

Product Management in Telecom Industry – Using Requirements Management Process

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Abstract

As the telecom market becomes more consolidated the industrial key players are forced to release product versions to the market at a growing pace in order to comply with customer requirements and market trends. The time between the initial feedback or requirement originating in the field until the product release and the application satisfying the demand is becoming more critical. Product management's ability to identify the requirements and match them with the company's core SW resources and technological assets is becoming a core competence.

NICE Systems is a worldwide leader of multimedia digital recording solutions. NICE products are used by 65% of Fortune 100 companies in 30,000 sites including contact centers, financial institutions, public safety sites, ATC (air traffic control) sites, CCTV (closed circuit television) security installations and government markets.

In this article, we will discuss the implementation of an effective way of managing requirements and how it improved the daily work of product managers as well as their counter-parts in the rest of the company.

1. Introduction

1.1 Objectives and Scope

The activity of a Product Manager (PM) is centered on product requirements: gathering, defining, organizing, filtering, tracking, and more, starting from sales needs, to Product Requirements Definition (PRD) development and product acceptance.

The software Capability Maturity Model (CMM) was put forth in 1989 as a means to improve the software development process [1]. The first key process area of the first level identified by the CMM is requirements management.

Product Managers, in their definition of products, actually perform requirements management, which is the core of product definition.

In this article, we will show how an effective process of managing requirements will improve the daily work and

process of product managers as well as their counterparts in the rest of the company.

1.2 Background

NICE Systems is a product-based company, meaning that it sells mostly “off the shelf” products and more seldom projects that are customizations of the basic off-the-shelf products.

NICE develops its core products as generic building blocks ready to be integrated into specific customers' solutions, so that little or no customization is needed. A Product Manager can be responsible either for a building block or for a full solution.

The main products are enhanced by additional features and capabilities that are added in new versions, while new products get added to enhance the global solution.

The scope of this article encompasses a group of about 10 product managers managing two product lines (applications – infrastructure), and approximately 30 subjects to track and provide requirements for. In some instances a subject may be a product of its own, in other instances subjects such as, Voice over IP (VoIP), Alarms are common across several products. Each subject requires tens of product features and hundreds of software capabilities to be developed. Thus, the Product Manager is fully occupied with defining new requirements, tracking requirements to implementation, etc., which is the essence of Requirements Management.

1.3 Motivation

Working practices in product management before

One of the most important missions of product management is to define a product and its upcoming versions. In order to do so, the product manager goes to visit customers to better understand their needs, participate in conferences or events, and keep an eye on the competition etc.

The result of this process is a “shopping-list” or “wish-list” that the product manager maintains and tries to implement in a product. Most of the time, an organized product manager will have his/her list in standard electronic

forms such as Microsoft Word or Microsoft Excel documents. These documents are rarely shared, but rather passed to the development team for discussion, and the final content, once agreed on, becomes the basis for the on-going work and the specific tasks of each team.

Problems with not having a product requirements process/tool.

Some of the issues that a company might face with regards to product requirements management may be:

- An R&D team has finished its task load earlier than foreseen. Do they have additional items they can develop?
- A product manager left the company? Oops, his whole list disappeared with him.
- What is the number of requirements missing from the developed product?

These are examples of the possible drawbacks from working with Word or Excel documents. Managing a little number of requests with Word or Excel between teams is fine as long as the list is small (no more than 20 features). However, as soon as the number of requests becomes larger, static documents limit the dynamics of the requirements process.

Numbering requests is not easy with Word or Excel documents. In Word, if the product manager wants to add (or delete) a feature in the middle of a numbered list, the full numbering scheme is impacted... unless he does it manually! If a product manager chooses to organize the features in groups and sub-groups. How would he number them in Excel? Although there are very efficient word processing and spreadsheet in the market, their use for product requirements tracking is not efficient enough.

The Need for a Requirements Process in Product Management.

What are the needs presented by product managers with regards to requirements? The needs are:

- A place to store, retrieve and sort requests
- A way to allot or link requests to versions or products
- A way to track whether or not a request for a feature makes it to the next version or not
- A way to share information with other relevant parties on a daily basis without putting in extra effort each time: development, testing, training, documentation and of course sales and marketing
- Organize the requirements in dynamic subjects and categories
- Follow-up on left out requirements
- Reporting

A database repository is one technology that could answer these needs. However, it is often perceived as “too complicated” or overkill. In a database, requirements can be stored, numbered, sorted and reported. It is backed up in a regular manner by IT so that if a Product manager has his

laptop crash for some reason or if he/she leaves, the wish lists don't disappear.

However, the drawback, and to our understanding the reason why it is almost never used as a repository for requirements, is that it needs to be loaded with the company specific products knowledge. To maintain it, the users must know how to program it, and it is not that easy for someone who doesn't necessarily have programming skills.

A step beyond the database stage is a tool that would have “programmed” the database, a tool with added functionalities to track requirements and versions, link them and share them. Requirement Management tools are not frequently used today in the industry. This article will describe an implementation of a requirements management process and tool in product management at NICE Systems.

1.4 Related work literature overview

Requirement Management was originally introduced by the CMM/SEI model [1] as the initial Key Process Area (KPA) needed to improve the software development process. The focus of the CMM is on tracing the system allocated requirements to the software implementation. Early work reported on requirement management mainly focused on software requirements management [2], and there are variety of commercial tools that support requirements management, including RTM/Integrated Chipware [3], DOORS/Telelogic [4], RequisitePro/Rational [5].

At the IEEE first international conference of requirements engineering [6], the software engineering community has been moving attention to the overall requirement engineering discipline, where the system engineering community established the INCOSE requirements management working group [7]. Thus, requirements management today encompasses the overall system life-cycle requirements, starting from customer needs to system and software capabilities. It covers all the specifications that are crucial for building right the right system that satisfies the customer needs.

The function of the Product Management as part of the marketing organization is described in a number of Marketing Manuals such as “Marketing Management” of Philip Kotler [8]. One of the main tasks of a Product or brand manager is “Initiating product improvements to meet changing market needs”. According to Philip Kotler, “Industrial-product managers spend [more] time with customers and laboratory and engineering personnel, think [more] about the technical aspects of their product and possible design improvements, and work more closely with the sales force and key buyers.”

Additionally Product management's roll is to act as a coordinator between marketing needs and requests for R&D capabilities to develop the products within defined timelines and budget and quality requirements [product management].

More recently, the requirements engineering community started to pay attention to the product requirement management processes, using requirement management methods and tools.

Siemens [9] has applied the Capability Maturity Model (CMM/SEI) and has performed more than 250 CMM-assessments over the last 10 years. Since these improvements focused solely on development processes, it was obvious that an additional assessment for product management processes is a necessity that helps understand and manage the entire process of the product life cycle. The assessment consists of a questionnaire, evaluation tools and templates for documenting and presenting the results.

Philips Medical System [10] describes their experience in improving the product requirements management process. They have moved from managing documents of requirements to a more efficient process where the requirements are managed in a database and published into documents for release projects. Their RM infrastructure was based on templates and attributes for categorization.

Davis [11] has lately presented the idea of Requirement Triage. Driven by an increasingly competitive market, companies add features and compress schedules for the delivery of every product, often creating a complete mismatch of requirements and resources those results in products failing to satisfy customer needs. Triage is the process of determining which requirements a product should satisfy given the time and resources available.

1.5 Paper Outline

Once the product Requirements Management (RM) scope, motivation and review have been presented above, the rest of the paper describes the product RM process that was chosen, and analyses experience gained from implementing both the RM process and tool.

Section 2 presents the product requirements management objectives. Section 3 gives the definition of the company's product RM process, including requirements stakeholders and deliverables. Section 4 describes the RM process establishment at the company. Section 5 considers the evaluation of the RM process improvement and progress in various dimensions, i.e., tool usage issues, ownership, etc. Section 6 provides results obtained from the RM process implementation along with some lessons learned. Finally Section 7 summarizes the company benefits from improving the product management RM process.

2. Product Management Objectives

2.1 Product Definition

Requirements are gathered to allow product managers to chose from and create a product that will be both competitive and suit their customer needs. This includes

categorization, additions, deletion, and merging of requirements. The product definition is a list of requirements that must be finalized and agreed upon by R&D and PM before the start of the development of a new version or product. In general, the product manager creates the full product definition including all needs and expectations.

2.2 Product Roadmap

The main output of marketing planning is the product and version roadmap. Such a document describes when versions or products are going to be released based on a time line. Example of a marketing roadmap is provided below in Figure 1. Example of a Product Roadmap.

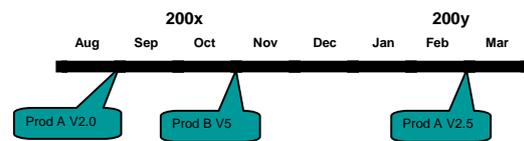


Figure 1. Example of a Product Roadmap

2.3 Release Management

The Release Manager is responsible for the next specific product version. The Release Manager works side by side with the Product Manager from whom he gets the required version content for the next development.

The main task of the Release Manager is to track the development of the product version content. In the process of development, certain requirements (features) might “disappear” and at the same time, new features or functionalities might be added. The better track is kept of the exact content of the version, the easier it is for other stakeholders such as training, technical writing, testing, and marketing to prepare the correct and most relevant materials.

2.4 “Wish Lists”

“Wish Lists” hold potential features or functionalities gathered in exhibitions, customer visits, training etc. by the product managers. All the items in a wish list don't necessarily make it into the product.

2.5 Product Validation (Coverage)

After the features have been developed, the product manager needs to check that they correspond to the features he or she requested. The product validation checks the coverage of the features in the new product or version.

Missing features can be discovered at that time, as well as inconsistencies. This stage is essential for the controlling

product definition as well as for the other stakeholders in the process (testing, technical writing, and training).

2.6 Sales' Knowledge for Buying-in Customers

Once a new product or version has been developed, the knowledge about the known capabilities has to be propagated to the sales forces. Benefits from added features need to be presented and explained, limitations need to be exposed.

3. Product Management & Requirement Management Process

3.1 Product Requirement Management Scope

As discussed up to this point, Product management activities are heavily requirement-centered, starting with requirement gathering, product or version definition, and product acceptance from R&D. Thus requirement management activities are strongly inter-woven in to the daily work of the product manager, whether they recognize it or not.

At NICE, we transited from intuitive requirement management activities to a well-defined and formal process of requirement management.

3.2 Product Management Stakeholders

Product Requirements have an internal hierarchy of content levels (refer to Figure 3). The first level is also the most abstract and represents marketing directions and highlights. The second level is the product definition in terms of features (a solution to market needs) and benefits to the customers. The third level is the translation of the product features into technical specifications needed for development. The fourth level is pure development specifications.

The variety of stakeholders identified in the Product Management process, i.e., sales, marketing, Product Managers, System Engineers, developers, testers, management, technical writers, etc., assume ownership of the requirement at different levels. Figure 2 summarizes the "handshake" between the various stakeholders.

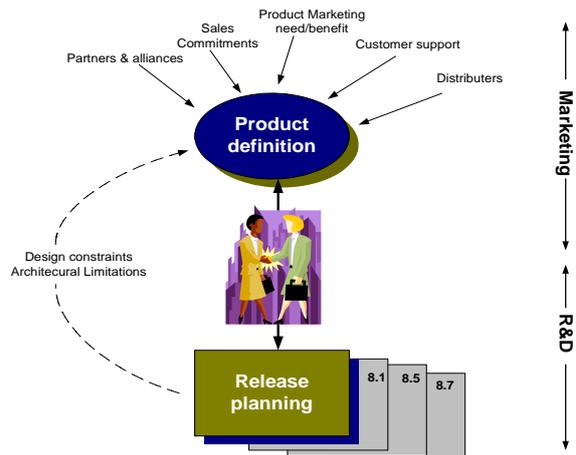


Figure 2. Marketing and R&D handshaking

The marketing group, via Product Managers (PM), receives requirements from many diverse sources, such as prospective customers, trade shows, existing clients, market trends, competition etc., in addition to design constraints raised by R&D. As mentioned earlier, these produce the product definition, which provides the full scope roadmap of the new product requirements for development.

One of the biggest challenges we faced at NICE concerned the connectivity between the marketing product vision and R&D.

The R&D group gets the product definition and delivers the product in the form of software releases containing different parts of the product definition. This creates a situation where not all the requirements are met, but they are delivered partially in evolving releases. This is managed in our company by a Release Manager via the product roadmap. The System Engineer, who usually belongs to R&D, translates the product features into technical system specifications that serve as a basis for R&D software development.

R&D and Marketing have different views and approaches regarding managing the product requirements. Requirement management methodology provides a solution to this difference in scope by managing the product features requirements through evolving software releases, and via a systematic traceability mechanism.

3.3 Product Management Deliverables

The typical product requirement management deliverables are the Product Description Sheet (PDS), the Product Requirement Document (PRD), the System Requirements Document (SRD) and product roadmap.

PDS – Product Description Sheet is produced by the Product Manager per release. The PDS serves as a working artifact for all the product development parties, i.e., sales, acceptance testing, and training. The Release Manager is using the PDS for tracking development progress.

PRD – Product Requirement Document is a full description of all product features (regardless of release boundaries) used by R&D development and testing.

SRD – System Requirements Document contains the technical system specifications defining the development of the product in R&D. The system specifications will then be analyzed and decomposed into software requirements which eventually will be documented in the Software Requirements Specifications (SRS) documents.

Product roadmap - is a planning mechanism of product evolution reflecting the business goals. It is a document which spreads on a time line the different versions and their main content.

3.4 Requirement Management Process Deliverables

The essence of Requirements Management process is traceability. Requirements traceability is performed by mapping requirements between two levels, i.e., product features definition and R&D technical specifications. The requirements flow down described in Figure 3 – Requirements levels and traceability, is typical in a product-based company. The requirements traceability allows systematic analysis of requirements compliance, discovering inconsistencies between the different levels of the requirements and requirement gaps (missing requirements). These traces are based on a many to many relationship between the levels.

Marketing Highlights -> Product Definition: This relationship is the link between the marketing benefits (values) or selling points and the product requirements produced as a result of the new customer needs.

Product Definition -> System Specifications: The trace between the product requirements and the system specifications that comply with them.

Product Definition -> Release Planning: The trace between the product requirements and the product release they will be delivered in, allowing tracking of evolving features through the different product releases.

The RM traceability scheme described in Figure 3 is the backbone of the product development process, starting from marketing values allocated and traces, to system technical specification needed for the software development.

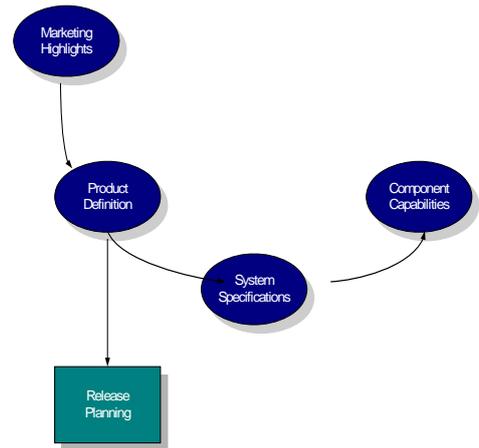


Figure 3. Requirements levels and traceability

This RM process schema can serve as a vehicle to produce the different product management deliverables, i.e., PDS (Product features per release), PRD (full product features definition), SRD (System Specifications), and Product Roadmap (product features per all planned releases).

Using advanced RM tools based on DB enables us to create and manage the traditional product management documents (PRD, PDS, SRD).

Using advanced RM tools based on DB for implementing this RM process schema, also enables direct access and visibility of product features compliance and coverage,

4. Requirement Management Process Establishment

At NICE, moving from an intuitive way of managing requirements to a structured methodology - the RM process, establishment was comprised of several main stages. We began with organizational preparations, carrying out an evaluation process to choose the correct tool for the task ahead and a buy-in process starting with upper management, the main stakeholders and their groups. This process was imperative for gaining their understanding and commitment for the RM activity.

The next stage was defining and building the RM process, identifying each stakeholder’s responsibility, inputs and outputs, and building the tool infrastructures to support this process definition. Once this was done, we were able to begin with training the users, and begin our first actual steps in RM.

The final and ongoing stage was the Domain Analysis, i.e., identifying the product domains and analyzing the requirements according to the domain attributes. This is the real beginning of requirements writing and impact analysis. It is ongoing because the product is always evolving; there are new additions, new concepts introduced all the time that

changes the perspective of analysis. Thus, defining these attributes and analyzing the requirements accordingly must be an iterative process.

5. Process Leads to Transition

The most interesting observation of the RM tool implementation was to see the learning curve happening in real-time, both from tool and process perspectives. The main issue was that this was the first RM process introduced to Marketing and R&D departments for managing requirements, which was formally a verbal and non-documented process. Thus, the whole organization was taking a big step forward in the RM process visibility and decision-making. It was an interesting lesson to track progress stage by stage.

5.1 Technical Tool-use Issues & Work-concept

While implementing the requirements management tracking tool, we encountered users' common learning issues, problems caused by misconception of the tool, or even more commonly, trying to impose conceptions developed using other tools, on the tool we chose (RTM [3]).

Most of the RM stakeholders were used to working in MSWord. Thus, the move to the tool required a more hierarchical way of organizing the requirements beyond the document-oriented view of sections and subsections in MSWord.

As a tool is based on a database the migration to this tool concept meant transferring to a multi-dimensional perception via database as opposed to the one dimensional document organization.

5.2 "Birth pangs"

Facing up to the new conceptual ideas, RM stakeholders were faced with the painstaking necessities of adapting the organizational requirements to reality, i.e., the quality of the existing requirements specifications and learning to analyze them.

The tool usage exposed the quality of the requirements content. Some were found to be unclear, many were missing or were over-generalized long "stories" slumped together with nitty-gritty details.

Moreover, the tool and process defined required the RM stakeholders to shift the existing mindset and learn to think categorically, analyze the content with respect to traceability, discovering non-compliance and inconsistencies.

5.3 Progression in a Linear Manner

It is important to note that the process establishment of RM did not progress in a linear manner, although this

would have worked in a more systematic way. The first group to own their territory was the System Engineers from R&D. This group was able to work independently and establish their RM environment.

The next groups to join were the R&D Software groups, who benefited from the System Engineers work of definitions and organization, but developed their own component requirements level and subsequently their own territory within the RM world.

After this was done the Marketing department joined the effort. The Product Managers were faced with building their own requirements block. Even though the groups were able to work independently, it is our experience that the Product Managers, being the driving force in defining the product requirements, would have benefited from adopting this at an earlier stage.

Traceability can be achieved in two ways. If progress is linear, i.e., product definition then system specifications then component capabilities, the traceability would have been the natural progression. However, since we faced existing legacy, the evolution of the traceability process worked both upstream and downstream.

5.4 Requirement Management Content Ownership and Accountability

The requirements contents ownership and accountability is the most important factor for RM implementation's success. The basis for RM is requirements availability, meaning that requirements are available, in other words thinking has been done and documented somewhere!!!

There are two types of RM ownership content, e.g., a Product Manager owns his own content at his level – the product requirements. The Product Manager is responsible for producing the product requirements content, its completion, quality, consistency, etc. The System Engineer is responsible for the system specifications etc.

The other type of RM ownership owns the traceability between the different levels. As this, by definition, falls between two stakeholders territories, we found that this question is of a political nature [12], motivating both sides to claim ownership as it is for example the power to decide the contents of the next product version. However, when faced with the reality of having to analyze the requirements and figure out how each stakeholder's "creativity" can be mapped to another level of requirements, they became overwhelmed.

5.5 Requirement Management Process Maturity

The first stage of RM implementation can be characterized as the Euphoria Stage, everybody involved has a fantasy vision of how it can solve practically everything. Then, the tool merely reflects the reality, which is (in some areas) not so glamorous. Reality, that is, unclear and incomplete requirements was shown, additionally and

even more importantly, it reflected the decision making mechanism and culture requirements definition within the company. Some people choose to slip into denial. Others use it to improve the process.

Reconciling the Expectations of Company, Employees and Tools

When implementing a development process, supported by tools in a company, we walk on a thin line. The RM tool can and should match the company's way of doing things, and should be tailored to the company's policy and procedures. However, and contradicting (or not), at the time the RM implementation is done, the existing RM process is usually not mature enough to benefit the RM tool features. For instant, Product Managers at NICE were not used to working neither with tools nor with procedures. It was the perfect time to try to step forward and improve the RM process itself.

Organization Managerial Culture

The purpose of RM is to achieve complete traceability, i.e., from customer, via the departments in the organization, to delivery. This requires setting an organization-wide policy that provides the framework for all parties and establishes upper management commitment, which in turn evokes a problem attitude towards actual implementation. We find the lack of such commitment to be a major political barrier to the RM process success.

Furthermore, the ability to achieve qualitative RM results is dependent on the managerial skills exhibited by the RM stakeholders. A manager, who does not value the importance of having the project requirements defined as a basis for managing his project activities [12], will miss the point entirely.

“Knowledge is Power”

Requirements are the essence of the product knowledge. As the requirements are defined mostly on an individual basis that is Product Manager, System Engineer, etc., who are generally the “professional aristocrats” because they are empowered by the organizational need for constant advice-giving. They may be reluctant to expose their knowledge in a database tool that is accessible by everyone, and loose their status and “the go to guy” for product information etc.

On the other hand, some stakeholders fear that by exposing the requirements content they produced, they might be found lacking professionally. So in a way, Requirements visibility is in contrast with “knowledge is power”.

6. Results

A huge effort has been put into entering the new features in the repository, linking the features to the various versions, and re-creating the baseline of features for the

existing versions in order to have a full view of the product in its different phases.

The results, however, are more qualitative than quantitative. The work of the release managers has been eased enormously. They go to status meetings with a list of requirements to be developed directly from the RTM system, and not, as they did before, with a list manually concatenated from all the product managers. This new process saves many meetings and manual updates as an update in the system is immediately viewable by all the stakeholders.

We measured that the number of synchronization meetings as lowered by 40-50% from previous situation freeing the product managers and R&D managers to perform their jobs.

Release managers and product managers can also create reports of many kinds for their daily work: how many features were added for a specific market segment, what didn't make it into the version, and more.

We can estimate that the number of changes in the release content has been reduced by about 40 - 50% from the previous work without the RTM.

Testing groups, R&D, and every stakeholder in the company have the same reference and discuss the same item. Marketing people find it easier to create sales document since all the features and their benefit are immediately accessible.

On the quantitative side, we have about 30 subjects for about 6 products and we reached today 1300 product features in the repository.

Since a new version is defined incrementally from the previous version, we realized we needed the full product definition in the RTM system and thus started to enter the requirements that were documented (or missing) in many different legacy documents.

7. Conclusions

The daily use of the RTM system enabled visibility of the full product with its existing and missing requirements. The ease of use of the repository made it possible to complete a full product description, something that was never successfully achieved before.

One major reason for this is that project personnel had to execute specific RM activities via the RM tool. This was either not really done beforehand or required additional activities such as traceability. Unfortunately, sometimes we found that requirements were the lowest priority issue in the project interest and therefore no RM solution was expected, i.e., there was no real commitment to RM.

We can estimate that the number of changes in the release content has been reduced by about 40- 50% from the previous work without the RTM. A huge time saving has also occurred lowering the number of synchronization meetings by 40-50% from previous situation freeing the

product managers and R&D managers to perform their jobs.

Our main conclusion is that the process maturity level of the organization tremendously affects the rate of RM deployment and success. The main obstacles to success of RM are the lack of basic project management norms along with requirements norms.

Two years after introducing the RM solution to the organization, we find that the ideas introduced in this paper must be constantly re-enforced and reviewed. This is due to the fact that after each step forward, process maturity is growing, enabling a new and better view of the RM process.

Product Management is now more formalized in terms of lists of requirements rather than product description by “story telling”.

Dynamic and multi faceted organization and tracking of product requirements is a very powerful working asset used by all project stakeholders; defining and prioritize products, tracking development, testing and acceptance.

By using the new process and the repository, Product Managers can go beyond the feature by feature tasks. Since they have a total and constant in-depth view of the product, they can spend more time on other issues such as messages, positioning and more.

Having this requirements infrastructure, enables product management accommodating new evolving market demands along with new business opportunities as normally exist in the telecom industry.

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