exp, /cvmfs/sw.hsf.org/)

Snapshot of the current situation (last release LCG_102a)

	C7	C7 ARM	C8s	C9s	Ub22	Mac12 M1
gcc 11	T, C, R, S	T, C, R	T, C, R	T, C, R	T, C	
gcc 12	T, C, R					
clang 12	T, C, R					
clang 13						T, C

C7 (ARM): CentOS7 (aarch64), C{8,9}s: CentOS{8,9} Stream
Ub 22: Ubuntu 22.04 LTS, Mac12 M1: MacOsX 12 on M1

Native

S&S infrastructure and Web Server

Infrastructure

- Resources mostly accessed through Openstack
  - x86 VMs, ARM, GPU-enabled, x86 physical machines
- CentOS8s docker-host:
  - Ready to use docker images: centos{7,8stream,9stream}, ubuntu{20, 22, …}, …
- Mac Minis for MacOsX
  - Shared w/ ROOT, G4
- CI: Jenkins, GitLab-Ci

EOS Web Server for RPMs and tarfiles: https://lcgpackages.web.cern.ch/

- Staging/shared area, binary TAR balls: tarFiles, tarFiles/sources
- RPM repo: repo configuration files at lcg/etc/yum.repos.d/lcg.repo
  - lcg/repo/{7,8,9}/{x86_64,aarch64}/LCG_NN/LCG_NN_*layers* *(layer metapackages)*
  - lcg/repo/{7,8,9}/{x86_64,aarch64}/Packages *(real packages)*
  - lcg/repo/{7,8,9}/{x86_64,aarch64}/debug/{LCG_NN,Packages} *(same in debug)*
  - lcg/contrib/{7,8,9} *(compilers, …)*
  - Legacy repositories: rpms_contrib, rpms, rpms_updates, lcg/{repo, contrib}/6

S&S stakeholders

	ATLAS	LHCb	SWAN	BE	CLIC, NA61, NA62, other SME, …
Nightlies (C)	✓	✓	✓	✓ (dedicated views)	✓(selections)
Releases (C)	✓		✓		✓(selections)
Releases (R)	✓	✓			

- Partial stacks provided for development builds to specific projects
  - E.g. Geant4, VecGeom, DD4hep, AdePT, …
- LIM meetings to discuss/decide content of nightlies stacks and releases
  - About 10 people, all LHC experiments represented

- Many users on lxplus and elsewhere
  - Increasing over time due to the phase out of /afs/cern.ch/sw
  - About 1 request per week, mostly ML related

Activities in 2022

Considerations from PoW 2022

Considerations

- The current infrastructure and {build, test, deployment} system needs maintenance and consolidation
- We need a firm step forward towards Spack adoption
  - What would be the workflow w/ Spack?
    - Role of binary caches, need for RPMs (ATLAS), …
  - No real equivalent use case in the Spack community
    - This can only be achieved together w/ experiments
  - Relation w/ key4hep
- The role of the generator service (GenSer)
  - Has become integral part of the LCG stacks
  - Recover unique central role between authors and customers
    - In connection w/ ECFA generators efforts. And key4hep

Priority

Spack

- Focused on providing LCG_102 through Spack
  - Option 0: plain replacement of LCGCMake
- Implemented as bundle package, build cache on S3

- Stack (gcc 11.2.0):
  - /cvmfs/sw.hsf.org/spackages6
- View (gcc11.2.0):
  - /cvmfs/sft.cern.ch/views/LCG_102spack1
- Build caches (gcc 11.2.0 and clang 14.0.6):
  - openstack.cern.ch project: lcg-spack
  - http://s3.cern.ch/swift/v1/gcc11.2.0
- Documentation:
  - https://gitlab.cern.ch/sft/sft-spack-repo/-/blob/master/Readme.md

Harald Minde Hansen

100 PR in upstream Spack

- Details in H Hansen's technical studentship report

Last year's activities: highlights (1)

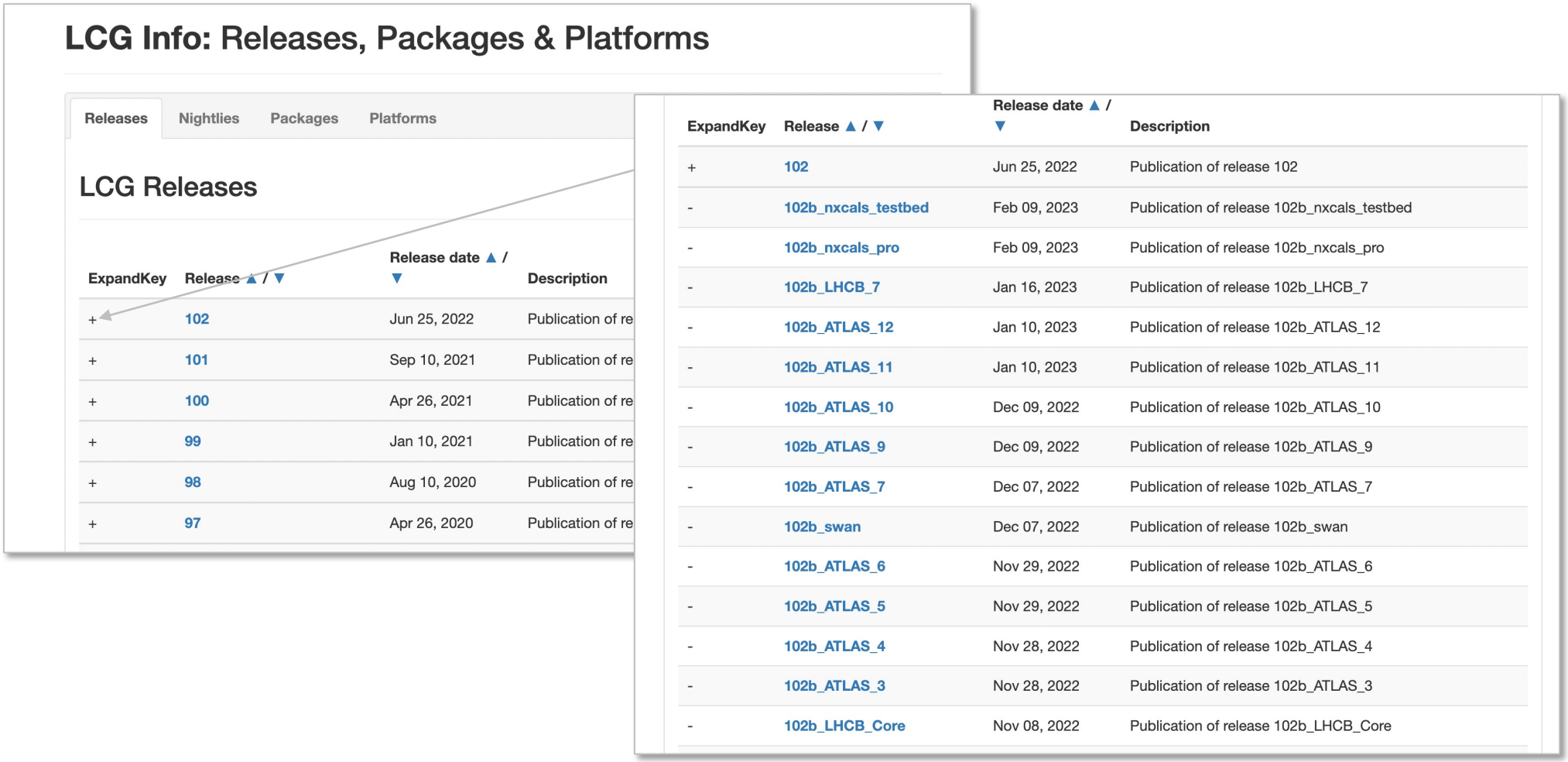
- Jenkins
  - 3x Regular updates
- Puppet
  - Support for configuring ROOT CentOS8 Stream docker hosts (see ROOT CI)
- Resources
  - Got access to new IT ARM nodes through OpenStack
    - 2x 10 core virtual machines
- Nightlies/Release procedure, build and deployment
  - Added centos{8,9}stream and Ubuntu 22 LTS builds
- LCGCMake
  - Install python wheels from our own pip-mirror (w/ I Razumov)
- Testing
  - Run tests in CI before they are used on the nightlies
  - Test python packages version consistency ("pip check")
- No more Python 2

Last year's activities: highlights (2)

- lcginfo.cern.ch: new landing layout w/ improved readability
  - Overall consolidation
- Package content
  - Continued to critically review the package content / versions
    - Considerable fraction of work goes into package updates
  - Many new generators / versions included
- Support
  - JIRA continued to be the main support channel and planning tool
  - Service Now Functional Element: Software Development For Experiments
    - Low activity (1-2 /month) mostly connected to AFS phase out

LCG_101 → LCG_102a
+ 78 new packages
- 2 removed
108 updated packages

New lcginfo landing page



LCG Info: Releases, Packages & Platforms

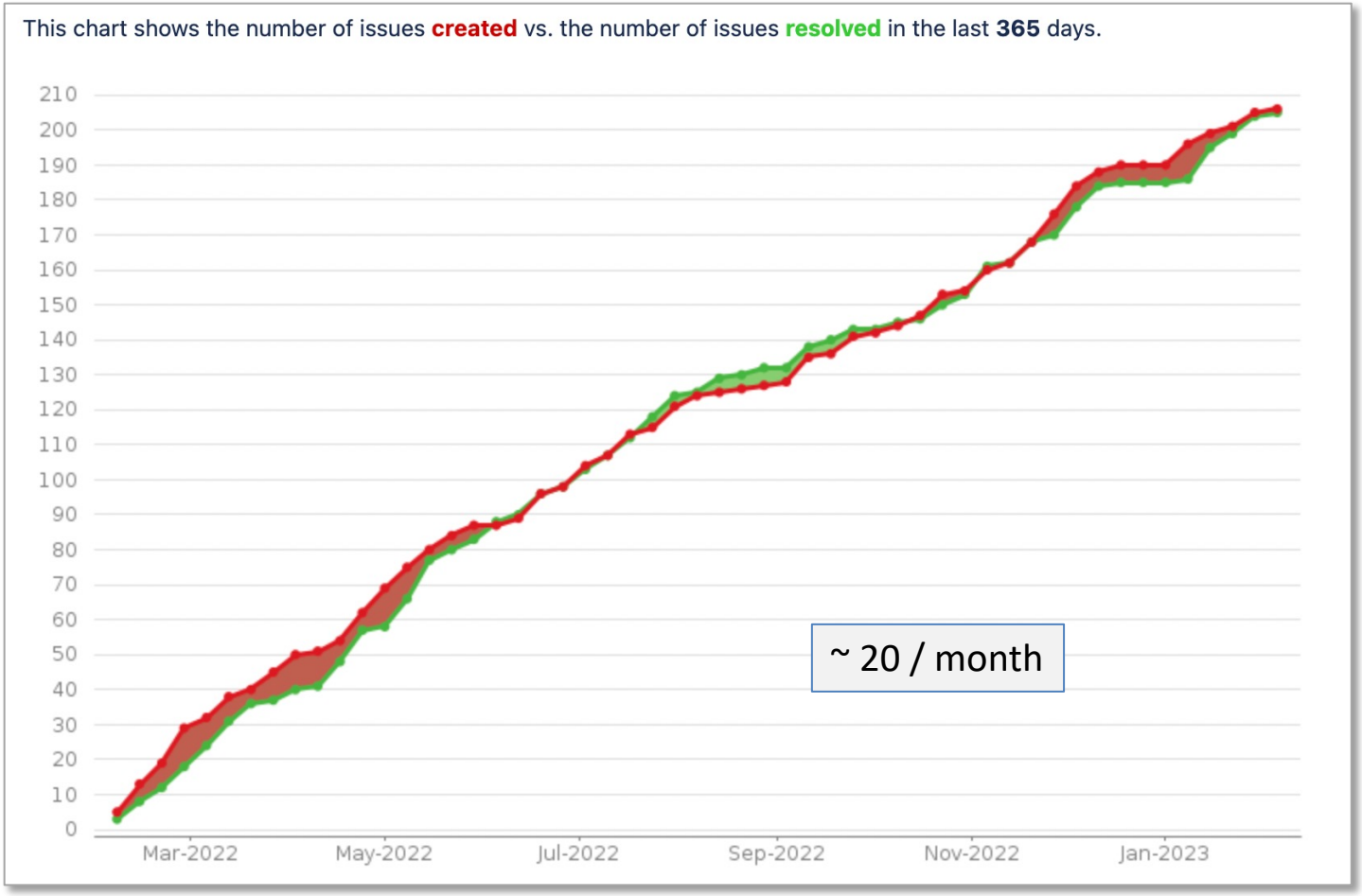
Releases | Nightlies | Packages | Platforms

LCG Releases

ExpandKey	Release ▲ / ▼	Release date ▲ / ▼	Description
+	102	Jun 25, 2022	Publication of release 102
+	101	Sep 10, 2021	Publication of re
+	100	Apr 26, 2021	Publication of re
+	99	Jan 10, 2021	Publication of re
+	98	Aug 10, 2020	Publication of re
+	97	Apr 26, 2020	Publication of re

ExpandKey	Release ▲ / ▼	Release date ▲ / ▼	Description
+	102	Jun 25, 2022	Publication of release 102
-	102b_nxcals_testbed	Feb 09, 2023	Publication of release 102b_nxcals_testbed
-	102b_nxcals_pro	Feb 09, 2023	Publication of release 102b_nxcals_pro
-	102b_LHCB_7	Jan 16, 2023	Publication of release 102b_LHCB_7
-	102b_ATLAS_12	Jan 10, 2023	Publication of release 102b_ATLAS_12
-	102b_ATLAS_11	Jan 10, 2023	Publication of release 102b_ATLAS_11
-	102b_ATLAS_10	Dec 09, 2022	Publication of release 102b_ATLAS_10
-	102b_ATLAS_9	Dec 09, 2022	Publication of release 102b_ATLAS_9
-	102b_ATLAS_7	Dec 07, 2022	Publication of release 102b_ATLAS_7
-	102b_swan	Dec 07, 2022	Publication of release 102b_swan
-	102b_ATLAS_6	Nov 29, 2022	Publication of release 102b_ATLAS_6
-	102b_ATLAS_5	Nov 29, 2022	Publication of release 102b_ATLAS_5
-	102b_ATLAS_4	Nov 28, 2022	Publication of release 102b_ATLAS_4
-	102b_ATLAS_3	Nov 28, 2022	Publication of release 102b_ATLAS_3
-	102b_LHCB_Core	Nov 08, 2022	Publication of release 102b_LHCB_Core

JIRA created/resolved tickets



Last year's activities: highlights (3)

- ROOT CI upgrade
  - Modernisation, in particular using containers for linux flavours
  - Started investigating SPI/G4 model, finally chosen GitHub Runners
    - Easier for 3rd parties
  - Status: basic ingredients up and running w/ Github workflows
    - Infrastructure to build/update container images, run on puppetized Docker hosts
    - Incremental builds with Openstack S3 Object Storage

Last year's activities: highlights (4)

- RPM restructuring
  - Removed duplications by introducing a *Packages* per architecture
    - About 30% of current packages
  - Decouple revision number from major release number
    - Enable implementing mechanism to patch RPMs
  - In place since LCG_102
- New cvmfs test repositories with gateway enabled
  - /cvmfs/sft-test.cern.ch, /cvmfs/sft-test-nightlies.cern.ch

Last year's activities: releases

Releases

- LCG_102{a,b}: ROOT v6.26/{04,08}
  - Layers: 102, 102cuda, 102swan, 102_ATLAS_{1…12}, 102_LHCB_{core,7}
  - OS: centos7, centos7 arm64, centos{8,9}s, ubuntu 22, mac12arm
  - Compilers: gcc 11, gcc 12, clang 12 (clang 13 on mac)

Special views

- Continued to build devNXCALS (for BE), dev{3,4}cuda, devswan
- New builds for LHCb
  - dev{3,4}lhcb (and briefly dev5lhcb on top of LCG_101)

Plan Of Work 2023

Guidelines

- We need a firm step forward towards Spack adoption
  - What would be the workflow w/ Spack?
    - Role of binary caches, need for RPMs (ATLAS), …
  - Based on the current experience in the HEP community
    - LHCb, CMS, Key4hep
- The current infrastructure and {build, test, deployment} system needs maintenance and consolidation

Spack: what next?

- Foster discussion about Spack-based workflows
  - Pure replacement of the current ones (option 0)
  - Provision of layers as Spack environment yaml files (LHCb)
  - Other?
- Dedicated workshop/meeting
- Provide a usable nightly test build to exercise the machinery
  - dev3spack

Infrastructure

- Jenkins
  - Move to Java 11
  - Clean-up of obsolete jobs
  - Consolidation of pipelines
    - Support for running single step
- Move to Alma9
  - Replacing CentOS9 stream
- Fully integrate aarch64 Openstack VMs
  - Builds for centos7 and alma9, via containers

Build system

- Clean recipes
  - Removing ifs for old versions / Operating Systems
- Investigate further optimisations of re-use of binaries to minimise redundant compilation
- Prototype support for *micro-architecture levels* builds
  - x86_64_{v2,v3,v4} supported by Gcc ≧ 11, Clang ≧ 12

Deployment system

In collaboration w/ CernVM core team

- CernVM-FS publication
  - Move to using CernVM-FS Gateway
    - Test repository sft-test.cern.ch and sft-test-nightlies.cern.ch available
  - Need to find a way to maximize concurrency
    - Current directory structure not optimal
- Investigate use of S3 for caching binary artefacts
  - Several instabilities experienced in waves with EOS
  - Use experience from spack builds and ROOT CI
- Containers
  - Provision of *baseline-system-definition* containers
    - Ready-to-use minimal image

Testing, AoB

- Testing
  - Finalize inclusion of *roottest* in regular tests
    - Specific pipeline step
  - Run other similar test suites?
    - Integration tests provided externally (e.g. experiments)
      - GaudiTest as example
- AoB
  - Workshop with stakeholders and users to get feedback
    - Or dedicated extended LIM

Support / Documentation

- Support
  - LCG stack customers
    - And users of /cvmfs/sft.cern.ch (as AFS replacement)
  - Follow requests for new architectures, platforms, compilers, tools
    - PowerPC, ARM, …
  - Follow requests for new packages and versions
  - Investigate JIRA replacement
    - CERN choice, GitLab issues, …
- Documentation
  - lcgdocs: SPI documentation
    - Streamline and improve content organization

Service Tasks

Service/Task	Main Responsible	Alternate	Documentation
Jenkins service	Shahzad Muzaffar	Andre Sailer	HowTo
Coverity service	Gabriele Cosmo	Axel Naumann	
CDash service	Benedikt Hegner		HowTo
Puppetized nodes	Shahzad Muzaffar		HowTo
Windows nodes	Bertrand Bellenot	Gunter Folger	
Mac nodes	Olivier Couet	Axel Naumann	Howto, List
ITUM contact	Graeme Stewart	Jakob Blomer	
C5 contact	Jakob Blomer		HowTo
Jira Service	Ilias Goulas		
Printer Room HW	Jakob Blomer		

Please volunteer!

Thank you!

https://spi.web.cern.ch/

Outlook

- Consolidation of existing infrastructure
  - Following the evolution fo the requirements
- Get more concrete in the adoption of Spack as replacement of LCGCMake