

Modelling Cloud Computing Organizational Options

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Introduction

- Goal: identify a set of dimensions for positioning enterprises w.r.t. cloud adoption
- The interest for a single taxonomy contrasts with the complexity of the dimensions (orthogonal)
- Space of possible configurations is equal to the cartesian product of all the possible values for such dimensions
- We formalize dimensions as rules, allowing co-existence of dimensions in contrast between them w.r.t. their indication
- Rule result can be combined and reconciled with voting algorithms

Cloud Based Organizational Designs (CBOD) Project

Project's goal:

Developing a variety of means that will make significantly simpler the elaboration, the decision and the evaluation of cloud-based solutions from information system management and business point of view, accommodating the need for an holistic approach

Rule-based Formalisms

General form for rules:

$$A_0 \wedge \dots \wedge A_n \rightarrow B_0 / \dots / B_m \wedge \dots \wedge C_0 / \dots / C_m$$

- A_i elements compose the body of the rule (precondition)
- B_i and C_j elements compose the head of the rule (*logical consequence* of the body)
- \wedge is logical and
- symbol “/” separates alternatives for the same conjunct

Example: $A \rightarrow B_0 / B_1 \wedge C_0$ is a short-hand for:

- $A \rightarrow B_0 \wedge C_0$,
- $A \rightarrow B_1 \wedge C_0$

Dimensions

- Dimensions intermix technical, economic and organizational factors
- Inherently variable nature of some of these aspects, during the life of the organization
- Positioning is not always fixed, might vary over time
- Stable dimensions: tightly related to the company's inner-nature
- Relatively stable dimensions: defining the company's profile
- Variable dimensions: related to the kind of data analysis and data usage for the enterprise

Stable Dimensions 1/2

Dimension	Description	Rules
a.1	IT-related core business?	IT-RelatedCoreBusiness \rightarrow cloud
a.2	Enterprise size	SmallEnterprise \rightarrow SaaS MediumEnterprise \rightarrow PaaS/IaaS \wedge External/Hybrid cloud BigEnterprise \rightarrow PaaS/IaaS \wedge Internal/Hybrid cloud
a.3	Federated enterprise	Single \rightarrow Internal \wedge Privatecloud Federated \rightarrow Public cloud
a.4	Location(s) of the company	LocationCheapWithServices \rightarrow Internal cloud LocationExpWithServices \rightarrow External cloud LocationNoServices \rightarrow no cloud
a.5	Stability level of programs/requirements	Stable \wedge Custom \rightarrow no cloud Stable \wedge no Custom \rightarrow cloud Unstable \rightarrow cloud

Stable Dimensions 2/2

Dimension	Description	Rules
a.5	Stability level of programs and requirements	Stable \wedge Custom \rightarrow no cloud Stable \wedge no Custom \rightarrow cloud Unstable \rightarrow cloud
a.6	IT usage intensity patterns with time	Predictable \rightarrow Internal cloud Bursts \rightarrow External/Hybrid cloud
a.7	Pooling potential	PoolingInternal \rightarrow Internal/External cloud PoolingExternal \rightarrow External cloud
a.8	Data/program persistence requirements	Long \wedge no Access \rightarrow Internal cloud Medium/short \rightarrow Internal cloud Medium/short \rightarrow no cloud Long/Medium \wedge Access \rightarrow Internal cloud Short \rightarrow cloud
a.9	IT visibility in the pricing model	Visible \rightarrow Internal cloud Visible \rightarrow no Hybrid cloud NotVisible \rightarrow External/Internal cloud
a.10	Confidentiality and security	PublicData \rightarrow cloud PrivateData \rightarrow Internal cloud MixedData \rightarrow Hybrid cloud

Relatively-stable Dimensions

Dimension	Description	Rules
b.1	IT effort	High → cloud Low → External cloud
b.2	Horizon for improvements in the IT infrastructure	Long → cloud Long/Medium → cloud Short/Medium → External cloud Short → External cloud Short → no cloud
b.3	IT in/outsourcing	strongInternalIT → cloud limitedIT → SaaS outsourcedIT → cloud outsourcedIT → SaaS outsourcedIT → PaaS
b.4	Level of IT know-how	LowKnowledge → SaaS MediumKnowledge → PaaS/SaaS HighKnowledge → cloud
b.5	IT time-to-market	Short ^ Legacy → no cloud Long ^ Legacy → cloud no Legacy → cloud
b.6	IT importance	Strong → cloud

Unstable Dimensions

Dimension	Description	Rules
c.1	Volume and/or fraction of private data	no Privacy → cloud Privacy → no cloud Privacy → Internal cloud
c.2	Full data retention or integration with 3rd-party sources	ThirdPartyIntegration → Public cloud InternalIntegration → Internal cloud
c.3	Data processing flow	DataAnalysis → cloud DataIntegration → cloud BusinessIntelligence → Internal cloud B2C/E-Commerce → cloud
c.4	Fault-tolerance and high-availability	High ∧ CriticalTasks → Internal cloud High ∧ no CriticalTasks → cloud High ∧ MixedTasks → Hybrid cloud Low ∧ CriticalTasks → Internal cloud Low ∧ no CriticalTasks → no cloud Low ∧ no CriticalTasks → cloud
c.5	IT performance requirements	StrongRealTime → no cloud
c.6	Status of internal IT infrastructure (SW and HW)	OldInfr ∧ ComplexInfr → cloud OldInfr ∧ ComplexInfr → no cloud NewInfr ∧ ComplexInfr → Internal cloud OldInfr ∧ SimpleInfr → IaaS OldInfr ∧ SimpleInfr → External cloud
c.7	Data storage technology	LegacyStorage ∧ no Custom → Internal cloud LegacyStorage ∧ no Custom → no cloud LegacyStorage ∧ Custom → no cloud NewStorage → cloud

Example 1: New York Times and Washington Post (1/2)

- a.10 (confidentiality and security): mostly public available information
- b.3 (IT in/outsourcing): strong internal IT department
- b.4 (level of IT know-how): quite broad technical know-how
- a.5 (stability level of programs and requirements): one-time problem (unstable program and requirements)
- c.6 (status of internal IT infrastructure):
computationally-demanding task, IT infrastructure not suited;
new task, no legacy system
- b.5 (IT time-to-market): highly parallelized cloud solution was a plus
- a.2 (enterprise size): big enterprises, with required know-how allowing IaaS level solution

Example 1: New York Times and Washington Post (2/2)

Instantiation of the different dimensions:

- a.2: BigEnterprise \rightarrow IaaS
- a.5: Unstable \rightarrow cloud
- a.10: PublicData \rightarrow cloud
- b.3: strongInternalIT \rightarrow cloud
- b.4: HighKnowledge \rightarrow cloud
- b.5: no Legacy \rightarrow cloud
- c.6: OldInfr \wedge SimpleInfr \rightarrow External cloud

Example 2: Fratelli Levaggi Sedie

- a.2 (enterprise size): small handicraft firm composed by 5 artisans which realizes “chiavarina” wooden chairs
- b.4 (level of IT know-how): total absence of an internal IT department
- b.3 (IT in/outsourcing): external company for the realization of the website
- c.6 (status of internal IT infrastructure): website is hosted remotely on Aruba servers (no HW)
- In addition to the website, they use social networks (Facebook, Twitter), online videos, e-mails (exclusively SaaS services)
- a.2: SmallEnterprise → SaaS
- b.3: limitedIT → SaaS
- b.4: LowKnowledge → SaaS
- c.6: OldInfr \wedge SimpleInfr → External cloud

Conclusion

- Different dimensions for guiding in the positioning of enterprises w.r.t. cloud computing adoption
- Rule-based model circumvent the difficulty of grouping dimensions as needed by a taxonomy
- Preliminary validation by means of case studies
- Extensible and customizable model by means of rules and result aggregation strategy

Thank you for your attention