Combat the Menace of Scope Creep of Development Projects through the Use of EUReqa Methodology: A Collaborative and Iterative Requirement Engineering Process

Ravi Sankar, Assistant Vice President, Retail and Consumer Goods, Satyam Computer Services, One Gatehall Plaza Suite 300, Parsippany, NJ, P 203 241 5400, ravi_sankar@satyam.com

Rambabu Yeleti, Senior Consultant, Satyam Computer Services

Abdul Hakeem, Senior Consultant, Satyam Computer Services

ABSTRACT

EUReqA (Evolutionary Use Case driven Requirement Engineering Approach) is a new methodology for gathering requirements and was used to develop the Functional Specifications for a Large Fixed Contract Application Development Project. The requirements are built to suit the business drivers and consensus is built amongst the diverse set of stakeholders by iteratively moving from consensus at a high level and adding granularity and stakeholders simultaneously. If there is some divergence from scope or consensus the process moves the requirements back to the stage where consensus existed and then moves forward keeping scope in mind. The methodology was proven in a project where the requirements were collected and documented in the form of use cases and user interface prototypes in a period of three (3) months for a large system which eventually was built with over a million lines of code. The EuReqA methodology can and should be used for all large system development projects involving significant business processes and multiple diverse interests.

Figure 1.

INTRODUCTION

The primary measure of success for any IT based business solution is the degree to which it satisfies to the business objective which it intended for. Broadly speaking requirement engineering is the process of discovering those objectives by identifying right set of stakeholders and their stated and implied needs. There are numerous inherent challenges to this process chief among them is the diverse stakeholders with vague and conflicting goals and objectives.

In this paper we present a new reusable methodology called EUReqA (Evolutionary Use Case driven Requirement Engineering Approach) that we have developed to evolve detailed Functional Specifications for Large Fixed Contract Application Development Projects. EUReqA [1] uses a multistage iterative approach for creating detailed functional specifications by selectively involving the appropriate diverse stake holders during the following six (6) stages of the Requirements Gathering Life Cycle.

- Requirement Definition
- Requirement Elicitation
- Rapid Wire frame prototyping / Blueprint
- Requirement Validation
- Requirement Refinement
- Requirement Signoff
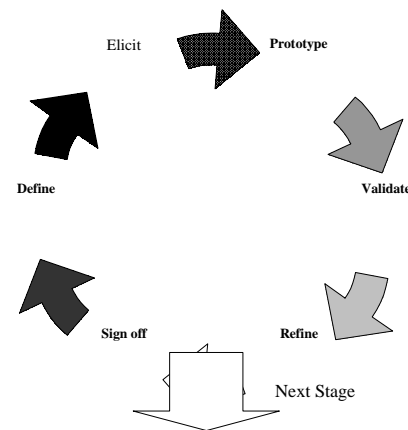
By using collaborative and iterative consensus at each stage, we ensure that the user acceptability at the later stages of the project is very high. Also as discussions force the requirements to creep and expand, the methodology will force the team to move back to the less granular stage, reiterate the consensus that was build and move forward. Also using the Prototyping stage forces the system requirements to be well documented in a visual easy to relate manner without much opportunity for expansion.

BACKGROUND

Pamela Zave [04] provides one of the clearest definitions of Requirement Engineering: "Requirements engineering is the branch of software engineering concerned with the real-world goals for, functions of, and constraints on software systems. It is also concerned with the relationship of these factors to precise specifications of software behavior, and to their evolution over time and across software families."

This definition is more appealing for number of reasons as it emphasis the importance of 'real world' goals that essentially are the prime factor for development of IT solutions, second it highlights the 'precise

specifications' These basically leads to analyzing requirements, confirming that they are the real needs of stakeholders, defining what designers/programmer have to build, and ensuring that they have build the software correctly.

As today more and more large IT projects are being outsourced and it is imperative that the requirements definition be adequately and appropriately defined. Loose definitions and lack of true consensus leads to increased scope at each stage of system development and complete runaway scope inflation by the time the project reaches the user acceptance stage. Functional Requirements is the area that is the avenue for lost margins and provides the foundation for user acceptance. Prior to development of the EUReqA methodology we found that that, while tools exist for documentation, we did not find an appropriate system or a standard methodology for managing the requirement gathering process.

The EuReqA methodology significantly improves the quality of the requirements definition thereby reducing scope creep and leading to a faster development process. Dean Leffingwell, CEO of Requisite, Inc., says [3] "the cost of correcting an error at the Requirements stage is five to ten times cheaper than the cost of correcting the error at the coding stage. …at the acceptance testing stage, it is twenty five to fifty times as expensive. The testing scripts and scenarios also are derived from the requirements leading to easier acceptance and deployment. Any large fixed bid contract for system development would benefit from this methodology. Other projects for which strict lime line adherence is somewhat mandatory would greatly benefit from using this methodology. This methodology is very timely since it offers solutions to the emerging business drivers in the management of large IT projects namely:

1. Outsourcing/off-shoring and
2. Large projects being driven and managed by business managers as opposed to traditional IT management.

 EuReqA is collaborative and Iterative and is based on the following four principles:

- **Collaboration:** In order to have richer understanding of business objectives and user needs and get all stake holders buy in, foster strong involvement of all stake holders during various stages of the requirement life cycle They techniques this include brainstorming and focus groups of SME, as well as consensus-building workshops with an unbiased facilitation by Functional and Technical Consultants of System Integrator
- **Multistage Iterative:** Flesh out the requirements in stages adding more granularities at each stage, developing consensus at each iterations with different stake holders.
- **Scope Adherence:** Avoid scope creep in the form of more complex functionality within the pre-defined 'features' i.e. control adding complexity within the same functionality
- **Time-Boxing**: Each stage needs to be defined in multiple short time boxes to get quick feedback from a broad range of users and helps to the gauge business user's perceptions

METHODOLOGY—THE EUREQA MODEL

EuReqA uses a multistage iterative approach for creating detailed functional specifications in the form of business use cases and a user interface prototype.

The stages involve in sequence:

1. Getting consensus on the high level Business Process
2. Identify the critical points in the business process as key features and thus also defining the potential use cases
3. Developing into high level Use case scenarios
4. Fully expanding on the Use cases
5. Developing the User interface prototype

Within each stage we need follow the process driven method to control scope and increase acceptance criteria. In these stages we need to

Figure 2.
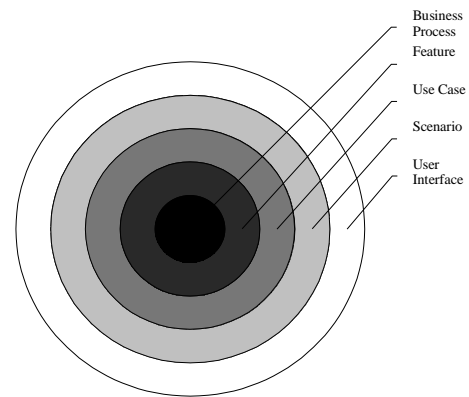
maintain consensus amongst the diverse stake holders (business subject matter experts, operations supervisors, IT managers, IT developers) each of whom have different agendas to be fulfilled. We recognize that there are varying needs and need to bring them in for acceptance at different levels of detail. The methodology and the overall process at the most conceptual level is similar to the Waterfall method of serially completing specific stages and moving forward. The significant variation is that in the EuReqA methodology we begin working on the next stage just as the prior stage is nearing completion.

The EuReqA methodology essentially is a hybrid approach combining the best of breed features of the RUP [2] methodology with the Waterfall method for SDLC. Other methods that are in the same vein usable for developing requirements are Boehm's Spiral methodology. The creation or functional specification at each stage whether it be a business process definition or wire frame prototype is developed rapidly at the highest level of understanding and consensus and granularity brought into it in an iterative fashion.

The other key and differentiating aspect of the EuReqA methodology is that it is a consultative approach which is geared to "Driving Technology with a Business Focus" unlike other methodologies where technology is the dog and wags the business tail. The EuReqA method requires that the development team manifest significant domain/business pedigree and leverage the same throughout the engagement to gain better acceptance. Typical IT Services companies that work on these engagements need to focus more on building good relationships to ensure the project is deployed successfully with user acceptance and not just focus on negotiating and delivering the contracts/project to the literal terms of engagement.

IMPLEMENTATION REFERENCES – CASE STUDY

EuReqA was successfully developed and tested in a project involving a multi-Billion dollar food company, who had contracted Satyam Computer Services as the System Integrator to build one integrated system to support the transportation operations of all divisions and business units, many of which had been acquired recently or in general used different processes and systems to support their operations. The major problem in requirements gathering were to build consensus amongst conflicting players such as business users, client IT management, adjacent system owners, Satyam functional consultants and Satyam technical leads to create a comprehensive system everyone would accept. The team had to avoid scope creep, open ended process redesign, and the general tendency to build a system that supported every possible variation of every transportation management activity.

The benefits of the methodology were manifest in the following ways:

- The Scope of the project was maintained close to the one envisaged while estimating, and allowed System Integrator to

maintain their planned margin at the same time the client got their system with all the required features

- Clear user requirements that were understood by architecture and development teams so that they can relatively quickly create the technical design and development documents
- The methodology and the system developed were very well received and accepted and team picked up more champions for our deliverables after the test and review at each iteration so that the final deliverables went to executive sign-off with consensus from all interested parties

The benefits received were validated empirically in the ability to keep to the schedule wherein the project team could quickly build a large application within 12 months which was broken up as follows:

- Functional Requirements covering about 200 use cases in about 3 months
- Technical Design of 1640 classes and related sequence diagrams in about three months
- Code Delivery of over 1910 objects with over 500,000 lines of code in six months
- Over 700 Test scenarios with multiple test scripts within each scenario
- Detailed Data model with over 180 Data base Files/Tables with over 1200 fields during the period of the functional and technical design.

DISCUSSION—BENEFITS AND DRAWBACKS
Many delivered IT solutions do not satisfy intended objectives and needs due, at least partly, to ineffective Requirements Engineering which often are treated as a time-consuming, bureaucratic and contractual process. This mindset is changing as Requirement Engineering is increasingly recognized as a critically important activity in any systems engineering process.

There are many specific benefits of this methodology. These include:

- Well articulated and thoroughly reviewed functional requirements in the form of use cases and process flow diagrams
- Scope of the project maintained close to the one envisaged while estimating
- Use of functional personnel to drive functional and technical requirements helps insure alignment with Business sponsors of IT projects
- Clear user requirements that were understood by architecture and development teams so that they can relatively quickly create the technical design and development documents
- Close Knit well bonded team to help us in the next stages of design development testing and deployment of the system

The key lessons learnt from this body of work are:

- Strong and clear commitment of Client business users and SMEs are key to capture the business requirements
- Need to have specialized skilled personnel with cross over skills of functional expertise and system design competence

- Building consensus at each stage is critical to ensure sign-offs and avoiding scope creeps and delays
- Develop good rapport with both Client business users and IS teams right in the beginning and nurtured through out, pay good dividends towards successful delivery
- An iterative approach towards requirement management enables us to start documenting the requirements without the fear of making mistakes and also enables us to set boundaries of scope at each stage
- Freeze scope in each stage, yet progressively building more detailed and accurate requirements allows us to get closure at each stage instead of rambling digressions on process redesign
- Expectations need to be clearly understood by all stakeholders
- Have clearly defined roles & responsibilities
- Develop a comprehensive evaluation plan and continue to monitor very closely against the schedule
- Collect data early and react quickly - taking an early pulse is critical to ensure that the process is kept on track and that the project enjoys success as planned.

CONCLUSIONS
The key learning was that the Eureqa methodology works very well for development of large complex systems with diverse stake holders. This methodology seems to work some advantages in the outsourcing/off shoring environment because the understanding is faster as granularity develops.

We must ensure that the boundaries of the work to be done within each of the multiple stages and iterations should be transparent; each user group should be communicated with clearly to improve collaboration. We also must ensure that all stake holders have an opportunity to provide input into the decisions relating to the new "one integrated process", and divide the total body of work into narrower manageable time boxed segments with specific tests at each stage and clearly defined test scripts derived from the requirements.

We suggest the continuous reuse of this methodology as standard best practice for collection and functional requirements documentation of all large development projects.

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