ATLAS Distributed Computing Operation Shift Teams experience during the discovery year and beginning of the Long Shutdown 1

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Abstract. ATLAS Distributed Computing Operation Shifts evolve to meet new requirements. New monitoring tools as well as operational changes lead to modifications in organization of shifts. In this paper we describe the structure of shifts, the roles of different shifts in ATLAS computing grid operation, the influence of a Higgs-like particle discovery on shift operation, achievements in monitoring and automation that made possible focusing more on tasks leading to the discovery, as well as influence of the Long Shutdown 1 and operational changes related to no beam period.

1. Introduction

The ATLAS experiment [1] at CERN (European Organization for Nuclear Research) is one of four major experiments at the Large Hadron Collider (LHC). Normal work of the detector with stable beam collisions started in March 2010 and ended in February 2013. This period of data taking is known as Run 1, and it includes the discovery of a Higgs-like particle in July 2012. Long Shutdown 1 (LS1), that followed Run 1, will continue until the beginning of the year 2015.

A Distributed Computing model is adopted by ATLAS in order to absorb and utilize the huge amount of data from the detector. More than 120 computer centers from all over the world are involved in different ATLAS activities, such as processing/reprocessing of data, Monte Carlo (MC) generation/simulation/reconstruction, data filtering and application of different size reduction techniques. Those computer centers are participating in the Worldwide LHC Computing Grid (WLCG) collaboration [2].

In order to provide adequate computer resources all centers are divided into different categories - Tiers. Tier-0 center is the only one and is located at CERN, while 11 Tier-1s are covering different countries. They are the first to get data transfers from Tier-0. More than 100 Tier-2s and Tier-3s are located at computer centers of universities and institutes, that are participating in the ATLAS Collaboration.

The ATLAS Distributed Computing (ADC) group [3] manages ATLAS grid resources which include CPU, storage, and network resources. There are several subgroups inside ADC which cover different areas of activities. In this paper we describe ADC Operation Shift Teams experience during 2012-2013.

2. Shift organization during Run I and Long Shutdown 1

There are several levels of ADC shifts [4] that are designed to provide reasonable response to incidents of the grid. The very last level is a system administrator at a site, who can fix the affected resource, for example reboot a problematic computer. At the top level there are shifts with 24/7 coverage, because some resources are more important than others and require immediate response.

Since 2008 24-hour coverage is provided by the ADC Operation Shift (ADCOS) team [5]. There are three 8-hour senior ADCOS shifts every day. They are normally done by team members from three different timezones located at home universities or institutes. There is only one expert ADCOS shift per day and it can be taken from any timezone. ADCOS shifters are responsible for a variety of tasks related to activities such as grid data processing, MC production, file transfers between different Tiers, and others.

In 2009 two new shift teams were introduced: ADC Manager on Duty (AMOD) and ADC Comp@P1 [5]. Both types of shifts needed to be taken at CERN. The AMOD shifter was required to carry a cell phone in order to be reachable at any time, day or night. Comp@P1 shift had to be taken in the ATLAS Control room during normal LHC operations and consisted of three shifts of 8 hours each. A team of AMODs is built up from top experts, who are to address or escalate issues with core services of the ADC. Comp@P1 shifter duty is to monitor the most vital grid resources, such as Tier-0 data processing, and data export from CERN to Tier-1s and to Calibration Tier-2s.

In 2012 all teams of shifters showed extreme devotion in providing high quality service and effective resource usage, and made vital contributions to the ATLAS experiment effort which led to the Higgs-like particle discovery. At the end of Run 1, the Comp@P1 team was decommissioned, and AMOD priority was reduced. Now it is possible to take AMOD shifts outside CERN, since no immediate response is expected. The LS1 change in shift structure affects quick response and timely problem solving, but it is adequate to the changes in use of computer resources. It should be emphasized that most of the ATLAS computing activities continue operating normally during LS1, only the Tier-0 part was reduced due to no beam condition.

In order to obtain a good quality of service, several improvements were introduced in 2012 and 2013. They can be divided into two categories: organizational changes, and improvements in tools used by a shifter. It should be mentioned that modifications are related mostly to the ADCOS team.

An additional motivation of trainee shifters to become seniors is that credit for trainee shifts is reduced to zero, and it is the first organizational improvement. This change along with a reduction of training shift sessions helped populate the team of ADCOS seniors.

Creation of ADCOS coordinators group is the second organizational modification. In this group, experts that can help with operational issues are working on current problems, like usage of opportunistic resources by the ATLAS Cloud computing group. This work leads to a constant improvement of the ADCOS instructions available to shifters through the corresponding ATLAS

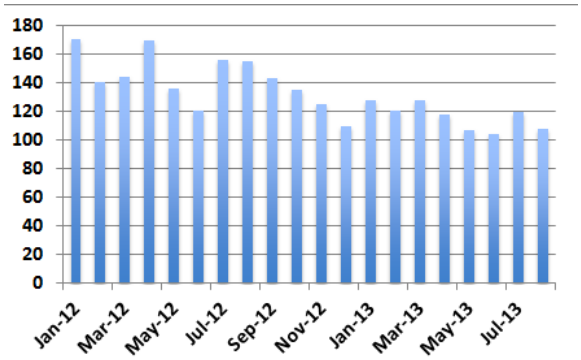

Figure 1. The number of GGUS team tickets per month opened by ATLAS members in 2012-2013

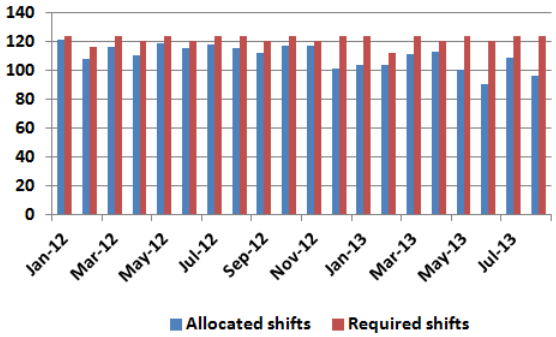

Figure 2. Allocated vs. required ADCOS (senior + expert) shifts in 2013

TWiki web page.

3. Shifter tools

Monitoring, issue debugging, and reporting applications are three major types of tools for a shifter. By checking the numbers of reported problems one can estimate the site efficiency as well as some other parameters of the ATLAS computing. Figure 1 shows that the number of GGUS tickets [6], issued by shifters with /atlas/team role (team tickets), was somewhat reduced in 2013 in comparison to 2012. From Figure 2 it is clear that this reduction in part can be explained by the change in ADCOS team coverage. On the other hand a significant part of reduction comes from improvements in applications.

ADC Monitoring tools [7] are constantly evolving and now include a variety of monitoring pages available to shifters, which holds current and historical information about various ATLAS computing resources. Improvements of such applications and production of new ones lead to more efficient use of time by shifters and easier problem spotting.

One of the most important tools developed during Run 1 is the ATLAS Grid Information System (AGIS) [8]. It keeps information about current site configuration for all ATLAS sites, collects expected downtime information and transfers all of the above to a predefined number of applications. This system creates one place for all important information and provides user friendly interface.

Many operations that were manual two years ago are done automatically now. Usage of AGIS downtime information leads to automatic manipulation (release, acquire) of site resources, for example Panda [9] queues. These manipulations would have been shifter's responsibility a few years ago.

Another approach to automating is using probes for resource checking. Tools like HammerCloud [10] and SAAB [11] can test resources by sending a test job or doing a sample transfer. The results of tests are used for automatic blacklisting/whitelisting of corresponding resources which dramatically saves shifter's time.

At the end it should be mentioned that such automatic tools have a way to report incidents to the proper predefined recipients and as a result reduction of GGUS tickets to sites can be seen, since one of primary goals of GGUS tickets is to notify the site squad about incidents. Figure 3 shows that number of successful grid jobs is not reduced in 2013 with respect to 2012. It means that ADC shifters, with help of improved monitoring tools, are properly providing high quality service.

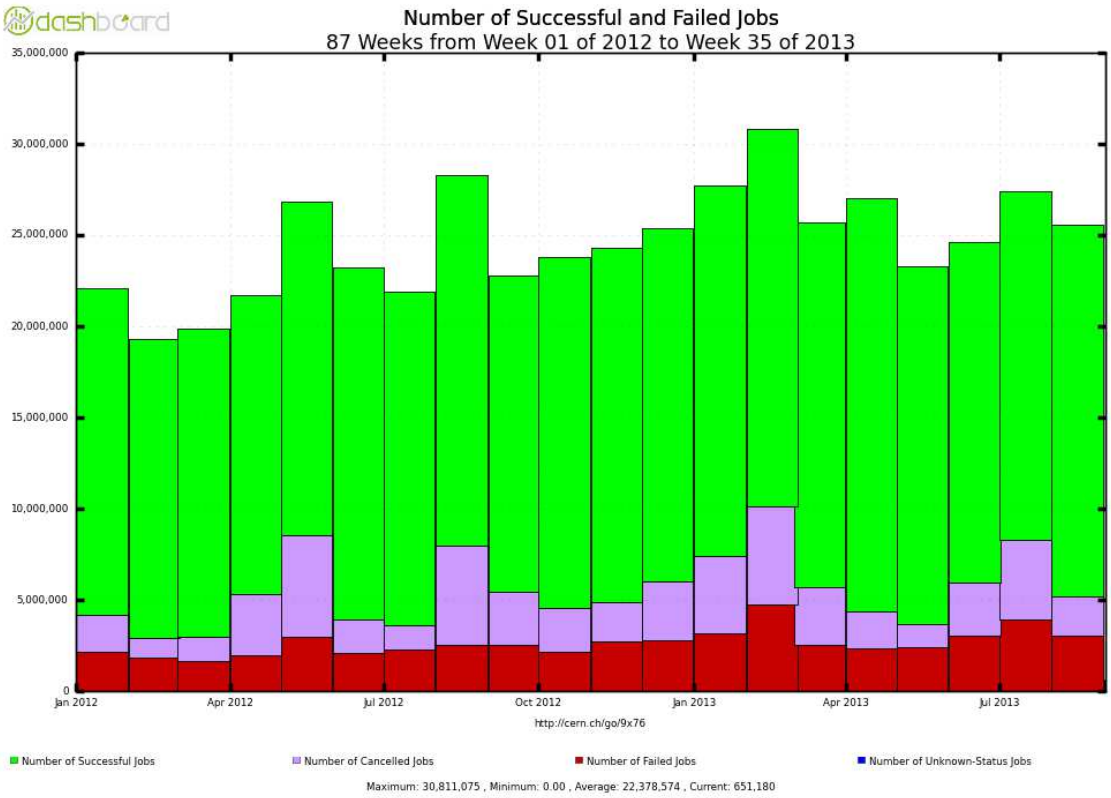

Figure 3. The number of successful and unsuccessful grid jobs in 2012-2013. Test jobs are not included in the plot.

4. Conclusions

The year 2012 was very exciting with the discovery of a Higgs-like particle. Teams of ADC shifters have been providing fast detection, debugging, reporting of all incidents and proper help with solution implementation. After Run 1 some reduction of shifters was observed, but improvements in monitoring tools and new automatic tools help keep high standards for years to come.

Acknowledgments

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