

Mapping Cross-Cloud Systems: Challenges and Opportunities

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Inevitability of cross-cloud computing

“82% of enterprises have a **hybrid cloud** strategy, up from 74% in 2014.”

State of the Cloud Report,
RightScale, 2015

“Users are running applications in an average of 1.5 public and 1.7 private clouds.”

State of the Cloud Report,
RightScale, 2016

Most significant trends:

- “Security, Integrity and Data Privacy
- **Interoperability and Portability**
- Moving to the Cloud
- Standards
- Certification”

Cloud Computing Users Needs,
ETSI, 2015

“25% of enterprises will be deploying [...] into some type of **hybrid cloud**”

“Private cloud is the preferred option for the majority of enterprise workload types, followed closely by **hybrid cloud** deployments.”

Cloud Management Platforms,
451 Research, 2014

Confusion

- Non-convergent terminology
- Lack of shared best practices
- Unidentified research directions

Contributions

- Definition of CCC
- Classification capturing major efforts
 - describe their modus operandi
 - comment on suitability and limitations
- Review of current challenges
- Outlook on research+business opportunities

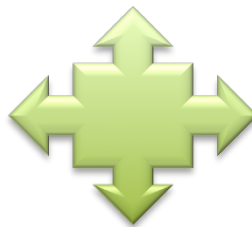
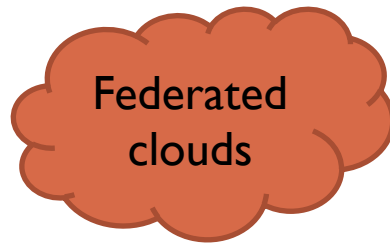
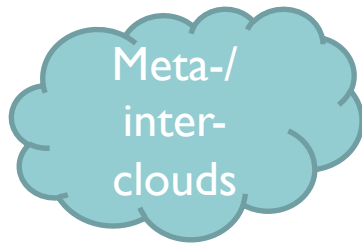
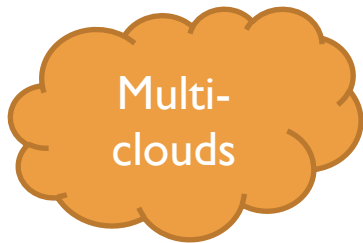
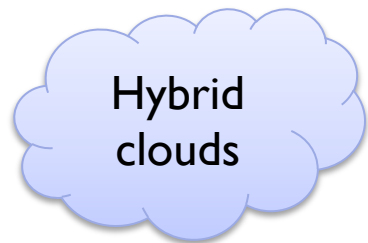
Disclaimers

- Developer perspective, mostly on IaaS
- Drawn from literature and *CrossCloud* events
- Not professing an “uber cloud”
 - commercially unrealistic
 - diversity is healthy

Definition

- A cross-cloud application is one that consumes more than one cloud API under a single version of the application.
- Instigated by
 - change to predetermined plan
 - need to be free from long-term commitment

Dictionary



Application
Developer

Common
Programming
Models

Translation
Libraries

Broker

Common
API

Challenges

- Value-added services
 - e.g. AWS ElastiCache
 - drive usage up for more gravity, ~~not revenue~~
 - ...and attracting new users
 - most developers take the path of least resistance
 - CCC becomes an *academic* exercise



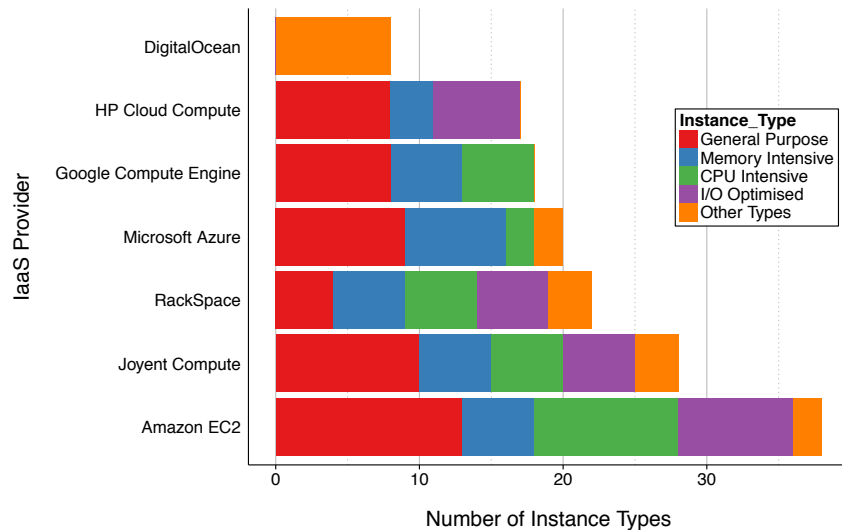
Challenges

- Brokerage market is rather slim
 - trusting a 3rd party?
 - expertise!
 - businesses that have it does not need brokerage
 - businesses that do not have other priorities



Opportunities

- Strategic decision making
 - customers need assistance: entering, migrating



(as of Aug 25th 2015)

Opportunities

- Strategic decision making
 - customers need assistance: entering, migrating
 - room for non-partisan consultancy and arbitrage
 - metrics available: ThousandEyes, CloudHarmony
 - gain knowledge in different domains (CSPs, appl's)
 - quantifying migration costs
 - use ML for thrashing-free decision support

Opportunities

- Crowd-sourced cloud knowledge
 - progress on: metrics (get & compare), billing APIs
 - share for informed users, market competitiveness
 - contextualize QoS metrics to appl. profiles
 - build community knowledge to auto. verify SLAs
 - effect of such evidence-based culture on market

Opportunities

- Migration vehicles
 - containers and unikernels ftw
 - opened up migration possibilities
 - suitability for migrating different workloads
 - life cycle management across disparate host clouds



Opportunities

- Edge market places
 - more hunger for the cloud: more devices, services
 - especially for DC-poor locations with potential
 - DCs being built, but a long-term solution at best
 - a solution: community clouds serving local markets
 - programming abstractions to bridge infrastructures
 - fog offerings by CSPs

Concluding remarks

- Overview of cross-cloud computing
 - definition, classification, challenges, opportunities
- Cloud computing remains industry-driven
- Plenty of room for system innovation

Thanks

- Participants of the CrossCloud event series
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- Q&A

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