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A Maturity Model of IT Service Delivery

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Abstract

This paper presents a maturity model of IT service delivery that consists of maturity statements grouped on five maturity levels. The model is founded on maturity model properties and IT Capability Maturity Model (IT Service CMM). It was motivated by the interest and limitation of Nicaraguan Internet Service Providers in formalizing and assessing specific IT service elements. The model was applied to traceable information of the current status of IT service delivery in a Nicaraguan Internet Service Provider.

Keywords

Maturity model properties, IT Service Delivery Elements, IT Service CMM.

1. Introduction

Nowadays, IT service management is one of the challenges of organizations because of customer demand for high quality service. IT service providers are continually striving to improve the quality of the service, while at the same time trying to reduce costs (ITIL 2003a).

Nicaraguan Internet Service Providers (Flores et al. 2010) are interested in formalizing and assessing specific IT service delivery elements that are considered significant to managing IT service. This practical problem motivated the formulation of the research question: *how can the IT service delivery maturity level of an organization be assessed based on traceable information of its current IT service delivery status?* To answer it, an IT service delivery maturity model was developed based on maturity model properties and IT Service Capability Maturity Model (IT Service CMM). The proposed model was applied to the traceable information on a case study of a Nicaraguan Internet Service Provider (Flores et al. 2010). Traceable information (Yin 1994) is considered as “information that is organized and documented based on interviewee data, interviewee claims and the support for those claims”.

2. Analysis of Maturity Models that dealt with IT service

The term “maturity” is understood as the stages or levels of improvement that characterize a specific entity (Andersen & Henriksen 2005). Maturity model properties are listed as follows (Klimko 2001; Weerdmeester et al. 2003):

- The development of a single entity is simplified and described with a limited number of maturity levels (usually four to six).
- Levels are characterized by certain requirements that the entity must achieve on that level.
- Levels are ordered sequentially, from an initial level up to an ending level (the latter is the level of perfection).

These properties are prevalent in maturity models that deal with IT service. These models claim to be developed based on Capability Maturity Model Integration (CMMI) (SEI 2009), a collection of best practices that helps organizations improve their processes and is founded on the Capability Maturity Model (CMM) (CMM 1994; Paulk et al. 1995), which defines *Key Process Areas* as defined groups of related activities that together achieve the set of goals defined for each maturity level. At the following a brief description of models that dealt with IT service:

Capability Maturity Model Integration for Service (CMMI-SVC) (SEI 2009) reflects the unique challenges of process improvement in service industries. CMMI-SVC is composed of 5 levels of maturity of the service and 24 process areas. Of those, 7 are service-specific process areas: capacity and availability management, service continuity, service delivery, incident resolution and prevention, service transition, service system development, and strategic service management processes.

Control Objects for Information and related Technology (COBIT) 4.1 (ITGI 2005) is a framework for information technology (IT) management. COBIT 4.1 defines 5 levels of maturity of governance and 34 IT processes. The “Delivery and support” domain is concerned with the actual delivery of required services and is composed of 13 IT processes.

Service Management Process Maturity Framework (PMF) (ITIL 2007) focuses on assessing the maturity of each of the Service Management processes; it is organized into five maturity levels of IT service management and five areas: vision and steering, process, people, technology and culture.

IT Service Capability Maturity Model (IT Service CMM) (Niessink & Van 2004) is oriented to assess the maturity of IT service processes and identify direction for improvement and its target is to help service organizations improve service quality. IT Service CMM is available at (www.itservicecmm.org). IT service CMM consists of five levels of maturity. Each maturity level contains specific key process areas.

The models above are evaluated based on the criteria of examination presents bellow.

- Maturity model developed based on CMMI and deals with IT service.
- Maturity model defined based on key process areas as a main entity of construction and is oriented to IT service
- Maturity model that has maturity levels oriented to IT service processes.
- Maturity model that has the most key process areas placed on IT service delivery processes of IT Infrastructure Library (ITIL). ITIL v.2 provides the IT service delivery processes (ITIL 2003a): service catalogue, financial management, service level management, capacity management, continuous service management, availability management and security management (ITIL 2003b).

The analysis is focused on analyzing the consistency of the models to CMMI and identifies the model that is the most suitable to IT service delivery processes.

- Criterion 1. It is satisfied by COBIT 4.1, PMF, CMMI-SVC and IT Service CMM. COBIT 4.1 has a “Delivery and Support” Domain. PMF is oriented to service management. CMMI-SV and IT Service CMM have been designed to deal with IT service.
- Criterion 2. It is satisfied by COBIT 4.1, PMF, CMMI-SVC and IT Service CMM. COBIT 4.1 has 13 key process areas to IT service in the “Delivery and Support” Domain. PMF has 5 key process areas. CMMI-SV has 7 service-specific process areas. IT Service CMM has 16 key process areas to IT service.
- Criterion 3. It is satisfied by PMF, CMMI-SVC and IT Service CMM. COBIT 4.1 maturity levels are oriented to governance.
- Criterion 4. It is satisfied by IT Service CMM; most of its key process areas are placed on IT service delivery processes.

3. Research approach

The research approach adopted is design research concerned with “devising artifacts to attain goals” (Simon 1981); it is used for scientific study in the field of Information Technology (IT) when artificial, human-made phenomena such as organization and/or information systems are examined (March & Smith 1995; Markus et al. 2002). Design research addresses research through the building and evaluation of artifacts designed to meet the identified business need.

The design-science research guidelines (Hevner et al. 2004) were adopted and applied as follows.

- Design as an Artifact (guideline 1): Section 4 presents the design and development of an IT Service Delivery Maturity Model (SDMM).
- Problem Relevance (guideline 2): The problem was formulated as the research question *how can the IT service delivery maturity level of an organization be assessed based on traceable information of its current IT service delivery status?* This research question was motivated by the need of Nicaraguan Internet Service Providers to formalize specific IT Service Delivery Elements. Internet Service Providers play a significant role in the development of private and public sectors, connecting them to the World Wide Web.
- Design Evaluation (guideline 3): Evaluation is not covered in this paper, but will be developed as further works. The evaluation will be addressed through qualitative and quantitative approaches to assess efficacy, utility and quality of the proposed IT artifact (see section 6).
- Research Contribution (guideline 4): The proposed SDMM is a new model for formalizing and assessing IT Service Delivery elements.
- Research Rigor (guideline 5): The proposed model is founded on research science guidelines (Hevner et al. 2004). SDMM is based on IT service concepts and maturity model properties, and IT Service Capability Maturity Model.
- Design as a search process (guideline 6): The proposed model was applied to the traceable information on case study of a Nicaraguan Internet Service Provider (Flores et al. 2010) as a demonstration of its applicability.

- Communication of Research (guideline 7): The proposed model is supported by IT service delivery elements that are significant for managing IT service delivery by Business and IT executives from Nicaraguan Internet Service Providers.

4. IT Service Delivery Maturity Model (SDMM)

The proposed IT Service Delivery Maturity Model (SDMM) is a mechanism for formalizing and assessing IT Service Delivery Elements. IT Service Delivery Elements are defined as activities, guidelines, performance indicators/metrics, methods/tools and components of SLA, Budget, Cost and Depreciation related to IT Service Delivery processes.

The Nicaraguan Internet Service Providers that participated in the previous study (Flores et al. 2010) are interested in formalizing and assessing specific elements of IT service delivery. These elements are grouped by their characteristics in order to reduce the complexity of their manipulation as follows.

- *Service Definition* is a day-to-day activity focused on specifying customer requirements for the service to be contracted. *Business and technical service information* related to business units and business process that rely on the IT service, supporting services, shared services, and component items necessary to support the provision of the service to the business. Hereafter, these elements will be referred as *service operation*.
- *Negotiation, agreement and maintenance of Service Level Agreement with the customer*: this is concerned with negotiating with the customer when a service is specified, then agreeing on the service to be provided, and retaining customers. Hereafter, these elements will be referred as *service achievement*
- *Budgeting, IT accounting and charging*: this is concerned with predicting and controlling the spending of money, accounting fully for the way it is spent, and billing customers for the services supplied to them. Hereafter, these elements will be referred as *service economy*.
- *Future business requirements, service performance and resource utilization*: this is concerned with monitoring the throughput of IT Services and supporting Infrastructure, forecasting future customer requirements and utilizing IT infrastructure resources. Hereafter, these elements will be referred as *service capacity*.
- *The recovery of required IT technical and service facilities* within required and agreed-upon business timescales. Hereafter, these elements will be referred to as *Service continuity*.
- The *required availability of IT service* of the business is constantly met. Hereafter, this element will be referred as *Service Availability*.
- *Management of a defined level of security* on information and IT services. Hereafter, this element will be referred as *Security Measures*.

In order to formalize the above-mentioned IT service delivery elements, the following design considerations of SDMM were proposed:

- SDMM must incorporate maturity model properties (see section 2).
- SDMM's maturity statements must satisfy the requirements for the five maturity levels described by IT service CMM (see section 2). IT service CMM is constructed based on CMMI and its key process areas are placed on IT service delivery processes (see section 2.1).

- The statements of maturity are propositions for assessing the maturity level of IT Service Delivery elements.

Following the design considerations described above, the maturity model properties were adopted and complemented based on IT Service CMMM as a requirement of maturity levels. The statements of maturity are propositions that can be used for assessing the maturity level of IT service delivery elements. An example of the construction of the maturity statements of service operation is presented as follows.

- Service operation groups two IT service delivery elements. So two statements of maturity are required.
- Level 1. It is characterized as ad hoc and occasionally even chaotic and its statements of maturity are shown in table 1 where service operation is marked by (*).
- Level 2. It is characterized as a repeat of earlier successes and its statements of maturity are shown in table 2 where service operation is marked by (*).
- Level 3. It is characterized as documented, standardized and integrated into a standard process and its statements of maturity are shown in table 3 where service operation is marked by (*).
- Level 4. It is characterized as a service process and the delivered process is quantitatively understood and controlled; its statements of maturity are shown in table 4 where service operation is marked by (*).
- Level 5. It is characterized as quantitative feedback from the processes; its statements of maturity are shown in table 5 where service operation is marked by (*).

The maturity statements of IT service delivery elements are presented in table 1, 2, 3, 4 and 5. These statements can be used for formalizing and assessing the IT service delivery elements.

Table 1: Statements of maturity at Level 1 (Initial)

Service Operation (*)	- Customer requirements are not clearly collected or defined; that causes unnecessary effort by IT staff to provide the service contracted - Isolation of the systems exists, such as customer, troubleshooting and monitoring/supervision systems
Service Achievement	- There are no expert negotiators to attend to customers - Agreements with customers are not formally written as a contract - Customer requests are not prioritized and sometime not even attended
Service Economy	- There is no budget at the company. Money is allocated based on demand - Expenditures are not recorded in IT accounting - Customers are overcharged or undercharged
Service Capacity	- Customer trends are not analyzed - IT service performance is not monitored against Service Level Agreement (SLA) target - Resource utilization is not always analyzed right when an incident occurs
Service Continuity	- Personnel are reactive to customer IT service incidents and do not inform customers about the solution in progress
Service Availability	- There is a lack of analysis and reporting of the availability, reliability and maintainability of IT components and planned expenditure on IT upgrade
Security Measure	- Physical security measures are not in place, such as the physical separation of the computer room

Table 2: Statements of maturity at Level 2 (Repeatable)

Service Operation (*)	- Template forms for customer requirements and some services have already been defined in a services portfolio - Customizing reports are based on interchanging information amongst systems.
Service Achievement	- There is at least one expert negotiator at the company - Basic contract structure is used for SLA

	- There is a well-defined personnel commitment to customer requests
Service Economy	- Budget is planned but not applied - There is a trained accountant - Discrepancies in charges are quickly identified and resolved with the customers
Service Capacity	- Future business requirements are considered for formulating a new service or characterized for the service contracted - IT service performance is analyzed based on customer complaints - Changes of component parts of the IT infrastructure are appropriate to ensure service availability.
Service Continuity	- Continuity and recovery mechanisms are well known and established through the personnel, who are conscious of the importance of providing good IT service
Service Availability	- Availability is underpinned by the reliability and maintainability of the IT Infrastructure and effectiveness of the IT support organization.
Security Measure	- Technical security measures are implemented to provide security in a computer system or network - Repressive measures are used to counteract any continuation or repetition of the security incident, returning to a previous stable situation

Table 3: Statements of maturity at Level 3 (Defined)

Service Operation (*)	- Procedures are defined for gathering and following up on customer requirements until the service is contracted by the customers - An automatic report generator is implemented that collect information from systems - The real situation of the services is recorded in systems
Service Achievement	- Guidelines are established for negotiation with customers - SLA template is applied for agreement with customers - Help desk (troubleshooting) system is implemented for customer requests
Service Economy	- Budget is implemented but not always followed - A cost analysis is implemented for spending - Charging and pricing policies are defined for guiding billing systems
Service Capacity	- Methods for forecasting future customer requirements have been implemented but their accuracy is not always analyzed - A tool is used to identify and understand IT service performance incidents - A tool is used to monitor and measure components within the IT infrastructure
Service Continuity	- Business Impact analysis is used to quantify the loss of the IT services and assess the impact of all changes
Service Availability	- Availability techniques are deployed to provide additional infrastructure resilience to prevent or minimize the impact of component failure to IT service
Security Measure	- Security organization measures are put in place such as clear responsibilities and tasks, guidelines, reporting procedures and measures that are properly matched to the needs of the business, from policies to work instructions.

Table 4: Statements of maturity at Level 4 (Managed)

Service Operation (*)	- Customer requirements are monitored and followed up on - Systems related to customers are interconnected, sharing database
Service Achievement	- The negotiation with customers is followed up on and supervised - Process/procedure for fulfilling SLA is instituted in the organization - Reactive approach to customer complaints and response to customer requests is instituted in the organization
Service Economy	- All activity has allocated money in the budget - The expenditures are supervised and monitored - The process/procedure for charging is implemented and verified on customer bill for IT services
Service Capacity	- Forecasted business requirements are accurate and satisfy the customer SLRs - A tool is used to monitor and supervise IT service performance constraints - Current resource utilization trends are produced and future resource requirement estimations are instituted in the organization
Service Continuity	- IT recovery plan is implemented and supports critical business processes
Service Availability	- Availability and recovery design criteria for each new or enabled IT service are used at the organization
Security Measure	- Risk analyses are used for countermeasures of security incidents

Table 5: Statements of maturity at Level 5 (Optimized)

Service Operation (*)	- Review and improvement procedures/processes are established in order to be efficient and effective in defining customer services and signing contracts
Service Achievement	- Negotiation processes/procedures are already established for training and supervision of negotiation process - Training and supervision are used to correctly fulfill SLAs

	- Process/procedure is used to measure customer perceptions as proactive attitude
Service Economy	- Budget is annually reviewed and adjusted according to the business plan priorities and requirements - Suitable accounting method is implemented, reviewed and supervised. Everyone involved with IT accounting has appropriate training - Recovery of the IT service expenditures cost is collected on time
Service Capacity	- Future business requirements for IT services are considered and understood, and sufficient capacity to support the services is planned for and implemented in a capacity plan with an appropriate timescale - IT service performance is accurately analyzed, improved and forecasted - Designed, procured or amended configuration of IT infrastructure component is based on capacity and utilization addressed by required response times, expected throughput and usage pattern, and is articulated in the capacity plan
Service Continuity	- ITSCM Plan is established and derived from Business Plan Continuity Plan
Service Availability	- The capability of the IT infrastructure, services and supporting organization is optimized to deliver a cost effective approach - Availability Plan used for the proactive improvement of the IT infrastructure and sustained availability level that enables the business to satisfy its business objectives
Security Measure	- Security plan is based on SLA for all IT services and risk analysis of impact on the business

At this stage, we identify the need for scoring the IT service delivery element maturity level that contributes to agile manipulation of the information. The score to be assigned is the number of the maturity level (1 to 5). If the IT service delivery element is closer to the next higher level, a “+” is added after the score level. If it is closer to the previous lower level, a “-” is added after the score level.

5. Application of SDMM

The traceable information to be presented were extracted from one of several case studies that were developed among Nicaraguan Internet Service providers (Flores et al. 2010); using a method for analyzing IT service delivery in order to collect and validate traceable Information. The organization studied offers high-speed Internet connectivity services over fiber optical and wireless. This organization will be referred as Organization A.

Organization A has a flat organizational structure that encourages communication through the whole organization and is more dynamic than formal. The majority of its clients are corporate organizations that represent 80% of the profit, but it also covers medium and small companies. Its practices related to IT service delivery have been assessed as follows.

The customer requirements are collected and clearly expressed in service specifications, and a sight survey is used to analyze the feasibility of the new IT service. There is a customer database system that is interconnected with the billing system and accounting system. These functionalities scores “1+” for service operation.

The sales manager has more than 15 years of experience. Sales executives have a service portfolio available for offering services. Any bidding is handled by the sales manager, IT staff and chief executive officer. Service Level Agreement has a defined template form. Any customer request is recorded in a troubleshooting system for following-up, but there are no established guidelines for negotiating with the customer. These functionalities score “3-” for service achievement.

The budgeting process is not developed; economic resources are allocated based on demand. The IT accounting department supervisor is trained in accountancy and service charge discrepancies are reported by the customer and quickly solved through the billing system. These functionalities gave a score of “1+” for financial economy.

Future customer requirements are not analyzed, but the Steering Committee forecasts bandwidth consumption based on its experience. Service performance is reported by customers through a help desk system. When an incident is reported, a ticket is opened in the

troubleshooting system until the incident is solved. Moreover, there is a tool known as ORION for network monitoring service performance. ORION is a network performance monitoring tool that enables quick detection, diagnosis and resolution of network outages and performance issues. It offers network-centric views designed to deliver the critical information needed most and was developed by Solarwind (Solarwind 2003). These functionalities score “2+” for service capacity.

The personnel are not proactive at preventing customer complaints. The IT staff is reactive and informs the customer of any progress regarding the incident reported. Any incident is recorded and followed up on in a troubleshooting system as knowledge database. The troubleshooting system cannot identify or follow patterns of service performance. The personnel seem to know what to do to keep the continuity and recovery of IT service; their dynamic organization structure promotes personnel commitment. These functionalities score “2” for service continuity.

Although neither reliability nor maintainability are measured for IT service, the service availability is measured when it decreases or increases using ORION (Solarwind 2003), which is a network performance monitoring tool. These functionalities score “1” for service availability.

Organization A has experienced several critical situations in its 10 years that have contributed to the physical separation of the computer room, definition of the roles and responsibilities of its personnel for job description, and implementation of repressive and corrective measures to counteract any continuation or repetition of the security incidents, but there is a lack of guidelines and reporting procedures to match the need of the business for confidentiality, integrity and availability. These functionalities score “2+” for security measures.

Organization A is has more formalized service achievement that concern with negotiation, agreement and maintenance of the service and Service Capacity that deals with customer’s trends, service performance and resource utilization. The least formalized is service availability focused on availability, reliability and maintainability of IT components.

6. Comparing SDMM with Sousa Pereira’s model

According to Bruin et al. (2005), the main phases of generic model development are scope, design, populate, test, deploy and maintain. Scope determines the specificity and extensibility of the model. Design incorporates the needs of the intended audience and how these needs will be met. Populate is necessary to identify what needs to be measured in the maturity assessment and how this can be measured. Test is for relevance and rigor. Deploy includes the model’s generalisability. Maintain incorporates track model evolution and development. These phases are used for comparing the proposed model with Sousa Pereira’s model (Sousa Pereira et al. 2010):

- The proposed model has as stakeholders industry and designed for self assessment by business and IT executive. Significant IT service delivery elements for IT service management are assessed by maturity statements. The proposed model is complement by a method for analyzing IT service delivery (Flores et al. 2010) in order to collect and validate traceable information on case study. The proposed model is required by Nicaraguan Internet Service Providers.
- Sousa Pereira’s model has as stakeholder practitioners, and designed for measuring organization ITIL maturity and help them in implementation; it is based on stage model and continuous model. Both of them guide organization in ITIL implementation. The first one when a company don’t know where to start and the second one when they know what

processes assess or implement. The model evaluation is focus on incident management process.

7. Discussion

SDMM is an IT artifact constructed following design-science research guidelines (see section 3). The proposed model was structured based on maturity model properties, and IT Service CMM (see section 4). It is an alternative for formalizing IT service delivery elements that are considered significant for IT service management by the Nicaraguan Internet Service Providers. The results show the feasibility and applicability of the model proposed, which can be used to assess the IT service delivery. This model is prescriptive, providing a complete view of five maturity levels that are oriented to formalize the IT service delivery elements.

SDMM can support an informed decision about the IT service delivery maturity required by the organization; its steering committee can evaluate the current status of maturity of IT service delivery and decide a maturity level for improving its formalization through a cross sectional study or a longitudinal study, depending on organizational requirements.

SDMM shares several characteristic with Sousa-Pereira's model. Both of them are based on ITIL processes. SDMM cover IT service delivery elements while Sousa-Pereira's model has been designed for covering all ITIL processes.

SDMM requires more tests for increasing its reliability and overcoming the ambiguity of the maturity level scoring when the IT service delivery element analyzed places in the middle of two levels. It is not possible to establish if it is closer to the next higher level or to the previous lower level of maturity.

The majority of design-science guidelines were implemented; however design evaluation is intentionally not covered (see section 2). It will be developed as further work. A design research will be required that includes qualitative and quantitative approaches for evaluating the utility, quality and efficacy of the proposed IT artifact. To evaluate utility, a representative sample of IT and Business Executives will be defined and a questionnaire for collecting information will be submitted to them. The questionnaire will allow us to measure specific variables of the functionality of the proposed IT artifact. Inferential statistics will be adopted for processing the data collected. To evaluate quality and efficacy, several case studies will be executed in order to examine the value and expectation of the proposed IT artifact by the participant organizations based on its adoption as a complement to the IT processes.

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