Performance Anomaly Detection in HPC

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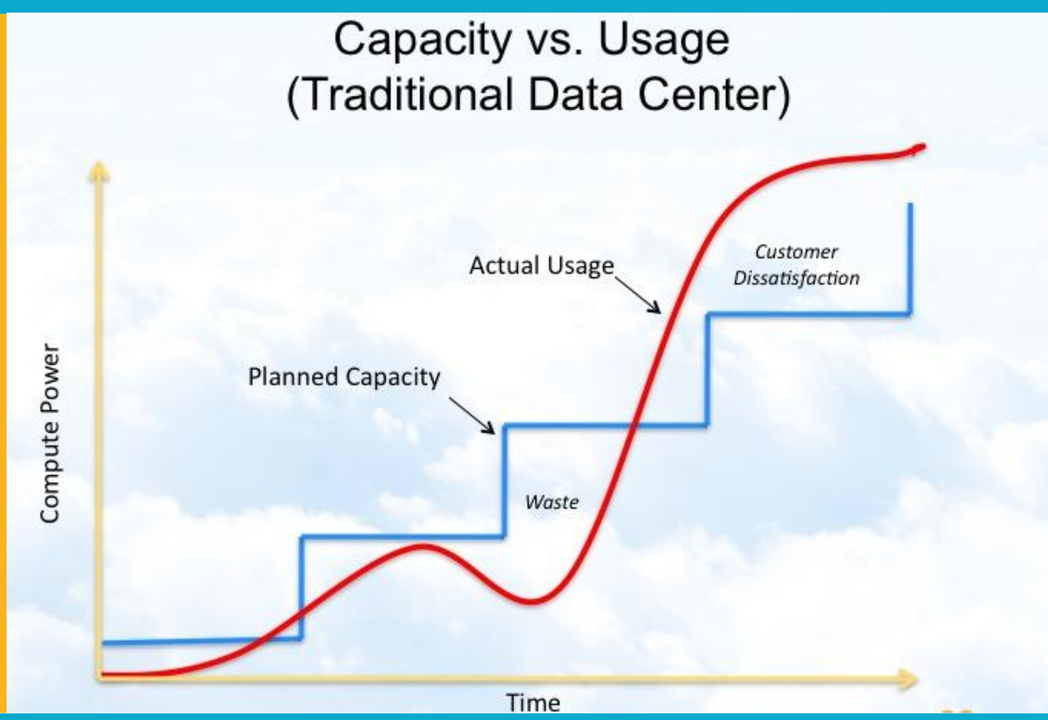
Motivation of the work

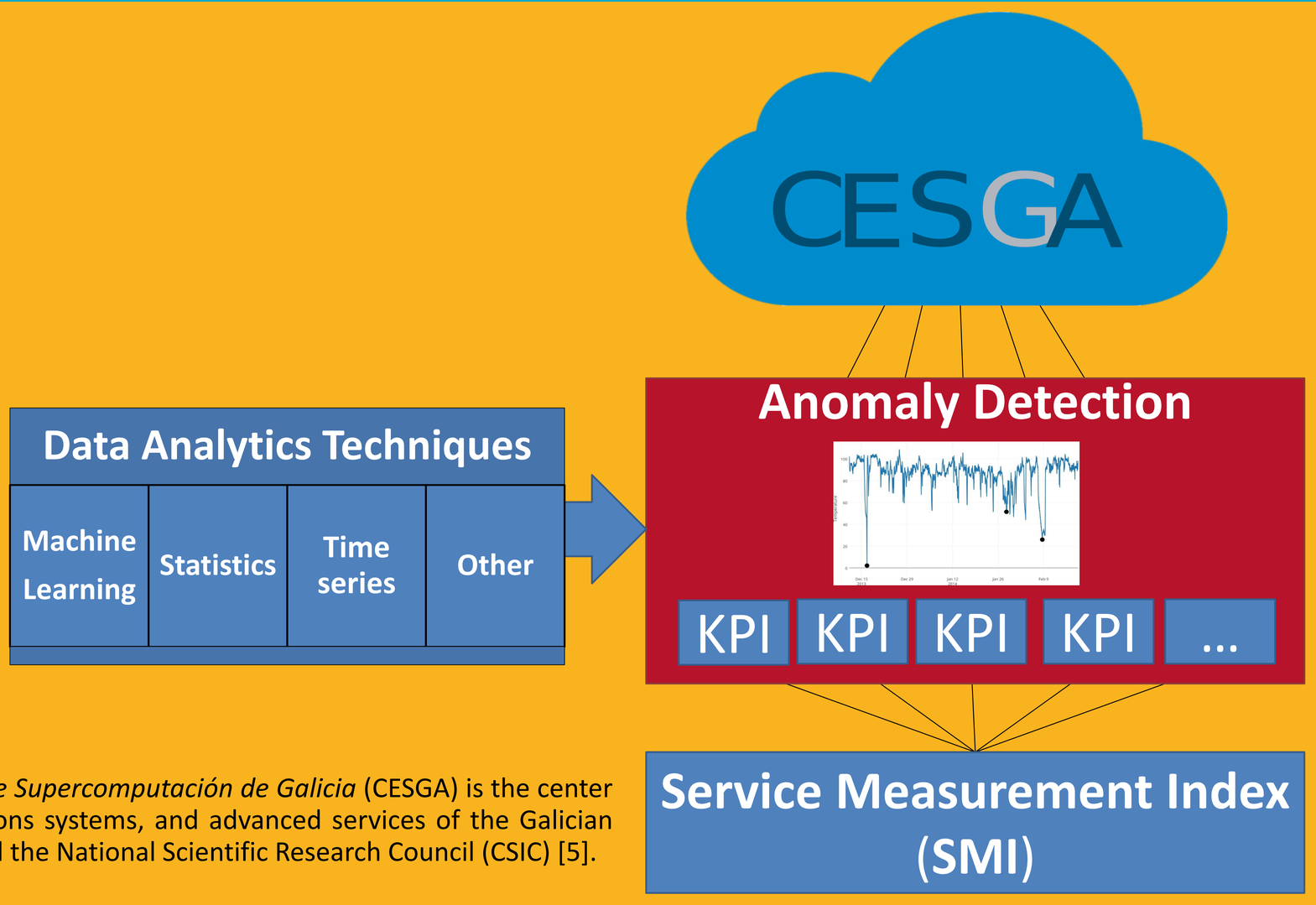
In recent years the demand for High-performance computing (HPC) data centers has increased. HPC often consists of thousands of computing services. Given the high costs related with the setup of such systems, it is vital that the service provider maximize the utilization of the limited data center resources as efficiently as possible and reduce the service cost to fit the “pay as you go” pricing model [1]. As HPC systems and applications continue to increase in complexity, HPC systems become more exposed for performance problems like resource contention, software- and firmware-related problems, etc. that can lead to premature job termination, reduced performance, and wasted compute platform resources. Permanent management of such systems health has a huge impact financially and operationally. So it is essential for the HPC operators to monitor and analyze the performance of such complex system environment [2].

These performance problems moved the research on computational intelligence into a new era to develop the tools and techniques to identify these anomalies. These tools use some data analytic techniques such as Statistical, Machine Learning, Time series, Threshold, etc [3]. that capture information on a large number of the time-varying system performances metrics, and then analyze the relationships among system components and applications [4].



Thesis Objectives

1. Identify the primary challenges and limitations of the HPC cloud performance operationally and financially.
2. Compare the current state-of-the-art techniques on anomaly detection.
3. Choose the proper state-of-the-art techniques on anomaly detection that fits the selected KPIs within the cloud.
4. Evaluate the selected anomaly detection technique on a HPC cluster, private cloud (CESGA).



CESGA

- *Fundación Pública Galega Centro Tecnológico de Supercomputación de Galicia* (CESGA) is the center of computing, high performance communications systems, and advanced services of the Galician Scientific Community, the academic system, and the National Scientific Research Council (CSIC) [5].

Research Plan

2018

- State-of-the-art analysis.
- Assess the different proposals and approaches in the specialized literature to face similar technical problems and to account all challenges and limitations.

Next Year Planning

2018 -2019

- Collect and analyze the datasets of resource usage data and key performance indicators and metrics of the node's performance in HPC datacenter provided by (CESGA) to analyze them.

2018 - 2019

- Design an adequate methodology that allows an efficient detection of potential anomalies in HPC datacenters. Its characteristics should be compared to the state-of-the-art approaches to assess the improvement and advantages.

2019-2020

- Evaluate the methodology designed on a HPC cluster, a private cloud, in order to assess its performance and behavior.
- Preparing the documents required for the PhD defense.

The results of the state-of-the-art and the work on defining a new procedure to detect anomalies using the data provided by CESGA will be disseminated in international journals and/or conferences.

References

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[4] L. Yang, "Anomaly management in grid environments," University of Chicago, Chicago, 2007.

[5] "Cesga," 2016. [Online]. Available: https://cesga.es/en/cesga. [Accessed 25 May 2018].