Web-based Applications and/or Networked Legacy Systems

Using Information in Government Program

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Linking legacy systems and their attached databases to new web-based applications and distributed data bases seems to be a natural way of evolution. In fact, there is very high demand of doing so ("e-commerce"). As known from reliable sources on the subject (IBM, CISCO), most relevant information still resides on legacy systems with a low degree of interconnectivity into the world of the web. However, pushing for integration of the two worlds will have a complex problem coming with it. If so, forget integration, however, is not the answer. Both market demand and the reward when doing it right make the integration too appealing. So, organizations **will** go ahead with it and **will** then be exposed to "the problem" and its ramifications.

The article tries to shed some light on the technological aspects why something that looks like an everyday technology issue could soon become a monster version of the Y2K problem. The only difference is that there will be no particular date when the bomb explodes. Rather than a big bang, the problem will gradually unfold and lead to slow suffocation. Most traditional businesses and public sector organizations will begin to suffer from it soon. When doing it right, newcomers and newstarters will have a head start over the traditional organizations. Given the high need for integration of old and new systems, the business side of the problem translates into four questions for traditional organizations:

(1) How can the effect of the integration problem be eliminated, or at least reduced?
(2) What options are there?
(3) What are recommendable steps if one has to deal with a legacy?
(4) What does it cost?

In order to understand the problem in full, and also why a handy label for it is not easy to find, some insight into the technological side is needed which will be presented in the following.

The Technology Side of "the Problem"

Two major realms of application systems exist in the standard and quasi-standard *networked* world today: one is the traditional host based realm which is best represented by IBM mainframes that are interconnected via SNA (Systems Network Architecture) - hereafter referred to as NLS (= Networked Legacy Systems). The other is the emerging realm of dynamic/interactive web applications which are based on client/server architectures that are linked via standard Internet protocols (hereafter referred to as WAppS (Web based Application Systems) and WDBs (Web based Data Bases).

Applications of both realms perform transaction processing which by definition includes database access and update. Beyond transaction processing, Enterprise Intelligence Systems (EIS) access databases in both realms.

Issue 1: **The Weight of Sunk Money**. The accrued dollar investment in NLS has arrived at such immense amounts, and more than that, the dependence on the respective

infrastructures has evolved to such enormous degree, that any quest for or attempt to replacing NLS applications and databases has proved to fall by the wayside. Decision-makers are averse to the risk involved and are more willing to swallow the bitter pill of huge running costs. There will be no short or medium replacement for NLS, maybe even for a very long-term.

Issue 2: **Unclean Programs/Lack of Documentation**. Part of the problem of being locked into NLS (apart from the proprietary nature of the systems) stems from the way, NLS applications have been programmed. NLS applications frequently lack proper documentation, they are coded in anything but object oriented programming languages, so these applications overwhelmingly handle everything in a single program: the user interface (UI), the business logic (BL), and the database access (DBA) which is -by the way- the deeper root of the Y2K problem. Regarding their lifespan these applications are almost unmaintainable.

Issue 3: **The Need for Interoperability.** Since most relevant corporate data (and presumably most relevant government data also) reside on NLS[1], the question arises how both realms are or can be connected in a way that at least WAppS may have access to both NLS applications and databases.

Issue 4: **Here We Go Again**. Applying lessons learned from the NLS experience means to (1) prefer object orientation in all WAppS development projects which also includes proper documentation throughout all project levels, (2) strictly restrict developments to open, nonproprietary systems (even at the expense of missing a fancy feature for a while), (3) understand the "application program proliferation law" that says application programs and their attached structures (database, UIs) last longer than ever expected. When looking at many WAppS development projects, however, the lessons learned are being ignored; many WAppS do not comply with any of the rules outlined above. Linking such unclean WAppS into NLS will create tremendous ramifications of an old problem, needless to say that they will also lead to prohibitive running costs.

Issue 5. **The Threat of Stall**. While the demand for decision oriented "actionable information" and for decision process relevant knowledge obtainable from IT systems among managers and other user is ever growing, the integration of (unclean) NLS and unclean WAppS will make reaching this goal ever more challenging if not impossible.

Levels of Dealing with these Issues

The issues outlined above must at least be addressed from four which are

(1) Corporate/political strategy,
(2) Organizational process and structure,
(3) Information technology, and
(4) Budgetary considerations

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[1] See Internetweek, July 20, 1998, Legacy Migration: Scaling to IP

In the following discussion, the IT level will prevail, which shall not convey the wrong impression that the answer is seen to be in more or newer information technology. Quite the opposite may be true. This short paper is intended to open a discussion on technology related matters without disregarding the other perspectives in the ongoing undertaking.

Questions like "Where is the organization headed? Which goals does it want to achieve? What are long-term desired outcomes? What are short-term expectations? What are the drivers for the organization's strategy? What options of alternative strategies have to be maintained?" fall under the strategy perspective. Upon answering these questions, certain implications for the other three perspectives are predetermined, i.e., at some point in the discussion, the strategy implications must be clarified and their impact on the other perspectives. Example: Why bother with NLS if the business decides to change its core purpose such that old structures are no longer needed, and with them old technology becomes abandonable.

Questions regarding organizational process and structure deal with the actual embodiment of the strategy in an organization's daily life. Since organizational processes and structures cannot change rapidly, any implementation and adjustment of structure and process must address the repercussions of such impact throughout the whole system, e.g. as we know today, to a certain extent reengineering of business processes relies heavily on capable IT as enabler. If this enabling does not come to happen, reengineering of business processes is bound to failure.

Budgetary considerations must address the financial viability and cost-effectiveness of any budget-relevant action by itself and as part of the overall picture. What may be quite affordable today can become unbearable tomorrow (e.g. writing one or two little COBOL programs in 1974 was no big deal but how expensive have these programs become in the meantime?). Total cost of ownership is a perspective that looks beyond the initial investment and the running costs of the early years. It at least considers long-term aspects such as ongoing (re-) training costs for maintenance staff, expansion costs, and dismantling costs.

Potential Advantage for Newcomers and Starters

It is evident that new companies and those departments of established businesses that start with a clean slate may be able to develop an enormous advantage over traditional organizations since they basically do not carry the burden of dealing with any legacy of the past while venturing into new fields.

This advantage, however, can be exploited only if the lessons of the past are applied, i.e., IT projects have to be based on (a) long-term oriented, comprehensible, and complete documentation of business processes (b) an uncompromised, object oriented approach to

resource (application, databases, network entities, etc.) development and deployment such as OMG's COBRA [2]

Approaches to Deal with the Problem (or Parts of it)

If there are legacy systems to deal with the organization has three main avenues to chose from: To some extent, most organizations will travel on all three of them at the same time.

(1)   **Migration/Replacement**, i.e., phasing out the old systems and structures, building new systems (porting the old databases into the new environment, rewriting the applications) on basis of renovated or reengineered business processes,

(2)   **Encapsulation**, i.e., shielding NLS against the environment, maybe even to the extent of freezing them in terms of further developments. This approach involves building front-ends that serve as gateways between WAppS, WDBs and their NLS equivalents

(3)   **Expansion**, i.e. adding Web/Internet capable components to NLS in a fashion, that NLS can directly be accessed from WAppS, and maybe even the other way around, that NLS can access both WAppS and WDBs.

As mentioned, the most common approach will be a hybrid that is any combination of the three with a clear preference for (1) and (2) in the mix, not only for cost reasons.

IBM has recently estimated that in the private sector 70 percent of all relevant corporate data and applications still reside on NLS of which only one half has some sort of TCP/IP connectivity. CISCO confirms this estimate, however, says that only 30 percent of NLS have any TCP/IP connectivity [3]. These figures also serve as a benchmark for the public sector where the percentage of relevant data and applications sitting on NLS might be even higher and that of TCP/IP connectivity even lower (if research institutes, universities, and the military are not taken into account).

With the tsunami of *ecommerce* surging through the private sector, these proportions will undoubtedly change soon; in other words there is high demand for service and supply regarding the three avenues mentioned above. It must be noted here, that "ecommerce" is only the tip of the iceberg or a special form of true Web-based transaction processing in general. In analogy, Web-based EIS will soon arrive in larger quantities, likewise creating high demand for some sort of integration with NLS. The example of ecommerce in the private sector will soon lead to a broadened understanding of the opportunities, and hence a strong demand for Web-based transactions and EIS in the governmental sector.

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[2] "CORBA (Common Object Request Broker Architecture) is a standard for distributed objects being developed by the Object Management Group (OMG). The OMG is a consortium of software vendors and end users. Many OMG member companies are developing commercial products that support these standards and/or are developing software that use this standard."
(see http://www.acl.lanl.gov/CORBA/)
[3] See InternetWeek, ibid.

Players and Products in this New Field

Players and products in this new field can be divided into three categories:

(1)   Comprehensive application development, deployment, server and Web/NLS integration architectures
(2)   Heavy duty / large scale Web-focused development, deployment and maintenance systems
(3)   User-front-end oriented development tools

All products mentioned hereafter under (1) and (2) run on mainstream platforms such as Windows NT and/or popular Unix implementations such as Sun's Solaris, HP/UX etc.

Comprehensive application development, deployment, server and Web/NLS integration architectures

Two small, privately held but well-renowned vendors under this category are **Bluestone** Software, Inc., of Mt. Laurel, New Jersey and **NetDynamics**, Inc., of Menlo Park, California.

Bluestone SW calls its approach "Enterprise Interaction Management" (EIM). With its Sapphire/Web) family of products the company says it is capable of "providing a complete infrastructure where Web enabled, enterprise-class business applications can be developed, deployed, integrated and managed …"[4] Components are Sapphire/UBS (Universal Business Server), a server for WApps, the Application Manager, the Developer, and the Enterprise Deployment Kit. The software is developed using Java or C++ and the development tool generates such code itself. Product reviews by analysts state that the product family offers a wide range of multi-tier application management functions and is well suited for heavy -load "big-time enterprise Web applications" [5]

Bluestone's Sapphire products come with so-called Integration Modules (SIMs) which provide connectivity to ERP systems such as SAP and Peoplesoft, as well as transaction and messaging systems such as CICS, MQSeries, and Tuxedo. Sapphire integrates and supports CORBA, RMI, and COM. Bluestone offers a unique pricing scheme based on IPY (Interactions per year).

NetDynamics's definition of the same field comes as "Enterprise Network Application Platform". The product, NetDynamics 4.0, has five major components: the Application Server, Platform Adapter Components (PACs), the Command Center, the Studio, and the Java Object Framework. These components are pure Java and CORBA implementations. The Application Server is capable of load balancing and providing fault tolerance. The Component Monitor is able to watch the behavior of modules and objects in a very detailed fashion, Via PACs integration with ERP systems such as SAP and Peoplesoft is

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[4] see http://bluestone.com
[5] see internet World, April 20, 1998, "The Power to Handle Big-League Applications"

maintained, as well as with CICS and Tuxedo transaction processing systems. A whole host of other applications (including NLS) is interfaced by means of PACs. The Command Center is used for local and remote systems management. Studio is the Integrated Development Environment (IDE) by which both Java and HTML applications can be generated. The Java Object Framework provides a comprehensive set of Java classes and methods. Analysts praise the comprehensiveness and cleanliness (in terms of compliance to standards) of NetDynamics family of products.[6]

Both companies have Fortune 100 corporate customers.

Heavy duty / large scale Web-focused development, deployment and maintenance systems

Apple Enterprise Systems (what used to be NeXT), a division of Apple Computer of Cupertino, California, is the only full-fledged representative, while the other one, **NetObjects Fusion** of Redwood City, California, a privately held firm, IBM funded (among others), partially falls into this category.

Apple Enterprise Systems' product is known under WebObjects. Its current version 4.0 incorporates Lightweight Directory Access Protocol (LDAP) and CORBA integration. The product consists of three building blocks: WebObjects Builder, Enterprise Object Modeler, and Project Builder. WebObjects Builder "controls the visual layout of the application and binds the HTML forms or Java applets to pre-built objects on the server for database access and business logic".[7] Enterprise ObjectModeler "models the relationship between business objects in the application and datasource schema".[8] Project Builder forms the IDE for WebObjects. WebObjects has a good reputation among developers and users. Development times for object oriented WApps under WebObjects are reported to be short. Maintainability is rated high. The corporate customer list of WebObjects is quite impressive in terms of its length and its names. Apple claims that most major ecommerce sites are developed and maintained under its product.

NetObjects Fusion

NetObject Fusion 3.0 is a site oriented Web project development environment which acts as the intermediary between Web editors of all kinds and WApps builders, Webservers, and all sorts of Web Browsers. It lets the WApps developer use a visual design approach to creating and maintaining a Website structure. It also helps integrate and maintain the input from various editors and libraries besides its own powerful page editing features, (which includes multiple browser optimization). NetObjects Fusion supports Open Data Base Connectivity (ODBC) or ISAM technology. Data base interfacing beyond these methods is accomplished via third party products. The product is more "publishing" than transaction processing oriented. The product has won a lot of attention and support

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[6] see Computer Wire, December 1, 1997 "Review of NetDynamics 4.0"

[7] See http://www.apple.com/webobjects/product/featurebenefit.html

[8] ibid.

among the professional web publishing community. It is highly decorated with prizes from numerous publications in this field. The product is Windows 95 or NT based only. Among the supporters of NetObjects are IBM, Chrysler Corporation and others.

User-front-end oriented development tools

Companies and products in this category are only mentioned for the sake of completeness and because most integrate into the systems in the other two categories.

(1) Macromedia's DreamWeaver
(2) Microsoft's FrontPage98
(3) GoLive Systems' GoLive Cyberstudio
(4) Adobe's Pagemill

Beside page authoring these products also let the developer perform web site management to various extents. Their foremost focus is however on web publishing rather than transaction processing support.

Summary and Recommendation

The high demand in both the private and public sector for Web based transaction processing and EIS usage creates the need for a more organized and structured way of developing Web based applications. This holds true for "new" non-legacy laden developments of WApps, but even more for WApps that have to integrate with NLS. In order to benefit from the lessons learned, this generally calls for an object oriented, holistic approach to these developments that takes the longevity of applications and the inherent budgetary and technological risk into account. Otherwise an organization might find itself in the unpleasant position of being prisoner to its past with reduced options for its future. When building and reformulating corporate strategies that boil down to organizational processes and structures with all its financial implication, the technology side of the whole picture has to be well understood in terms of its overall impact. This impact can be quite significant as the "Y2K" problem shows. There are estimates that up to 70 percent of 1999's IT budgets are just spent on fixes in this respect.

Since WApps appear at a time when more powerful development and maintenance tools and architectures are available than in the past, the proponents of these technologies should be contacted and invited for an ongoing dialogue. These are the companies of Bluestone Software, Inc., Net Dynamics, Inc., and Apple Enterprise Systems. The companies shall be asked to present their understanding of the situation, their stance regarding the issues, and their answers in terms of products and services. This might then lead to one or more evaluation projects and benchmarking of live sites in the private sector. It will enable the Center for Technology in Government to thoroughly and competently advise state agencies on the subject in the most relevant aspects of the matter. It will help the vendors to get into direct contact with the governmental sector.