BIOGRAPHICAL INFORMATION

Adam Tonkin
Solutions Architect
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Experience:

Mr. Tonkin has 10 years of technical experience across all facets of GIS and related technology projects – including architecture/design, development, and deployment. His extensive Utilities experience includes:

- Creating a hardware/infrastructure plan for Southern Company's ESRI-based Enterprise GIS, including working closely with Southern's Technology & Architecture sub teams and defining detailed enterprise ESRI GIS hardware and infrastructure architectures spanning the next 6, 18, and 36 month time phases, and associated estimated cost.
- Serving as technical/engineering lead for a $19M project to implement and integrate GIS, Outage Management System, Graphical Work Design, Mobile Workforce Management, and network analysis technologies for a major electric utility. Responsible for design, configuration, customization and integration of 6 new systems, including leading integration of these systems to existing SAP, IVR, CIS, and SCADA systems.
- For SchlumbergerSema's Utility practice, defining architecture deliverables/process from application level projects to multi-system strategic initiatives and creating and presenting technical architect training worldwide.
- Serving as Systems Analyst in development of Cinergy's Customer Interactive System which supports customer-related inquiries and requests (moving service, meter readings, bill inquiries etc.).

Mr. Tonkin's background includes IT consulting, project engineering, product development, and systems analysis roles. He has extensive architectural experience across both application level projects and multi-system strategic initiatives.

CPFL: GIS Implementation Outside the US

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The CPFL (Companihia Paulista Forces De Luz) is a 3,5 million customer Electric Utility based in Campinas Brazil. In mid-2002, the long-awaited CPFL GIS-D ("Gestão Integrada do Sistema de Distribuição"- Integrated Distribution System I *project to replace some of CPFL's major operational systems began. One factor that made this project unusual was its size; the project scope included the deployment of six major systems including GIS, OMS and MWM. Another was the period between the initial consulting engagement and the actual implementation project (2 years).*

Despite the above, the most challenging aspect was the cultural aspects of the delivery model. Contrary to the emerging pattern of today; this project was 'out-sourced' to the United States - specifically Denver office of SchlumbergerSema (formerly Convergent Group) - which would construct, configure and deliver an internally integrated solution; and managed by the Brazil office - which would grow a team of engineers to eventually deploy and integrate this system at CPFL without Denver involvement.

As overall Project Engineer, Adam Tonkin was involved in the design, construction, maintenance and eventual 'handing over' of a shared yet productive environment. This paper shares some of the lessons learned and initiatives taken through various phases of the GIS-D project, along with technical, cultural and time-zone barriers that were broken.

Introduction

As with many IT projects; the complexity with a GIS-based integration project lies not necessarily coming up with a solution to meet the requirements problem; but the way the solution is implemented through the requirements gathering, development, and – typically the most important – the way the solution is deployed.

When characterizing IT projects, a “GIS-based Deployment” could refer to the simple matter of installing a product ‘out-of-the-box’, importing some data and starting work. At the other extreme, a GIS initiative can involve an extensive model creation exercise, configuration, customization and integration tasks and an exhaustive training, testing and deployment program. Such projects, which require a great deal of customer-facing and on-site work, are not as frequently ‘out-sourced’ as opposed to purely development, product-focused and/or data entry type work. Over the past decade off-shore development has increased dramatically, with the vast majority of major US-based IT firms exporting some level of work to international offices.

The structure and nature of the CPFL GIS-D project warranted a reversal of trend, whereby a local team would perform the majority of on-site work including the deployment and integration of the software with CPFL-based systems, and the Denver based development team would configure, customize any third-party applications, manage external vendors and develop any applications required. A technology transfer goal would need to be met also, where Denver would be transferring technology to the Brazilian team.

This paper describes the CPFL project experience by first:

- Providing some background and scope detail
- Walking through the fairly standard project methodology including project initiation/coordination, requirements, design, development, testing, and deployment. In this case, the paper will focus more on requirements and the up-front component of the project as this was where routines were established and other guidelines set for later stages
- Highlighting the experiences and challenges (some of which were overcome, some not) which differentiated this project from a standard implementation.

At the conclusion of this paper, it is hoped the reader has some appreciation for the complexities involved in such a project and can find some applicability to the solutions used in even local-based projects.

Project Background

During the course of the mid-to-late 90’s several US-based utilities underwent extensive overhauls of operational back-office systems as part of single projects due to a variety of reasons including:-

- The push to support the change to W2K - some systems did not support W2K inherently and needed replacement
- The drive to integrate (what were previously) isolated systems and processes – and it was seen as beneficial to do this at the same time rather then “piecemeal”
- The relatively affluent nature of utilities given the period pre-deregulation, pre- energy crisis, and pre Enron like impacts

Such large projects required a great deal of Business Process impact analysis and preparation, and this work was often performed in a separate engagement by external consultants. In early 1999, CPFL conducted a study with AD Little (focusing on business process) and Convergent Group (focusing on technology) to identify the needs and benefits for CPFL engaging in a large-scale multi-system initiative.

At the time, CPFL was focused on taking advantage of the news Commercial Off-the-shelf (COTS) solutions and were prepared to re-engineer their current business practices to support this new technology. At the completion of the consultancy engagement, CPFL embarked on an internal exercise to organize their processes to prepare for the upcoming technology implementation, and the technical requirements which were identified by Convergent Group were collated and a Request for Proposal issued.

Due to many factors including (but not limited to) market and exchange rate fluctuations, organizational changes at CPFL, the extensive RFP evaluation process was protracted over the course of 2.5 years. Convergent Group, at that time acquired by SchlumbergerSema, was selected as the prime contractor to support CPFL GIS-D implementation in November 2001, and contract discussions began. Again, external influences impacted negotiations. As such, it was not until June 2002 that the contract scope was actually signed, and not until August 2002 that a formal kick-off was actually held.

CPFL's high-level implementation goals, the nature and size of this project, the continued exchange rate issues, and the state of the SchlumbergerSema Denver office (which was being downsized at a rapid rate), meant that the team recognized the requirement to move at an extremely rapid rate. While this project may have been one of the largest undertaken by Convergent Group/SchlumbergerSema, it would also follow one be one of the most aggressive timelines.

Initial Project Scope

Although some time had elapsed between the initial technology assessment and the beginning of the technology implementation, the detailed technical requirements which had been exhaustively detailed remained for the most part unchanged, and were embedded in the final contract. The list of technologies and the respective vendors for each to be implemented included the following:-

- *Geographic Information Systems (GIS)* – Smallworld from General Electric Network Solutions (GENS)
- *Outage Management Systems (OMS)* – Centricity from CES International
- *Distribution Planning Systems (DPS)* – Adept (and Engines) from PTI Inc.
- *Mobile Workforce Management (MWM)* – Mobile Workforce System (MDSI)

- *Work Design System (WDS)* - Convergent Works Integration Manager (CWIM) from Convergent Group
- *Maintenance Planning* - Facilities Inspection & Maintenance System from Convergent Group

These systems would in turn be integrated to a variety of CPFL system including the following:

- Works Management System (WMS) - SAP PS
- Materials Management System – SAP MM
- Asset Management System – SAP PM
- Integrated Voice Response (IVR) – URA/ Eriksson
- Supervisory Control and Data Acquisition (SCADA) – SDDT (in-house)
- CIS – SIC
- Transmission Planning – Proplad (in-house)

Finally, the GIS data would need to be migrated from the source system, knows as Prodadis. Figure 1 – Overall (Initial) Project Scope displays the initiate scope in terms of the integration required. In this figure, “MO” refers to the “Model Office”, which was Convergent Groups brand name for the integrated solution comprising the systems described above.

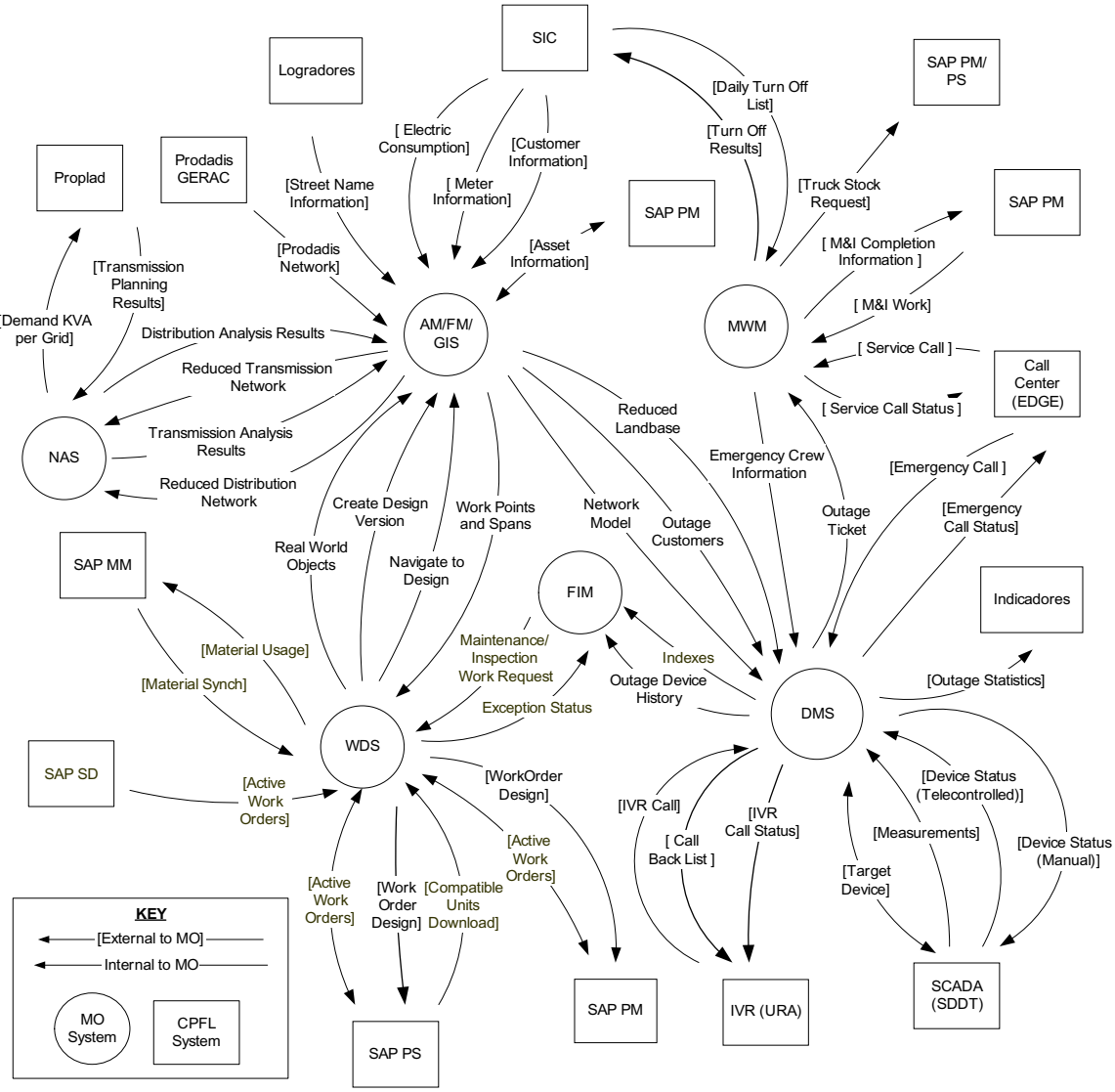

Figure 1 – Overall (Initial) Project Scope

Project Initiation/Coordination

As described above, the CPFL engagement would be managed by the SchlumbergerSema (Now Atos-Origin) Brazilian based office. Although the Project Manager had been hired during the contract negotiations team; the entire Brazilian team would be hired specifically for this project, primarily due to the fact that CPFL's headquarters in Campinas was over 2 hours drive away from the head office in Sao Paulo the skill base necessary for the project was new for the Brazilian office, that was also going through an expansion phase at that time.

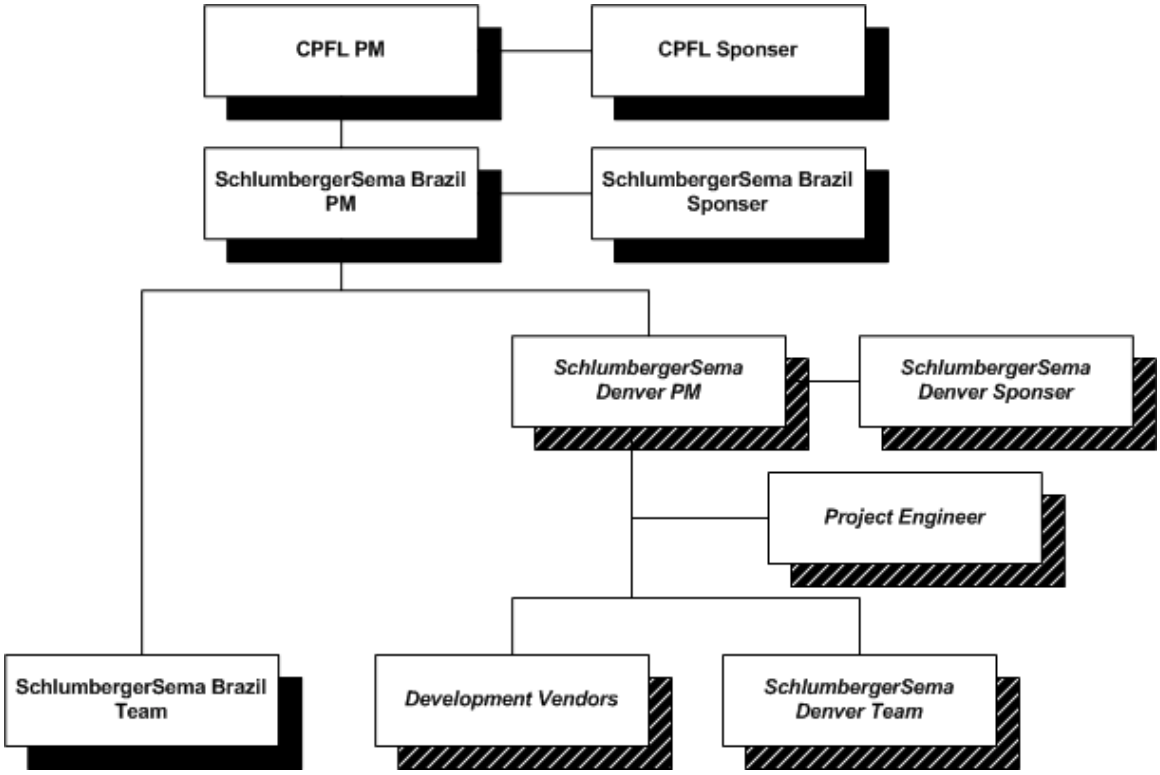

Figure 2 - CPFL GIS-D Project Organizational Structure

Figure 2 - CPFL GIS-D Project Organizational Structure shows the reporting structure between the organizations, the boxes with solid shadows indicating Brazil-based staff and the striped Denver (or in the case of third-party vendors, North American based) vendors. The proportion of staff (as shown in Figure 3 - Resource Loading) was projected to being with a large Denver contingent, then taper off as more Brazilian staff were trained and familiar with the software, and finally ready to integrate and deploy.

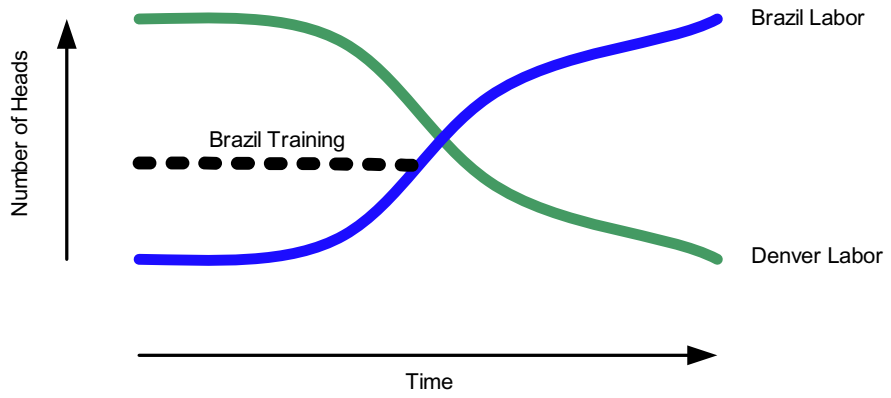

Figure 3 - Resource Loading

In terms of the project itself, the most obvious and difficult barriers was the language barrier. The team leads for SchlumbergerSema and a few of the leads for CPFL spoke fluent English, but many of the CPFL end users involved in the project (24 'core team' who were allocated full-time to the project, 80 'key users' who took part in workshops etc.) For the initial project kick-off meeting, on 30th July, simultaneous translators were employed and the CPFL audience wore headphones. This meant that the initial presentations went very smoothly, in terms of communication.

Requirements and Requirements Management

The requirements sessions would be conducted in an intense 8 week period during which at any one period there may have been 3 concurrent workshops, each focusing on a different technology, the data model, or integration. Often the workshops had over 15 people, or in a joint workshop such as the combined GIS Data Model & OMS, nearly 40 people. This led to some entertaining discussion, but obviously made consensus somewhat difficult at times.

The workshops would be conducted by the Denver team with the SchlumbegerSema team for support and to also learn about the technology. In this case, the translators used would repeat one sentence at time to the group. Each team would have a clear and published agenda entering workshops and at the completion would walk through the detailed requirements described above to identify which had been discussed and a description of how the requirement would be met made. In many cases these discussions would result in a spirited (Portuguese) debate over whether this was satisfactory for CPFL, in which the translator would have difficulty keeping up – and summarizing the discussion for the Denver team.

This period highlighted an unforeseen result of the delay between the consulting engagement and implementation project commencement. Due to such an extended period; many of the original CPFL team who took part in the consultancy had moved on, or out of CPFL altogether. Business Processes had been changed to suit the technology at the time, which of course had evolved. The initial guidelines of “altering Business Process to suit COTS” had also changed as a result, so CPFL was much more focused on trying to support the existing way that did work, having spent the time re-engineering their internal process.

These issues led to some expressions of discomfort from the CPFL team, as the initial requirements workshops for each technology dove straight into the detail of the relevant system, without each team having a clear or detailed (save the initial presentations) view of the overall context of the solution or the part the technology they were assigned to played in the overall CPFL goals. A hurried series of meetings were conducted to develop some overall Process diagrams which would in turn be used as communication tools for the rest of the team. This task accomplished, the project continued to move forward at its rapid pace.

During the requirements gathering sessions, any issues that were not resolved, or started taking too much time to discuss, were listed on the board during the workshop (then spreadsheet) to be registered as Action Items with due dates. The list was termed the “Parking Lot”, and it was not uncommon for the next few months to hear a stream of Portuguese conversations punctuated with the occasional “Parking Lot” in English. At the completion of the workshops, the Denver team returned to the US to document the requirements specifications, which in turn would be translated and approved. Although a few return trips were required, and use of video conferencing technology extensively employed; the requirements gathering period completed as per schedule.

CPFL, like most customers, had a very firm view of the intended solution and how this would be implemented. The requirements associated with each system (and/or their interpretation of the requirements) pushed the respective technology to its limits in terms of functionality. That being said, effective requirements management was critical to both manage the expectations of CPFL in terms of what was possible and making sure this ‘level of understanding’ was not lost. To maintain track of all issues a “Requirements Traceability Matrix (RTM)” was created, which was a detailed spreadsheet mapping the original requirement and contract reference number through the entire lifecycle of the project. Figure 4 - Requirements Tracking shows at a high-level shows how requirements were tracked from the initial contract and scope of work, through to the “Business Requirements” (an overall summary of the requirements) through to the implementation related documents, and tracked using the RTM

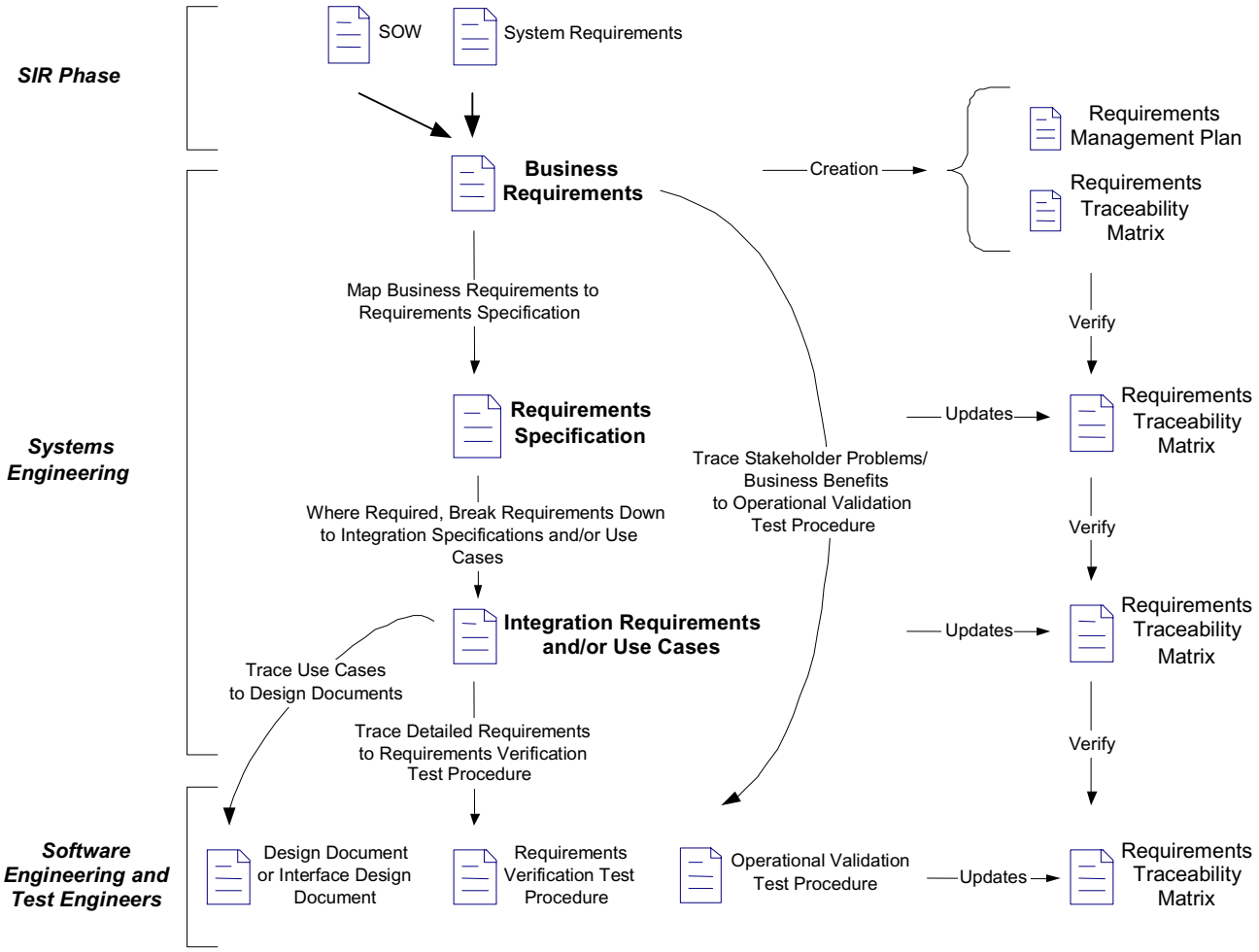

Figure 4 - Requirements Tracking

A combination of the two spreadsheets, (Action Items and Requirements Traceability Matrix) enabled a clear understanding of what immediate issues required attention. The Action Items spreadsheet, initially used to identify potential Change Control/Request issues, was eventually expanded to support issues beyond the requirements period into design and development phases (such as “need data type of attribute X”), and finally used to categorize critical action items that were then incorporate into the schedule when they became serious enough to affect the “critical path”[1]. Although the spreadsheet and its use were not exactly popular within either the Brazilian or Denver team; it did serve a very important (and successful) purpose for the Project leadership team.

[1] Project Management term used to describe a task or collection of task which, if delayed, delays the entire project end date

Having commenced work on the requirements documents, an issue remained as how best to exchange documents. A 128kbps dedicated link between Denver and CPFL was planned, but due to internal CPFL political issues was delayed. In the end, a two stage approach was used. First, to maintain consistent location of the documents, an indexed directory structure was used to avoid the issues of English/Portuguese names for items. (See Figure 5 - Directory Structure). Initially it was thought that the structure would be replicated in Portuguese with the numbers used to keep each in sync, but quickly it was recognized that with using the index made the names –whether they were English or Portuguese – irrelevant, when one could say “Look in 01/01/04/01/03... ” to find the correct location.

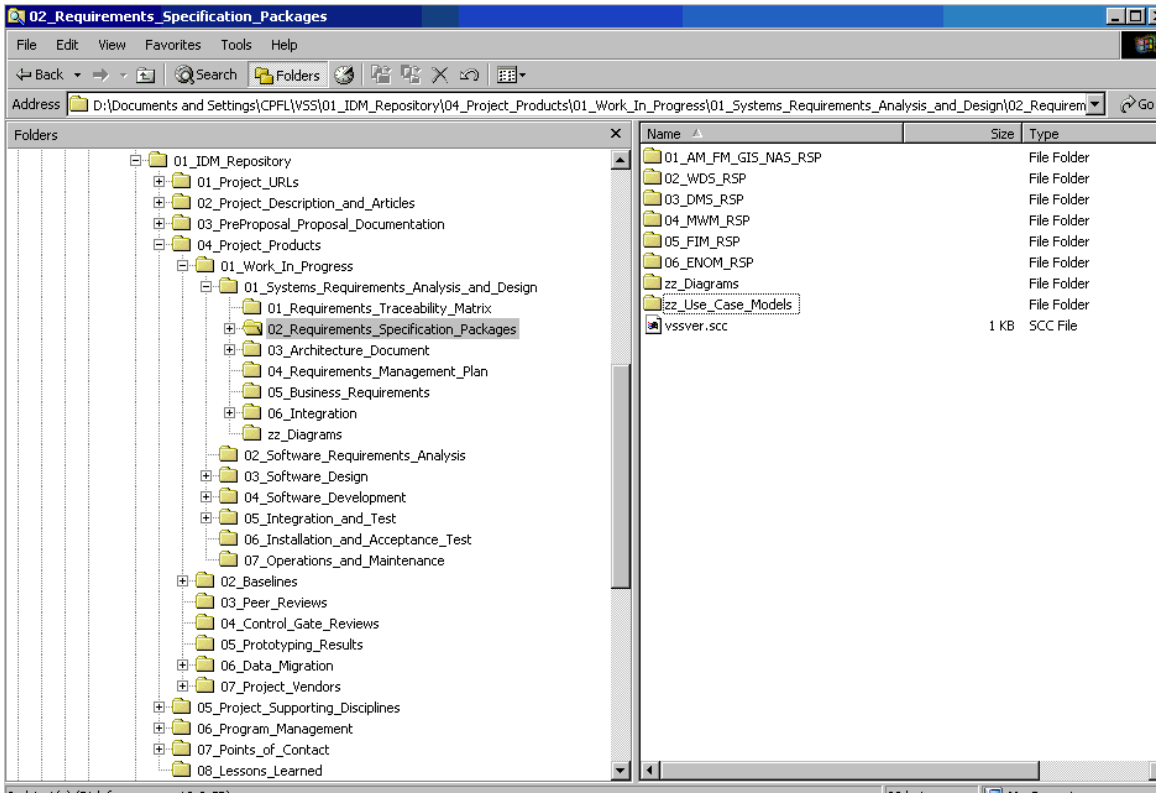

Figure 5 - Directory Structure

Secondly, the structure was implemented in Visual SourceSafe and published to a Web directory, which would be made accessible via the internal SchlumbergerSema intranet. This required those staff on-site at CPFL to dial-in to their local office and download documents, sometimes a cumbersome process, but it functioned nevertheless.

One final issue remained; communication between the teams. CPFL offices would not allow long-distance OR toll-free calls to be made from their office lines. Apart from the expensive option of video-conferencing, the only option was the similarly expensive alternative of dialing the Brazilian teams' personal cell phones or the Project managers' direct line. Given the language issues, the phone conversations would often prove difficult. All of this meant that a quick response to a question would be ultimately reliant on email – not the most reliable approach for obtaining fast results.

The solution to this issue was very simple and identified early; the use of Instant Messenger. While not all of the SLB Brazil or CPFL team spoke fluent English, virtually all could read and type it. Also, even if one team member was not 'signed in', another was no doubt close by. The use of IM (Microsoft MSN) in this case was so pervasive that at one point on site at CPFL, two team members who were having trouble verbally communicating due to language difficulties used MSN to effectively exchange information while sitting less than 3 feet from each other.

Design

Following the aggressive nature of the project, design on the project commenced in most cases before requirements were officially "signed off". Even in the cases where requirements had deviated from the original contract, "Proceed-at-risk" decisions were made by the leadership team to commence work before this was 'officially' approved. While this did open up the SchlumbergerSema team to commercial risk, it was rarely employed, done so on in cases where the outcome of the decision to proceed was almost certain and only where pausing design and development would have had critical impact on the schedule.

Obviously in a project such as this there were a huge amount of design decisions made, from those regarding customization of third party products to developing stand-alone applications to support functions rather than attempt to 'bend' an existing applications. This latter decision was applied in the case of transmission planning functionality; where it was felt by both parties it would be easier to take customer load and geography information and apply complex algorithms (which often changed) to determine the best future location for substations in a stand-alone Microsoft based app; than attempt to massage this data into a form where it would be accepted by the very complex and rigid in-house application to perform the same task. In this case, the legacy app was retired and a new more easily modified tool was created.

Perhaps on of the most important decisions made was the direction to follow in terms of the global integration strategy. As mentioned, CPFL had a number of external systems in place, and the integration would be performed by the Brazilian team. CPFL had given much thought to employing some form of middleware and had analyzed some possibilities, but no clear selection had been

made and in any case the use of EAI or tasks to support configuring and deploying an EAI technology were completely out of scope.

How then to best continue implementing the technology in Denver in a form which, when complete could:-

- Easily be understood and expanded upon by the Brazil Team
- Follow a consistent path for each technology
- At some point be replaced (or complemented by) use of an EAI technology.

A fairly simple yet comprehensive strategy would be employed to support these requirements, which was possible mainly due to the fact that the majority of systems employed an Oracle RDBMS for its repository. Each Denver team would design a set of 'Island (Database) Tables' to support the integration points for their respective technology. These would represent an 'exchange point' where information could be pulled or pushed to or from external systems, primarily using a series of PL/SQL routines which would in turn call procedures or write out data depending on the nature of the target system. Figure 6 - Generic Integration Approach shows the high-level view of how this would be implemented.

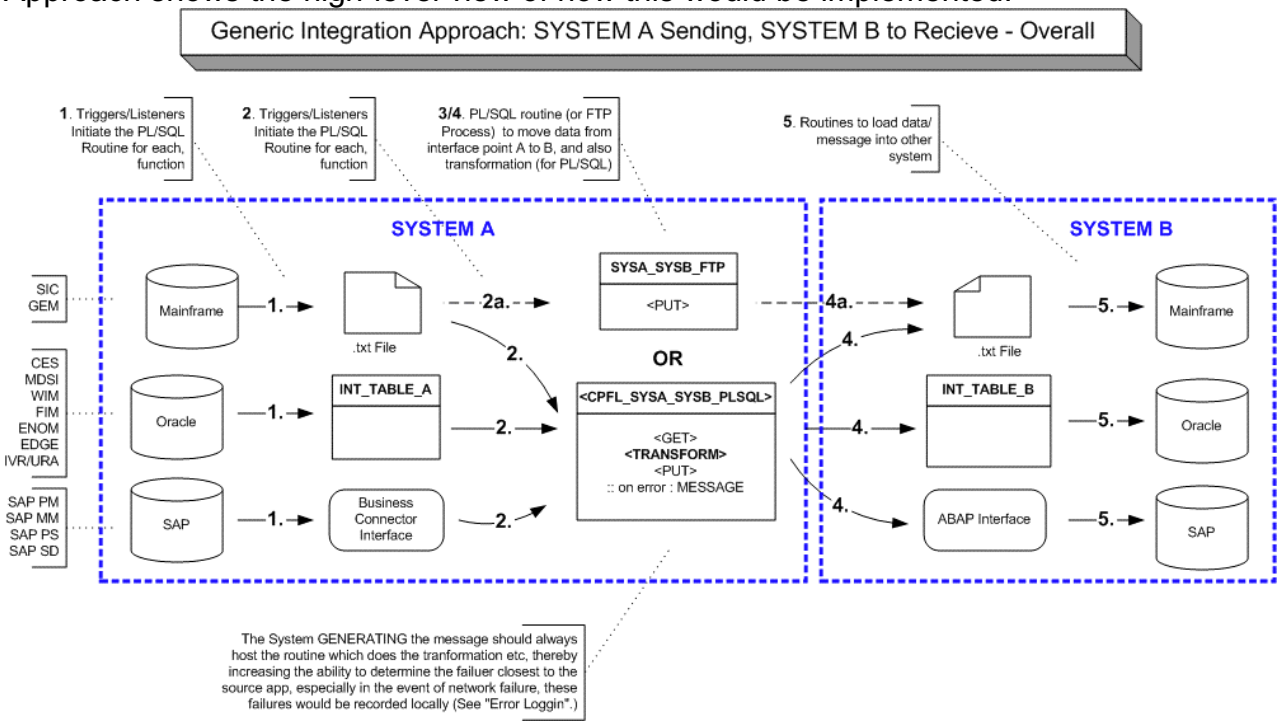

Figure 6 - Generic Integration Approach

This design also enables the use of a very simple error-handling approach. Using Java in this case, a generic error-handling app was designed which would read from each of the (identical) "error tables" residing on each system to present a single view for integration errors throughout the entire solution. (See Figure 7 - Generic Error Handling)

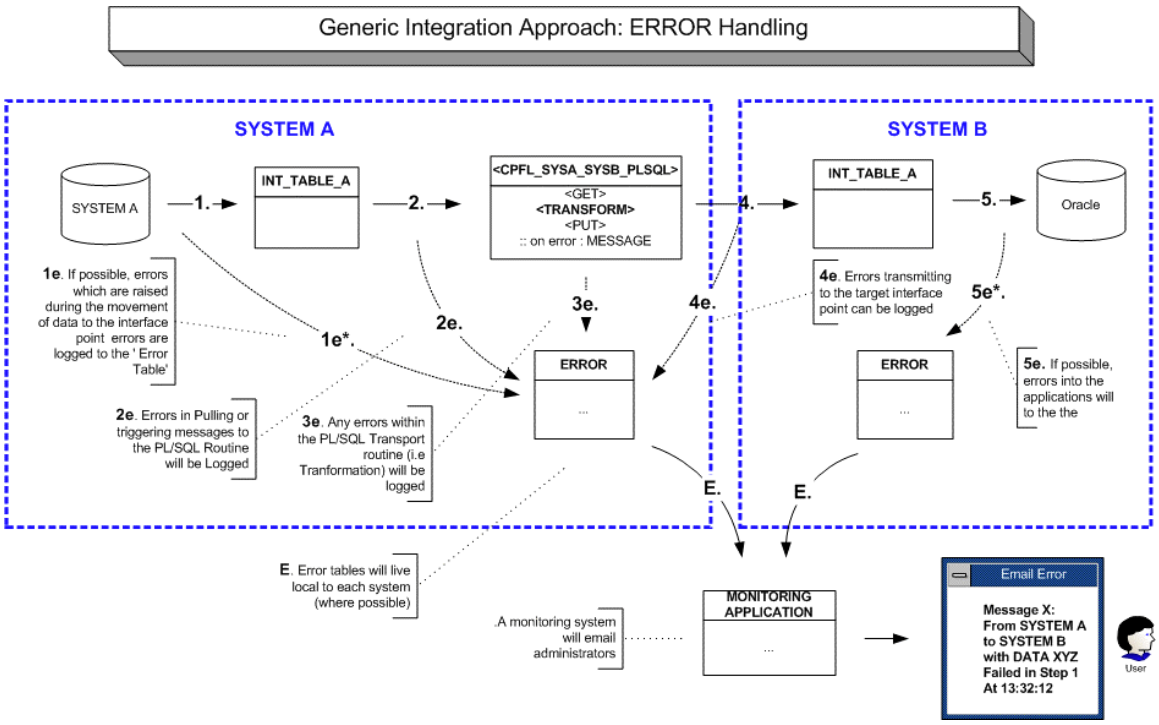

Figure 7 - Generic Error Handling

At the completion of design reviews (conducted internally), development on the overall solution began.

Development

Apart from a number of unclosed Action items and change control issues; the Development period, while extremely busy and frantic, did not encounter a huge or insurmountable amount of obstacles in terms of technical challenges. The team had now swelled to over 40 people in total (as planned) to accommodate the 'crunch period' in configuring, customizing and developing the software.

Some issues that arose which caused headaches were related primarily to the localization issue, that is, the 'porting' of each of these applications to operate using a Portuguese user interface (the underlying data model for each app remained in its native form).

For example, it became apparent early on (and even more so later by the Brazilian team, described in the "Integration" chapter) that some applications were not as fully localized as others. While this issue was complicated, fixing it for "Convergent Group" applications (WIM and FIM) was much easier due to accessibility of the source code.

Third-party applications presented another problem entirely, as any issues had to be worked around. It was soon recognized the difference between a system that had (in the past) been 'Globalized' (designed to be totally language independent)

than ‘localized’ (‘made’ to work, through employing globalization or other means, for a particular language), and also the different ‘levels’ to which these terms had been applied. For example, while in one system the GUI could be modified to change the “Ok” button label to its Portuguese equivalent, it was not until development that the team realized that the system functionally was based receiving an actual English ‘ok’, and translating the term had tragic results.

These and other issues were again examples of problems which would not have arisen without the challenge an international project presents. Still, like in most cases, a blend of common sense and hard work meant a solution was never entirely out of reach.

Test

Toward the latter stage of development, a release strategy and test management plan (written months previously) was put into effect. This followed a fairly straightforward pattern:

1. Developers would, upon completion of development, perform a unit test on their functionality to determine it was operating correctly
2. Once it was time to create a new ‘release’, a build of the entire source would be undertaken and ‘Release to test’.
3. The Test team, using Test plans developed for each task by the team leads and covering all requirements would carry out their tests
4. Every 2-3 days, the Test Team together with the Project Manager and Project Engineer would decide whether it was ready for a ‘new build’, based on whether they had carried out all test plans, or the release was too unstable, or other issues
5. The process would return to step 2.

Using Rational’s Clearquest to manage the defects, this process worked quite well. Unfortunately, the aggressive nature of the project meant that the an exhaustive test of the software during this process could not be completed – as there was only a small amount of original CPFL data made available for testing. This issue would be rectified, but at that point in time prior to FAT and SAT the team (Both Denver-based and Brazilian) would have been more comfortable with a longer period of test.

Another reason this was not possible was the external pressures coming to bear on the project. After SchlumbergerSema had purchased Convergent Group, organizational and market issues meant that their entry into the Utilities market was not successful. From 2001 on, a downsizing had commenced which, until now, had left the CPFL project relatively unscathed. This had begun to change however, and meant that the technology transfer to Brazil was accelerated and the schedule was now utmost priority.

The next planned stage of the project was Factory Acceptance Testing (FAT). Ideally, as per normal FAT, the customer would fly to the development facility (in Denver) to review the state of the solution before agreeing to install it on test environment at their own facility for Site Acceptance Testing (SAT). In this case, the issue of wanting total team consensus for each aspect of the technology (roughly 15 people per technology) and the resultant cost for CPFL for flying each team to Denver meant that they this approach was not feasible. Ultimately, a two-stage approach was followed.

First, members of the SchlumbergerSema Brazil team, acting on CPFL's behalf, would travel to Denver to perform a preliminary review and test of the software. Second, the team would make use of the dedicated link (now available), and employ the thin-client Citrix Solution to run the software in CPFL, while being hosted in Denver. Two conference rooms were set up in Campinas, each with projectors, while SchlumbergerSema Brazil Team members demonstrated the software by connecting directly to Denver.

While the team was still not totally confident with the level of testing by stage one, CPFL was very happy with the results of the FAT, having now seen the software for the first time. The Citrix solution worked extremely well, and as a result moved forward with a suggestion made earlier by the SchlumbergerSema team to use Citrix to support the final production solution wherever applicable.

Integration

The integration phase was the first time the Brazilian team was left alone executing the tasks without the support from Denver. The solution had passed through Factory Acceptance Test (FAT), which as described above was not considered entirely mature, and several challenges appeared during the phase.

The fact that FAT was done in software not yet localized masked several defects from the localization process. In many cases, this was the result of more code dependent of English strings (like in the 'ok' example above), and also GUI components not obeying internationalization rules, brought necessity of getting Brazilian resources up to speed on development for the GIS platform, activity that was not planned originally, in order to fix defects on preparation for Site Acceptance Test (SAT).

The integration of the interfaces with the external systems was done accordingly with the strategy originally designed by the Denver team, despite the late decision adopted by CPFL of using middleware to implement some of the integrations. The model of using "island" tables to isolate the GIS from SAP demonstrated to be very robust, fitting to the middleware quite well. Other integrations were implemented and tested without major pitfalls.

Deployment

The final deployment was completely done by the Brazilian team. The major pitfalls on this phase were related with the lack of experience of the Brazilian team on supporting the object systems on a production environment.

Performance was an issue on the GIS systems until the correct setup was done on the server side; including operational system tuning; Oracle database tuning and the correct administrative procedures were implemented on the GIS.

A full set of training material customized to the customer environment and to the Portuguese language was developed. The process of development of these materials allowed for a growing understanding of the overall system that is helping significantly the support organization recently formed to be up-to-speed with the maintenance obligations.

Summary

In all, the GIS-D project presented a series of obstacles beyond a standard GIS implementation. Many long nights, passionate discussions, and extended stays away from home (both for members of the Denver Team and the Brazilian Team) helped deliver a solution to CPFL. While the fact that the project was conducted over such a wide geographical area was definitely an issue, the lessons learned included many which can be applied to local projects also, and can serve as a guide to GIS implementations in general.