ATLAS Sim@P1 upgrades during long shutdown two

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Abstract. The Simulation at Point1 (Sim@P1) project was built in 2013 to take advantage of the ATLAS Trigger and Data Acquisition High Level Trigger (HLT) farm. The HLT farm provides around 100,000 cores, which are critical to ATLAS during data taking. When ATLAS is not recording data, this large compute resource is used to generate and process simulation data for the experiment. At the beginning of the current long shutdown (LS2), the HLT farm including the Sim@P1 infrastructure was upgraded. Previous papers emphasized the need for "simple, reliable, and efficient tools" and assessed various options to quickly switch between data acquisition operation and offline processing. In this contribution we describe the new mechanisms put in place for the opportunistic exploitation of the HLT farm for offline processing and give results from the first months of operation.

1 Introduction

ATLAS [1] is a general purpose experiment located at point one (P1) of CERN's large hadron collider. ATLAS employs a large computer farm, summarized in table 1, to facilitate data acquisition and event selection. The Sim@P1 project aims to opportunistically use the trigger and data acquisition high level trigger resources for offline computing. The High Level Trigger (HLT) [2] is a mission critical part of ATLAS data taking and is physically connected to the control network of the detector and the "data" network which allows connections to the CERN data centre through a switch at P1. When working with Sim@P1 it is important to ensure the secure isolation from the physical resources at P1, seamless integration into the ATLAS distributed computing system, and reliable transition between the functions of the resources. A system satisfying these criteria was developed during the first long shutdown of the LHC [3]. Isolation is achieved by running virtual machines on the physical HLT hardware. The virtual machines are managed using the cloud framework OpenStack [4]. The virtual machines share the "data" connection of the HLT hardware through a tagged VLAN providing network isolation on the level of the Ethernet frame managed by the switches. This

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Table 1. The hardware at P1 currently available for use with Sim@P1. The C6100 nodes are the decommissioned old HLT. They provide 11008 hyper-threaded (HT) cores permanently running in Sim@P1 mode. Not all cores are used to ensure the virtual machines provide sufficient memory for ATLAS offline workloads. The other hardware is switched to Sim@P1 mode when data taking is not foreseen in the next 24 hours. These opportunistic resources provide up to 97216 additional cores. Usually the trigger and data acquisition team retains some resources for their needs.

Product name	Intel® Xeon®	HT Cores	Memory [GB]	VM Cores	Nodes
C6100	X5650	24	24	16	688
Centerprise	E5-2650 v4	48	64	48	360
Persy	E5-2660 v4	56	64	56	440
MegWare	E5-2680 v3	48	64	48	680
QuantaPlex T41S-2U	E5-2680 v3	48	64	48	472

VLAN allows the Virtual Machines to connect to a controlled list of interfaces in the CERN general purpose network. This list specifies the interface of the machines needed to allow offline workloads to be delivered and executed. To minimize impact of Sim@P1 on the Trigger and Data Acquisition (TDAQ) operation, only simulation tasks from the central production system are submitted to run at P1.

The original implementation of Sim@P1 ran successfully during the first long shutdown of the LHC facilities between 2013 and 2015. Once the experiment resumed data-taking, the system was used in opportunistic mode [5]. The HLT was switched from TDAQ function to Sim@P1 mode for intervals of a few days during technical stops and machine development. To allow this opportunistic usage a set of scripts were developed to manage the transition of resources between TDAQ and Sim@P1 mode.

During the second long shutdown of the LHC facilities, starting in 2019, the HLT will be upgraded. Along with the upgrades to the HLT we plan to upgrade the Sim@P1 infrastructure. We plan to replace the controller nodes, upgrade to a new version of OpenStack, and replace the scripts managing the virtual machines with Cloudscheduler [6].

2 Section title

For bibliography use [7]

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References

[1] The ATLAS Collaboration JINST **3** S08003 (2008)

[2] The ATLAS Collaboration, *Technical Design Report for the Phase-I Upgrade of the ATLAS TDAQ System* (CERN, Geneva, 2013) 120-122

[3] S. Ballestrero *et al.* J. Phys. Conf. Ser. **664** 2 022008 (2015)

[4] Openstack project, "OpenStack" [software], version Icehouse, available from https://www.openstack.org/software/icehouse/ [accessed 2018-09-24]

[5] S. Ballestrero *et al.* J. Phys. Conf. Ser. **898** 8 082012 (2017)

[6] R. J. Sobie *et al.* arXiv:1302.1939 [cs.DC]

[7] Journal Author, Journal **Volume**, page numbers (year)

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