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Abstract	SSICLOPS is an EU-funded H2020 project which started in February 2015 and has a duration of three years. SSICLOPS focuses on techniques for the management of federated private cloud infrastructures, in particular cloud networking techniques, within software-defined datacentres and across wide-area networks. The project will design, implement, demonstrate, and evaluate three specific use cases; namely, a cloud-based in-memory database, the analysis of physics experiment data, and the prototypical extension of network stacks for a telecom provider.

Keywords	Clouds, datacentres, performance analysis tools, orchestration of cloud resources, intra-/inter-cloud communication, use cases

Project co-funded by the European Commission in the H2020 Programme		
Nature of the deliverable	**R**	
Dissemination level		
PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to bodies determined by the SSICLOPS project	
CO	Confidential to SSICLOPS project and Commission Services	

SSICLOPS

SSICLOPS will empower enterprises to create and operate high-performance private cloud infrastructures that allow flexible scaling through federation with other private clouds without compromising their service level and security requirements.

AT A GLANCE

Project title:

Secure and Scalable Infrastructures for Cloud Operations

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Programme: ICT-2014-1

Further information:

http://www.ssiclops.eu

Concept

SSICLOPS will empower enterprises to create and operate high-performance private cloud infrastructures that allow flexible scaling through federation with other private clouds without compromising their service level and security requirements.

The SSICLOPS federation will support the efficient integration of clouds, no matter if they are geographically co-located or distributed, belong to the same or different administrative entities or jurisdictions: in all cases, SSICLOPS will deliver maximum performance for inter-cloud communication, enforce legal and security constraints, and minimize the overall resource consumption. In such a federation, individual enterprises will be able to dynamically scale in/out their private cloud services, because they dynamically offer own spare resources (when available) and take in resources from others when needed. This allows to maximize own infrastructure utilization while minimizing excess capacity needs for each federation member.

SSICLOPS-powered private clouds will offer fine-grained monitoring and tuning capabilities along with workload planning and optimization tools to maximize the performance across a broad spectrum of workloads and across a wide operational scale, as we will demonstrate using three highly diverse use cases. The SSICLOPS solution will be based upon state-of-the-art open source products used broadly in private cloud deployments today to provide enterprises with full control over their own deployment.

Technical Approach

Cloud consumers face a difficult tradeoff: make use of extremely high-performance, scalable, and reliable public clouds, while suffering their substantial negative impact on security and privacy, or develop their own private cloud infrastructure that will lack many of the economies of scale experienced by hyperscale cloud providers.

SSICLOPS aims to allow institutional cloud consumers to avoid facing this tradeoff through improvements to the state-of-the-art in private cloud infrastructure, and by providing explicit techniques and tools to overtly address the security-scalability tradeoff space spanning private and public cloud infrastructure.

Private and hybrid cloud technology is a key enabler for future ICT growth, especially when deployed in regions of the world with strong data confidentiality, privacy and consumer protection legislation such as the EU.

Hyperscaler public clouds have open APIs, but the system software of the cloud infrastructure is proprietary (and carefully – manually – optimized). On the other hand, private and hybrid clouds are usually put together based on open-source components (APIs are public *and* system software is public). Open source is good for security, transparency, and cost; however, cloud infrastructure assembled only from open-source systems and commodity hardware has a lower degree of integration and optimization compared to the custom code that runs the hyperscalers. That leads to a performance difference, and it can cause feature disparity, creating the undesirable incentive to migrate sensitive data from private to public clouds in search of improved reliability.

The goal of SSICLOPS is to minimize those performance and feature set differences by revisiting and re-optimizing the whole software infrastructure used in private clouds from applications, protocols, operating systems and networking stack and hypervisors. The result will be that private cloud infrastructures gain performance and feature parity with hyperscaler public clouds, a key challenge for cloud infrastructure technology: a recent poll by 451 Research shows that "Technology immaturity is still the major problem, cited by 47% of respondents facing IT roadblocks." Advances in private cloud technology can be a catalyst for private cloud adoption.

Ambition

SSICLOPS pursues highly ambitious goals that cut across a number of related areas, such as:

- Clouds,
- Networking and Operating System Infrastructure,
- Distributed Computing Platforms,
- Securing data in clouds and across clouds, and
- Inter-cloud communication and computation.

Impacts

SSICLOPS will develop secure network infrastructure and increase the security levels for intra- and inter- cloud communication.

The project will investigate solutions for:

- *Trusted Federated Cloud Computing* (specification and enforcement of security and privacy policies),
- *Security-Aware Storage and Processing* (enabling cloud data processing functions to become security-aware and apply appropriate security measure to sensitive data), and
- *Hardened Cloud Data Transport* (securing network system platforms and control planes and lightweight/efficient security for (inter-cloud transport).

Another focal area for SSICLOPS is performance, reliability and flexibility for intra- and inter-cloud transport.