TSSG

Consultation on Cloud Computing Research Innovation Challenges for WP2018-2020

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TSSG

Telecommunications Software & Systems Group

- **Founded:** In 1996, has 100+ researchers (131 people) in Waterford.

- **Expertise:** is a leading software R&D Centre with particular expertise in network, mobile and communications services.

- **Science:** is a leading SFI funded SRC Centre working with IBM, Cisco and Alcatel-Lucent. Working extensively with multinationals such as IBM and Cisco through its world class research programmes, such as the Science Foundation Ireland (SFI) Connect Centre.

- **International:** is one of Ireland's leaders in the EU collaborative R&D programmes (FP7/Horizon 2020) and has worked with over 450 companies across 35 countries.

- **Industry:** completed over 210 direct industry projects in Ireland over the past 5 years and has spun out a number of leading international start-ups such as FeedHenry Ltd, a groundbreaking mobile cloud platform company (acquired by RedHat NYSE: RHT in 2014 for €65 million)

Challenge 1: Federation of Clouds

- Multiple H2020 projects on open source cloud platforms has caused…

    - Bespoke could infrastructures, tailored to project needs

    - Added complication due to need to integrate with open source platforms such as CloudStack (enterprise cloud platform… middleware)

    - Further integration with front end / back end tech needed

    - Additionally, integration with tools for clustering (e.g. Pacemaker), monitoring, config, logging, alerts etc, will be required

    - Multi-partner projects, developing cloud components further complicate the landscape, and can degrade cloud performance.

    - In short, these challenges require deeper focus on integration/federation

Challenge 1: Federation of Clouds

- Privacy of data flowing between countries, and din particular IaaS locations

  - Expectation will be that IaaS will be distributed throughout Europe (to achieve a European-wide cloud)

  - How to handle infrastructure and protection of privacy in this context

  - Potentially requires a common privacy solution to be adopted across Member States

Challenge 1: Federation of Clouds

- Considering European Open Science Cloud (common virtual environment for storage, sharing and re-using data across disciplines and borders).

  - Will be underpinned by European Data Infrastructure

  - Brazil is making similar efforts – country-wide researcher cloud network (currently implemented on a per-institution basis)

  - EUBrasilCloudForum project has proposed that the WP2018-2020 includes projects which will federate open science clouds across continents, so allow R&I communities to share info/data securely

    - Suggestion is to establish an EU-BR Federated Cloud Initiative (work somewhat started via the Cloud 28 plus project (Europe's cloud of clouds), but Brazil not yet included)

Challenge 2: Cloud Network Management

- Much research has been carried out relating to services / service management. Often focus heavily on security, but need to look at adaptability:

  – How cloud services can be provided to support a maximum of end user's requirements, while maintaining self-managing capabilities

  – How cloud services efficiently compose between multiple services that are thrown into the cloud (bearing in mind that the cloud can be composed of large numbers of services, and previous discovery/composition services may not be viable)

  – How could cloud infrastructure support multiple cloud providers fostering cloud interoperability, and what interaction models will exist between infrastructure and service providers

  – How can cloud infrastructure comply with future green ICT initiatives

  – What are the implications of the above on human-centric mobile services on the client side

  – How can cloud solutions support pervasive services (eg. Linked thin clients)

Challenge 2: Cloud Network Management

- Solving adaptability brings challenges:

  – Development of software platforms that enable services to be developed quickly with embedded (self-)adaptive-ness

  – Management of diverse platforms which mobile and social networks are driving

  – Incorporation of security policies to

    - Link user data privacy to service providers

    - Link policies between service providers themselves

  – Performance identification/monitoring in federated data centres

  – Automated and secure load sharing in federated data centres

  – RAMCloud (data centres with no hard disk) job scheduling

  – Micro clouds for distributed processing

  – Interoperability of cloud service providers, enabling data portability

  – Interworking of cloud and mobile services/apps

  – Intersection of cloud and new networking tech (SDN, 5G, …. For wide disperse area coverage)

  – Intelligent cloud, capable of self-healing, dynamic recovery, fast maintenance

  – ……

Challenge 3: Security, privacy, data protection and Trust

- Many open source cloud platforms do not have security integrated:

  - E.g. OpenStack uses the Keystone service… OpenStake has non-secure socket layers, meaning this can open access to Keystone too…. This means that if OpenStack is adopted as the main open source cloud for EU Research partners, encryption will become an issue

  - Cloud security – paramount to proper functioning of future digital economy

  - Architectural shortcomings of cloud deployments and trust issues are still to be overcome

  - Applications rather than networks are targeted for attack. Multidimensional approach to security is needed:

Challenge 3: Security, privacy, data protection and Trust

- Multidimensional approach to security is needed:

    - Harmonised risk models across main global players are required

    - Uniform uptake of cloud solutions should be investigated – to ensure consistency across security situations

    - Security of data centres – international collaboration needed – e.g. enforcement of organisational security policies for data centres through legislation and compliance requirements (while remaining pragmatic)

    - Innovative use of cloud resources to improve security and privacy – offloading user computing activities to the cloud – architecture needs to strike a balance between local devices and cloud servers

    - Systematic approach to cloud security is required……

Challenge 4: International Cooperation on Cloud Computing

- Multiple important, interesting topics for international cooperation include:

  - Cutting edge cloud tech – 5G, Cloud, IoT, Big Data, mobile edge computing

  - Solutions (relative to large centralised clouds) must be user and context aware, dynamic, and with the capability to handle heterogeneous demands and systems

  - Convergence between European and international interests and policies related to clouds

    - Federated clouds, government clouds, data science clouds…..

  - Standardisation around collaboration, data sharing, portability, high performance computing, scalability

  - Globalisation and cloud technology is putting a strain on traditional privacy frameworks.

Further Challenges …

- Development of international cultural-based trust models

- Development of international trust models for cloud computing that can be measured and verified

- Securing cloud computing for enterprises – new business models and market strategies, ease of access for SMEs, cloud portability to enable SMEs to compete, raising awareness (relevant laws, security, trust, data protection….)

Thank you
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