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BUGET AND CONTROL BOARD, DIVISION OF STATE INFORMATION TECHNOLOGY

Applications Development: Delivering Quality Applications

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STATE DOCUMENTS

Certified Public Manager Program Project Class of 2009. Presented to Randy Byars, Deputy Director,
Operations, DSIT

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Problem Statement

In the late 1960's, the South Carolina State Legislature recognized the need for a group within state government to offer data processing services to state agencies. The group was formed and has evolved over the years. The original goal was to provide data processing services to state agencies at a more cost-effective manner than could be offered by private industry and to equitably offer the cost of these services to the state agencies that used the services¹.

In July 2007 the Report of the Government Efficiency and Accountability Review Committee (GEAR) stated

Recommendation Thirty-Six

Finally, two major changes need to be made to the State CIO organization. First, there needs to be a new attitude adopted throughout the organization.

Second, the State CIO organization needs to be split into two separate entities, one of which needs to be a cabinet level state CIO.

"The CIO's office has lost its way. They seem to concentrate on acquiring control, not providing cost effective, efficient service."

Customer of the CIO's Office²

In 2008 the Division was reorganized and renamed the Department of State Information Technology (DSIT). The new Division Director, Tom Lucht, explained to the staff *"The objectives of the reorganization are set: to increase communication across and within ranks, to establish more direct reports to me for accountability (mine and theirs), to begin the process of identifying the next*

¹ Stephens, CPM Project 2000 available at the State Library

² Gear Report URL <http://www.bcb.sc.gov/BCB/BCB-gear-info.phtm>

generation of leaders, to isolate and focus on the remediation of unproductive service areas, and to establish a culture of excellence and openness. To be the best.”

The goal of the organization is to offer efficient, cost effective and valuable services to South Carolina clients. This means a re-evaluation of the existing services, rate structures and staff to make the organization more transparent. The perception of the “old” organization was that they dictated the IT direction for the State. As part of the culture change the new organization needs to change that perception to one that partners with its customers by listening and assisting them in meeting their IT goals.

It is the charge for all at DSIT staff to ensure the Division offers the best value for their customers at a reasonable cost. This project will focus on application projects developed and maintained by DSIT as well as applications developed by other agencies and hosted by DSIT, and how we can validate the quality of the performance for those applications. One application, eLeave, (developed and maintained by DSIT staff) will be used as a model of how the process needs to be changed to better solve the issues of performance problems.

eleave was developed in 2002 for the Budget and Control Board. It gave employees the ability to submit/view leave requests and check leave balances via the Internet – 24/7. The idea was to reduce the cost of paper leave statements and offer an enterprise application that could eventually be used by many other agencies at a reasonable cost. The actual cost savings for the development of the paperless application was estimated at \$44,531, a 1.26 year pay back for the development. The application function is a web frontend to facilitate the approval of a leave request from an employee to a supervisor and generate a transaction that would be processed by the existing legacy mainframe Leave application. This also met the agencies objectives of reuse of a legacy system while using newer technology; web access; to prolong the longevity of the mainframe application. The cost to agencies to use the application was

originally priced at \$10 per employee per year for both the mainframe Leave System and the eLeave frontend. The price per employee was reduced to \$5.75 in 2005 by adding more users from other agencies.

Data Collection

Several areas were looked at to collect data to determine the quality of the performance for the eLeave application. The criteria included: the number of work orders (or calls to the Service Center with complaints about response issues), number of users, application flow, change requests, utilization of the application in seconds and number of transactions created by the application.

Work Orders: DSIT was using two work order systems to track problems or issues called in by customers depending on which work group is assigned the issue. The two server groups; Unix/Linux and Window along with the Mainframe and Network groups were using a Computer Associates (CA) product called Service Desk. The Applications group used the Pinnacle product known as Customer Work Order Fulfillment (CWOFF). A query was done on both work order systems looking for the key words “response issues” to eliminate any other work orders entered for eLeave. We also needed to separate any issues relating to the mainframe system Leave to get a true picture of the eLeave interface. All work orders were printed out and manually reviewed to verify they were response related issues.

Number of eLeave users: At the beginning of each fiscal year a report is run calculating the number of mainframe Leave users for each agency. The DSIT Customer Relations group contacts each agency liaison to verify the numbers and to determine the anticipated change in personnel for the upcoming fiscal year. The CWOFF system was used to show the number of users billed for using the system based on those two factors. To date the eLeave application is used by thirty-four agencies with a total of 14,354 employees.

Application Flow: eLeave is a web based application. The work flow to execute the code requires many layers to keep the data secure. The user is authenticated by means of a user name/password combination and granted access to the system. Based on edits and security features built into the code the user can request information pertaining to them. Supervisors are given access to anyone in their chain of command as defined in the Personnel system. Firewalls are another layer of protection from the end user to the backend (database) to prevent unauthorized access to the system. The servers and firewalls have had changes in their configuration to keep current with new levels of security.

Change Management: DSIT has a Change Management process that tracks all modifications and changes made via a change request submitted to the Change Advisory Board (CAB) this ensures that all areas of the organization are aware of how that particular change may affect their area of responsibility. Like the work order systems, the Change Management database was queried for the key words 'eLeave', 'response' or 'performance' to cull only the changes that would affect eLeave.

Utilization and Transactions: The eLeave application has a billing filter component that notes the date/time when our filter is called as the processing is moving down the chain (or back up). These times, the difference between the two times, and the requested resource name is then written to the log file. These logs are totaled each month and a record is created in the CWOFF system to charge the customers for the utilization on the server.

Data Analysis

Work Orders

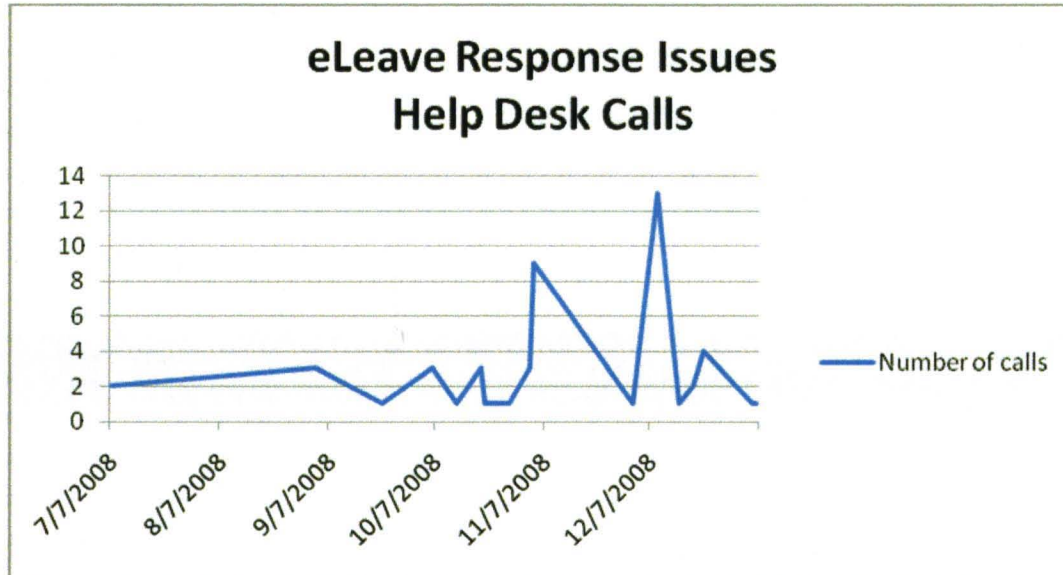


Figure 1

Depending on which Service Desk personnel received the customer call and their interpretation of the issue determined which group or work order system was used. Also, not all performance issues were reported via the Help Desk. Many customers contacted their “favorite” DSIT employee or they just chose to wait it out and see if performance got better later in the day. Some samples of the comments in the work orders from the CIO/DSIT staff were: “The *mainframe* was at 100% utilization due to month end reporting, try later in the day”, “it’s a network issue”, “Not my area” or “I tried the application myself and had no response issues, can’t repeat the problem, close the work order”. The staff became very complacent in responding to repeated calls. The customers became used to the lack of quality based on the assumption it was other applications taking the processing power therefore they accepted the slow response. After talking to several customers it seemed that “everyone knows eLeave runs slow on

Mondays". This was unacceptable by all customer service and quality standards. As shown by Figure 1 it did not appear that the complaints escalated until November 2008. (Other records such as non recorded emails, phone calls and customer comments show a much higher instance of slow response of eLeave had occurred for the past 18 months but properly recorded data is not available.)

Due to the lack of a single work order system and auditing procedures for cross work group issues the problem was allowed to continue without resolution until November 2008.

Number of eLeave Users

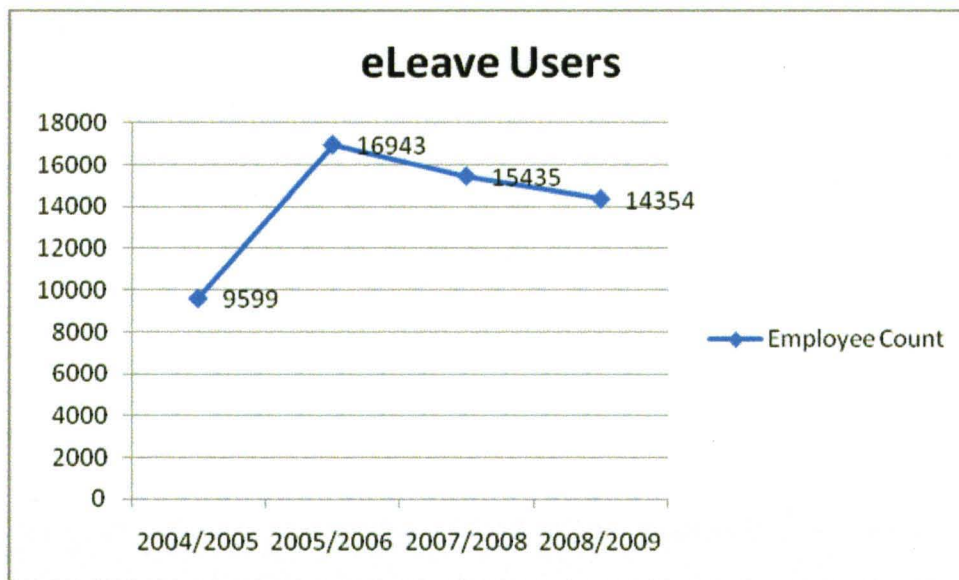


Figure 2

As shown by Figure 2 the number of users increased by approximately 77% from Fiscal Years 04/05 to 05/06 but has dropped approximately 15% to the current Fiscal year 08/09.

Application Flow: Figure 2 shows the path the application code follows (and servers used to provide connectivity) from the end user to the mainframe system via the internet application called eLeave.

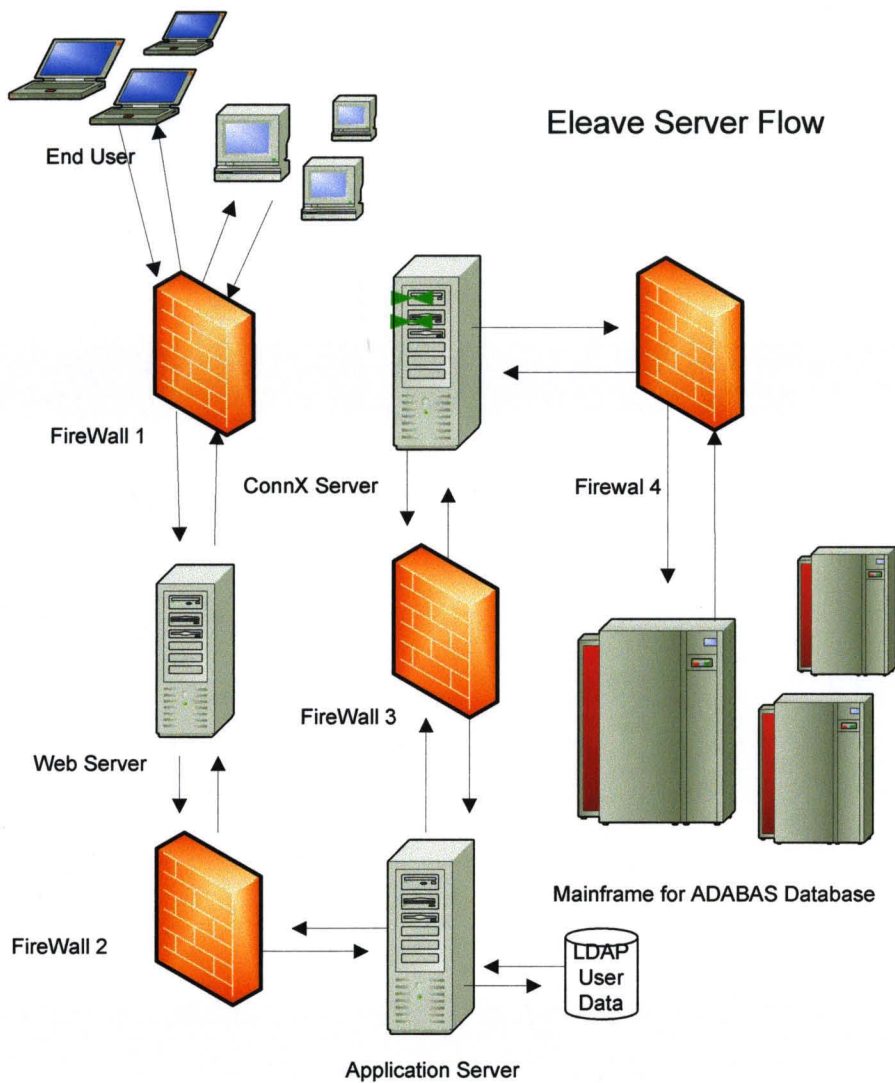


Figure 2

The application code is supported by the Applications Development Group. The Web and Applications Servers and Mainframe are supported by the Mainframe Group. The Windows ConnX server by the Enterprise Computing Group and the Firewalls and Network are supported by the by the Network Group.

Change Management: Since March 2008 there have been 544 changes submitted to the CAB, approximately 46 of those changes could have affected the eLeave application. There were two significant changes made that coincided with the spike in utilization in November 2008. The first was an upgrade to the Mainframe operating system. The other was the upgrade to the ConnX code on the mainframe without the corresponding upgrade to the code on the ConnX server. This server translates the SQL or query from the web application to the database on the mainframe.

Utilization and Transactions:

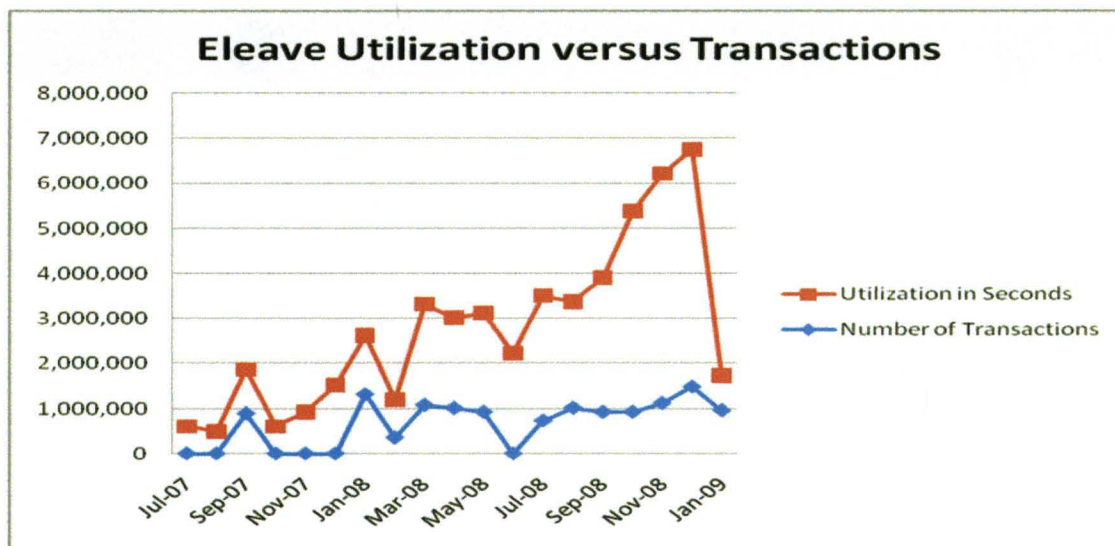


Figure 4³

There was a large increase in the cost of running the application as evidenced in the billing to the owner (Applications Development) each month. Higher utilization was the cause of the higher cost in running the application. As shown by the number of users in Figure 1 there was an actual decrease in users over the time period. The transactions remained fairly constant yet there was growing utilization (or server time) to process the transactions.

³ In Figure 4 the transaction count for the months of July, August, October, November and December 2007 were unavailable

A team was formed by Randy Byars, Deputy Director Operations, DSIT of Network, Server, Mainframe, Application and management staff that collaborated with a contractor from the Software provider for the ConnX and Mainframe Database (ADABAS); Software AG, to determine where the problem truly was. Nine employees from these areas were sequestered in a conference room to work together to solve the problems. Over the course of 4 weeks (including weekends and Veterans holiday) the staff worked to determine where the problems were. It was like peeling an onion, where each layer offered a partial solution but also opened up new problems that needed to be addressed. Appendix I provides the Project Plan used for this process. In summary, the changes made were:

1. Monitor the network for performance issues
2. Review each SQL statement (call to the database) for performance issues
3. Add indexes to the database to allow for retrieval of the requested records rather than read the entire database to obtain the requested records.
4. Change the configuration on the ConnX server and mainframe ConnX components to increase performance
5. Perform load testing to show how the servers and application would perform with many users accessing the system at the same time.
6. Move the ConnX server to the same network as the web server, application server and mainframe to remove the translation issues of two firewalls.

In January 2009 the utilization dropped to 772,721 seconds with 958,727 transactions. Previous highs were 5,105,434.00 seconds for 1,119,971 seconds in November 2008. The response times have gone from

9 minutes in the worst case to sub <1 second response on those same pages after the final changes were implemented. These changes were to remove two firewalls from the infrastructure. The application will be monitored on a daily basis by the Applications staff to ensure no further issues arise.

Implementation Plan

The following recommendations are offered as possible solutions to the broken processes:

1. DSIT has tools to monitor the network and the servers as well as other tools that can help the developers test their application prior to going to production. The problem lies in who owns the products and who has knowledge of the existence and use of these products. A full inventory should be taken of all tools available for use in monitoring and reviewing application performances by each area that currently host the tools. This should be done by the end of the second quarter of the current Fiscal Year.
2. Improve the entry and reporting of CA Service Desk work orders to categorize issues for performance, functions, access and other reasons. This will allow for the ability to automate reporting and enhance the escalation process of problems more expediently. The Service Desk needs an analyst who can track trends and proactively report issues in a timelier manner. The analyst should also follow up on work orders by doing customer surveys on issue response and outcome satisfaction.
3. Continue to break down 'silos' at DSIT by bringing all the server groups (mainframe, Unix/Linux, Windows Operating Systems, Systems Database Administrators) under one Senior Manager. Build an Applications staff with Applications DBA's that are charged with optimizing SQL calls to the database for both internal and external applications prior to being promoted to production for all customers in the hosted environment.
4. The Billing Group should monitor the billing to help detect changes in the application performance by increases in monthly billing. The owner of the service should be held accountable for determining increases are justified, not a system problem. The Applications Development

group should be charged with writing reports that compare monthly billing for each service and customer with thresholds that can be changed for each service.

5. Create a full inventory of all production applications (and the servers and databases they use) as well as networks and firewalls to assist the Change Management Group in determining who and what could be affected by upcoming changes. Use of this inventory will allow enough time for proper testing before implementing those changes.

Evaluation Method

Evaluation methods for each recommendation:

1. The inventory of tools used for monitoring should be completed by the second quarter of the current fiscal year. Training and use of those tools should be tracked and reported to each service owner to evaluate the functionality of the tool and make recommendations on upgrades to Executive Management. Detailed procedures on how to use, evaluate and execute the monitoring and debugging tools needs to be developed.
2. The Service Desk needs to put a trained analyst over the development of categories for each application and service offered by DSIT. The CA Service Desk work order process should be modified to utilize the categories and reporting developed to monitor repeat issues. Those issues should be escalated to the service area in charge and monitored for solutions by the Issue or Problem manager until successful conclusion. Customers should have sign off on each work order prior to being closed.
3. Reorganization of the Server Groups, DBA functions and Applications Group to include Application DBA's should be seriously considered by Executive Management to further breakdown silos.
4. The Billing group should develop metrics that show the fluctuations in billing levels for trending. Increases or decreases could be cyclical depending on the service and customer.
5. All monitoring tools should be evaluated for use, functionality and ability to detect problems. Tools that don't offer the benefit should be replaced by ones that do, to help detect issues and potential solutions.

Summary and Recommendations

The staff has done an excellent job of manually working through the problem over the course of the last two months and has successfully solved the response issue. But this one application problem is an indication of a broken process on how DSIT monitors application hosting to meet customer expectations. This application is not mission critical but is an application that thirty-four agencies and 14,654 state employees count on for accurate and timely access to their leave information.

There were many contributing factors to why the service and quality for this application declined over the last year. It is the intent of this project to show to management at DSIT that a formalized process needs to be in place to monitor the utilization of applications. This will cut down on the cost for running applications in the hosted environment at DSIT. It should include processes and tools for debugging applications prior to going live in production and for monitoring throughout the life cycle of the system to ensure the highest quality and most cost effective applications for the end users. There is a proposal to begin writing Service Level Agreements with penalty clauses for non performance for the DSIT customers. By having a process and tools to monitor the applications we would have the metrics to prove compliance and show how to fix noncompliance.

Appendix I

Project Plan

Project Name:	eLeave Response		
Prepared by:	Michelle Hawkins		
Document Revision/Release Status			
Revision	Date	Description of Changes	Author / Editor
1.0	11/08/2008	Initial draft	Michelle Hawkins

1. Executive Summary

A summary description of the project is included in the Project Scope Statement. Please refer to that document for the items listed below.

Project Purpose and Justification:	To investigate the response times of eLeave. Response times of eLeave for the past year has been declining. Within the last month it has become worse.
Project Objectives:	Speed times of eLeave Project.
Project Approach:	Fast paced approach. Staff's representing each area, Mainframe, Network, Applications, and Windows were present on Saturday, November 8, 2008 to work as a project team. The team convened at 9:00 am at BBR in room 105 and stated what the problem is, steps that we had taken so far, and what steps we need to take now.
Project Assumptions and Constraints:	No Assumptions being taken. Currently no constraints.
See Project Charter for Budget Overview:	No charter needed.

2. Technical Project Documents

Provide a detailed listing of the following documents and provide (where possible) a link to document(s) referenced:

<p>Definitions of Steps Taken before Saturday:</p>	<ul style="list-style-type: none"> • Current versions <ul style="list-style-type: none"> • 7.4.4 ADABAS • OS 1.7 • 6.2.1 ConnX (Mainframe) • 9.00 Build 36 ConnX (server) • Windows 2000 (Current Prod ConnX) • New Versions <ul style="list-style-type: none"> • Windows 2003 (New Prod or Test) • Would like to go to OS 1.9 • 6.6.3 ConnX (Mainframe) • 10.5 Build 8003 ConnX (Server) • Multifetching has been removed in 6.6.3 • New ConnX for mainframe and server was installed and eLeave app changed to point to new. The app was deployed to production using new connection and things became worse. • Response problems on and off for about a year. One theory is that the app becomes worse toward the end of the year because it is reading 2 years worth of data at that point. Come the first of the year would always improve because of the roll up and back to reading only one year's worth of data. • About 6 files that application is reading. • Andy Shaw stated that about 200 transaction of leave a day. This only means people submitting leave. This would not include people just browsing and looking at their leave. • @ 15,000 user for the eLeave system. • Betsy stated that utilization is up on the Web Sphere server. • Data Dictionary has not been updated since 2005. This will have to be looked at. If changes have been made to the ADABAS tables and not updated in the dictionary then could cause problems. • John Robinson can see connection problems in the ConnX server logs. 	
<p>Specification Document(s):</p>	<ul style="list-style-type: none"> • The specifications for this project are to improve response times for eLeave. This may be done by improving a set of things not just one thing. Meaning tuning the software, SQL statements within the application, servers, and network. 	
<p>Design:</p>	<ul style="list-style-type: none"> • At this time there is no design change plan. • This may change if all else falls with the project. • Some design changes that could take place. <ul style="list-style-type: none"> • Move the ConnX server to UNIX instead of running from a Windows box. • Move the ConnX server to Web Sphere instead of running from a Windows box. • Abandon ConnX and using another product such as EntireX or ADABAS SOA Gateway. 	
<p>Implementation</p>	<ul style="list-style-type: none"> • TBD 	

2. Technical Project Documents

Plan:		
Training Plan:	<ul style="list-style-type: none"> No training plan needed at this time. 	

3. Project Plan Documents Summary

Place an "X" within the brackets ([]) for each document included in the Project Plan.

Project Baseline Documents *(May be changed only after appropriate review and approval.)*

<p><input checked="" type="checkbox"/> Project Scope Statement (Provides a documented description of the project as to its output, approach, and content.)</p>	The project is to define problems with the current configuration of the eLeave program and correct the slow response of the application. A team consisting of every area of expertise is assigned to the project to help with analyzing problems or possible problems found.
<p><input checked="" type="checkbox"/> Work Breakdown Structure (WBS) (Describes a deliverable-oriented grouping of project elements that organize and define the total scope of the project.)</p>	Link to WBS Document.
<p><input type="checkbox"/> Full Project Schedule (Provides the project schedule using a Gantt chart. The schedule must include milestones, task dependencies, task duration, work product delivery dates, quality milestones, configuration management milestones, and action items.)</p>	
<p><input type="checkbox"/> Milestone Schedule (Provides a high-level project schedule using a Gantt chart. Includes only project milestones – e.g., phase completion milestones, executive reviews.)</p>	
<p><input type="checkbox"/> Project Budget (Describes cost and budget considerations including an overview, a time-phased project budget, additional resource requirements, and estimated cost at completion.)</p>	
<p><input checked="" type="checkbox"/> Quality Plan (Provides a plan that defines the person(s) responsible for project quality assurance, procedures used and resources required to conduct quality assurance.)</p>	To Be Added at a Later Date
<p><input type="checkbox"/> Risk Management Plan (Provides a plan to integrate risk management throughout the project.)</p>	

3. Project Plan Documents Summary

<p>[] Change Management Plan(s) (Provides the Project Team with a change management methodology for the project baselines, scope, schedule, budget and quality.)</p>	
<p>Subsidiary Planning Documents <i>(May be updated by the Project Manager as required.)</i></p>	
<p>[] Risk Log (Provides a prioritized list of all identified project risks along with plans for management, risk owners, status, etc.)</p>	
<p>[] Change Request Log (Provides a list of all proposed changes to the project along with status, priority, date resolved, etc.)</p>	<p>See WBS for changes.</p>
<p>[] Resource Plan (Provides a list of who is involved in the project, responsibilities / assignments, authority, schedule and degree of participation.)</p>	<p>Randy Byars – Operation Director - Larry Strock – Windows Manager - Betsy Hartman – Applications Manager – Project Documenting - - Alan Lunsford – Tech Support Manager - Doug Griswold – Tech Support – Web Sphere support - Gary McKeever – Tech Support – Mainframe Support - Denny Fallaw- Tech Support – Mainframe Support - Steve Sandel – Windows Support – CONNX Windows Support - - Qiao Xin – Applications Developer – Java/eLeave App Support - - John Robinson – Windows Support – CONNX Windows Support - Jason Hooks – Network Support - Michelle Hawkins – Internal Applications – Project Documenting – 600-2369 Bob St.Ledger – CONNX Support -</p>
<p>[] Cost Benefit Analysis & Return on Investment (ROI) (Provides the Project Team with information to make a balanced decision about the costs and benefits, or value, of various economic choices.)</p>	
<p>[] Procurement Plan (Identifies those needs for the project which can be met by purchasing products or services from outside of the organization – e.g., plan for RFP.)</p>	

3. Project Plan Documents Summary

<p><input checked="" type="checkbox"/> Communications Plan (Defines the information needs of the project stakeholder, and the Project Team by documenting what, when, and how the information will be distributed.)</p>	<p>See Resource Plan above.</p>
<p><input type="checkbox"/> Configuration Management Plan (Provides the Project Team with a change management methodology for identifying and controlling the functional and physical design characteristics of a deliverable.)</p>	
<p><input type="checkbox"/> Phase Exit Plan (The <i>Phase Exit Plan</i> ensures that activities of each phase have been finished, reviewed, and signed off so that the project may move into the next project phase.)</p>	
<p><input checked="" type="checkbox"/> Addenda (Additional documents related to the project.)</p>	
<ul style="list-style-type: none"> ▪ Issues Log 	<p>See WBS document.</p>

5. Project Plan Approval / Signatures

Project Name:	eLeave Response
Project Manager:	Michelle L Hawkins

I have reviewed the information contained in this Project Plan and agree.

Name	Role	Signature	Date (MM/DD/YYYY)
Betsy Hartman	Application Manager		
Larry Strock	Windows Manager		
Alan Lunsford	Tech Support Manager		
Randy Byars	Project Sponsor, Operations Director		

The signatures above indicate an understanding of the purpose and content of this document by those signing it. By signing this document, they agree to this as the formal Project Plan.

Project WBS Approval / Signatures

Project Name:	eLeave Response		
Project Manager:	Michelle L Hawkins		
<p><i>The purpose of this document is to provide a vehicle for documenting the initial planning efforts for the project. It is used to reach a satisfactory level of mutual agreement among the Project Manager, Project Sponsors and Owners with respect to the objectives and scope of the project before significant resources are committed and expenses incurred.</i></p>			
<p><i>I have reviewed the information contained in this Project WBS and agree:</i></p>			
Name	Role	Signature	Date (MM/DD/YYYY)
Betsy Hartman	Application Manager		
Larry Strock	Windows Manager		
Alan Lunsford	Tech Support Manager		
Randy Byars	Project Sponsor, Operations Director		

The signatures above indicate an understanding of the purpose and content of this document by those signing it. By signing this document, they agree to this as the formal Project WBS document.