

WLCG Update

Ian Bird

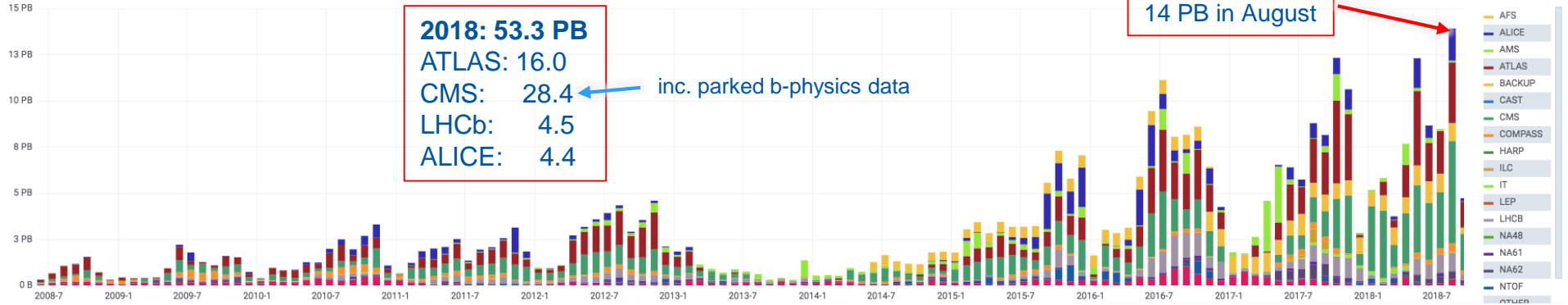
LHCC Referee's meeting

CERN, 11th September 2018

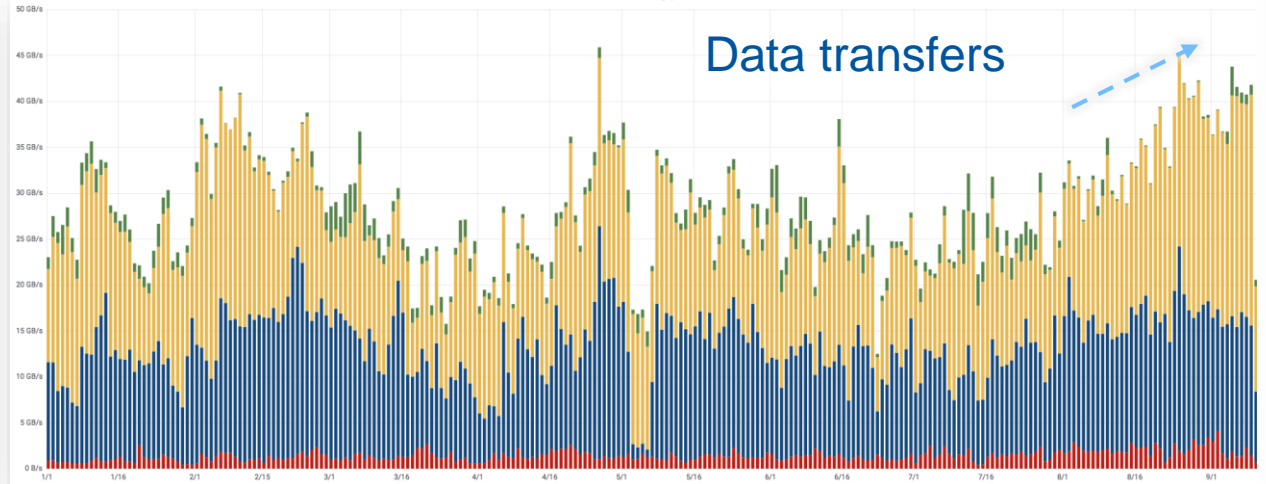


Data

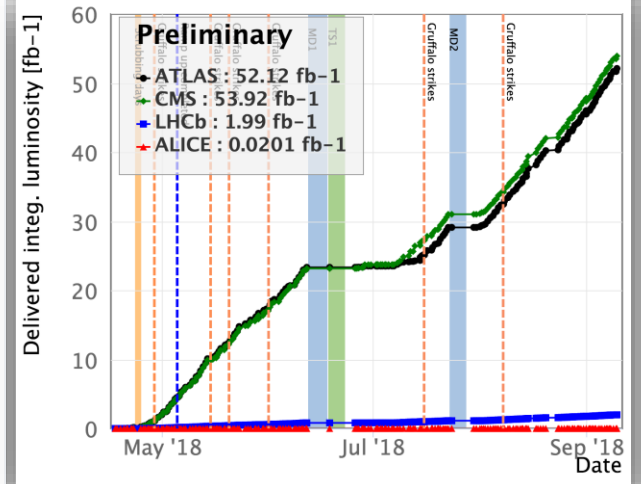
Transferred Data Amount per Virtual Organization for WRITE Requests



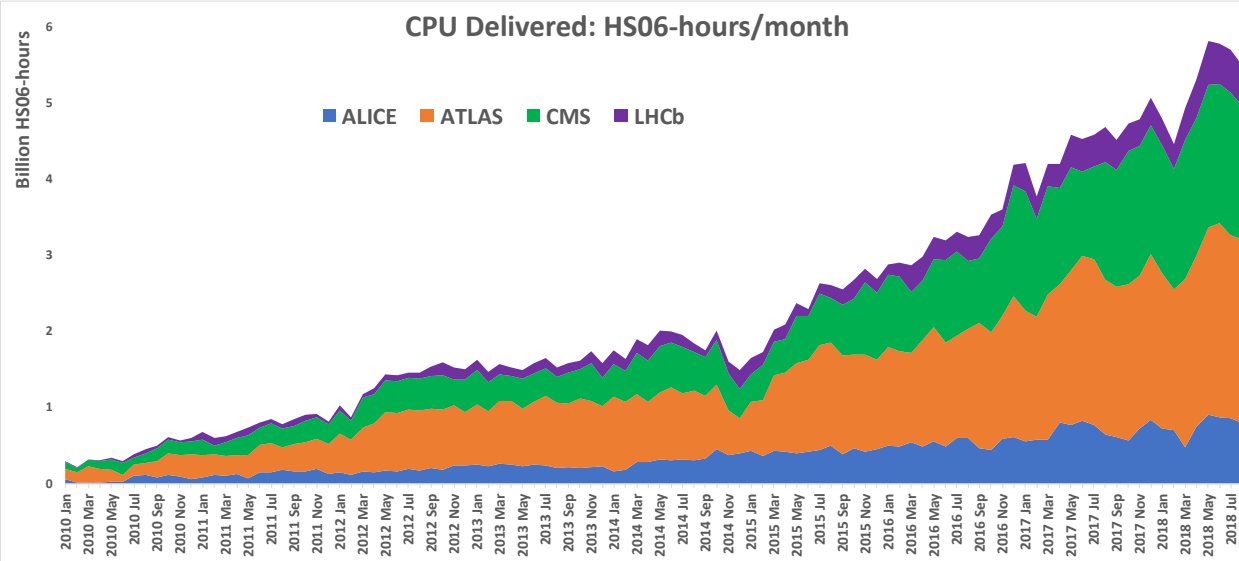
Transfer Throughput



Delivered Luminosity 2018



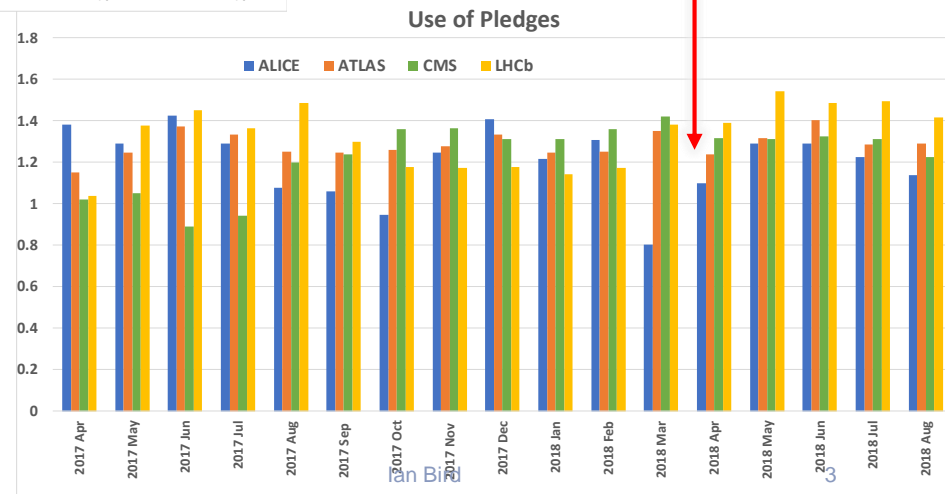
CPU Delivered



New pledge year

New peak: ~242 M HS06-days/month
~ 780 k cores continuous

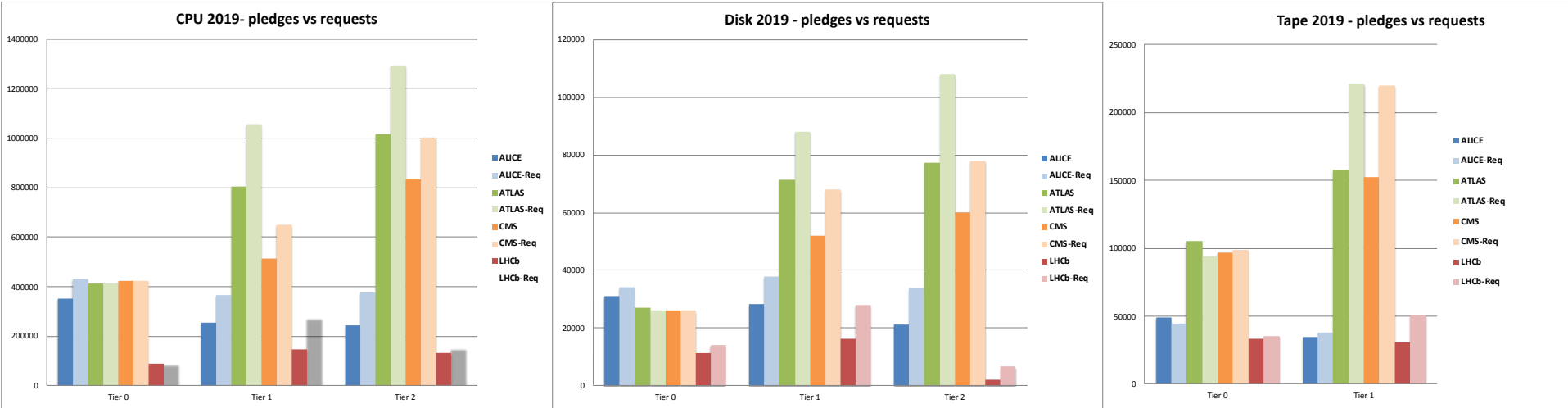
(From sites that pledge)



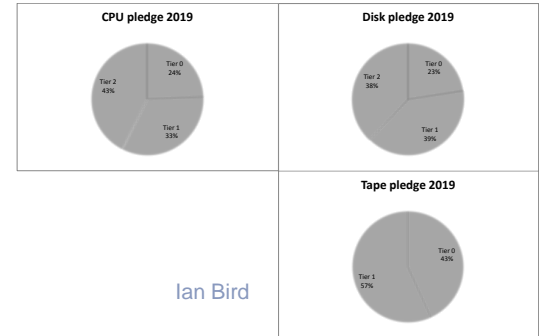
Preparation for HI run

- ❑ This week there will be a test of HI data taking; anticipate higher rates than we have seen before
 - From DAQ → tape
 - All experiments participating
 - Generate data and send to Tier 0, check for bottlenecks and unforeseen problems
 - (although LHCb is running production)
- ❑ Aggregate data rates ~19 GB/s (ALICE 10 GB/s, 3x3-GB/s)
 - IT will add some internal data eventually, to check limits
- ❑ 2-days (13+14 Sep). If problems are found, no chance to re-test, have to be corrected for the run

2019 Pledge situation



2019 pledges wrt requests:
As given in REBUS
- Final updates due for October RRB



Run 3 running conditions – 1

- ❑ Following discussion with LHC operations
- ❑ Still many unknowns
 - E.g. experiment planned trigger rates are tbd
- ❑ Expected conditions:
 - 7 TeV per beam, gives small reduction in beam size
 - The main limitation is the heat load in the cryogenics
 - Expect BCMS filling scheme; 25ns
 - 2544/2556 bunches, $\beta^* = 27\text{cm}$
 - 1.3×10^{11} protons/bunch
 - 2×10^{34} (could be a bit higher) is the limit due to the inner triplet cooling
 - This will not change in LS2
 - This is a pile up of ~ 60

Planning for Run 3

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- Not much change in understanding since last meeting

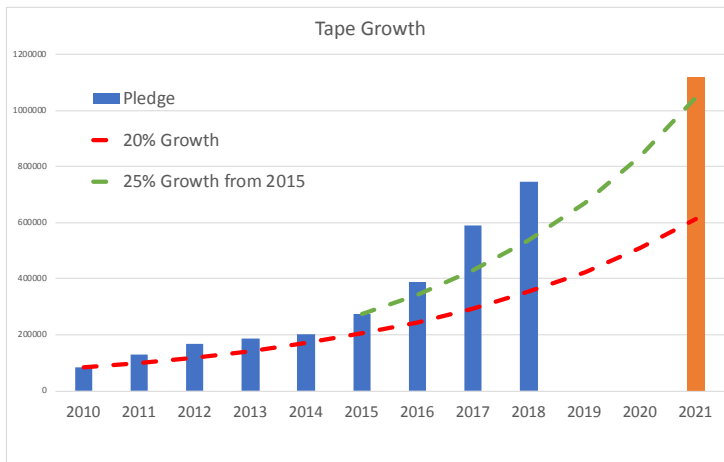
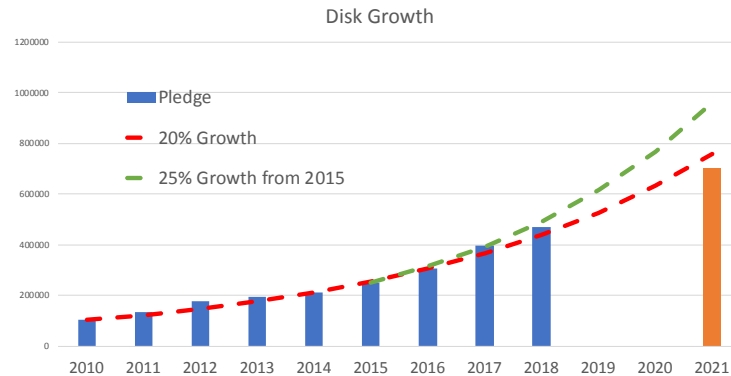
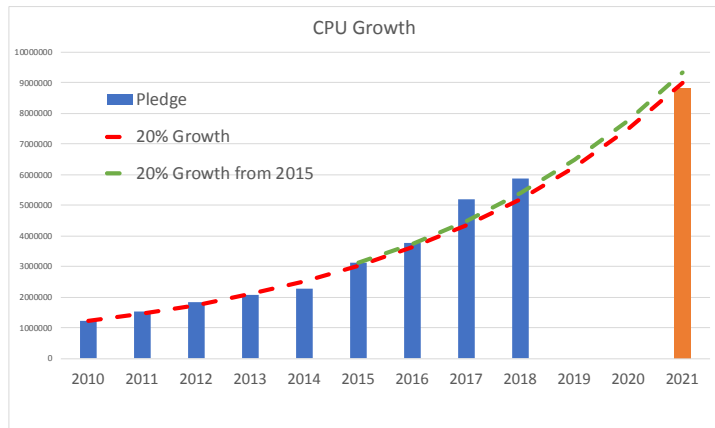
- Best estimates:
 - 2021 will be "light" commissioning year
 - 2022 $\rightarrow 1.3 - 1.5 \times 2018$ depending on trigger rates and levelling duration (and virtual luminosity)
- Still many unknowns:
 - Accelerator conditions
 - Trigger rates, pile-up, parked data, etc.
 - ALCE and LHCb real needs above 2018
- Seems likely we will hit limits of "flat budgets"

Summary

- Run 3 is very hard to plan for ...
- 2018 is already at \sim nominal Run 3 conditions, but hints that LHC conditions will be pushed ...
- Many unknowns from experiments – need some guidance likely trigger rates, sustainable pile-up, etc.
 - Demands continue to increase – maximized trigger rates, parked much more HI data than foreseen, ...
- 2021 is likely to be a short year, but 2022,23 could be very demanding on resources
 - We could reach limits of available budgets
 - This seems likely at CERN ...
 - Strong hints remain that "constant budget" is the only realistic scenario
- What happens when we hit a resource limit?

Parameter	BCMS	BCMS pushed a bit	Nominal - pushed	Comments
Energy [TeV]	7.0	7.0	7.0	
β^* (1/2/5/8) [m]	0.3 / 10 / 0.3 / 3	0.3 / 10 / 0.3 / 3	0.3 / 10 / 0.3 / 3	Plus beta* levelling to 25 cm
Long-range separation [sigma] - assumed emittance	9.2 sigma - 2.5 um	9.2 sigma - 2.5 um	9.2 sigma - 2.5 um	
Initial Half X-angle (1/2/5/8) [μrad]	-160 / 120 / 160 / -150	-160 / 120 / 160 / -150	-205 / 120 / 205 / -150	Anti-levelled to 130 urad
Number of colliding bunches (1/5)	2592	2592	2748	BCMS - 240 bunches/injection from SPS
Bunch population	1.3e11	1.4e11	1.7e11*	* ruled out, initially at least, by e-cloud heat load
Emittance into Stable Beams [μm]	2.5	2.6	3.0	
Bunch length [ns] - 4 sigma	1.1	1.1	1.1	
Virtual Luminosity (L0)	2.3e34	2.6e34	3.2e34	
Levelling time (hours)	2.0	3.8	7.9	
Luminosity per 12 hour fill (burn only)	0.65	0.7	0.8	
Luminosity lifetime (tauL) - end levelling	13 hours	14 hours	15 hours	Approx. - assuming burn only
Integrated/140 day year (fb-1)	65 - 70	70 - 75	85 - 90	NB Ballpark!

Resource evolution



- 2010-2018 – pledges
- 2021 assume 1.5 x 2018

HL-LHC progress

- ❑ Data (DOMA project): Activities ongoing in several areas:
 - Caching and data access
 - Third-party copy
 - Investigation of lower-level protocols (with SKA and GEANT)
 - Replacement of gridftp
- ❑ Software activities – via HSF
 - Software Institute proposal being funded by NSF
 - HSF organizing for specific projects: first are *simulation, reconstruction, analysis*
- ❑ Compute Provisioning & Access
 - Not really started yet, but discussions with HPC providers (PRACE) being organized
- ❑ Authentication, Authorization working group
 - Converging on token-based models, looking at integration with services, etc.
 - In collaboration with international partners and projects
- ❑ System Performance and Cost Model working group
 - Active since last year
- ❑ Technology and Market Tracking
 - Has been long-term activity

HL-LHC Computing Upgrade R&D

Community White Paper (CWP)
HEP community white paper on possible evolutions of computing and software infrastructures, see also full set of papers

WLCG Strategy towards HL-LHC
The strategy document that outlines the strategy and R&D projects of WLCG for preparation of HL-LHC computing

Computing & software R&D
The background is given in the Community White Paper (and individual topic papers), and the WLCG Strategy documents above. These propose a number of R&D projects that will contribute to the development of the distributed computing environment for HL-LHC. These R&D projects are listed and linked below.

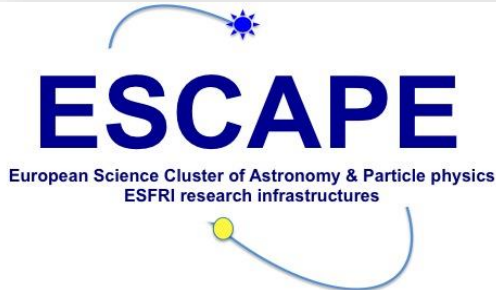
Projects & Activities

- Data Organisation, Measurement Access (DOMA)
- Software performance improvements
 - Organised by the HEP Software Foundation (HSF)
- Compute Provisioning and Access
- Authentication, Authorization Working Group
- System Performance and Cost Modelling Working Group
- Technology and Market Tracking



ESFRI Science Projects

HL-LHC	SKA
FAIR	CTA
KM3Net	JIVE-ERIC
ELT	EST
EURO-VO (LSST)	EGO-VIRGO (CERN,ESO)



Goals:

Prototype an infrastructure for the EOSC that is adapted to the Exabyte-scale needs of the large ESFRI science projects.

Ensure that the science communities drive the development of the EOSC.



ESCAPE Project has been approved

Funded at the requested level

Project likely to start in January 2019

...ess FAIR data management, long term
..., open access, open science, and
to the EOSC catalogue of services.

Challenges

Infrastructure for Open Science
-source scientific Software and

Service Repository

WP4 – Connecting ESFRI projects to EOSC through
VO framework

WP5 – ESFRI Science Analysis Platform

Task 2.2 Content Delivering and Caching

Task 2.2 Storage Orchestration Service

Task 2.1 Storage Services

Task 2.1 Data transfer services

LHCC; 11 Sept. 2018

Task 2.3 Efficient Access to Compute

HTC/Grid

HPC

Cloud/
commercial

citizen

Task 2.4 Networking

Task 2.5 AAI

Ian Bird

Data centres (funded in WP2)

CERN, INFN, DESY, GSI, Nikhef, SURFSara, RUG,
CCIN2P3, PIC, LAPP, INAF

Review of strategy

- ❑ Fairly urgent to converge on a date for the review
- ❑ WLCG-HSF workshop planned for w/b 18th March 2019
- ❑ Would like to be able to use that also as preparation for review
- ❑ Desire to be able to plan around a timetable

Summary

- ❑ Data taking very smooth – no operational concerns,
 - 50 PB pp data so far, expect +25 during HI
- ❑ ESCAPE project approved – will help fund data lake development and integration
- ❑ Run 3 conditions still uncertain
 - 30-50% resource increase compared to 2018 (for ATLAS and CMS), more for ALICE and LHCb
- ❑ Projects for HL-LHC starting in many areas
 - As set out in the strategy