Supporting Software Services' Trustworthiness in Collaborative Networks

Maiara H. Cancian
Ricardo J. Rabelo
Christiane G.von Wangenheim

GSIGMA - Intelligent Manufacturing Systems Group
DAS - Department of Automation and Systems
UFSC - Federal University of Santa Catarina
Brazil

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Introduction

Collaborative Networks (CN) paradigm relies on the existence of three essential pre-conditions:

- *Collaboration*: among involved partners.
- *Trust*: partners shall trust to one another.
- *Digital transactions*: (most of the) activities carried out via computer networks.

In essence, all this aims at enabling organizations to *agilely and adaptively define, set up relations and operate with other organizations*.

Introduction

Supporting this requires several issues to cope with in businesses and collaborations, such as:

- Business processes effectiveness;
- Interoperation;
- Value added perception;
- Trustworthiness;
- Cooperation;
- adequate Business Models;
- People empowerment;
- …
- and *Flexible and Advanced ICT infrastructures*.

Prominent approaches:

SOA (Service Oriented Architecture) ,

Utility ,

Cloud Computing ,

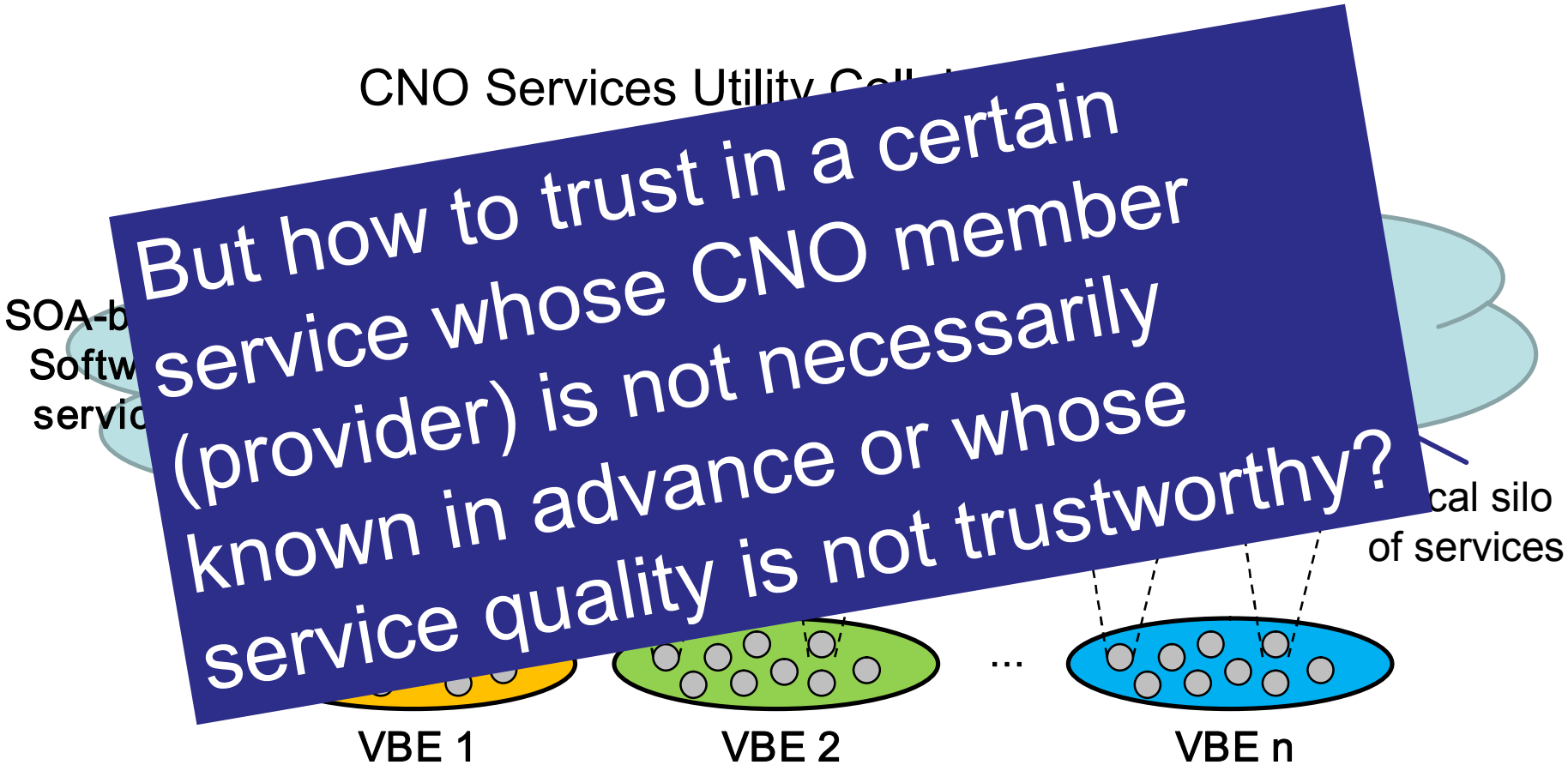
and *SaaS* (Software as a Service)

paradigms.

Evidences and General Motivation

- Several CNO members **already use** SOA-based solutions;
- Several CNO members develop their own software services but keep them in their **isolated silos**;
- Several applications are nowadays **already offered** under the SaaS model;
- CNO members (including software developers) **can share** (i.e. acting as **providers**) their services and **can use** (i.e. acting as **clients**) the others' services to compose their own new SOA-based applications.

Research Scenario



Motivation

- CNO members (as clients) **must feel confident** to access and to use a given service.
  - minimizing the risk of *crash* in their SOA-based systems due to the lack of quality of the accessed services.
- CNO (as providers) should be **prepared for exposing their services**, applying adequate quality implementation processes.
- Problem: **There are not concrete guidelines**, practices or reference models on how software services should be implemented when they have to be accessed & used under the SOA/**SaaS** model.

Objective & Approach

Proposing a *Reference Guide* devoted to software services for SaaS model regarding CNO view.

More precisely, developing a guide that can be used by both CNO members that want to share their services (as 'providers') and by CNO members that want to access such services (as 'clients') with confidence about services' quality.

Objective & Approach

In essence, a reference guide is constituted by a **list of quality processes requirements** (from the software development point of view) that should be followed by a partner that wants to share its software services under the SaaS model in way to express its *capability* and *maturity level* to offer trustworthy services.

In a guide, a list of concrete **best practices** and **governance actions** should be also associated to every single process requirement, meaning specifying how to introduce it as well as to monitor/maintain it.

Underlying hypothesis

CNO members can increase their collaboration level by means of sharing services, and they will be more confident to do this if both providers can know how to prepare their services for SaaS in a large collaboration environment, and clients can know (be confident) about the others' services quality.

→ "*quality certification*" as a mechanism for global **reputation**.

Guide Development Methodology

Main steps:

1. Identification, organization, terminology normalization & formalization and relevance of which **process requirements** are needed to "guarantee" trustworthiness in a scenario of services sharing among CNO providers and clients under SaaS;
   - 84 answers (out of 280) from specialists ces from all over the world (Internet survey and person
   - 25 criteria were identified a *important* and *essential* for supporting that scen
2. **Mapping** betwe iness requirements and the most relevant softwar reference models (e.g. CMMI, CobiT and ISO/IEC 15504);
   - Identification of existing best practices for each process requirement and their fitness level (QFD methodology) by a group of specialists.
3. First guide evaluation.
4. **Specialization** of identified practices to SaaS and CNOs.
5. Second guide evaluation.
6. Definition of **maturity levels.**
7. Final **Validation.**

It is an ongoing PhD work.

Guide Development Methodology

ITEM	QUALITY CRITERIA RELATED TO THE PRODUCT OCCURRENCES			
	Essential	Very important	Not critical	Unnecessary
Accessibility	59.26%	25.93%	14.81%	null
Reliability	58.02%	37.04%	3.70%	1.23%
Performance	27.16%	58.02%	13.58%	1.23%
Availability	33.33%	41.98%	19.75%	4.94%
Scalability	20.99%	50.62%	27.16%	1.23%
Integrity	69.14%	25.93%	4.94%	null
Interoperability	27.16%	51.85%	19.75%	1.23%
Robustness	29.63%	48.15%	20.99%	1.23%

ITEM	QUALITY CRITERIA RELATED TO THE PROCESS OCCURRENCES			
	Essential	Very important	Not critical	Unnecessary
Acquisition	34.57%	48.15%	17.28%	null
Change control	22.22%	56.79%	19.75%	1.23%
Quality control on software process	38.27%	45.68%	16.05%	null
Version control	30.86%	48.15%	19.75%	1.23%
Development and requirement management	48.15%	35.80%	16.05%	null
Maintenance	29.63%	45.68%	22.22%	2.47%
Certification of process quality	6.17%	37.04%	45.68%	11.11%
Security (of sent and stored data)	54.32%	38.27%	7.41%	null
Help desk	19.75%	49.38%	29.63%	1.23%
Tests	30.86%	54.32%	13.58%	1.23%

ITEM	QUALITY CRITERIA RELATED TO THE ORGANIZATION OCCURRENCES			
	Essential	Very important	Not critical	Unnecessary
Infrastructure capability	32.10%	59.26%	7.41%	1.23%
Technically competent employees	29.63%	37.04%	33.33%	null
Prevision of continuity of service	29.63%	41.98%	23.46%	4.94%
Technically competent in business	22.22%	50.62%	25.93%	1.23%
Utilization of standards	35.80%	41.98%	19.75%	2.47%
Governance	complement	complement	complement	complement
Reputation	complement	complement	complement	complement

Guide Development Methodology

MATRIZ DE CORRELAÇÃO

Legenda:

Essencial
Muito importante
Importante
Fracamente importante
Desnecessário

ISSO 15504 (ACQ, SPL, ENG)

		ACQ.1 Acquisition preparation	ACQ.2 Supplier selection	ACQ.3 Contract agreement	ACQ.4 Supplier monitoring	ACQ.5 Customer acceptance	SPL.1 Supplier tenDering	SPL.2 ProDuct release	SPL.3 ProDuct acceptance support	ENG.1 Requirements elicitation	ENG.2 System requirements analysis	ENG.3 System architectural Design	ENG.4 Software requirements analysis	ENG.5 Software Design	ENG.6 Software construction	ENG.7 Software integration	ENG.8 Software testing	ENG.9 System integration	ENG.10 System testing	ENG.11 Software installation	ENG.12 Software anD system maintenance
PRODUTOS	Acessibilidade	D	D	D	D	D	D	D	D	I	M	D	I	D	D	D	D	D	D	D	D
PRODUTOS	Confiabilidade	I	I	I	I	E	F	F	F	E	E	I	I	M	I	I	E	I	E	I	M
PRODUTOS	Desempenho	I	I	I	I	E	F	F	F	E	E	E	E	E	M	I	E	I	E	F	M
PRODUTOS	Disponibilidade	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
PRODUTOS	Escalabilidade	D	D	D	D	D	D	D	D	I	I	E	I	M	D	I	I	I	I	F	I
PRODUTOS	Integridade	D	D	D	D	D	D	D	D	I	E	M	M	I	I	I	I	I	I	F	I
PRODUTOS	Interoperabilidade	D	D	D	D	D	D	D	D	I	M	E	I	M	D	D	D	F	I	D	D
PRODUTOS	Robustez	D	D	D	D	D	D	D	D	M	M	D	M	D	D	D	E	I	E	D	M
PRODUTOS	Segurança	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Aquisição	E	E	E	E	E	E	E	E	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Controle de mudanças	D	D	D	D	D	D	D	D	I	I	I	I	I	D	D	D	D	D	D	D
PROCESSO	Controle de qualidade de processo de software	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Controle de versões	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Desenvolvimento e Gerência de Requisitos	D	D	D	D	D	D	D	D	E	E	E	E	E	D	D	D	D	D	D	D
PROCESSO	Manutenção	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	E
PROCESSO	Suporte/help Desk	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Testes	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D	D	D
ORGANIZAÇÃO	Capacidade de infra-estrutura	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Funcionários tecnicamente competentes	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Governança	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Previsão de continuidade do serviço	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Reputação	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Tecnicamente competente na área De negócio	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Utilização de padrões	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

ISSO 15504 (OPE, MAN, PIM, RIN, REU)

		OPE.1 Operational use	OPE.2 Customer support	MAN.1 Organizational alignment	MAN.2 Organizational management	MAN.3 Project management	MAN.4 Quality management	MAN.5 Risk management	MAN.6 Measurement	PIM.1 Process establishment	PIM.2 Process assessment	PIM.3 Process improvement	RIN.1 Human resource management	RIN.2 Training	RIN.3 KnowleDge management	RIN.4 Infrastructure	REU.1 Asset management	REU.2 Reuse program management	REU.3 Domain engineering
PRODUTOS	Acessibilidade	E	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D	D
PRODUTOS	Confiabilidade	I	I	D	D	I	M	F	F	D	D	D	F	I	F	I	F	E	F
PRODUTOS	Desempenho	I	F	F	F	M	I	F	F	D	D	D	F	I	F	I	F	I	F
PRODUTOS	Disponibilidade	E	F	D	D	D	I	D	D	D	D	D	D	D	D	E	D	D	D
PRODUTOS	Escalabilidade	E	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D	D
PRODUTOS	Integridade	F	D	D	D	D	D	D	D	D	D	D	D	F	D	D	D	D	D
PRODUTOS	Interoperabilidade	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	F	F	F
PRODUTOS	Robustez	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PRODUTOS	Segurança	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Aquisição	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Controle de mudanças	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Controle de qualidade de processo de software	D	D	D	D	D	D	D	D	E	E	E	D	D	D	D	D	D	D
PROCESSO	Controle de versões	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Desenvolvimento e Gerência de Requisitos	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Manutenção	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Suporte/help Desk	D	M	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Testes	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Capacidade de infra-estrutura	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D	D
ORGANIZAÇÃO	Funcionários tecnicamente competentes	D	D	D	D	D	D	D	D	D	D	D	E	E	M	D	D	D	D
ORGANIZAÇÃO	Governança	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Previsão de continuidade do serviço	M	I	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Reputação	D	M	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	F
ORGANIZAÇÃO	Tecnicamente competente na área De negócio	D	D	D	D	D	D	D	D	D	D	D	D	I	F	D	D	F	I
ORGANIZAÇÃO	Utilização de padrões	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I

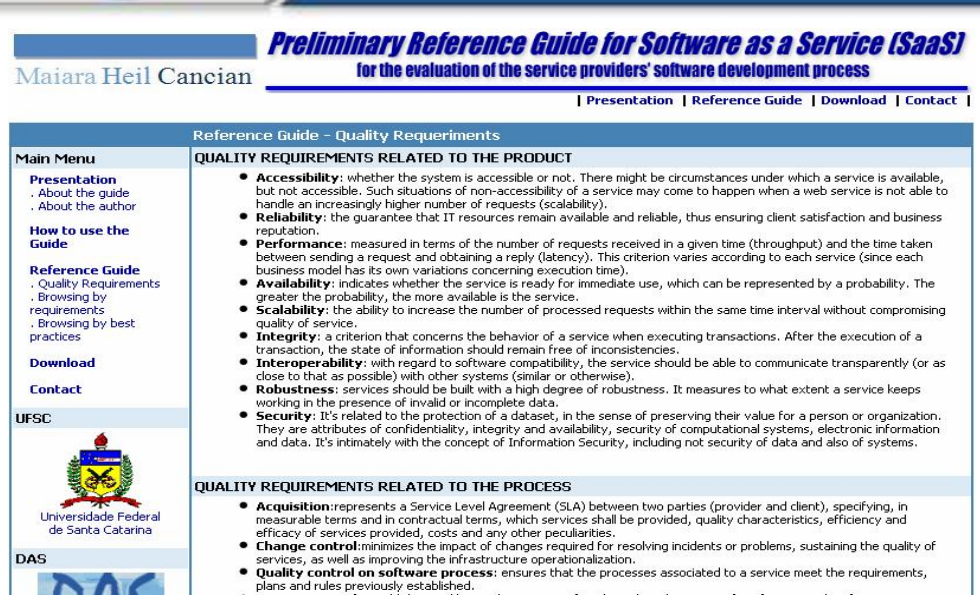
ISSO 15504 (SUP), CMMI for Services, COBIT

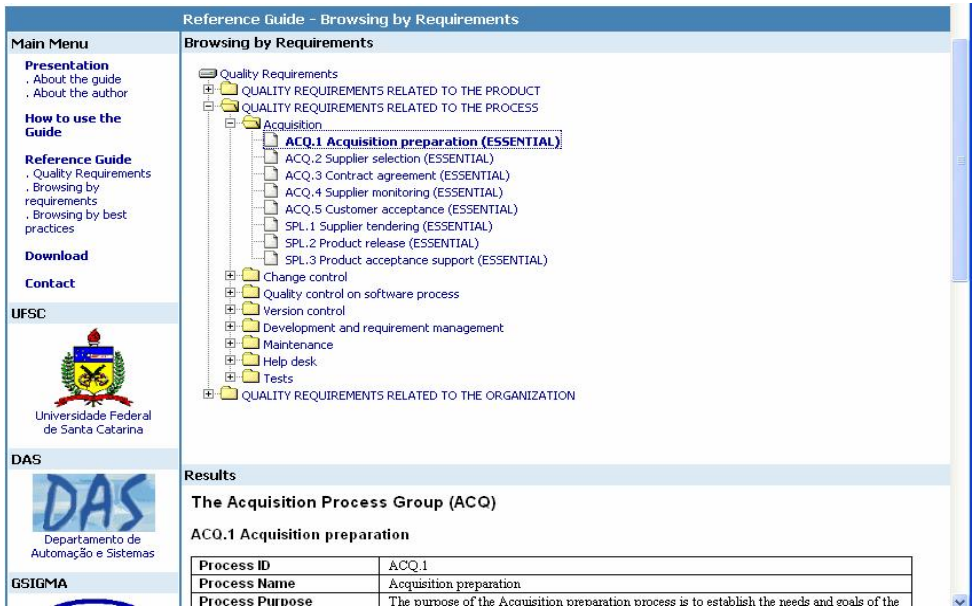
		SUP.1 Quality assurance	SUP.2 Verification	SUP.3 ValiDation	SUP.4 Joint review	SUP.5 AuDit	SUP.6 ProDuct evaluation	SUP.7 Documentation	SUP.8 Configuration management	SUP.9 Problem resolution management	SUP.10 Change request management	Strategic Service Management (STSM)	Service System Development (SSD)	Service System Transition (SST)	Service Delivery (SD)	Capacity anD Availability Management (CAM)	InciDent Resolution anD Prevention (IRP)	Service Continuity Management (SCON)	COBIT
PRODUTOS	Acessibilidade	D	D	D	D	D	M	D	D	D	D	D	D	D	D	D	D	D	D
PRODUTOS	Confiabilidade	F	E	E	D	D	M	F	I	F	I	D	D	D	D	D	D	D	D
PRODUTOS	Desempenho	F	E	E	D	D	M	F	I	F	I	D	D	D	D	D	D	D	D
PRODUTOS	Disponibilidade	D	D	D	D	D	M	D	D	D	D	D	D	D	D	D	D	D	D
PRODUTOS	Escalabilidade	D	D	D	D	D	M	D	D	D	D	D	D	D	D	D	D	D	D
PRODUTOS	Integridade	D	D	D	D	D	M	D	D	D	D	D	D	D	D	D	D	D	D
PRODUTOS	Interoperabilidade	D	I	M	D	D	M	D	D	D	D	D	D	D	D	D	D	D	D
PRODUTOS	Robustez	D	D	D	D	D	M	D	I	I	I	D	D	D	D	D	D	D	D
PRODUTOS	Segurança	D	D	D	D	D	M	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Aquisição	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Controle de mudanças	D	D	D	D	D	D	D	D	D	E	D	D	D	D	D	D	D	D
PROCESSO	Controle de qualidade de processo de software	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Controle de versões	E	D	D	D	D	D	D	E	D	D	D	D	D	D	D	D	D	D
PROCESSO	Desenvolvimento e Gerência de Requisitos	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Manutenção	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
PROCESSO	Suporte/help Desk	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	E	D	D
PROCESSO	Testes	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Capacidade de infra-estrutura	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D	D	D
ORGANIZAÇÃO	Funcionários tecnicamente competentes	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Governança	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E
ORGANIZAÇÃO	Previsão de continuidade do serviço	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	D
ORGANIZAÇÃO	Reputação	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Tecnicamente competente na área De negócio	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
ORGANIZAÇÃO	Utilização de padrões	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

The Guide offers two options for browsing over requirements and their best practices:

- Browsing by requirements;
- Browsing by processes.

Preliminary Reference Guide





Process ID	ENG.1
Process Name	Requirements elicitation
Process Purpose	Requirements elicitation process aims to gather, process, and track evolving customer needs and requirements throughout the life of the product and/or service so as to establish a requirements baseline that serves as the basis for defining the needed work products. Requirements elicitation may be performed by the acquirer or the developer of the system.
Process Outcomes	As a result of successful implementation of Requirements elicitation process: 1) continuing communication with the customer is established; 2) agreed customer requirements are defined and baseline; 3) a change mechanism is established to evaluate and incorporate changes to customer requirements into the baseline requirements based on changing customer needs; 4) …
Base Practices	**ENG.1.BP1: Obtain customer requirements and requests.** Obtain and define customer requirements and requests through direct and continuous solicitation of customer and users. NOTE 1: Requirements may also be obtained through review of customer business proposals, target operating and hardware environment, and other documents bearing on customer requirements. **ENG.1.BP2: Understand customer expectations.** Ensure that both supplier and customer understand each requirement in the same way. Review with customers their requirements and requests to better understand their needs and expectations and to check the feasibility and appropriateness of their requirements. [Outcome: 6] NOTE 2: Environmental, legal and other constraints that may be external to the customer need to be considered. **ENG.1.BP3: Agree on requirements.** Obtain agreement across teams on the customer requirements, obtaining the appropriate sign-offs by representatives of all teams and other parties contractually bound to work to these requirements. [Outcome: 2] **ENG.1.BP4: …**

Final Considerations

- A reference guide has been devised and presented as an approach to provide services trustworthiness in a scenario of services sharing among CNO members while members autonomy is preserved;
- The guide´s ultimate goal is to serve as a quick and easy source of information both for clients and providers allowing:
  - CNO 'clients' to have a more solid basis on how selecting services from CNO 'providers';
  - CNO 'providers' to know which quality requirements should be supported and which practices should be used for each process to offer their services under SaaS in a CNO.
- …

Final Considerations

- This facility is important as long as small companies have enormous difficulties to go through each quality reference model and to evaluate which one is better aligned to their strategy and to SaaS / CNO.
- This first version of the guide was evaluated and very positive answers were got. Apart from the natural technological and organizational issues that should be addressed when any new quality process is introduced in a company, it is believed that the main difficult to implement a guide like this is culture, i.e. how to 'convince' CNO members to share their services and that they can access the others' services with confidence.
- Besides the other methodology steps showed, next steps also intend to identify more properly additional "CNO-related" criteria for the tackled scenario, e.g. 'collaboration frequency'.

Thank you !

UFSC - GSIGMA

www.gsigma.ufsc.br

Maiara Heil Cancian, M. Eng.

maiara@das.ufsc.br

Final Considerations

- A recently research about Reference Models for specifics areas (like SaaS) shown that there are 52 cases; (WANGENHEIM, C. G. V.; HAUCK, J. C.; SALVIANO, C. F. et al. Systematic Literature Review of Software Process Capability/Maturity Models. SPICE 2010 Conference, 2010. Pisa/Italy.)
- We research together about the validations techniques that these 52 Models are implemented;
- Just 11 Models were validated, and in same cases, the specifications are very poor;
- This information show how difficult is validate this kind of work;
- We intend to improve our SaaS Model and using this research (about validation methods) validate the Guide;

Software Trustworthiness and Quality

- Trustworthiness can be determined based on some information, like personal experiences, observations, recommendations and global reputation;

- A complete research about Software Trustworthiness and Quality was performed and documented in this article;
  - As a conclusion, it was realized that there is no quality reference models for software services devoted to SaaS.

Software Trustworthiness and Quality

Trustworthiness in loosely coupled computational systems (such as SOA/SaaS) has received great attention in the last years.

- It can be defined as a "measurable property with different entities at different levels".
- Trustworthiness can be determined based e.g. personal experiences, observations, recommendations and global reputation.

Next Steps

Future short-term improvements in the guide include:

- the definition of more detailed practices to cope with SaaS for every single criterion;
- the creation of different capacity levels allowing a better assessment by CN members;
- A more solid and larger validation of the guide, using appropriate methodologies;
- More CN-related criteria may be added to the guide, such as, for instance, 'collaboration frequency'.