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A JOURNEY OF DISCOVERY

# Automated Inventory and Monitoring of the ALICE HLT Cluster Resources with the SysMES Framework

J. Ulrich<sup>1</sup>, C. Lara<sup>1</sup>, Ø. Haaland<sup>2</sup>, S. Böttger<sup>1</sup>, D. Röhrich<sup>2</sup>, U. Keschull<sup>1</sup>  
for the ALICE HLT Collaboration

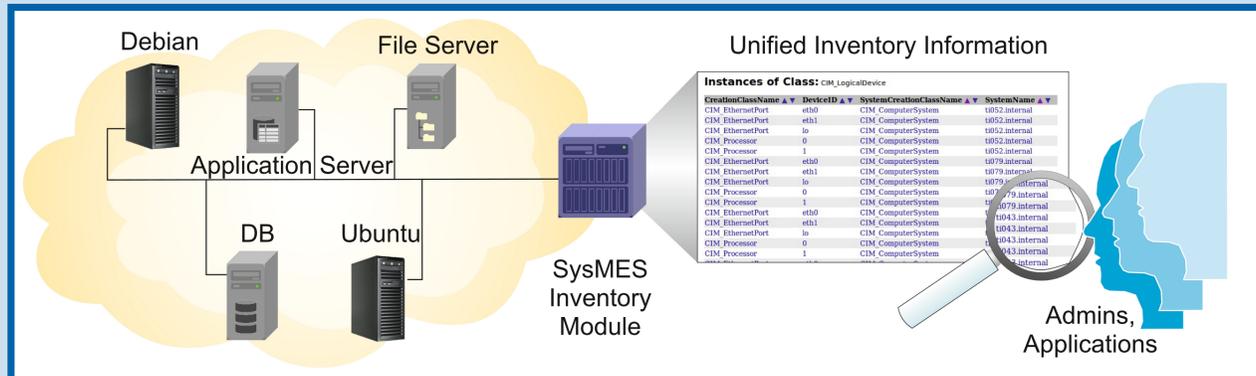
<sup>1</sup> Infrastructure and Computer Systems for Data Processing (IRI), Institute for Computer Science, Goethe University Frankfurt/Main, Germany  
{j.ulrich,lara,boettger,kebschull}@iri.uni-frankfurt.de

<sup>2</sup> University of Bergen, Department of Physics and Technology, Bergen, Norway  
{Oystein.Haaland,Dieter.Rohrich}@ift.uib.no



## Introduction

- Administration of heterogeneous Computer Clusters requires Information about the Node Configuration
- Inventory Databases provide that Information
- Inventory Solution should automatically update Data and should support Heterogeneity and custom Hardware

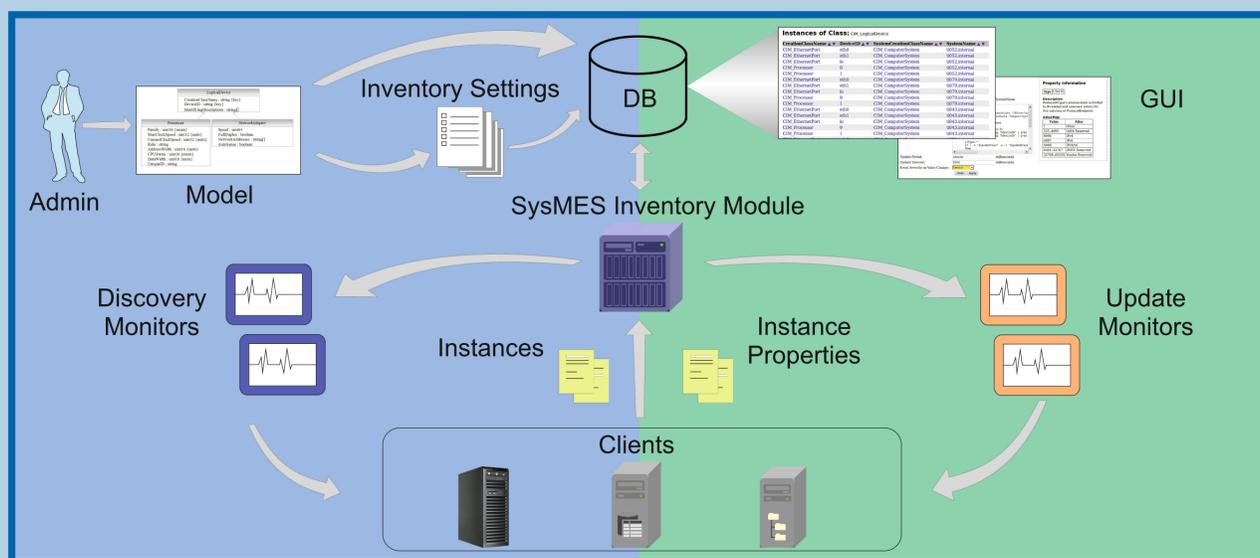


- SysMES Inventory Module automatically keeps the data up to date, complete and consistent
- SysMES Inventory Module provides an unified and centralized Access to the Information for Administrators and other Applications

## Concept

### Configuration Workflow

- Administrator defines Common Information Model (CIM) schema [1] of the Environment and configures Inventory Settings
- Administrator generates Discovery Monitors from the Inventory Settings
- Administrator deploys the Discovery Monitors to the Cluster Nodes using the SysMES GUI



### Operation Workflow

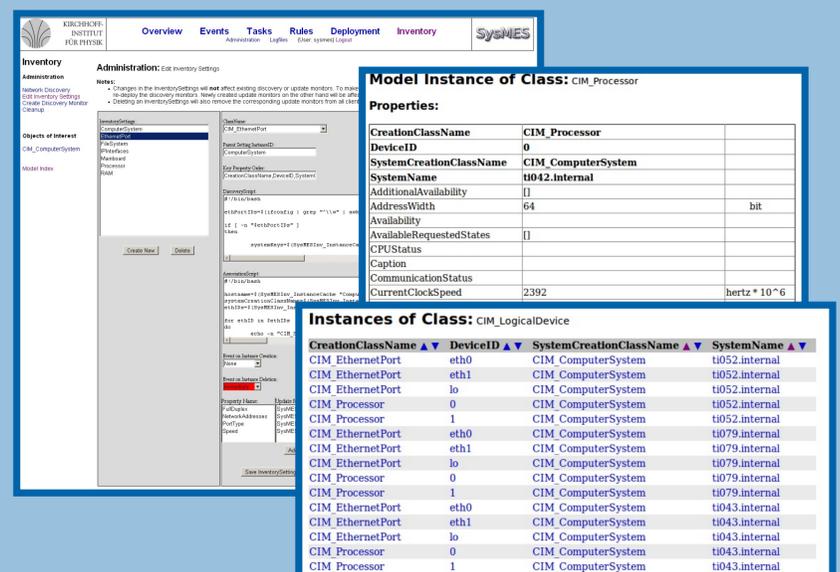
- Discovery Monitors detect objects (instances)
- Inventory Module automatically generates necessary Update Monitors and deploys them to the Clients
- Update Monitors collect the properties of the instances
- Instances and their properties can be viewed through the GUI

## Current State of Implementation

The inventory module is integrated into the system monitoring and management framework SysMES [2]. Therefore, it is written as a Java Enterprise Edition (Java EE) application running on a JBoss Application Server.

The current implementation provides an inventory of the actual state of the environment. The detected instances and their properties are stored in a relational database using object-relational mapping (ORM) [3]. Administrators can access the data through the SysMES GUI and applications can access the data directly from the database.

The implementation of a target state is also planned but is still in work. The target state represents the state the environment should be in and when it is compared to the actual state, it allows to detect misconfigurations and defects.



## Conclusions, Results & Outlook

The SysMES inventory module provides an automated, highly customizable inventory solution that fulfills the needs of heterogeneous computer clusters with custom hardware.

Functionality and performance tests in a test cluster have proven that the SysMES inventory module is able to build an inventory of the actual state of a cluster of 60 nodes with 23 properties in about 4 minutes and updating 20 properties of 100 nodes, i.e. 2000 properties in total, takes about 72 s [4, section 7.4].

The plan for the future is to finish the implementation of the target state and reduce the network traffic. Then, the inventory module will be thoroughly tested to ensure that it has no negative effects on the application running in the cluster. After that, the inventory module is ready to be installed on the production partition of the ALICE HLT cluster.

## References

- [1] CIM Website: <http://www.dmtf.org/standards/cim>
- [2] Boettger S., Breitner T., Lara C., Ulrich J., Zelnicek P. and Keschull U. for the ALICE HLT Collaboration: *Autonomous System Management for the ALICE High-Level-Trigger Cluster using the SysMES framework*, 2011, Journal of Physics: Conference Series **331** 052003
- [3] Haaland O., Herman M., Ulrich J., Lara C., Röhrich D. and Keschull U. for the ALICE HLT Collaboration: *Realization of inventory databases and Object Relational Mapping for the Common Information Model*, 5th International DMTF Academic Alliance Workshop on Systems and Virtualization Management (SVM), 2011
- [4] Ulrich J.: *The Inventory Module of the SysMES Framework*, 2011, Diplomthesis, Kirchhoff Institute for Physics, Heidelberg University, Germany