



Management Guide

Strategies and Technologies

Published July 2000

Legacy Renovation

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Management Summary

Legacy renovation is about application use and reuse, building on the strengths of the past by combining them with the opportunities that present and future technologies offer. In many respects the change of century has had an enormous effect in determining the scope of the legacy renovation market. The fear of being non-compliant for Year 2000 (Y2K) drove many companies to replace legacy applications with modern, typically Enterprise Resource Planning (ERP) Systems. In effect, they came to a watershed and decided they did not want to make the investment to achieve compliance, especially if not one jot of extra functionality could be obtained as a by-product. This perfectly legitimate choice was one option; the only other alternative was to retain some or all of what was installed and undertake a remediation process. Unless making the choice purely on financial grounds, it is difficult to perceive an organisation selecting this option if it did not foresee a long-term role for the remediated software. The life span of remediated products may be between five and ten years. Whilst forecasting technological developments over this length of time is virtually impossible, it is fair to say that users will become far less concerned with what, to use a motoring analogy, is under the bonnet, and much more switched on by what it can do.

The Information Age

The pace of technological change is bewildering for those working in, and observing the IT industry. However, they can take solace in the fact that employees involved in the business sector are experiencing a dose of the same medicine. Driven in large part by internetworking technology, there is a fundamental shift occurring in the nature of business. Underlying it all is the information revolution, a sea-change in life that will prove to have a major impact, such as the one that occurred when the developed world moved from an agricultural to an industrial society. Clearly, those companies engaged in service-type industries, or producing sophisticated consumer goods, will be at the leading-edge of this change, and will need to move quickly to modify the business model. That said, even those companies in the lower reaches of the supply chain, producing basic commodities, will find the way they conduct business changing as the new IT paradigms become ever more pervasive.

The Technology Gap

The problem with an ever-changing business model is that it becomes virtually impossible to keep IT systems in synchronisation. This technology gap represents an under performance by IT when measured against what the business wants, and needs. Development timescales have always been an issue for business, and the pace of change is now exacerbating the problem to a degree where a company's only option is to use all of the building blocks at its disposal, whether these are legacy applications, modern application packages, middleware, or internetworking technologies. In other words, to reap the technology dividend, which now allows anything to be linked to anything, and to provide seamless interconnectivity. Legacy, in an IT context, is usually taken as referring to a mainframe application, although more recently even some client/server applications have been accorded this dubious accolade. At the bottom of every renovation decision there should be a perpetual debate about the continuing benefit that a particular system brings to the organisation. Butler Group has recently started work with noted American guru Paul Strassmann and, on the basis of his many years work in tracking companies in the US, is convinced that his metrics are the only way to measure and benchmark the information management infrastructure of an enterprise. Although these metrics are certainly not specific to legacy renovation, it is worth taking note of one of Mr Strassmann's findings. This is that, over time, the continuing investment in a legacy application is not rewarded with an equivalent increase in value. In short, more and more money represents less and less value. Hence, the need to continually review legacy as a component of IT infrastructure, and why re-engineering of the core of legacy applications, on any sort of scale, can be discounted as too difficult, too expensive, and not representing good value.

Enterprise Application Integration

Around 15 years ago, no doubt limited by the connectivity products of the day, there was a belief that a corporate strategy involving a homogenous infrastructure was the only way to go. This nirvana, however, was rarely achieved. Standing on the threshold of the new millennium, a new reality exists regarding the need to take existing systems, be prepared to integrate bought-in products, and extract the best out of those systems which may be old, but which are still central to business process execution. This has been brought about by the extension that is being made to systems once regarded as a total solution, the ERP Suite.

Long predicted as being a dying breed, the mainframe continues to go from strength to strength.

The fact that organisations now have to take account of Customer Relationship Management (CRM), Supply Chain Management, and Business Intelligence (BI) solutions means that wholesale integration is unavoidable. Some of the ERP vendors are acquiring this functionality to create extended ERP from one source, but it is rare that all requirements across the board can be sourced in this way. Furthermore, many companies are taking advantage of disk and database technology to reduce the number of file systems needed to support applications. A unified view of data is surely becoming one of the first holy grails of 21st century computing.

E-Business and the Emergence of Real-Time Computing

It would be misleading to omit the effect of e-business as a driver in the legacy renovation arena. It might appear inappropriate to introduce the topic given that e-business appears to be the domain (no pun intended) of Web servers, browser technology, and HyperText Markup Language (HTML) – dynamic or otherwise. The truth is that early incarnations of the catalogue, or Web shop front, characterised by Butler Group and others, as e-commerce, frequently failed by virtue of the success they achieved. The inability to process huge volumes of transactions, without the necessary back-end processes is enshrined in e-commerce folklore. The importance of true integration of the Web with all IT services, is now well understood, and it should be apparent that the mainframe is an obvious candidate for processing the types of traffic generated by a successful e-business application. The speed of processing required, and indeed the increased incidence of what are termed real-time computing applications, further compel organisations to make use of powerful server technology. Business-to-business applications, which are involved in bidding for contracts, or offer the cheapest spot rates, are good examples of this type of technology.

Pragmatism, Probably the Best Choice

It is perhaps worth restating that the needs of a business should be satisfied by appropriate technological solutions. Inclusion of particular hardware, operating system, and software platforms must always be based on a well-rounded IT strategy which reconciles the sometimes opposing factors of age versus modernity, value versus cost, ambition versus practicality, and time versus development constraints.

Whither the Mainframe?

Many people would, no doubt, question the role of the mainframe in today's IT infrastructure. Long predicted as being a dying breed, the mainframe continues to go from strength to strength. Indeed, based on the success of the Network Computing paradigm, if not the Network Computer itself, mainframes are incredibly well positioned to play an increasing role in an evermore server-centric IT world. There are many reasons why this move to server-based applications is happening, but they include, better networking capability, Total Cost of Ownership (TCO) benefits, speed of deployment, and the need to provide a consistent view of the corporate information store. In deciding on a technological structure for IT systems, it is particularly important that companies should take cognisance of the fact that many of their future system users will not be under their control, but will sit in the virtual world of the extended enterprise. For some types of organisation, particularly those engaged in business-to-consumer e-business, this is current reality on a global scale.

Extended Middleware Moves Centre Stage

The developments that have facilitated the opportunity for a totally heterogeneous solution to business needs, lie mainly in the area of connectivity, not particularly wires and plugs, but software traditionally known as middleware. This category of software solutions is also being labelled as application integration tools. Middleware has actually been around since the first Transaction Processing (TP) Monitors were introduced. IBM's Customer Information Control System (CICS) is a good example. However, their role was essentially about connecting different computing platforms together, or as in the case of a TP Monitor, inserting application server capability into the host client connection to provide better throughput.

Today, middleware is often an integral part of a family of tools, which allow the creation of graphical clients, but then facilitate connection to a legacy host. There are a number of ways of doing this, but perhaps one of the most common and less invasive of the host is screen scraping. As the name implies, a legacy character screen, such as an IBM 3270, or DEC VT100, has its outputs mapped to a graphical client which scrapes the information as it is presented.

This approach has the advantage of having no impact on the legacy application from a code modification point of view. One of the other advantages present in many screen-scraping tools is the flexibility offered in the type of client. It is entirely possible to use a mix of clients, ranging from UNIX X-motif, through 16-bit and 32-bit Windows clients, to Java, and the Web browser using HTML. Consideration as to which is appropriate is essentially a strategic decision, but one that takes account of the different classes of users involved. Web browsers with HTML forms may be acceptable for the casual user, but are not going to cut the mustard if a professional interface is required.

Internetworking Technologies

Oracle's move to promote the NC may not have resulted in widespread adoption of the devices, but has certainly moved the debate forward in terms of thin-client technologies, of which the Web browser is just one example.

The Internet has been a great force for change at the technological level. Frequently characterised as a plaything, it has driven the greatest revolution in low cost networking and connectivity. There are still issues with security and digital certification, but it represents the way forward for companies regardless of their size. As an integrator, or a tool for legacy renovation, it has the power to provide a graphical front-end for any application, and is increasingly important in exporting client-side services beyond physical enterprise boundaries. Oracle's move to promote the Network Computer (NC) may not have resulted in widespread adoption of the devices, but has certainly moved the debate forward in terms of thin-client technologies, of which the Web browser is just one example. Java, the 'write once, run anywhere' language is being widely used, although this technology and others' including eXtensible Mark-up Language (XML), are still quite immature. The truth is that they offer the best chance of providing a consistent front-end for business integration. Currently regarded as a distinct technology area, internetworking protocols such as Transmission Control Protocol/Internet Protocol (TCP/IP) are rapidly becoming accepted as true IT standards.

Conclusion

It is probably entirely fitting that there is a feeling of great expectation regarding business and IT futures at the dawn of the 21st century. Although our predecessors probably shared similar emotions in 1900, this change of century is not the whole story. The cost and performance of computing equipment has reached levels where all but the most financially constrained companies are able to afford the IT infrastructure of their choice. In fact, for many organisations, the time is fast being approached where the limit is imposed only by corporate imagination. This is a situation that offers great opportunity for those able to take it. As a consequence, it poses a threat for all those who are not able, or are unwilling, to participate in a brave new world, where information has replaced the capital asset as a key determinant of wealth. Agility is the key, and if a business is to remain agile, then IT as a function has to be integral to the business objectives and similarly agile, especially if the technology gap is to be avoided. Development of applications from scratch even using Rapid Application Development tools and components, is for the moment, at least, not the whole answer. Perhaps, in ten years time, all applications will consist of pre-built components assembled into an application framework. For the moment, however, success is likely to be built on the ability to provide intuitive, consistent client interfaces that sit almost like an umbrella over the top of whatever currently provides the core functionality.

What is underneath should no more be an issue for the business user than is the telephone network infrastructure that routes traffic to their desktop, home, or mobile device. Butler Group believes that an explosion of integration activity will take place over the next few years, if only to leverage the investment made in their legacy systems to make them Y2K compliant. It is also apparent that corporate mergers and acquisitions will continue to be a dominant force on the business scene, ensuring that the issues surrounding legacy renovation and integration will continue to play a major part in shaping future business strategy.

Business Issues

The Present Situation

The competitive positioning of many organisations is being adversely affected by a distinct lack of integration throughout the enterprise. Whilst the biggest impact is undoubtedly in the area of IT, its influence can be felt by the whole business. A company's employees may be struggling to cope in an ever increasingly competitive, global market. To use a boxing analogy, they are fighting with one hand tied behind their backs.

Many organisations are almost totally dependent upon computer systems that in many cases have been deployed for anything from 10 to 20 years, in a number of instances even longer. One reason for the longevity of these systems is simply the plain fact that they are crucial to the business. This is where their business-critical applications reside. Other systems have been deployed in the meantime, affecting both front- and back-office processes. The one thing that all these systems have in common is that they do not integrate; they are basically stand-alone systems, which create business inefficiency and consequently a lack of competitiveness. Legacy systems in particular were not intended to communicate with external applications. However, this has unknowingly and unwittingly created a time-bomb that has been waiting to explode, that time is now.

The Way Forward

The potential for immeasurable scalability offered by the Internet is a vital competitive advantage not attainable by any other means, embracing both internal and external recipients.

From a business perspective, the need to modernise, integrate, and Web-enable legacy systems has become an absolute imperative, in order to exploit the strengths of the Internet, namely its global reach, the adherence to standards, ease-of-use, and availability. The potential for immeasurable scalability offered by the Internet is a vital competitive advantage not attainable by any other means, embracing both internal and external recipients.

Through the pervasive influence of the Internet, organisations can empower their mobile workers, presenting them with a key competitive edge, particularly in the areas of field sales and service/maintenance industries. Mobile workers are able to access centralised data sources, both for updating data held on a laptop computer, and just as importantly to update the centralised database with new information. For example, access to customer information whilst on their premises, presents field sales personnel with a facility that is capable of providing a genuine customer service, and at the same time gain important competitive advantage.

For organisations that wish to establish a credible CRM programme, the power of the Internet is the key enabler. But the Internet alone is not sufficient; access to all of an organisations' data has to be provided. However, there is little doubt that the Web provides a powerful, low-cost conduit for deploying strategic applications and conducting business electronically.

The Importance of Standards in Legacy Renovation

The importance of standards cannot be over emphasised. It is the lack of standards that has largely contributed to the present situation within the world of IT, characterised by heterogeneous environments, disparate systems, islands of technology, and consequently fragmented information. This rather disturbing picture has adversely affected business competitiveness, with many organisations under-performing as a consequence, which has resulted in their very existence being threatened.

In order to avoid making the same mistakes, many of the major vendors involved in the legacy renovation market have grouped together to form the Enterprise Integration Council (EIC) and the Zero Management Council of Advisors. The main aims of both organisations are to develop standards based on strategic business goals and to provide organisations with a clear and precise framework for evaluating Enterprise Application Integration (EAI) tools and services.

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The provision of standards, be they *de jure* or *de facto*, is critical in ensuring that all participants are at least singing from the same hymn sheet. They provide the kind of road map that is essential if organisations are going to find their way through, and survive in, the increasingly competitive business jungle. Standards are essential for developing interoperability, and currently there is little evidence to suggest that the necessary standards are emerging.

Businesses that have grown by acquisition and mergers are only too well aware of the dangers and pitfalls of working with incompatible technologies. It is a problem that is most often overlooked in these situations, and yet its impact on business strategy and performance can be a major factor in determining the future success, or otherwise, of the organisation. The creation of the EIC is intended to focus the drive towards developing standards, a requirement that must be addressed while the legacy integration market is still in its infancy. Otherwise its efforts, while being well intentioned, will be in vain and proprietary systems will prevail over open systems.

The key to the maturity of the enterprise integration market is heavily dependent upon organisations, such as the EIC and Zero Management Council of Advisors. They are both in influential positions to progress and manage the emergence and future direction of the market. The EIC has an opportunity to provide the necessary framework to ensure the development and adoption of EAI standards. The influence of the steering committee, which will be responsible for developing the specific goals and priorities, is paramount. This will consist of a combination of permanent and elected members, who will take an active part in the ongoing process. Butler Group believes that there is just cause to be optimistic about the future direction in this important area, particularly as the EIC consists of so many influential business and IT organisations, which are all highly dependent upon a successful outcome.

Vertical Market Specifics

Legacy Renovation is a subject that is swiftly moving up the scale of corporate awareness. What was once a topic of concern only for the IT department, is shifting away from its former niche position, and is increasingly finding its way on to the boardroom agenda. Not surprisingly, what is driving this rapid refocusing of senior managers' technical appreciation, is the realisation that IT is such an entrenched and critical supporting process, that any business development is fully reliant on either changes or integration to the appropriate back-office systems, data, and applications.

There are numerous factors and trends within specific vertical markets that are exacerbating the drive to renovate legacy systems and applications within organisations. Several stand out as being head-and-shoulders above the rest, particularly the need to embrace an e-business or e-commerce trading model. That has, however, been covered in some detail in the chapter on Renovation Drivers. Other vertical market specifics include:

- **Financial Sector** – Mergers and Acquisitions.
- **Manufacturing** – Extending the Supply Chain.
- **Utilities** – Cross Product Support.
- **Central and Local Government.**

Conclusion

Changing business strategies and the need for quick responses to short-term threats, all impact on the legacy business-critical systems and applications of the enterprise. No longer can they remain hidden in the data centre, cocooned from the harsh commercial realities to be found outside those air-conditioned walls.

The investment in hardware, software, network infrastructures, and skilled and trained staff within a typical organisation, if such an entity exists, is enormous. This makes a replacement plan economically unrealistic, and forces the company to assess how it will rejuvenate or integrate, in order to meet the new challenges and opportunities that lie over the horizon of the impending digital commercial landscape.

There are some common threads that run through specific vertical sectors. There are, in fact, too many to cover in this brief analysis. What managers must bear in mind is that change will continue its relentless march into the next millennium and beyond, and organisations must continue to integrate and leverage their existing IT assets, even if that includes some legacy systems.

The companies that can remain agile and responsive to change, and can continue to maximise their current investment in IT, will be the successful ones in the new milieu.

Technical Issues

Enterprise Application Integration

Without doubt, enterprise-wide integration of IT is one of the greatest challenges facing companies today. This is because of current drivers and initiatives such as e-business, ERP and extended supply chains, Knowledge Management, CRM, and the general requirement for improved corporate agility, which have now all become absolutely imperative. Organisations realise that they need to adopt a corporate business model, which can provide end-to-end process alignment across both new and legacy systems. EAI takes the approach that the sum of all these parts is 'the system'.

The Good Old Days?

EAI aims to provide the order and discipline to systems integration that, until recently, has typically been lacking. In 'the good old days', IT shops integrated applications by hard-wiring applications together. Much of this point-to-point integration was achieved via interfaces that were created using bespoke software or low-level middleware products. These were characteristically developed on a short-term tactical basis, as a secondary priority to delivering the core system features, and with the outcome that the interconnectivity was rarely of an elegant, flexible or robust nature. Integration, particularly with legacy systems, was not usually a very attractive proposition for developers, generally being high risk, low satisfaction 'conversion' work. Much of the task concerned trying to understand what had gone before, and was fairly constraining in terms of meeting the requirements of the systems being connected.

The general quality of systems integration was undeniably low. Consequently, many companies are now lumbered with spaghetti-like links that are badly documented, poorly understood, add complexity, and make ongoing maintenance expensive. This is why CIOs today are constantly distracted by, and bogged down in, the technicalities of plumbing, which prevents due consideration of higher-level business and information issues. Such poor integration lowers the perceived value of the information systems in place.

Conclusion

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The future integration and rejuvenation of these solutions will no doubt present a new and different challenge to the organisation, as technology relentlessly marches onwards.

Companies must unlock the data held in all their systems; they cannot afford wholesale replacement, in terms of time and cost, even if this was a feasible option. In order to make the transformation to e-business thrive, or even survive in a real-time business environment, companies need to integrate, which offers a different perspective on legacy renovation.

EAI is more than middleware, since it represents a strategic rather than merely a tactical approach to enterprise-wide integration. EAI enables renewal in the use or reuse of a company's corporate asset, its information. This asset, stored in archaic legacy systems, is likely to be underutilised. It needs to be rejuvenated by improved accessibility, increasing its value, in an enterprise-level context. Although accessible via a Web browser, this type of renovation is potentially much more valuable than any extension that is achieved through renewed physical presentation only, perhaps of data in a stand-alone context.

EAI allows companies to leverage investment in legacy systems in a low-risk way. It enables a business focus by encapsulating the complexities of IT plumbing and provides the ability to accommodate change, in a real-life incremental manner, without real pain. EAI can provide a level of future adaptability that certainly makes legacy applications less of a liability and more of a valuable, accessible corporate asset.

Web Development

The impact of the Web has been compared to the importance of writing, and the Internet revered as 'IT's greatest gift to the world'. Few IT trends have been hyped more than those that relate to the Web, even bearing in mind the industry's tendency for hyperbole.

Without doubt, the Internet has grown to become an enormous force that is dynamically altering the way in which business is conducted. However, its intoxicating effect has inevitably resulted in exaggeration, oversimplification and subsequent apoplexy for many CIOs that are contemplating the exploitation of the Web for business benefit.

For large, established companies, the main challenge is integration. A Web site should really be compared to an iceberg, since below the waterline lurks the extensive infrastructure integration issues; the true depth of the challenge for long established companies, of creating a Web infrastructure that ties together back-office legacy systems with new applications.

Technical Considerations

Although technically, there are similarities with other IT expansion projects, the complexity of e-business and e-commerce initiatives tend to be significantly higher than normal. Much of this complexity boils down to the need to integrate old legacy applications and back-end systems that exist on disparate, heterogeneous platforms, with emerging Web technologies. Linking and/or migrating these legacy solutions adds both time and cost, and introduces risks that can jeopardise the initiative. If business on the Web is going to be credible and viable, then a number of other critical factors complementary to legacy integration are also crucial to success.

Business Processes

The integration of legacy not only presents technical problems but also business process challenges. Process changes are almost inevitable, due in part to the greater flexibility and accessibility of the Web. For example, an existing legacy process could involve buying, storing, and selling a commodity. The same process on the Web may be transformed to selling, sourcing, and delivering that same commodity, for instance a book, or music CD. Operating different front-end processes concurrently, that are tied to the back-end, with legacy financial systems for example, can present real difficulties. This is a likely scenario for many established companies. Connectivity means impact, and therefore, processes may need to be overhauled.

Conclusion

Regardless of information to the contrary, setting up an effective, scalable, reliable, and successful e-commerce/e-business operation is not an overnight affair. The legacy integration challenge is one of the reasons for this. The development of a competent front-end, in a business and technical sense, is another. Highly integrated, high-performance Web sites are a relatively new phenomena. Consequently, many CIOs will face a steep learning curve in the establishment and ongoing provision of a Web-driven service, that facilitates customer and partner needs.

E-business requires a breakout strategy. A growing list of companies are vying to be 'in at the start' because of the huge market potential. Many do not expect to return a profit for sometime yet. Amazon.com has been around for five years now, and it is still not profitable. However, Amazon.com has taken a lead, one that has forced rivals to also Web-enable their businesses in order to compete effectively.

Such companies offer attractive products to build market presence. They intend to achieve profitability by servicing an established customer base through a low-cost structure. Whether existing companies can continue to provide differentiated services through what is perceived as a complementary channel, without cannibalising existing business models, remains to be seen.

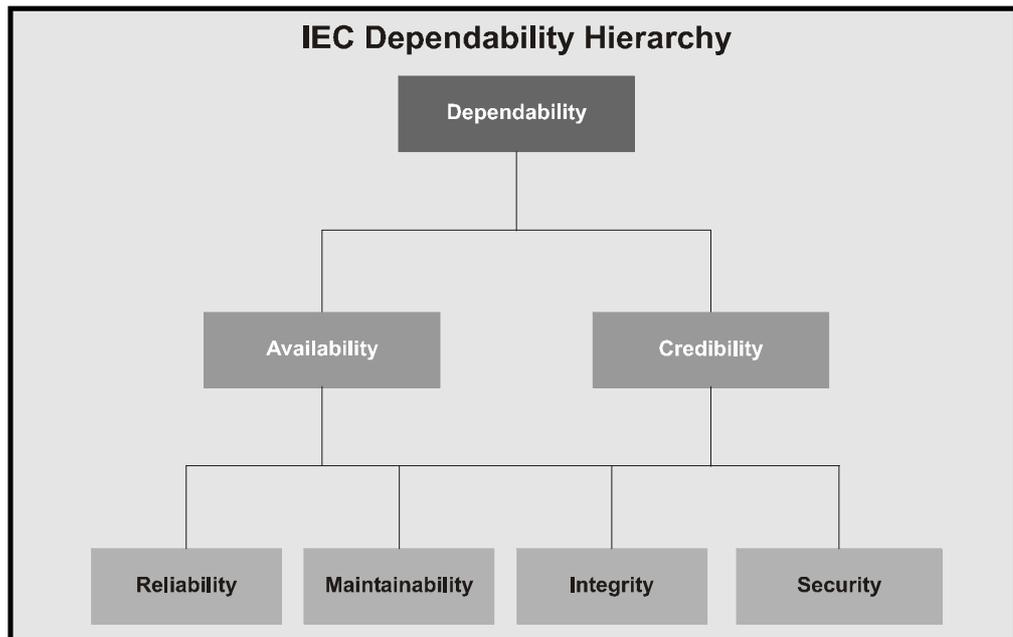
Risks of Legacy Renewal

Risk can be simply stated as 'deviation from the expected'. In theory, risk should only be accepted if a compensating benefit is available. As the migration towards multi-tier architectures and Web-enabled systems continues apace, many enterprises wish to reuse legacy assets in the new architecture. Legacy techniques, such as rejuvenation or extension, can present both opportunities and threats, and these factors should be considered as part of the overall IT strategy before any project is initiated. For instance, the benefits of using Web browsers include increased flexibility and lower deployment cost per user. In practice, once renewal has been decided upon, the negative aspects of risk become important and most companies try to minimise any possible adverse impact on the organisation's resources, earnings, and cash flows.

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Legacy system reusability has become a central issue, especially if legacy modules fail to perform as well as expected when componentised, wrapped, screen scraped or otherwise interfaced to the upgraded IT infrastructure. Risk-affected legacy considerations include determining the correctness of existing programs, moving to a customer-focused operation, interfacing with mainframe applications, the degree of integration obtainable, undesirable interactions between modules, and finding access into legacy application internals.

The extent to which a system can be relied upon to perform a task repeatedly and correctly under given conditions is termed its dependability. The International Electrotechnical Commission (IEC) has defined a system dependability hierarchy, which cannot be assessed directly, but results from subsidiary properties: availability and credibility. Availability is the ability of a system to perform a required function over a period of time. This in turn is dependent upon reliability or freedom from non-operation – and maintainability, or the ability to be retained in or restored to the correct function.



Credibility is the extent to which the system does what it was designed to do, and relies on two factors. Firstly, system integrity, the assurance that the state of the system is recognised and signalled, for instance, by displaying warnings if necessary. The second component is security, the ability to withstand incorrect inputs or unauthorised access.

The dependability of the overall system is reliant upon its architecture and the dependency properties of the constituent modules. All aspects are in fact interlinked. For example, if the architecture includes redundancy, then the availability is dependent upon the integrity properties of the redundant items. That is, the redundant modules will not be brought into play unless the system recognises an incorrect state and acts accordingly. Similarly, system security requires that the security modules are available, and function correctly as the result of high reliability and maintainability. Likewise, the security of the components, for example for verifying data transferred internally between parts of the system, determines the integrity of the overall system.

Many modern large IT environments, multi-vendor and multi-site based, look rather like the ‘house that Jack built’ – a collection of diverse and disparate systems. This situation may have arisen for a variety of reasons, including company mergers and acquisitions, ‘bolting on’ platforms or applications to perform particular functions, or upgrading processes selectively while retaining legacy systems. This is not in itself a recipe for disaster, but can become one, if the various add-on parts do not leverage the common infrastructure.

Although products from competing vendors may integrate to a certain extent, full functionality is likely to be constrained in certain areas if the products differ in their overall aims and in the facilities exposed at the interfaces. Hence, one determinant of high leverage is that the separate parts are aligned where business-critical to the organisation. Conversely, mis-matched features may be an overhead, but as long as these do not cause conflicts or incompatibilities, the situation can be accepted by the enterprise.

Companies with adaptable IT infrastructures are likely to make best use of their existing applications and, among other things, provide compatibility and options for extension.

Therefore, exploiting an effective IT strategy requires the ability to reduce exposure to risk caused by proprietary, unchangeable IT applications and architectures, together with difficult migration issues and unknown future business needs. Companies with adaptable IT infrastructures are likely to make best use of their existing applications and, among other things, provide compatibility and options for extension.

Legacy Issues

Reusing legacy systems resembles recycling, where picking through the heritage items may not be as exciting as a new acquisition, but can lead to cost savings and a reduced impact on other parts of the organisation. Company business rules are likely to reside in legacy applications, which often represent a significant past investment, in terms of both money and time. When considering a legacy renewal project, the risks can be divided into proposal risks, which are common to all vendors or contractors, and performance risks to which an individual supplier is exposed.

Conclusion

Butler Group believes organisations should seek to reduce the risk of their projects to 'As Low As Reasonably Achievable' (ALARA). The main risk management techniques can be broadly described as:

- **Avoidance** – Reject progressing the project and, of course, forgo the potential benefits.
- **Reduction** – Minimise the possible harm by appropriate physical or administrative controls, including duplication of essential components.
- **Retention** – Put aside monies to meet the maximum loss eventualities, so-called self-insurance.
- **Transfer** – Get some other organisation to take on or share the contractual risk. For example, by outsourcing the IT services.
- **Insurance** – Pay a fee to an insurer to cover some or all of the potential loss.

Legacy risks are an inherent feature of ever-changing business requirements and fast improving technological developments, which often become incorporated as major step-forwards in product offerings. Legacy renewal products can, at first sight, appear to be the 'silver bullet' that allow substantial IT benefits from existing applications. However, Butler Group believes that, as far as possible, the risks should be fully investigated, assessed, managed, and controlled for satisfactory project identification and implementation.

Business Intelligence

If a person is considered to be intelligent then it is assumed that he or she is both knowledgeable and in possession of an appropriate number of facts to be able to make an informed decision.

Business Intelligence has come a long way since the early relational databases and the query tools of yesteryear. Many organisations have taken a firm grasp of the concept and have invested correspondingly, with the aim of developing a business environment and culture that operates with increased knowledge and intelligence. Whilst this may appear to be something close to a statement of the obvious, it is important not to forget the rationale of BI amidst the hive of activity and the heavily clad veil of marketing verbiage. In order to expand on this, it is necessary to attempt to quantify what is meant by intelligence. If a person is considered to be intelligent then it is assumed that he or she is both knowledgeable and in possession of an appropriate number of facts to be able to make an informed decision. Therefore, transposing this definition to a business scenario, it becomes apparent that in order for an organisation to operate intelligently, it must have suitable access to all of the relevant data and information. This is not necessarily all that easy to achieve. Or put another way, the more data an organisation has at its disposal, the greater the potential for effective BI.

Blowing the Cobwebs off Legacy Data

Legacy systems and applications traditionally harbour the core business processes and transactions, which have been developed and customised over many years. As a consequence they provide a tremendously rich source of BI, which like gold in a mine, requires careful and considered extraction if its full potential is to be realised. Modern technologies, to a certain extent, are able to interface with one another, either directly, or through the use of middleware.

The adherence to common standards such as Open DataBase Connectivity (ODBC) and SQL has given rise to easy integration between database, data warehouses and data marts, and front-end SQL driven applications. However, extraction of the data held within legacy systems is not always so easy, as popular legacy mainframes and databases prove to be somewhat unyielding with regards to their data riches. In terms of BI, this data is considered to be necessary, as without it, like a jigsaw with a piece missing, the enterprise will never have the advantage of being able to view the full picture. The unattractive alternative is to have a series of disparate application or platform specific BI solutions that are restrictive and can only answer precise and localised business questions. Integration of all the enterprise data is the key to successful BI, and this must include data from legacy systems, ERP suites, and Web sites, as well as any bespoke departmental databases.

Conclusion

Legacy systems form the heart of some organisations and are the result of many years of combined experience, development, and fine-tuning. The reliability and security these systems provide, reinforces their position as being an integral part of the enterprise for the foreseeable future.

Having reached this conclusion, it follows that the wealth of valuable data that propagates these systems must be made to work for the enterprise, if the investment is ever to be recouped.

The modern enterprise has become extremely efficient at the collection of vast amounts of data which, if left untapped, exist only as remote islands. BI is now being used as a strategic tool for the delivery of competitive advantage, through the integration of these data sources for subsequent near real-time analysis. Butler Group believes that BI should no longer be the realm of a number of power users or key decision-makers. The optimum solution is achieved by passing the ability to interrogate data down to the lowest level. In this way, BI empowers users throughout the business to ask previously unimaginable questions and leverage the power of data integration. Only from this grass-roots approach will the enterprise unlock the value of legacy data and be able to truly operate intelligently.

Renovation Drivers

A legacy system or application is one in which a company or enterprise has already invested much time and money. A legacy application could be a DataBase Management System (DBMS) running on a mainframe or a mini-computer. It will have inherited its characteristics from languages, platforms, and systems of earlier generations of technology. It would be fair to state that nearly all enterprise-class organisations that utilise computers have legacy applications and databases serving critical business needs.

Currently, many companies are in the process of renovating their legacy applications utilising new programming languages and operating systems that support open or standard programming interfaces. This will, in theory, make it easier to update applications without having to rewrite them. Many organisations will have spent considerable amounts of time, money, and effort in building these systems and applications, and still need to run them efficiently and to produce a good Return On Investment (ROI), even though they are no longer regarded as cutting-edge technology.

Given the prevalence of legacy systems throughout global enterprises, there are quite naturally many drivers that feed the desire and the necessity to renovate them. Perhaps the over-riding one is the need to meet changing business conditions. Other ones (equally important under certain conditions), include: the ongoing requirement to contain or reduce associated IT costs; the growing necessity to achieve corporate agility; addressing and satisfying legitimate staff and resourcing concerns; and lastly, the business-critical need to integrate diverse systems and architectures, following merger or acquisition activity. The latter point is gaining increasing importance within the corporate boardroom, as the trend for mega-mergers accelerates.

Of all the very many definitions available that purport to summarise legacy systems, perhaps the most erudite and succinct is the following statement:

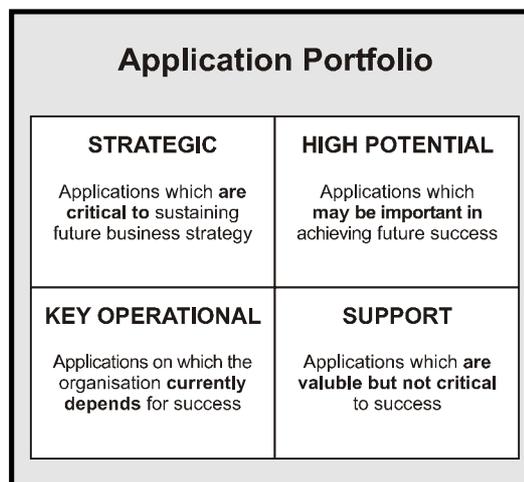
“Legacy systems are critical systems that cannot be modified efficiently.”

Other drivers that are contributing to the shift in business focus, include an increased awareness and adoption of customer-centric strategies, and the growing requirement to leverage an organisation’s intellectual assets, manifested by the exponential growth of Knowledge Management-type solutions. In addition, the need to integrate ERP systems with legacy systems, has also been a consistent factor in the renovation stakes.

Conclusion

'If it ain't broke, don't fix it', remains the most cliché-ridden phrase of the corporate IT department, with 'let's not re-invent the wheel' coming in a very close second.

They both, however, mask a fact that is as true as it is simple. If an application is doing a good job and continues to provide business benefit in excess of its maintenance and upgrade costs, leave it alone to get on with it. This should hold true irrespective of how old it is, what platform it sits on, how blasé the support staff are, or any other non-strategic viewpoint. These types of system often fall into the Support or Key Operational segments of an organisation's application portfolio (see diagram), which dictate that they are not going to drive the next generation business strategy. They are the engine room of the enterprise, and as long as support staff continue to oil the wheels, and give them an occasional dust down, do not interfere with them. However, what often catapults them into the vision of senior managers, is the critical factor that strategic data is often contained within their creaking code. In this eventuality, renovation and integration is a must.



Many IT departments would be well advised to broaden their business as well as their long-term vision.

Butler Group believes that ageism is pandemic within the IT industry, as is a short-term, stove-piped vision, which continues to populate the enterprise with islands of departmental data and systems. Many IT departments would be well advised to broaden their business as well as their long-term vision. Only then will legacy systems be viewed in a holistic manner that is capable of leveraging their strengths within a synergistic framework.

Enabling Technologies

Legacy Migration

The decision to migrate is a complex one, which should not be taken lightly.

The decision to migrate is a complex one, which should not to be taken lightly. There are several alternatives available for modernising legacy code that are mentioned elsewhere in this Management Guide. They include systems replacement, re-engineering using approaches such as Component-Based Development (CBD), front-ending using screen scraping tools, or integration using EAI or middleware.

At one time, migration only involved transferring from one stand-alone solution to another. It was quite often a straight swap, intended merely to meet departmental needs rather than a higher level tie-in with overall corporate objectives. Whilst not wishing to oversimplify the planning and effort involved in such transitions, they were not subject to the complexity inherent in today's interconnected, and often global IT environments, nor were there such diverse opportunities for replacement, re-engineering, or refurbishment of information systems.

Initially, the decision has to be made as to which legacy systems are no longer used by the organisation and can therefore be discarded, and which are vital and could provide the maximum business benefits via migration. A comparison of existing solutions in-place, with business, IS, and IT strategies, is a necessary exercise to determine those systems that are suitable for migration. New external drivers, which may not yet have been integrated into these strategies, can also influence the decision.

Migration has several advantages over other methods of renovation. The major benefit is that it future-proofs the applications. In moving them to modern platforms that support Graphical User Interface (GUI) front-ends and modern development tools, such as CBD and Object-Oriented (OO) languages, further development can be undertaken. This approach reduces the maintenance required for the legacy systems, and the skill set needed. It is also easier to integrate migrated systems with other applications.

Many applications, particularly legacy systems, actually underpin the continued existence of a company.

Part of any legacy renovation process, regardless of the method employed, should begin with a full assessment of the software deployed within the organisation.

A migration should be regarded as a major undertaking. The cost of failure can be very high both in monetary terms and in the ability of the company to effectively run its business processes. Organisations often bring in outside resources that specialise in migrations to oversee the project. There should be a skilled and experienced Project Manager to ensure that it remains on target. Individuals can be made responsible for specific tasks, such as data and screen handling. The first task is to determine which processes are obsolete and therefore do not need to be migrated. A Software Asset Management (SAM) solution can be invaluable in determining which applications are no longer used.

Users need to be involved as their familiarity with the system can be exploited, and to implement the decisions. Application reviews determine the scope and objectives of the migration. An initial investigation, incorporating the documentation of the application and its components, an application audit, and the production of a draft project plan with cost and time estimates built-in, provides valuable information relating to the scale of the project.

Conclusion

There is no denying that IT projects are very high profile. Many applications, particularly legacy systems, actually underpin the continued existence of a company, a fact that is gaining increasing recognition from Chief Officers. By conducting some form of risk analysis, key points of failure can be identified, better contingency planning and coordination may be achieved, oversights can be avoided, and risk should be mitigated to some degree.

Naturally, there is a requirement for a business recovery plan; some kind of fallback position, given the business critical nature of key legacy systems. Also important is an exit strategy for the legacy system, a clear statement of when reliance on the old system will end, and related resources will be freed.

Migration is often underestimated, particularly with regard to the cleaning and re-mapping of data. It is frequently an arduous task, but one which must be carried out successfully. If done incorrectly it can put the future viability of the whole organisation at risk. Remember the old adage 'Garbage In Garbage Out'? Tools can assist with this activity, but significant human intervention is often still required, in what is considered a nuts-and-bolts job, which can receive insufficient attention from management.

Software Asset Management

Part of any legacy renovation process, regardless of the method employed, should begin with a full assessment of the software deployed within the organisation. This can simplify the renovation task, as all applications no longer used, because the business processes they originally supported have become redundant, can be deleted from the system, or at least left as is.

Unfortunately, many organisations ignore this very important step and end up with a much larger renovation project than is necessary. One of the major reasons for this is that companies simply do not have the resources or the technical capability to carry out a full inventory and assessment of the usage patterns of all of the software deployed throughout the enterprise.

The very nature of large organisations, in that they are often spread over several continents, with large mainframe installations located over multiple sites all running disparate systems, makes the logistics required for this type of inventory very difficult to achieve.

Such organisations can have many thousands of applications, comprising a mix of third-party solutions and in-house developed systems, accumulated over a period of 20 years or more. Some of the products may be duplicated, with different versions of the application being deployed in several divisions. Many of the internally developed applications no longer have any documentation at all, or it is so out of date as to be worthless. The original developers have typically long since departed, and there may not be the skills available to update the programs, rendering them obsolescent. This can result in many lines of code not being used. It has been estimated that on average, organisations do not use 50 per cent of their in-house developed code, but this figure can be as high as 80 per cent. This is where SAM systems are proving to be extremely useful.

Even if a renewal exercise is not being undertaken, the removal of unused applications can reduce the maintenance required to support the remaining products.

Conclusion

Legacy renovation is about much more than simply migrating, or modernising legacy code. As mentioned elsewhere in this Management Guide, an important part of any such exercise is an assessment of all of the business processes. In legacy systems, these are reflected in the software applications being used. The chances are that redundant processes have resulted in corresponding outdated code that is no longer used. Although it cannot replace the examination of business processes, SAM can speed up the operation by highlighting those applications still in operation. Even if a renewal exercise is not being undertaken, the removal of unused applications can reduce the maintenance required to support the remaining products.

SAM proved its worth in Y2K remedial project work by finding applications that were no longer used, therefore reducing the number of programs that Y2K work had to be carried out on. Butler Group believes that SAM has the same potential value for legacy renovation work, regardless of the method chosen to modernise legacy applications, and organisations ignoring this type of solution do so at their cost.

Middleware

Middleware is an integral part of legacy renovation, as it comprises a number of technologies that allow organisations to integrate a heterogeneous range of applications, platforms, and data sources. The importance of middleware products has grown over the past few years as the diversity of systems within single organisations has grown. Increasingly complex systems and applications mean that for many, the integration of legacy, third-party packaged and in-house developed applications, is the only viable option, and one which has created a growing market for middleware products.

Different Types of Middleware

There are many types of middleware product, each playing its own part in the integration of new and old systems. Middleware falls into a number of categories including: gateways, TP monitors, messaging, and object brokering.

Access to disparate data sources has been enabled by ODBC and Java DataBase Connectivity (JDBC). Technologies, such as Common Object Request Broker Architecture (CORBA), Enterprise JavaBeans (EJB), and ActiveX/Component Object Model (COM) are being used for OO development.

Middleware Standards

There are two major competing standards that provide frameworks for communication between objects. CORBA is an architecture that enables objects to communicate with each other regardless of the programming language they were written in, or the operating system they are running on. It was developed by the Object Management Group (OMG), an industry consortium. COM is a model for binary code, which was developed by Microsoft. It enables programmers to develop objects that can be accessed by a COM-compliant application. Both Object Linking and Embedding (OLE) and ActiveX are based on COM.

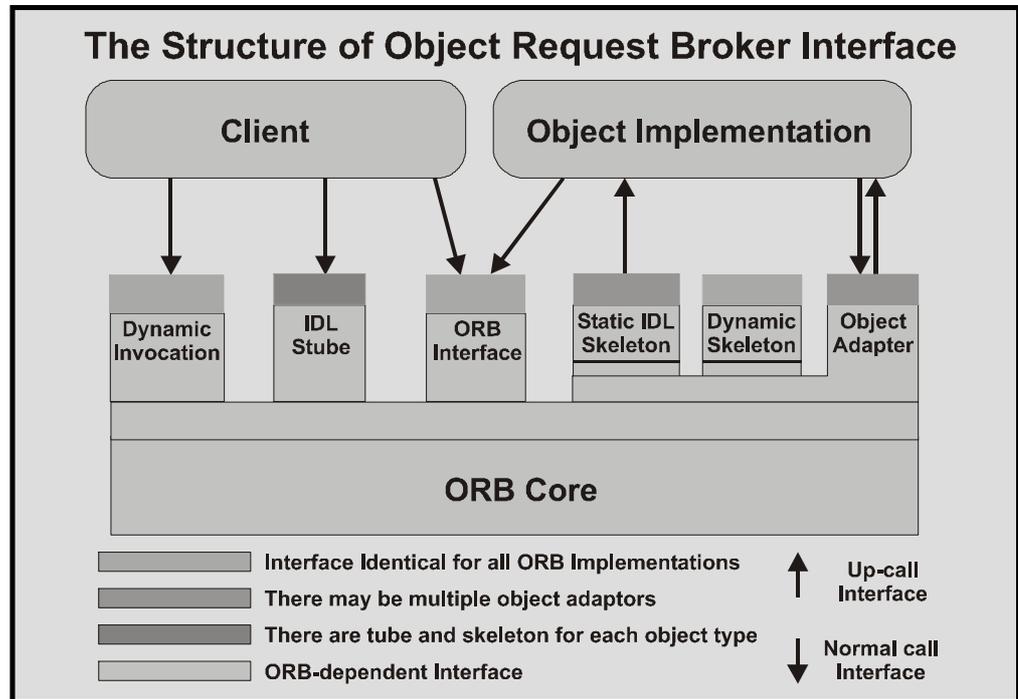
Enterprise JavaBeans

Java is covered in its own section within this Management Guide, but it is worth mentioning EJB at this stage as it is another entrant in the middleware arena. EJB provides a framework for components that can be 'plugged in' to a server. It has been designed to be compatible with CORBA. It aims to simplify the creation of applications, freeing developers from such low-level system details as managing transactions, threads, and load balancing. The aim of EJB is to provide the standard for client/server applications to be written using the Java language. It is compatible with, and uses other Java APIs and can interoperate with non-Java applications.

CORBA

Version 1.1 of CORBA, which defined the Interface Definition Language and the Application Programming Interfaces (APIs), enabling client/server interaction within a specific implementation of an Object Request Broker (ORB), was introduced in 1991. Version 2.0 was released in December 1994, and specified how ORBs from different vendors could interoperate.

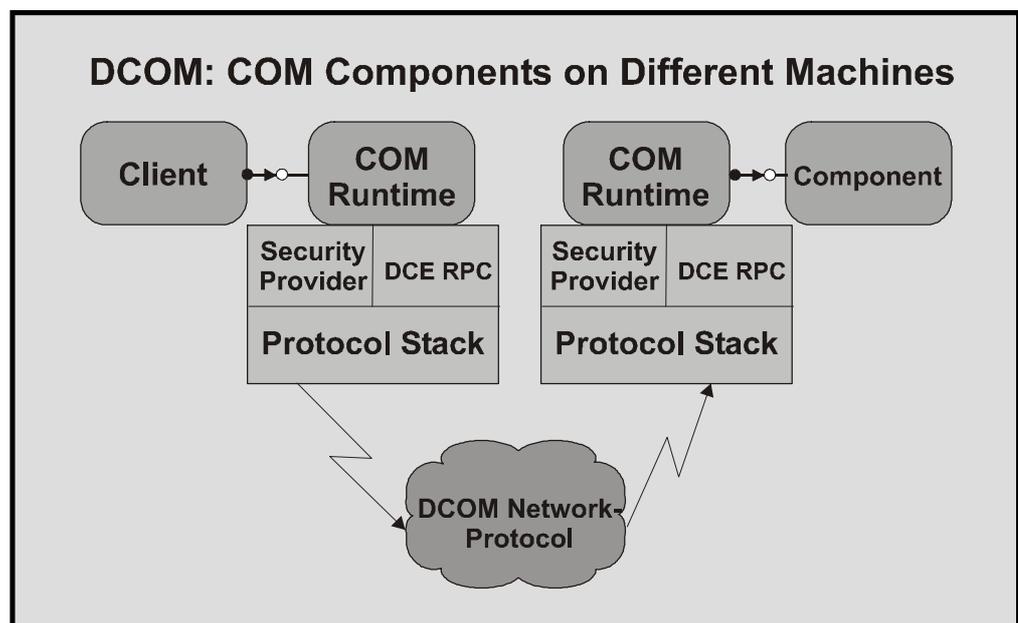
The ORB is middleware that establishes client/server relationships between objects. A method on a server object can be called transparently by a client using an ORB. This can either be on the same machine or across a network. The call is intercepted by the ORB, which is responsible for finding an object that can carry out the request, pass it the parameters, invoke its method and return the results.



CORBA enables users to transparently gain access to information without the need to know the software or hardware platform on which it is located, or where it is situated on the organisation's network. It is one of the technologies used for integrating legacy systems.

COM

COM was introduced in 1993, and provides a foundation for CBD. It was originally used on a single machine, but expansion allowed access to components on other systems. It defines the interaction between components and their clients. Distributed COM (DCOM), introduced in 1996, provides the ability to create networked applications built using components. It extends COM by supporting communication amongst objects on different computers, a Local Area Network (LAN), Wide Area Network (WAN), or the Internet through a network protocol.



A client that needs to communicate with a component in another process cannot call it directly. It has to use an operating system provided inter-process communication method, which is supplied transparently by COM. This is performed by intercepting calls from the client and forwarding them to the component in another process.

The link between the client and component is enabled by COM/DCOM runtime libraries. OO services to clients and components are provided by the COM runtime. The Remote Procedure Call (RPC) and security provider are used to generate standard network packets that conform to the DCOM wire-protocol standard.

TP Monitors

TP is the execution of an application that performs an administrative function by accessing a shared process. A TP monitor is a control program, which manages the transfer of data between multiple local and remote terminals, and the application programs that serve them.

Message-Oriented Middleware

Message-Oriented Middleware (MOM) is a client/server infrastructure that allows general purpose messages to be exchanged between multiple heterogeneous platforms. It generally supports asynchronous calls between the client and server applications, although normally synchronous messaging passing is also possible.

Database Middleware

There are two basic types of database middleware. Native database middleware is a proprietary access mechanism for a specific database server. Database-generic middleware allows applications and packages to communicate across different SQL dialects, network protocols, and native APIs using common interfaces. The most widely implemented database-generic middleware is Microsoft's ODBC.

Java DataBase Connectivity

JDBC is a Java API that allows Java programs to execute SQL statements. This provides the functionality to enable these programs to interact with any SQL-compliant database, which is, in reality, nearly all Relational DBMSs (RDBMSs). This makes it possible to write a single database application in Java that can run on different platforms and interact with a multitude of DBMSs. It is similar to ODBC, but is designed specifically for Java programs, rather than being language-independent.

Gateways

Gateways are useful for organisations that require data-connectivity middleware. It provides a highly flexible paradigm allowing IS to handle new architectures and technologies without requiring large rewrites.

Remote Procedure Call

RPC is a protocol that allows one program to request a service from another in a remote location, without having to understand network protocols. It is sometimes known as a function call or subroutine call. RPC uses a client/server model, and it allows an application to be used in a variety of networks without change. The client is the requesting program and the server the service-providing program.

Distributed Computing Environment (DCE)

DCE is an industry-standard set of integrated, distributed computing technologies that are independent of any individual vendor. It provides an environment for developing and maintaining client/server applications across heterogeneous hardware and software platforms. These include security services to protect and control access to data, making it easy to find distributed resources. They also incorporate a highly scalable model for organising widely scattered users, services and data.

The increasingly complicated nature of modern day systems has resulted in a requirement by organisations for not one middleware solution but several. Where many of these solutions have competed in the past, they are now able to compliment each other so, for example, a DCE solution may work in conjunction with RPC. Middleware provides a method of integrating legacy, new and third-party applications and Butler Group believes that it will continue to grow in prominence as new technologies are incorporated into the middleware arena, and organisations continue to need such services.

The increasingly complicated nature of modern day systems has resulted in a requirement by organisations for not one middleware solution but several.

Application Development

The nature of application development is changing. A few years ago, it was commonplace for an organisation wishing to develop a new system to simply replace its existing one. Although there is still some large-scale development work taking place, notably in government departments, it is much more likely that a company will mix and match a newly developed application with its legacy systems, and packaged products. Companies are generally no longer in a position to completely replace systems, due largely to the effect of the high cost of redevelopment on already tight budgets.

Changing Nature of Organisations

Most large organisations have undergone a great number of changes during the past few years. Increasing competitive pressures have forced many into mergers and acquisitions, often with overseas companies, to form huge multinational corporations.

This hive of activity is likely to result in a variety of applications, some written in-house, some bought-in packages, and others created especially by outside agencies or contractors through outsourcing activities, being deployed. It is extremely rare for any of the systems from one merged entity to be compatible with another, either in the way they are developed, or in how they are deployed. A major implication of a series of mergers and acquisitions on a particular entity is that many of the in-house development team could have been redeployed or simply left to find new employment. One of the biggest headaches for IT departments, has been a lack of documentation accompanying in-house developed systems, therefore the loss of the original programmers makes it very difficult to maintain the code. In the past, the only feasible solutions in this situation would have been either to standardise on the hardware and software systems of one of the companies within the new organisation, or to completely redevelop the systems from scratch.

Changing Emphasis of Application Development Vendors

Application development vendors have been forced to change the emphasis of their marketing campaigns. Vendors, such as Level 8 and Amdahl, which targeted organisations undertaking large development projects, are instead opening up their environments to support the integration of smaller applications with legacy systems. They need to either incorporate or include access to middleware products that enable the integration of applications from heterogeneous platforms. They must also provide support for middleware standards, such as COM/DCOM or CORBA, covered in the Middleware section of this Management Guide. For many vendors deciding which set of standards to comply with is a dilemma, although a truly open system should support both.

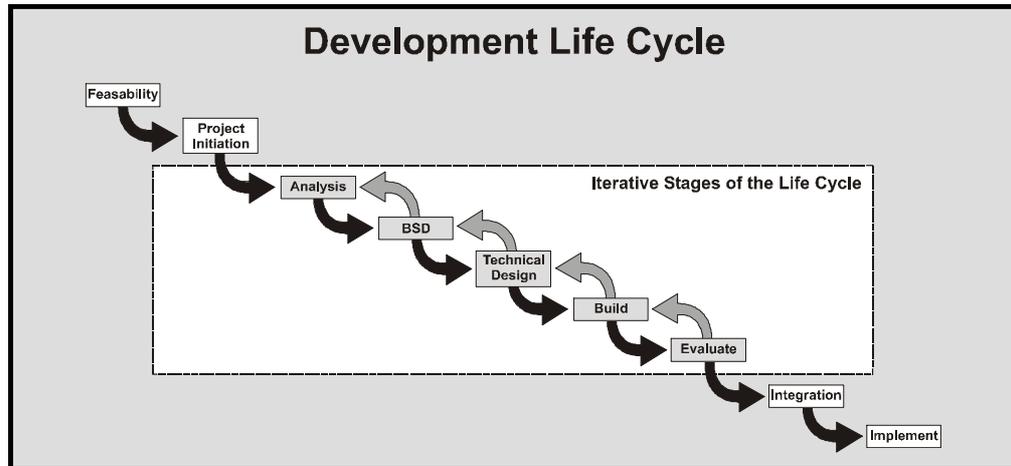
Modern Application Development Tools

Many vendors are including Computer Aided Software Engineering (CASE) or modelling tools as part of their development environment. A major selling point for any vendor is the reduction of development times using its product. Rapid Application Development (RAD) enables the scope of the problem to be set out at a logical, or very high level, resulting in a clear statement of the business objectives of the application. A dynamic model of the application is then created, which produces the physical specification. Developers and users work together, to produce a functional prototype that models the look and feel of the application. Project teams consisting of both developers and end-users review the prototypes, which are refined in an iterative process until the end-users are satisfied, at which point it becomes the design prototype used to model the business processes. The business rules are then investigated, refined and consolidated. With this type of RAD many different types of activity can take place concurrently.

The life cycle of the application involves quadrants for identifying, agreeing, creating and reviewing the prototype. With each iteration the prototype is moved forward from investigation through refinement to consolidation. RAD encourages the early implementation of key functionality, which can be integrated with existing systems.

RAD is now a part of the mainstream methodology for developing applications. It requires the breaking down of the development work into smaller chunks, each of which is the responsibility of a small group of users, analysts and developers.

Project management, project team structure, change control, configuration control, testing, quality, and software procurement are all important factors. Effective project management is a vital part of RAD in ensuring that the developers are motivated towards achieving the optimum business solution.



Conclusion

Very large development projects are not as widespread as they were a few years ago, nevertheless, application development still has a very important role to play in the modern organisation. Butler Group's research shows that 47 per cent of organisations surveyed have permanent application development staff, with 11.2 per cent hiring only contract developers. A further 19.5 per cent use a combination of permanent and contract staff. Only 22.3 per cent do not have any application development resource at all, and these are more likely to be smaller organisations. Although Visual Basic is the most widely deployed development tool, Butler Group believes that in many cases, it is used for legacy modernisation purposes to produce GUI front-ends for legacy applications, or to Web-enable systems, rather than for large-scale development projects.

Applications developed in the post-Y2K period may be smaller than those of the past, but while there are legacy systems in use within organisations requiring modernising or integrating, then there will still be a role for application development tools.

However, as the appearance of these tools continues to evolve and they become increasingly easy to use, it is likely that the old programming skills required in the past will be lost, as the developer of the future is only required to drag-and-drop objects onto a form. Butler Group believes that this situation will create a number of issues as to whether, with a reduced skill set, it will be possible to maintain these legacy systems, or if total replacement will eventually be required, again changing the role of application development.

Component-Based Development

Most application development tools vendors now support CBD or OO programming. These technologies have simplified the task of writing new applications. GUI development environments and drag-and-drop techniques have further reduced the skills needed and shortened development times, as programmers no longer have to understand the underlying language to create basic programs. An important element of CBD is the reusability of components. Many third-party vendors develop components that can be integrated into applications to again simplify the development cycle. CBD has also provided a way of integrating new and legacy systems, allowing newly developed applications to call legacy systems or vice versa.

Each new paradigm resulted in organisations needing to transform their then current systems. The fact that many of the present legacy systems are ones that have not been successfully updated, demonstrates that there are no easy solutions to the problem. The reasons for the continued presence of legacy systems are that there has been no justification to re-engineer them previously, or it was too difficult to achieve, plus they are vital to the running of the business. The focus of earlier paradigm shifts was to re-engineer and reuse code, and to move it to another platform. This is a much more drastic solution than wrapping the application up behind an interface and leaving it otherwise unchanged.

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The breakdown of the old monolithic business units into smaller processes has created a requirement for a similar restructuring of the systems that support them.

100% Pure Java programs will run on a whole range of systems including desktop computers, servers, mainframes, cell phones, and even smart cards.

Conclusion

Although there is little doubt that CBD provides a solution that meets the short-term objectives of an organisation, it does, by its very nature, render the newly componentised applications as legacy. However, the advantages of componentisation far outweigh this minor problem. The breakdown of the old monolithic business units into smaller processes has created a requirement for a similar restructuring of the systems that support them. This has in turn, created a need for applications to support new business processes and integrate them with the existing programs. In addition, many of the new processes require real-time integration at the transaction level, not just via replication and batch transfers of data.

There are several options available to organisations from fully componentising all applications to a phased transition involving a number of steps, or even the componentisation of part of a legacy application, whilst the rest remains a monolith.

The delivery of new applications with legacy componentisation is going to be a gradual process of compromise, iteration, and incremental delivery.

Java

One of the most exciting developments to emerge in computer languages over the past few years has been that of Java. Originally developed by a group of Sun Microsystems engineers, it is based on C++ and was designed to permit programmable objects to run across distributed systems. It was initially perceived as being a tool for producing Web pages. However, its full potential as a development language was soon realised, and its rise has been meteoric, as many of the major players in the IT market place have embraced it. The vision behind the language is 'Write Once Run Anywhere'. With this end in mind, Sun developed the 100% Pure Java program in an attempt to turn the language into a truly universal one, which will port straight onto virtually any machine. 100% Pure Java programs will run on a whole range of systems including desktop computers, servers, mainframes, cell phones, and even smart cards.

The problem with traditional programming languages is that, although they are supposedly portable across different platforms, in reality system-specific commands, such as printing, have to be written in a format understood by the native operating system. The code can be made to run across several platforms by using an 'IF' statement to determine the operating system and run commands specific to the implementation. However, the major problem with this, is that the platforms the code will run on have to be pre-defined, which is both heavy on code and time, and is inflexible. If an additional platform is required, the code has to be amended. With this in mind, strict rules for writing Java have been devised in order to keep the language pure and portable across all platforms.

Legacy Integration

One of the major inhibitors to the adoption of Java by organisations is the necessity to integrate not only a new language into their existing structure, but also new applications, architectures, and possibly a new strategy. Where an OO approach has already been adopted, this is not a problem, but if the company has a traditional IT infrastructure, using a language such as COBOL, then the adoption of a Java environment is much more complex. Java applications can use structured database tables, so to integrate one application with another, it is necessary to address the links towards the customised programming tables and interfaces.

Many companies are as yet reluctant to adopt Java on a large scale. As Butler Group's research shows, where only 0.3 per cent of organisations are using Java for application development work. However, some organisations have used Java to overhaul their entire product line, and move away from proprietary systems, gaining flexibility and reducing maintenance costs. The major influencing factors are the simplicity of deploying applications, portability and reusability of the software components.

Conclusion

From its inception, Java was regarded as a breakthrough in application development, being the first language that would run across any platform without modification to the code. However, it has not as yet proved to be quite that portable. Some problems are encountered when moving between platforms, and this is one of the reasons being claimed by Microsoft for developing its own Microsoft Virtual Machine. There is little doubt that the arguments between Sun and Microsoft have had a detrimental effect on the widespread adoption of Java, perhaps playing into Microsoft's hands.

Some companies are making the decision between whether to develop applications using Sun's Java Development Kit (JDK) or Microsoft's Software Development Kit (SDK) for Java, many more are awaiting the final outcome of the litigation against Microsoft before deciding which route to take.

Screen Scrapers

The Business Scenario

Increasing business pressures mean that systems must become more customer focused, have greater flexibility and be much easier to use. However, there are still billions of lines of legacy code, contained within business-critical applications that form the mainstay of many enterprises. It is estimated that up to 70 per cent of the world's information resides on mainframes and minicomputers. Much of it is over two decades old, and was not designed to accommodate today's dynamic business environment. Many CIOs are already engulfed in a maintenance backlog, comprising Economic and Monetary Union initiatives, and Business Process Re-engineering (BPR) programmes, in addition to the politics and power struggles commonly associated with IT service delivery.

The goal of converting everything to a Web-based architecture is neither feasible nor realistic given the resources available and the costs involved. In many circumstances, however, these legacy systems may still fit well with the business needs. Companies will not want to spend millions of pounds moving to the latest technologies if they perceive little real benefit. The approach may even be 'if it ain't broke, don't fix it', since such monolithic code may have been patched hundreds or thousands of times, by developers who have long since moved on to greener pastures, taking vital systems knowledge with them. Not surprisingly, many IT departments are ultra-sensitive about anything that affects their legacy systems, particularly given their business-critical nature. Establishing the value of existing investments in information systems is a complicated, but necessary part of IS strategy formulation that provides the direction of which, when and to what extent, legacy systems need to be replaced or renovated.

Pros and Cons

Screen Scrapers represent a non-invasive approach to legacy extension, where for one or more reasons, it is not acceptable to modify a host system for external access provision. They wrap code using standard protocols such as High-Level Language Applications Programming Interface (HLLAPI), at the user interface layer. Screen scraping is one of the most popular techniques for improving the presentation of host-based information systems.

Conclusion

Those companies that have dependable legacy systems which still add value to the business, and who are not in a position to develop full-blown Web applications, may benefit from screen scraping in the short term. Vendors of this type of product would argue, very reasonably, that a simple, speedy, non-invasive form of legacy rejuvenation is a better proposition, than wasting time and money webifying existing applications to solve yesterday's problems. What is certain, is that companies cannot afford to write-off their existing systems, and they do not have the means for wholesale replacement. Organisations will have to carefully evaluate their business position, the value of their information systems, and the feasibility of replacement or re-engineering. Only then can the best course of action be determined, and whether a tactical, interim solution such as screen scraping is a suitable proposition.

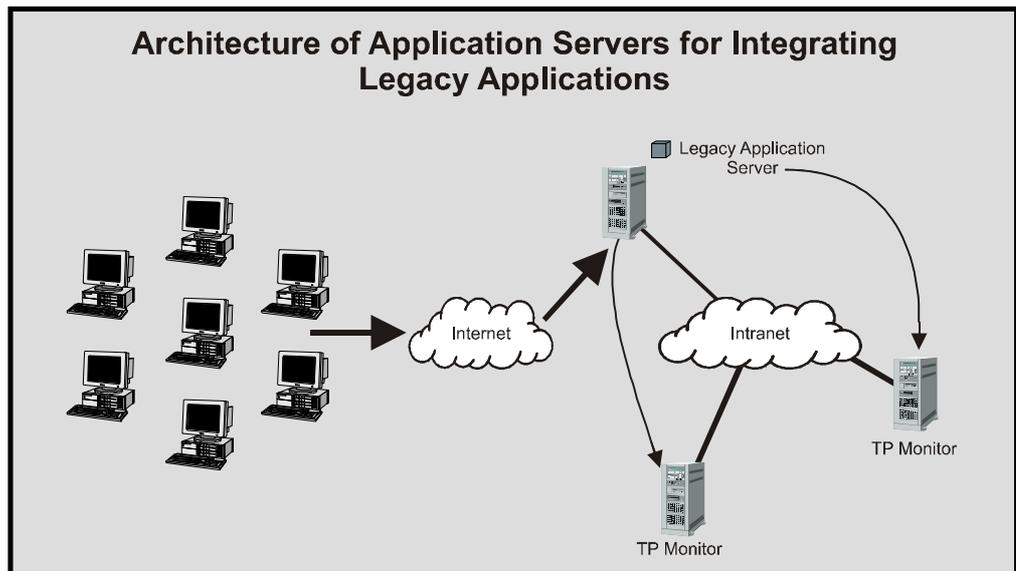
The volatility of business today is driving business change that must be reflected in information systems architecture. Butler Group believes that in the medium- to long-term, business success is likely to be most assured by utilising fully integrated, real-time Web systems, which provide total flexibility for change. Such systems require the tools, technologies, and methods, which give the dynamism to support such a response. A new façade will not be enough. If the overall aim is to lead and not follow, then ultimately this is the approach which must be taken.

The Role of the Application Server

The Problem

A major problem faced by many organisations, particularly but not exclusively those with large mainframe systems, is how to bring their business-critical systems up-to-date. This is particularly relevant where organisations are desperate to join in the e-commerce and e-business revolution. Legacy systems, which are almost as difficult to define as application servers, had in many instances been developed and deployed at a time when enterprise integration and the Internet did not figure in the corporate computing strategy of many businesses. The world of business has undergone many changes in the meantime, but the legacy systems have remained largely undisturbed, except for the odd end-user request. They are still predominantly stand-alone and in many cases deployed on different platforms, creating islands of technology and information. There is, however, an urgent need for organisations to adopt highly distributed systems in place of their existing centralised architecture.

The application server forms a layer of software that sits above the operating system to allow distributed application components to execute more easily in a managed environment. It facilitates the connection of thin-clients with a multiplicity of distributed computing applications, including databases and back-end systems such as ERP solutions, across the enterprise without having to install software on desktop systems or adding more servers to the network. This is leading to the emergence of 3-tier or multi-tier computing models in many enterprises, where more of the business logic is built on the middle-tier.



A number of advantages of the application server have already been identified by some of the early adopters of the technology. For example:

- Reduced cost and maintenance of client administration and support, creating TCO benefits.
- The ability to maintain a centralised application deployment and management environment, again with TCO benefits.
- The facility to provide RAD, encouraging developers to create applications that relate to many application servers as if they were on a single server, regardless of platform or location. A distinct advantage, particularly from a developer's point of view, is that instead of having to cope with a multitude of middleware products from various vendors, with the application server all the required software is bundled into a single product.
- The ability to allow data to remain at its original source for client/server needs and also to take advantage of Internet services, both now and in the future.
- In cases of failover, the capability of transferring from one application server to another provides users with high availability systems.
- Application servers also bring the benefits of distributed computing to a much wider audience.

The introduction of the application server into the legacy integration equation has fundamentally affected the ability to modernise and deploy legacy systems.

Conclusion

All this diversity and choice adds to the difficulty that IT managers have in deciding which vendor and technology to trust their future to, without finding themselves trapped in a technical *cul-de-sac*. Nonetheless, the introduction of the application server into the legacy integration equation has fundamentally affected the ability to modernise and deploy legacy systems, distribute business logic throughout the enterprise, and take advantage of all the competitive advantages currently on offer through e-commerce and e-business over the Internet.

Metadata Management and Data Mapping

Increasingly, organisations are faced with the need to access or move data from legacy information systems as part of a renovation exercise. These projects could be as diverse as migrating to ERP packages and data warehouses, data consolidation as a result of mergers and acquisitions, data improvement initiatives, or EAI that provide integration with legacy systems.

Data About Data

Unfortunately, metadata – the data about data – has always been an afterthought for many organisations deploying information systems. Historically, it has existed in people's heads, and to some extent technical metadata has been used in Data Definition Languages (DDL), database schemas and COBOL programs.

Metadata also exists as a result of analysis and design methodologies, and products that support these techniques, for example entity relationship diagrams stored within CASE tools. More often than not, it has been the preserve of only analysts, data modellers, and database designers. Metadata has therefore lurked within disparate systems and pervaded certain software categories for quite some time.

Application flexibility sometimes requires more than just renewing the front-end processes – the data structures may also need to be modified or extended. A number of approaches can be used, involving data profiling, data mapping, data replication, and legacy database servers.

Conclusion

The need to consolidate, move, improve, convert, and find new ways to reap benefits from legacy information is resulting in more and more legacy renovation projects. Whilst billions of pounds may have been spent in the pursuit of developing reusable code, it is probably fair to say that considerably less has been spent on the kind of infrastructure that actually encourages and enables reuse, allowing organisations to leverage their legacy data sources.

Greater collaboration between IT, the business, and partners is key to maximising the benefits that can be achieved from what may be regarded as both business and technical metadata, and also internal and external metadata. Global systems, distributed data, different formats and standards, new and legacy information, are all indications that the complexity of the IT environment will increase further. Effective metadata management is vital to make sense of all this. Organisations also need the tools to produce, store, and use metadata, and to profile, map, synchronise, extend, and migrate information from legacy systems to new technologies, in order to reposition it for the business challenges ahead.

Terminal Servers

Acquiring new applications or integrating with existing programs usually entails purchasing faster, more modern hardware to support the latest software. Desktop-based applications require ever higher processor clock rates, greater main memory, and larger disk drives. As the expected life of a PC is around three years, many companies are finding themselves with large stocks of 'old' machines, which have little value as resale items. The scrap value of legacy PCs is just about enough to pay a specialist disposal firm to collect them. Some companies virtually give-away unwanted PCs to staff. Even the local schools will not accept these low-powered computers, free of charge, because they are unsuitable for multimedia and Web-based teaching!

Another problem facing the IT manager is the installation and maintenance of all the new PCs and the associated applications deployed upon them. Client computer administration and support is reckoned to account for approximately two-thirds of the TCO of Windows-based PCs on a campus-scale LAN.

If old PCs, X-terminals, or UNIX workstations can be reused as the new breed of intelligent terminal, then substantial benefits may be obtained.

Today, IP dominates the Internet, and the majority of next-generation distributed application development will be based on it.

One estimate for the worldwide investment sunk into SNA applications is an awesome \$20 trillion

In addition, compared to plain terminals or 'green screens', PCs are estimated to cost about eight times as much in TCO and suffer from 12 times more downtime. One way to reduce costs is to centralise client management as much as possible, and with the arrival of 'thin-client' computing, there is pressure for the industry to come full circle and return to a server-centric approach. If, in addition, old PCs, X-terminals, or UNIX workstations can be reused as the new breed of intelligent terminal, then substantial benefits may be obtained.

The Appeal of Thin-Clients

Although originally marketed as a device that reduces TCO, thin-client computing has developed, onwards and upwards, to provide an easily managed productivity access solution. Thin-clients are used to access a variety of operating systems, distributed across remote locations, and the key issue now is how to deploy 'applications anywhere', quickly and easily.

Thin-client is a generic term that applies to a number of devices, including Network Computers (NCs), Windows-Based Terminals (WBTs), X-terminals, and browser-enabled appliances. The main difference between the types revolves around where the boot-up and application processing is accomplished.

Conclusion

Butler Group believes that the life of legacy hardware can be extended by their utilisation as WBTs and other similar thin-client terminals. This has the advantage that applications can be deployed where full featured or powerful PCs might not be appropriate, and allows resource-intensive applications to become usable across slow-speed telecommunications links. However, although it is often claimed that the TCO is significantly reduced, there is the hidden cost of high-powered servers and server cluster administration. Sales of NCs and JavaStations have remained relatively lacklustre, and the momentum appears to be with WBTs at present. Sun and IBM have abandoned the development of their JavaOS for Business initiative, a new Java-based operating system for NCs. Currently, Linux and Windows CE are fighting for leadership as the operating system of choice in the dedicated thin-client market.

Infrastructure Renewal

Many enterprises have large computer networks based upon proprietary protocols. Although networks were developed to provide access to early 'time sharing' computer systems in the 1960s, the common protocols were not established until the following decade. Often oriented towards specific underlying hardware, network protocols were introduced by vendors to connect terminals to host processors, such as mainframe computers. In the 1980s, the arrival of LANs led to a second wave of protocols, based on a network operating system, to link PCs to minicomputers or PC servers. Typical vendor or *de facto* protocol examples, include IBM's Systems Network Architecture (SNA) for terminal-to-mainframe connectivity, and Novell's Internetwork Protocol eXchange (IPX) for LANs.

In the 1990s, organisations were also implementing Internet Protocol (IP) networks, in order to take advantage of the new services and the technical benefits offered by IP. Open standards also led to low cost, high functionality multi-vendor solutions. Today, IP dominates the Internet, and the majority of next-generation distributed application development will be based on it. The success of Intranets, Extranets, and the Internet has resulted in many organisations standardising on IP, in order to converge their diverse and disparate networks into one underlying system.

Legacy Investments

Many organisations have a huge legacy investment in SNA hardware, software, and dependent applications. One estimate for the worldwide investment sunk into SNA applications is an awesome \$20 trillion, and after Y2K upgrading has taken place, the majority of this installed base will still have a useful life. Although perceived as rather 'old fashioned', like its compatriots the mainframe and COBOL programming, SNA provides a level of functionality as standard that IP-based networks are only just beginning to address. This includes high availability, predictable response times for high transaction rates, Quality of Service (QoS) for different types of users and applications, and secure access to business-critical resources. However, the major failings of SNA revolve around its host-centric proprietary nature and lack of dynamic configuration.

IP is prevalent in all market and geographical sectors, including the small business and home user, which SNA never attempted to target. Technologies and products for integrating SNA and IP have been around for a few years, and can now be considered mature.

The risks associated with conversion to IP have been reduced to the extent that a business case can be put forward for reducing costs, while laying the foundation for a combined voice, video, and data network. Using IP in the LAN and WAN allows easier integration with Web-based e-commerce and supply chain e-business systems. The adoption of enterprise IP is now significant and growing exponentially throughout the world, led by the US market.

The three main benefits of SNA/IP integration are:

1. Reduction in the number of telecommunications circuits – A single network infrastructure allows the elimination of multiple single-protocol lines and associated communications processors at many locations. Support, maintenance, and rental costs are therefore reduced.
2. FEP removal – Expensive to purchase and maintain, proprietary FEPs can be replaced by high-speed routers from a choice of vendors. FEPs are usually liable to both hardware and software maintenance contracts.
3. Desktop simplification – A PC running multiple protocol stacks for accessing several networks can be consolidated into one IP-based stack in conjunction with terminal emulators or Web browsers.

Conclusion

Butler Group believes that the viability of the mainframe should not be confused with the move towards the network convergence of SNA and other networks.

Butler Group believes that the viability of the mainframe should not be confused with the move towards the network convergence of SNA and other networks. Today's mainframe supports more than just batch-orientated scheduled jobs or block-mode terminal transaction processing. The re-emergence of server-centric processing has led to the mainframe's renaissance as a powerful Web e-commerce or Java application server. IBM is now integrating the mainframe and IP as closely as the UNIX vendors have done, and in addition, its computers and those of other manufacturers support a range of other protocols and services including Automated Teller Machine (ATM), Fibre Distributed Data Interface (FDDI), Token Ring and Ethernet.

SNA's architecture provides a guaranteed level of service and predictable response time, which took several years to establish successfully. Organisations will benefit by deploying IP, but need to optimise it for business use. IP is still some way from providing reliable and robust value-added services that can carry time-sensitive business application traffic. Bandwidth reservation, prioritisation and rate control features are being applied to IP, either by incorporating extensions to, or running IP over hardware that can support these capabilities, such as ATM. Unfortunately, there are a number of competing approaches to providing these functions, and not all routers support these capabilities.

Networks have migrated from single proprietary protocol to multi-protocol support. Butler Group believes that logical consolidation follows from physical consolidation, and in the future, a single protocol, IP, will prevail. Network managers wish to support fewer protocols, because this reduces the amount of hardware required, and simplifies the configuration issues. Fewer protocols result in bandwidth being used more efficiently, leading to reduced complexity and cost. However, the range of network applications will increase, making the prioritisation of services a prerequisite. Not forgetting the important human element, as SNA and IPX become perceived as yesterday's technology, resulting in the number of employees and contractors familiar with these legacy skills disappearing over time. Installing an IP-based network will ensure that existing workers are retained, and new staff that are trained in IP are attracted.

The Integration Challenge

Quite simply, the challenge for organisations is to maximise their considerable current investment in technology so that they can meet ever-changing business conditions, and capitalise on the opportunities presented, in order to achieve or sustain a competitive advantage. The investment can be in the form of data, applications, systems, or even personnel with a particular skill or specific technical experience.

Although articulating the challenge may be simple, achieving a successful outcome is an altogether more complicated and tortuous undertaking. It brings together both business issues of competition, internal process review and the external supply chain, and IT issues such as the current and future technological infrastructure, skills and resources, and how best to meet the business challenges.

When IT systems are compatible with business objectives, then enterprises will be far better equipped to meet and resolve the integration challenge.

There has never been a commercial landscape quite as diverse or fast moving, in the entire history of humankind – as there is today. Since the very early days of history, when cavemen may have traded animal skins for food, or other essentials, a very simple mix of skill and experience was all that was required to undertake the basic trading model. This continued until the industrial revolution forced a new set of entrepreneurial skills onto the merchant classes.

What is increasingly new in this rich mix of diverse functional experience, is that business managers now need real IT skill and appreciation, and IT managers need mainstream business proficiency. This has never been more apparent, and is actually leading to a diffusion of roles within many enterprises. At board level, senior managers appreciate that the IT strategy is too important to the overall success of the organisation to leave it up to the IT department alone. Butler Group believes that business is now so heavily dependent upon IT, that the sooner that the divisions between the two are broken down and melded into one, the better. When IT systems are compatible with business objectives, then enterprises will be far better equipped to meet and resolve the integration challenge.

Legacy in the Future

It is all too easy to perceive the integration and renovation of legacy systems as being a ‘one-shot’, never-to-be-repeated project. This is due, in part, to the fact that there has been such attention and commentary centred on mainframe computers, that the two phrases have become synonymous; legacy integration is often taken as solely meaning the integration of mainframe applications and data. This is clearly not the case. Legacy systems are not defined by a point in time, but by an inability to modify them in an effective and efficient manner, without undue expense or labour, in order that they comply with the rest of the computing infrastructure. Technological change, innovation and a volatile business environment all create and compound legacy system problems, and as such, the enterprise needs to investigate the implications of decisions made today on the infrastructure of tomorrow.

Change is inevitable in all things, and should therefore be anticipated, planned for and even welcomed in some cases. It is human nature to resist change, however, it is not necessarily a bad thing for an organisation and, more often than not, it actually leads to improvements in productivity or the working environment. Butler Group believes that organisations that are most responsive to change, in terms of possessing an adaptive culture, and are guided through the appropriate use of forward-looking IS/IT strategies, will thrive. Whilst other organisations become burdened with the next phase of thorny legacy issues, having already successfully addressed such problems, these agile enterprises will be able to follow a relatively painless path. Therefore, the future impact of legacy issues lies very much in the hands of the individual enterprise.

There is no such thing as being technology-proof and realising this is critical to avoiding future problems. As the stakes get higher and the rate of technology proliferation increases unabated, those organisations currently fire-fighting may find the blaze getting out of control.

The modern renovation techniques discussed in this Management Guide can help to future proof the systems of organisations against new technological advancements. There is little doubt that within the next few years with the relentless pace of change, the newly installed software and hardware systems of today will be regarded as legacy. Butler Group believes that if renovation exercises are undertaken now, then the next round of advancements will be less problematical. Now that organisations have resolved their Y2K issues, they will have more time to think about replacing legacy systems as the processes they support become obsolete.

Strategies and Technologies

Compuware

What do you need most?

Compuware UNIFACE

Legacy Renewal and Integration: A Fundamental Requirement for Faster, Easier E-Commerce

The Situation Facing Organisations Today

E-commerce has replaced Y2K as the strategic priority for all businesses, in all industries, in the new millennium but, because of Y2K, the past cannot be forgotten. To render legacy systems millennium compliant the majority of organisations had to make significant investment in them, and they now need to leverage this investment in the new e-commerce world.

In addition, legacy systems tend to control many of the core processes of the organisation and, from an e-commerce perspective, it is impossible to process huge volumes of transactions without the necessary back-end processes. The mainframe is the obvious candidate for processing the types of traffic generated by a successful e-commerce application, and the importance of true legacy renewal and integration is now well understood to be a fundamental requirement for faster, easier e-commerce.

Legacy renewal and integration is the process of understanding and extending business applications for reuse with new customer-facing e-commerce applications.

The Compuware Solution

Compuware provides a broad range of products and services that are designed to accelerate the process of legacy renewal during an application's entire life cycle. Compuware is the world's fourth largest independent software vendor, and can call on over 25 years of experience in delivering the largest and most complex OS/390 projects.

Analysis, Code Segmentation and Componentisation

Compuware XPEDITER/DevEnterprise facilitates the reuse of powerful back-end OS/390 components in distributed e-commerce applications. By automating analysis, code segmentation, and componentisation, XPEDITER/DevEnterprise simplifies the reuse process and reduces time-to-market. XPEDITER/DevEnterprise enables developers to separate presentation logic and application logic, and therefore reuse the application logic with an intelligent, customer-facing Web front-end. This is done by separating the 3270 terminal's presentation and application streams, and generating an interface that can be easily read into the UNIFACE signature repository. This powerful feature means that application developers can reuse OS/390 logic just as easily as if it were a component built in UNIFACE.

XPEDITER/DevEnterprise's easy-to-use graphical interface provides programmers with a view of their application. With XPEDITER/DevEnterprise, programmers perform the following operations:

- Statically analyse complex systems and programs.
- Dynamically analyse business functions, change source code, and recompile.
- Componentise application programs easily to simplify their reuse in other applications.
- Set program stops and breakpoints within source code to highlight and locate areas requiring performance tuning.

Enterprise Data Management

Compuware File-AID automates data migration and integration to move applications quickly and easily into production. Automated procedures and an easy-to-use graphical user interface provide a fast, consistent, and easy way to extract, transform, test, and load data. Because File-AID can connect directly to a variety of legacy and relational data environments, or read from raw extract files, there is no need to assemble teams of programmers that use COBOL, C, or other programming languages to manipulate data manually.

Compuware File-AID delivers the following benefits:

- High performance design saves time.
- Import source and target metadata.
- Reduced coding time.
- Address Database Management System (DBMS) diversity.
- Cut design and integration time.
- Enhance reliability with data cleansing.
- A comprehensive data management toolset.

Application Integration and E-Commerce

Compuware UNIFACE is an enterprise application development environment that is designed to enable organisations to integrate enterprise applications, and to extend and renew existing applications with new functionality and user interfaces. UNIFACE allows IT staff to develop and deploy applications in distributed, multi-tier environments, independent of the underlying technology infrastructure. UNIFACE applications are component-based and can be assembled and integrated using different models and implementation types, including CORBA, COM+, Enterprise JavaBeans, and Customer Information Control System (CICS).

Application Development

When business processes change, legacy applications need to be extended with new components, or integrated with other applications. UNIFACE facilitates these processes with a powerful three-stage approach to application development that encompasses modelling, component construction, and application assembly and integration.

Modelling – Developers create detailed models of business processes before tackling any technological issues. This helps to ensure that applications mirror business needs, since requirements are well-defined, easier to understand, easier to implement, and more adaptable to change.

Component Construction – UNIFACE provides developers with powerful, model-driven tools to construct components that implement the business models. Components inherit objects, rules, and behaviors from the model, which greatly accelerates the construction process. When developers adjust the model to introduce new business requirements, components automatically absorb these changes without additional coding, and so simplify the renewal process.

Application Assembly and Integration – Developers can assemble and integrate components using the UNIFACE Assembly Workbench without needing to know how individual components work, or how they are implemented. UNIFACE's ability to accommodate the entire spectrum of industry components – 3GL, Java, SAP, CORBA, and COM – is unique, allowing developers to extend and renew applications with components selected for quality and performance.

Application Deployment

UNIFACE's Universal Request Broker Architecture understands the model and language of the underlying middleware and uses its native functionality, making applications middleware-independent.

Meeting E-Commerce Challenges – UNIFACE provides a powerful Web application server that enables legacy code to be reused in distributed, Web-based e-commerce applications. UNIFACE WebApplication Server is a highly scalable, open application server that uses Hyper Text Markup Language (HTML) and JavaScript-enriched HTML as the presentation interface. UNIFACE WebApplication Server automatically generates HTML 4.0-compliant applications that run in standard Web browsers and require no client-side installation. Dreamweaver, the powerful HTML editor from Macromedia, is integrated with UNIFACE to accelerate the development of attractive front-end components for e-commerce applications. The low bandwidth required by the HTML presentation interface provides rapid response times, a critical consideration in e-commerce applications.

Harnessing the Power of the OS/390 as a Data Access and Integration Server – UNIFACE PolyServer for OS/390 works with native database drivers and functions as a data access and integration server. Applications running on a desktop are provided with simultaneous access to any number of databases controlled by different DBMSs on multiple server platforms. UNIFACE PolyServer for OS/390 provides automatic and transparent read/write access to DB2, IMS, ADABAS, and VSAM. It complies with the OS/390 production environment, including security access to RACF, ACF/2, and CA-Top Secret, and provides journaling and storage dump facilities on system failures. UNIFACE PolyServer for OS/390 is available on a range of operating systems, including UNIX, AS/400, VMS, and Windows NT.

Processing UNIFACE Business Logic Components on the OS/390 – UNIFACE Application Server for OS/390 allows developers to build components on one platform – for example, Windows 95 or Windows NT workstations – and to deploy them on any mid-range system or on the OS/390. Application performance improves because processing can take place where the data resides, a capability that is ideal for organisations engaging in e-commerce. Business components developed for client/server applications can be moved to the mainframe and reused in e-commerce applications, where performance is critical. Reusing proven business components compresses development and testing cycles dramatically, and performance and time-to-market also improve significantly.

UNIFACE client applications are routed via a network driver to UNIFACE Application Server for OS/390. This, in turn, either uses UNIFACE database drivers for native database access or UNIFACE PolyServer to connect to another remote server. Only relevant and fully processed information is returned to the client. The UNIFACE database drivers provide automatic and transparent read/write access to DB2, IMS, ADABAS, and VSAM. UNIFACE Application Server for OS/390 complies fully with the OS/390 production environment, including security access to RACF, ACF/2, and CA-Top Secret.

Processing and Executing Legacy OS/390 Application Components – UNIFACE Component Server for OS/390 enables UNIFACE applications to remotely call non-UNIFACE components. As a result, UNIFACE e-commerce and client/server applications can reuse existing legacy code that is executed as CICS or IMS/DC programs, including COBOL, PL/I, C and BAL. UNIFACE Component Server for OS/390 is able to interface to CICS and IMS/DC programs via a number of connectors:

- **CICS Connector** – An Inter Component Communication (ICC) driver enables workstations running UNIFACE, or UNIFACE Windows NT servers acting as clients, to connect to CICS transactions via TCP/IP or SNA/APPC (LU6.2).
- **IMS/DC Connector** – This connector enables workstations running UNIFACE, or UNIFACE Windows NT servers acting as clients, to connect to IMS/DC transactions via TCP/IP or SNA/APPC (LU6.2) on the OS/390. UNIFACE supports the ability to link to IMS/DC programs directly via: IMS Open Transaction Manager Access (OTMA) adapter (also known as ITOC); APPC/IMS; and IMS Listener BMP.
- **UNIFACE Connector for MQSeries** – This connector allows organisations to leverage existing MQSeries-compliant applications in a transparent and productive fashion. The UNIFACE Assembly Workbench can pull in MQSeries Application Programming Interfaces (APIs) and expose these interfaces to UNIFACE developers. This enables UNIFACE developers to send/receive MQSeries messages from a UNIFACE application, without needing to know anything about the physical MQSeries installation.

Compuware Professional Services

Compuware Professional Services provides consulting services that extend the value, life, and functionality of strategic applications. Consultants can provide assistance with all aspects of OS/390 environments, including:

- Strategy consulting.
- Architecture assessment.
- Application componentisation.
- Data transformation.
- Usability services.

Product Information

Compuware UNIFACE

UNIFACE is Compuware's enterprise development environment for building, renewing, and integrating strategic applications. By delivering solutions in the key areas of e-commerce, enterprise application integration, and legacy renewal, UNIFACE helps IT organisations to reduce the cost of ownership of their business-critical applications, and to increase the return on investment of the IT budget. UNIFACE's technology independence allows UNIFACE applications to run on an unrivalled range of databases, operating systems, hardware platforms, and network configurations (over 4,000 combinations). This powerful feature allows organisations to successfully manage business and technology innovation, and future-proof their most important applications against unforeseen change.

Corporate Profile

Compuware Corporation

In 26 years, Compuware has grown from a small local operation to a multinational software and professional services powerhouse, ranked among the top five independent software vendors in the world.

With fiscal year 2000 revenues of more than \$2.2 billion, Compuware is a world leader in the practical implementation of enterprise and e-commerce solutions. Compuware productivity solutions help 14,000 of the world's largest corporations more efficiently maintain and enhance their most critical business applications. Providing immediate and measurable return on information technology investments, Compuware products and services improve quality, lower costs, and increase the speed at which systems can be developed, implemented, and supported. Compuware employs more than 15,000 information technology professionals worldwide and has more than 127 offices with a presence in 45 countries.

From application development to testing and management, Compuware products help build and manage high quality, stable applications throughout the business enterprise. At over 14,000 client sites, Compuware products are at work bridging client/server, mainframe, and Internet-related technologies.

Business Alliance Partners

As a global leader, Compuware has a large network of business alliance partners. Over 400 partners offer more than 700 application packages and components that capture a wealth of specialised business knowledge. You can purchase high-quality, pre-built software for standard processes, such as finance and human resources, and tap the power of UNIFACE to build strategic applications that provide real business value.

Company Details

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Web Address:	www.compuware.com/uniface	
No. of Employees:	More than 15,000 worldwide	
Turnover:	Fiscal year 2000 revenues of more than \$2.2 billion	

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