CLOUD FORWARD CONFERENCE 2015
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Cloud Forward

Smart Cloud Engine and Solution based on Knowledge Base

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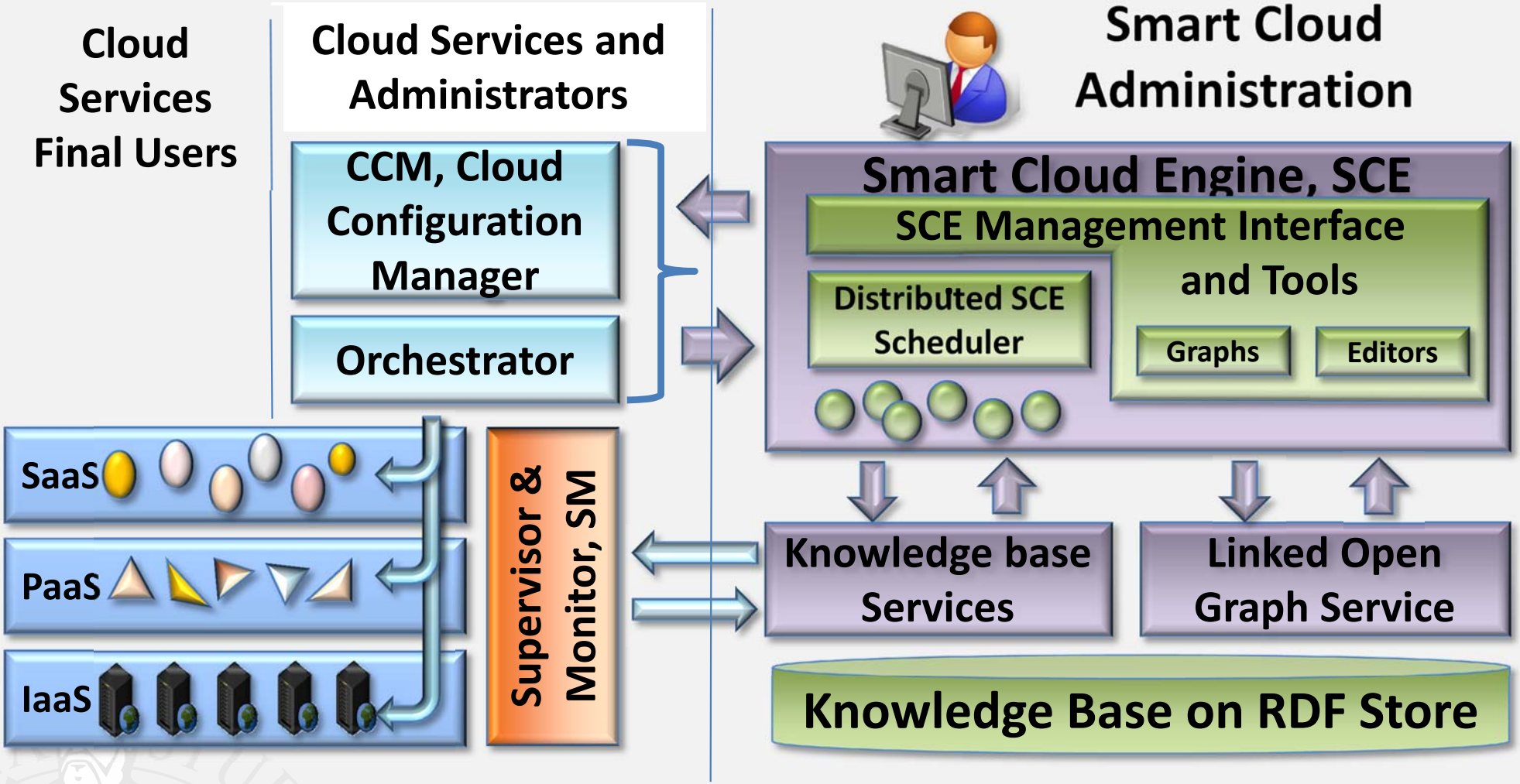
Context and Motivations

- **Relevant ICT infrastructures** are presently deployed on cloud to manage resources in an efficient manner
  - Cloud Customer vs Cloud Service Provider, CSP
  - Service Level Agreements, SLA
- **Smart Cloud Solutions** are becoming mandatory to increase resilience, reliability in cloud automation:
  - configuration/reconfiguration
  - dynamic scaling, elastic computing, migration, cloning, ..
  - cloud resources healthiness control
  - SLA management

Automation of cloud management

- formal verification and validation of cloud configuration in terms of resources, their relationships
- verification and reasoning about cloud security
- interoperability among public and private clouds
- discovering and brokering services and resources
- reasoning about cloud workload conditions, may be via simulation
- computing capability for horizontal and/or vertical scaling, thus elastic computing

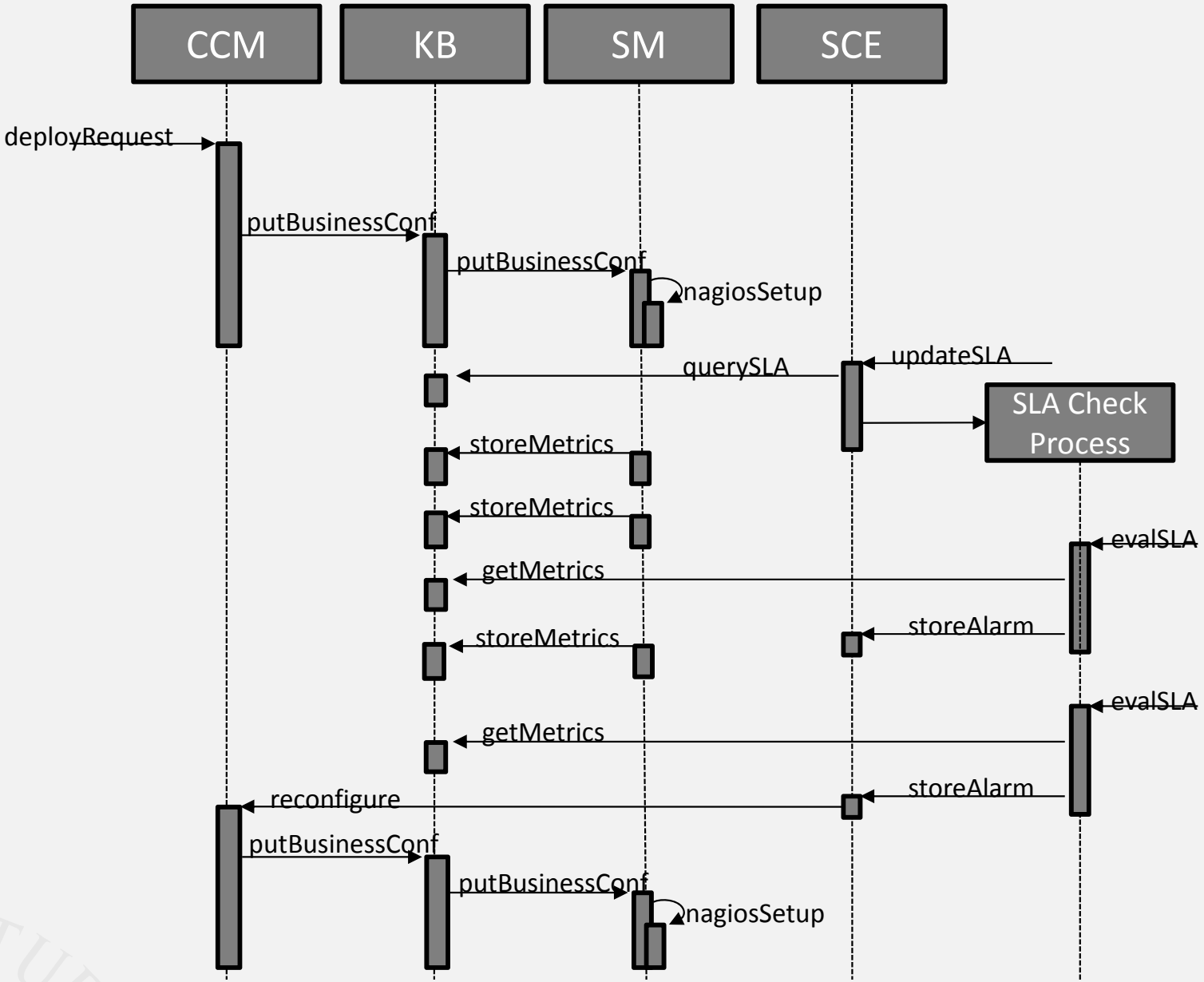
Smart Cloud Engine, SCE



SCE Main Features

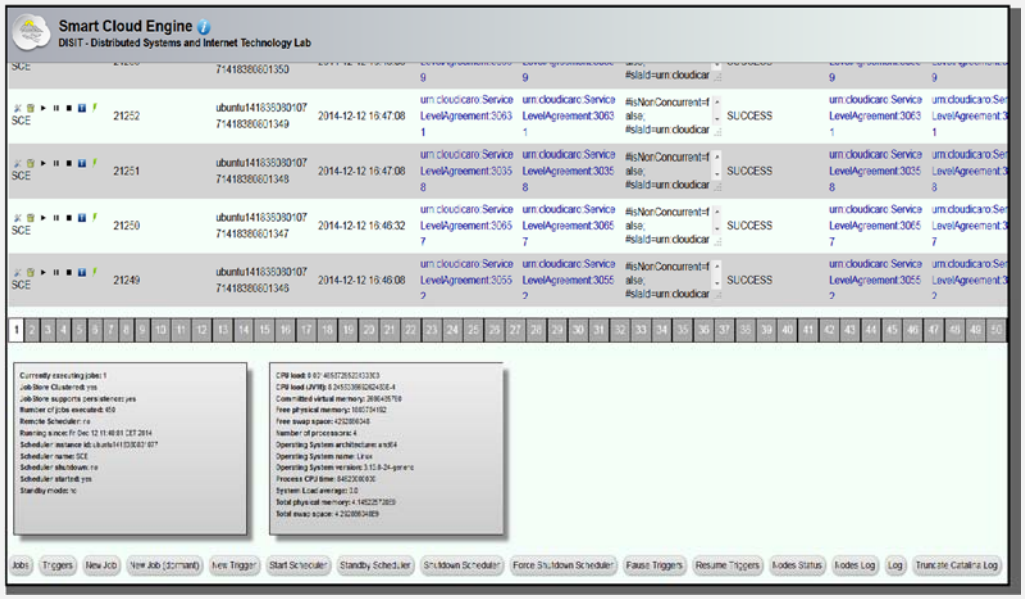
- **Receiving** business configurations, BC, and their SLA
- **Receiving** requests for verification and validation of specific BCs, → providing back:
  - Ack about consistency and completeness of a BC, and config.
  - suggestions, hints related to feasibility,
- **Automatically Assessing** sporadic and/or periodic tasks for
  - monitoring of the SLA associated with each single contract element
  - control of the health/security of any: BC, resource, service on the cloud at any level
  - controlling firing conditions activating reconfiguration strategies associated with BCs: scaling, cloning, migration, alarms, etc.
- **Allowing** the integration of SCE with a range of Cloud Management solutions: CCM and Orchestrators

Sequence diagram

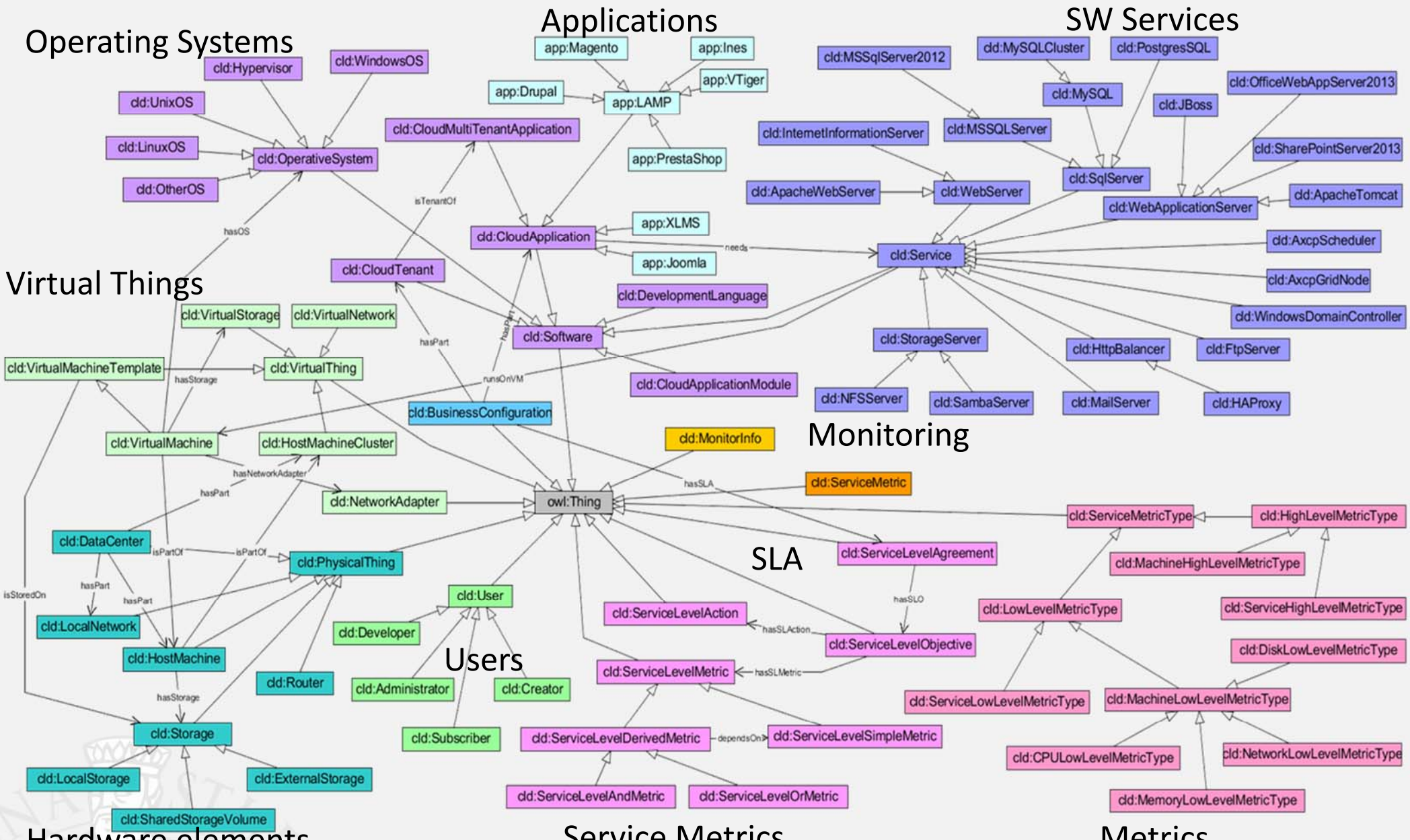


Smart Cloud Engine

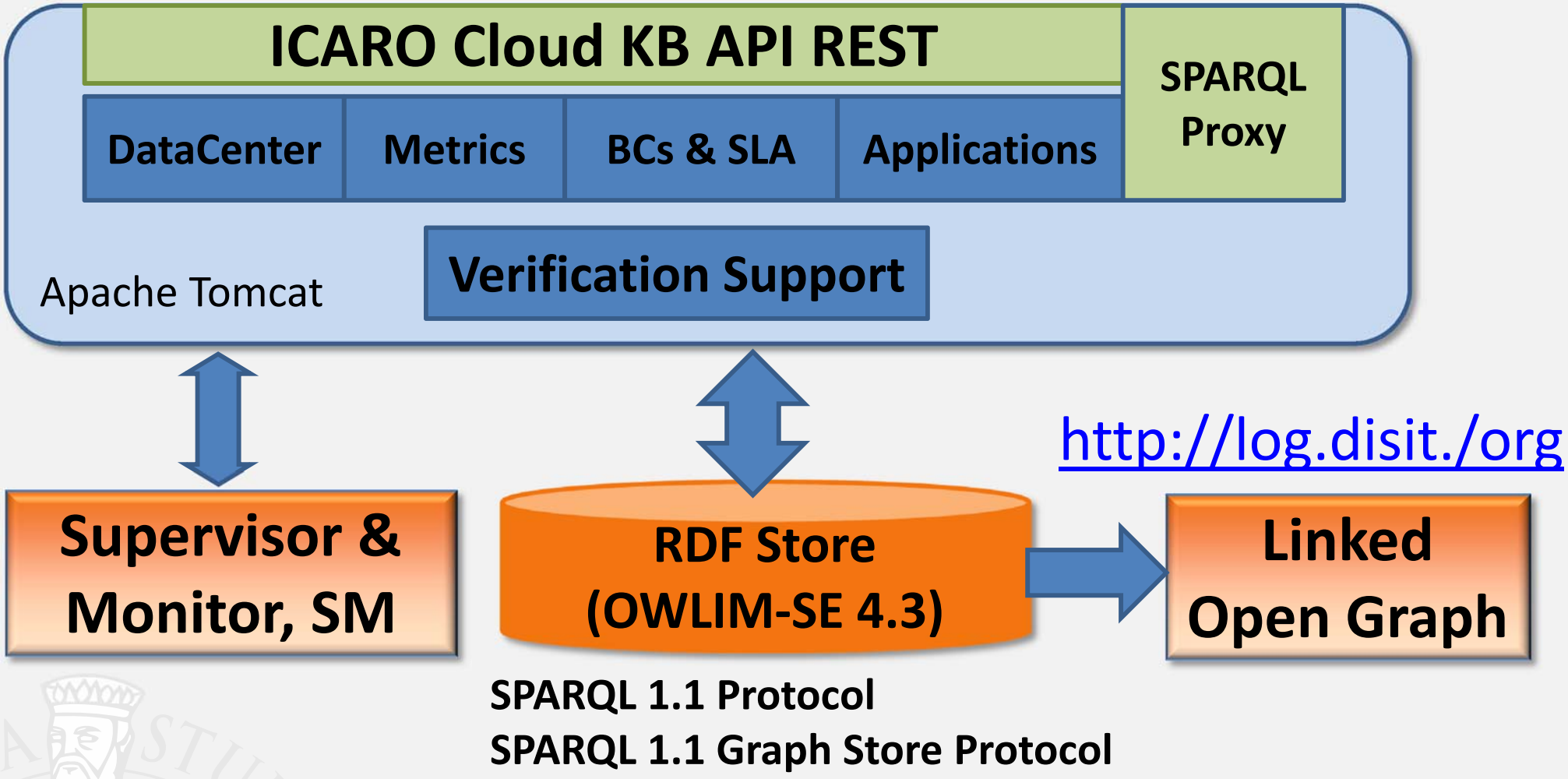
- **SCE Management interface**
  - Monitoring status/Logs of activated processes
  - Manual Action Rules
  - Decision support, alarms
- **DISCES**: a distributed scheduler for executing agents for automated computing
  - Monitoring processes



ICARO Cloud Ontology of KB



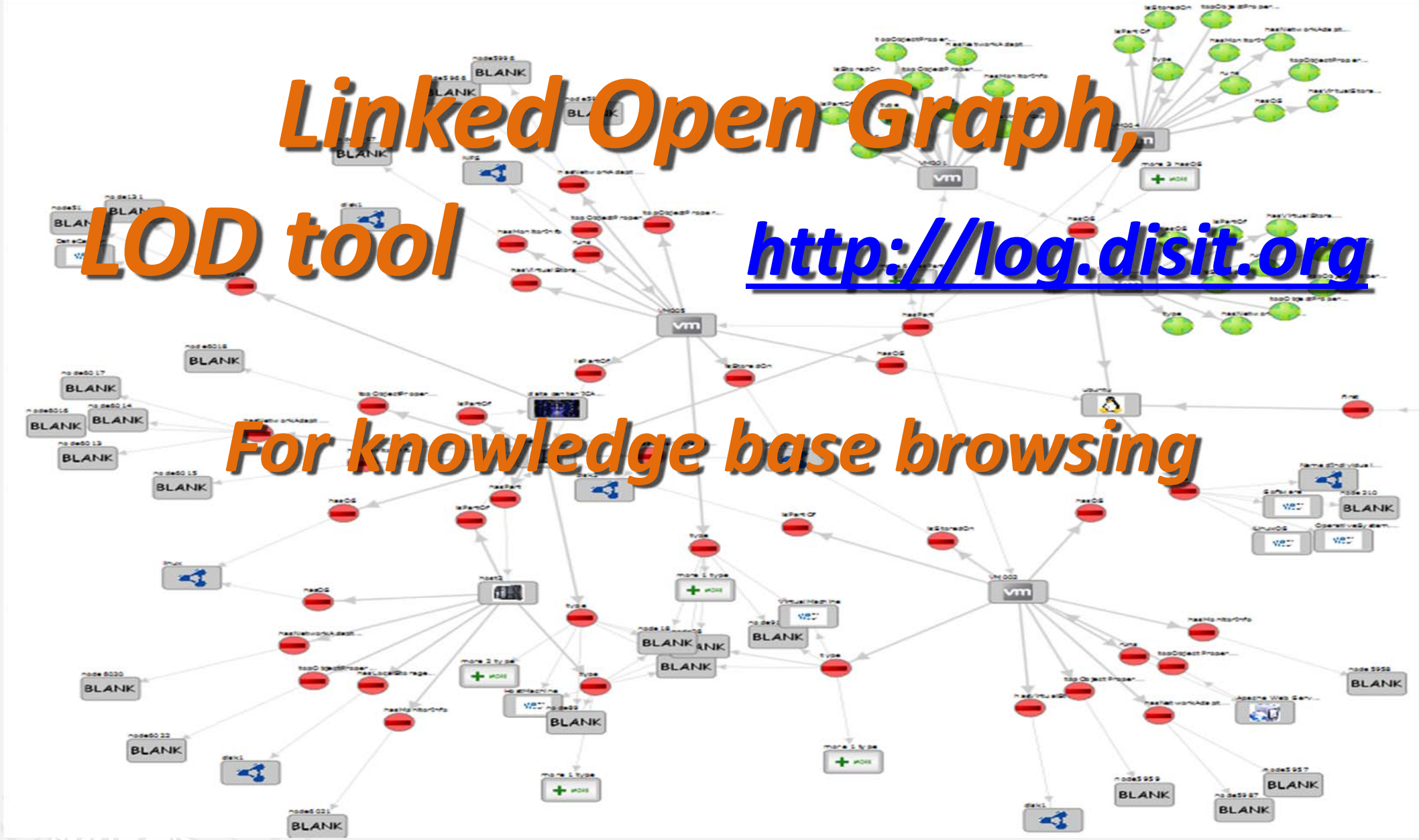
KB Internal Architecture



Linked Open Graph, LOD tool

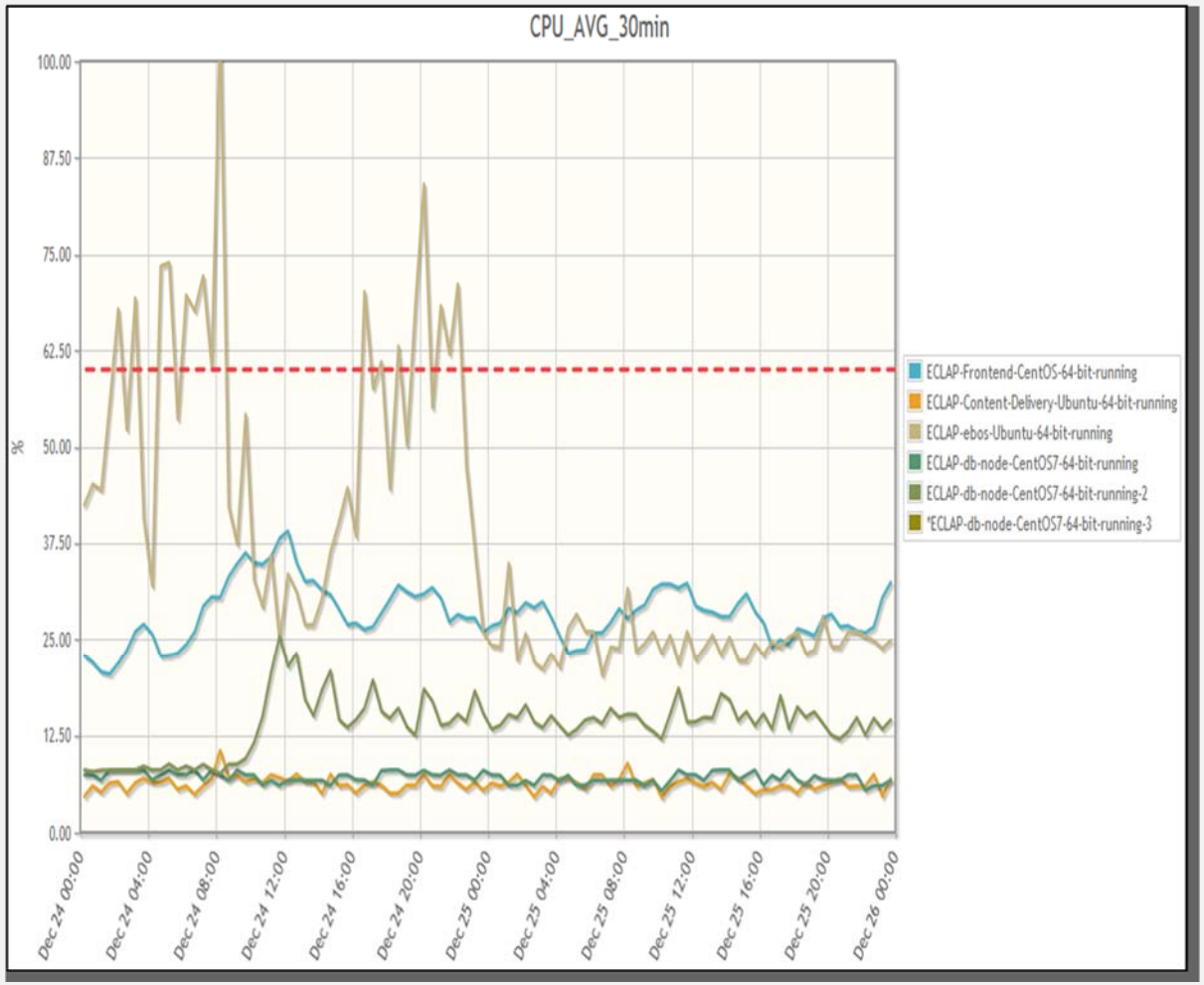
http://log.disit.org

For knowledge base browsing



Metric graphs per: BC/SLA, VM, Service,..

- **ECLAP social network:**
  - http://www.eclap.eu
  - 1 balancer
  - 2 web front ends
  - 1 back office for DB
  - Grid Scheduler and nodes for content ingestion and processing (N VM, 2 in this case)

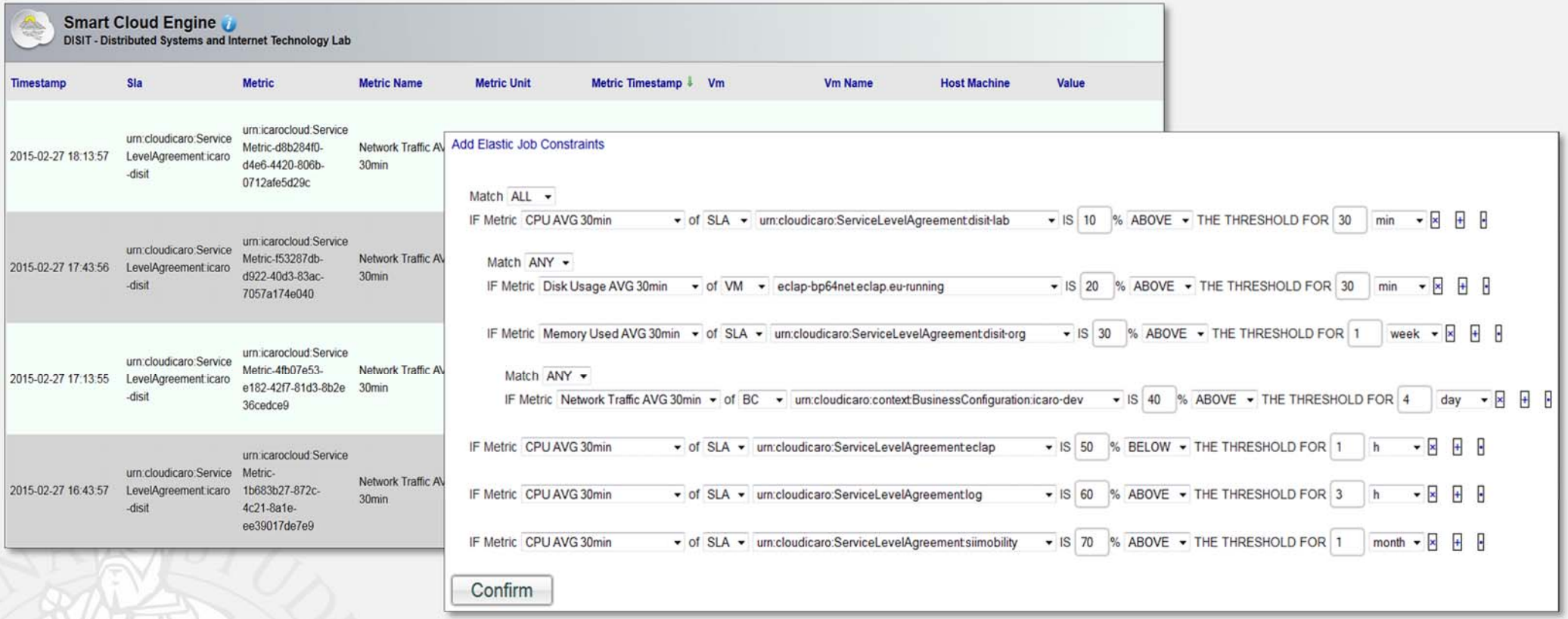


Experimental Results

Service Metric Monitored as the average value of 30 minutes on values assessed every 5 minutes	% of overvalues with respect to reference values expected as defined in the SLA	Incidence of overvalues with respect to the total number of measures (time slots) performed for the business configuration
Memory Usage	73.76%	**11.86%**
Disk Usage	54.03%	**8.57%**
Network workload	24.29%	**3.85%**
MySQL DB Size	59.55%	**2.12%**
CPU Usage	0.07%	0.01%
Apache HTTP response time	0.1%	0.008%
MySQL Connections resp. time	0.1%	0.004%
Tomcat HTTP response time	0.08%	0.003%

- 26.44% of the assessed time slots were affected by some overvalue, that may be associated to alarms for the detection of critical conditions
- collecting 3 months of data about service metrics, with about 3800 evaluations per metric per day

- ***Strategy Condition Editor*** for Elastic Cloud programming
  - Boolean rules with arbitrary complexity to activate procedures for scaling, migration, cloning, thus actuating solutions of control, balancing, self regulation, etc.
  - Conditions are evaluated on the basis of HLM and SLA for Services, VM, and Business Configurations with respect to absolute thresholds or percentages



ICARO Cloud project

- **Partners**: ComputerGross CSP and LiberoLogico
- **Objectives**: Reduce costs for managing on cloud complex configurations → Business Configurations with Service Level Agreements, SLA
  - Provides simple solutions for moving SW applications on Cloud
  - Automating cloud activities as: configurations, management, monitoring, control, reconfigurations
  - Managing high level metrics, HLM, at applicative level and managing BC with HLM on SLA

ICARO Cloud Architecture

Application Access on iCaro cloud Applications

SME

Access to BPaaS, Services Purchase

SLA

App Producers

Developers PaaS

CMW SDK

Subscription Portal

Configuration Manager

Business Producer

Smart Cloud Engine

Smart Cloud

Knowledge Base

Cloud Management

SaaS

PaaS

Cloud MiddleWare Services

IaaS

New

New

New

App/Srv Store

Supervisor & Monitor

Cloud Simulator

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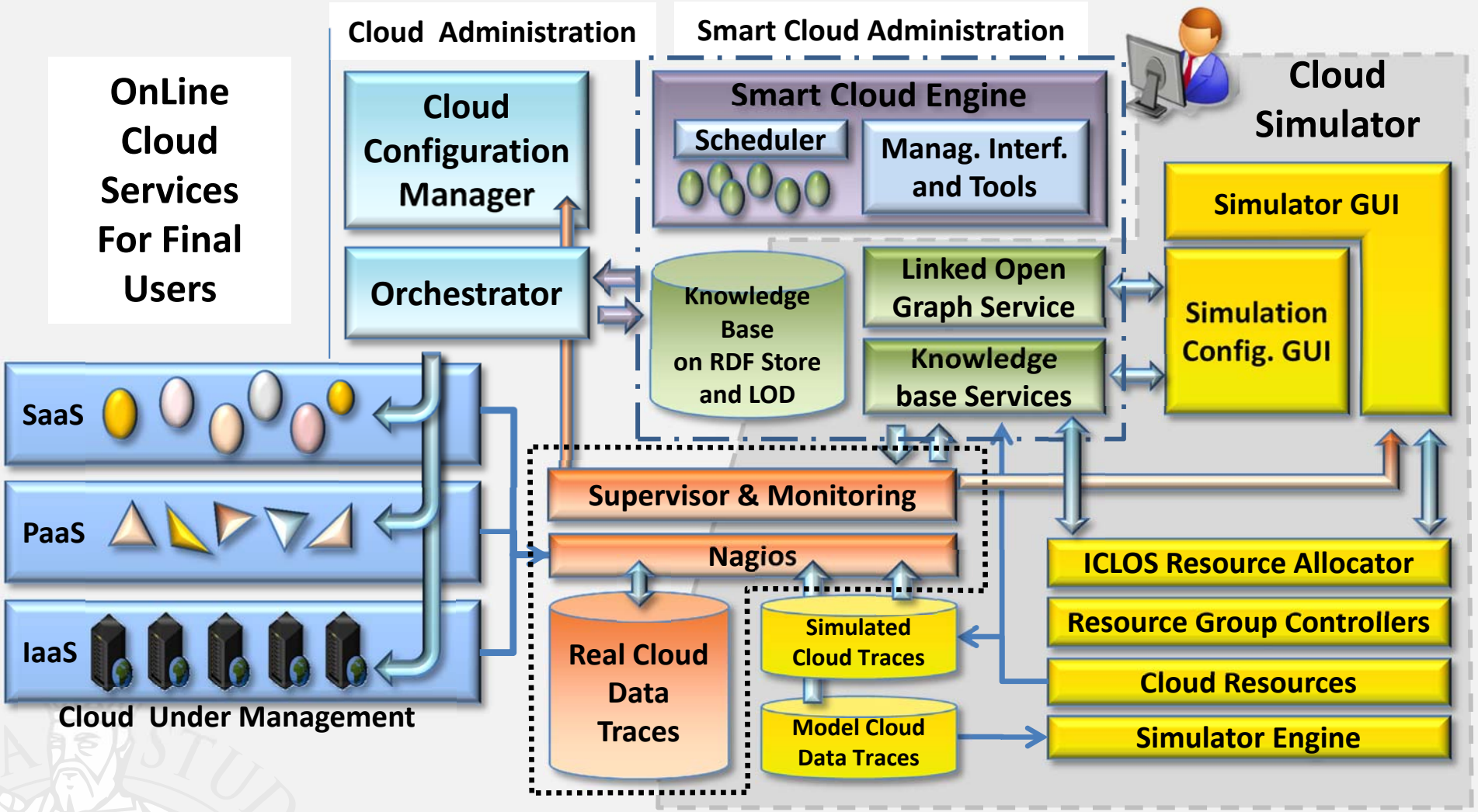
Progetto iCaro

La piattaforma cloud per l'accelerazione del business delle PMI toscane

[CUP 6408.30122011.026000074]

ICARO architecture with ICLOS



Conclusion: The proposed SCE solution

- is based on innovative Knowledge Base: ICARO Cloud Ontology and reasoning tools: BC, SLA, HLM, etc.
- enables a flexible management of cloud resources: verification, control, management: scaling, cloning, migrating, etc. dynamic cloud control
- is scalable and provides smart reasoning for different contexts
- can be easily exploited in connection with any cloud management tools such as configurators, orchestrators, and monitoring tools
- has been validated in ICARO Cloud project with CSPs on complex cloud configurations, and on DISIT cloud multitier solutions with good performance in terms of low operating workload and scalability.
- Supports scalability at level of distributed scheduler for the Smart Cloud Engine, on KB services and on Monitoring.