Australian Stock Exchange:
An Emerging Financial Hub Powered by IBM Technology

An IDC e-business Case Study

THE SUBJECT	ASX operates Australia's primary national market for equities and equity derivatives. Established in 1987 as a mutual organization of stockbrokers, ASX demutualized and went public in 1998. For the year ending June 30, 2001, ASX processed nearly 14 million equity trades valued at A$361 billion.
THE GOAL	To optimize the performance and availability of its B2C and B2B e-business solutions; to migrate toward a more standardized infrastructure, thus laying the groundwork for more rapid application development and lower support costs.
THE SOLUTION	ASX's B2C solution—targeted to retail investors in Australia—provides 20-minute-delayed stock prices, a listing of company announcements, and general stock market information. ASX's B2B solution—targeted to companies listing on the exchange and market participants—delivers a wide range of informational services. Both platforms employ IBM WebSphere Application Server. IBM MQSeries facilitates the sharing of data between these platforms and ASX's mission-critical back-end systems.
WHY IBM	*"We see WebSphere and MQSeries as highly synergistic tools for building complex, scalable solutions that leverage data from a wide variety of sources. The opportunity to have a partner with IBM's expertise in building these solutions—and the support resources to back them up—made our decision clear."*

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Executive Summary

Established in 1987, the Australian Stock Exchange Limited (ASX) is the nation's primary stock exchange for equities, equity options, and warrants. ASX also operates a market in fixed-interest securities. Positioned at the hub of the Australian financial community, ASX serves a diverse base of stakeholders, including brokers, third-party information service providers, retail investors and companies that list on the exchange. ASX's shift from mutual to public ownership—finalized in 1998—opened up a wide range of new service opportunities beyond its core business of listing, trading, clearance and settlement, and providing market data feeds. But to capitalize on this new set of opportunities, ASX saw the need to improve its ability to develop and introduce new services quickly. ASX saw migration toward a more standardized architecture as the answer.

ASX engaged IBM's Application Integration Middleware Group (Asia Pacific) to assist in the design, development and implementation of a range of B2C and B2B solutions. At the same time, ASX selected IBM MQSeries as its messaging platform and WebSphere Application Server to power these advanced solutions. ASX expects these standardized platforms to provide a solid foundation for its aggressive e-business agenda.

Innovation Spotlight

Using IBM WebSphere Application Server, ASX developed its Electronic Lodgement Service, which allows listed companies to place their company announcements electronically instead of having to fax or hand deliver them.

ASX's Solution at a Glance

▶ **e-business State**
External Integration

▶ **Core Functionality**
ASX's B2C and B2B solutions deliver market-related data and associated services to a wide range of stakeholders in the Australian equities market. The solutions are integrated with ASX's mission-critical backend systems, including its core trading and clearing systems.

▶ **Software**
IBM WebSphere Application Server (Advanced Edition), IBM MQSeries, IBM VisualAge for Java

▶ **Services**
IBM Application Integration Middleware Group (Asia Pacific)

▶ **Key Benefits**

▶ By moving toward a more standardized e-business infrastructure, ASX expects to speed its application development cycle—thereby improving speed to market.

▶ As a result of its eventual move from proprietary messaging platforms to IBM MQSeries, ASX expects to achieve significant reductions in application support costs.

▶ After deploying IBM WebSphere Application Server in its B2C solution, the time to present a cached Web page fell by more than 40% (from 4.7 seconds to 2.8 seconds).

▶ By migrating the B2C solution to WebSphere Application Server, ASX's servers now run at a 15% average utilization rate, compared to an 80% rate with comparable load under the previous platform.

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▶ Background

The Australian Stock Exchange Limited (ASX) was established in 1987 through the merging of six independent stock exchanges, operating on a regional basis. Originally structured as a mutual organization—owned by stockbrokers—ASX "de-mutualized" and went public in 1998. In addition to serving as Australia's primary national stock exchange for equities, equity options and warrants, ASX has emerged as a crucial information hub in the Australian—and global—securities community. Key players in the Australian market—ranging from market participants (e.g., brokers and investors) to third-party information vendors (e.g., Reuters and Bloomberg)—have come to depend on ASX for a reliable flow of mission-critical information. And ASX, whose central mandate is to maintain the integrity of the rapidly growing Australian market, has likewise become increasingly dependent on technology to deliver on this commitment.

"With today's volatility, we need a substantial amount of capacity 'headroom' within our IT infrastructure. When the market surges, volume for all the ancillary services—which we provide to support this market activity—also surges. For this reason, having a scalable, reliable IT architecture is vitally important to our business."

— Angus Richards, Deputy Managing Director, ASX

Since ASX's founding, the steady growth of trading volume on the Australian equities market—rising at an average annual rate of more than 25 percent—has made aggressive IT investment a strategic necessity. While average volume has a clear bearing on the company's IT capacity needs, the acid test is its ability to handle the volume spikes that increasingly characterize the market's activity. According to Angus Richards, Deputy Managing Director, ASX considers its central criterion for IT readiness to be an ability to handle a day-to-day volume surge to 150% of the previous all time peak volume. "With today's volatility, we need a substantial amount of capacity 'headroom' within our IT infrastructure," explains Richards. "When the market surges, volume for all the ancillary services—which we provide to support this market activity—also surges. For this reason, having a scalable, reliable IT architecture is vitally important to our business."

The core data processed by ASX falls under two broadly defined categories: 1.) all trade-related information from order through trade settlement and 2.) announcements that listed companies are legally required to make to disclose any actions or events that may have an impact on the company's stock price. Trade-related data flows move through ASX's internal systems in a straight through process. At the heart of ASX's central systems is a data archive known as CORE, which distributes order and trade data from its primary equities trading system (SEATS) and derivatives trading system (CLICK) to its equities clearing and settlement system (CHESS), its derivatives clearing and settlement system (DCS), and to data service subscribers. In contrast, the flow of company announcement data has traditionally followed a more circuitous route, with companies submitting the data by fax or hand delivery, and ASX in turn forwarding the company announcement data as a text message to its customers.

▶ The Need: New Services Call for a New Infrastructure

While the sheer magnitude of ASX's data processing activity has been a major driver of its e-infrastructure investments, one must look still further—to its

core business strategy—to paint a clear picture of the company's technology needs. Because ASX derives the majority of its business from core services such as listing, trading and clearing services, its revenues have been generally tied to the overall direction of trading volume on the exchange. As Richards points out, ASX's 1998 shift from a mutual ownership model to public ownership freed the company to pursue a range of market opportunities—but also posed challenges. "As a public company, we've gained strategic flexibility, which strengthens our long-term business model," says Richards. "However, we recognize that having the appropriate technological infrastructure in place will be absolutely essential to our success in pursuing these opportunities."

While the desire to pursue emerging business opportunities was a key driver of ASX's IT ambitions, an equally important factor was the company's need to deliver on its core mission—to provide the best-performing, most reliable services possible to its diverse base of stakeholders. By and large, this meant improving the performance of a range of existing Web-based B2B and B2C services through new and improved technology. The roots of ASX's performance enhancement efforts can be traced to early 2000, when the company enhanced its largely static B2C Web site to enable the dynamic delivery of 20 minute delayed pricing information. Though a significant improvement, the company's B2C enhancement was in many ways a prelude to deeper and more far-reaching enhancements to its Web infrastructure.

This was epitomized by ASX's June 2000 decision to build a Web-based solution that would allow listed companies to lodge their announcements electronically. According to Marg Williams, ASX's National Manager of Market Support, the decision to build an online announcement lodgement solution was significant because it marked the first time Web technology would be used to support a mission-critical ASX application. "Up until that time, Web technology was seen as neither mature nor stable enough to handle mission-critical applications," says Williams. "Our decision to build the online lodgement application using Web technology signaled a change in that perception."

At about the same time, ASX technology planners had also begun considering the replacement of the company's home-grown messaging middleware with a standardized technology. As Williams points out, ASX viewed the replacement of its existing middleware technology—which had been used to move data between its core legacy systems and numerous applications across the organization—as just one part of a broader move toward an enterprise architecture. "We saw the adoption of common, industry-accepted tools within our service delivery architecture as the key to building new services more rapidly and reliably—and more cost effectively," notes Williams. "As a company relying on the rapid development of new services to fuel its growth, our embrace of the appropriate set of such tools had emerged as a strategic necessity."

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► First Steps and Decision Process

Having resolved to move ahead on the electronic lodgement and middleware replacement initiatives, ASX was faced with two sets of choices related to enabling technology. While following essentially parallel decision processes for the two initiatives, the ASX evaluation team made its first choice on the middleware side, selecting IBM MQSeries. According to Williams, the maturity, reliability and overall functionality of MQSeries made it an obvious choice. "Our team placed a big value on MQSeries's guaranteed message delivery, which is an absolute requirement given the mission-critical nature of the application," says Williams. "We also saw MQSeries's built-in transactional services and its more mature message brokering capability as head and shoulders above those of other vendors we considered."

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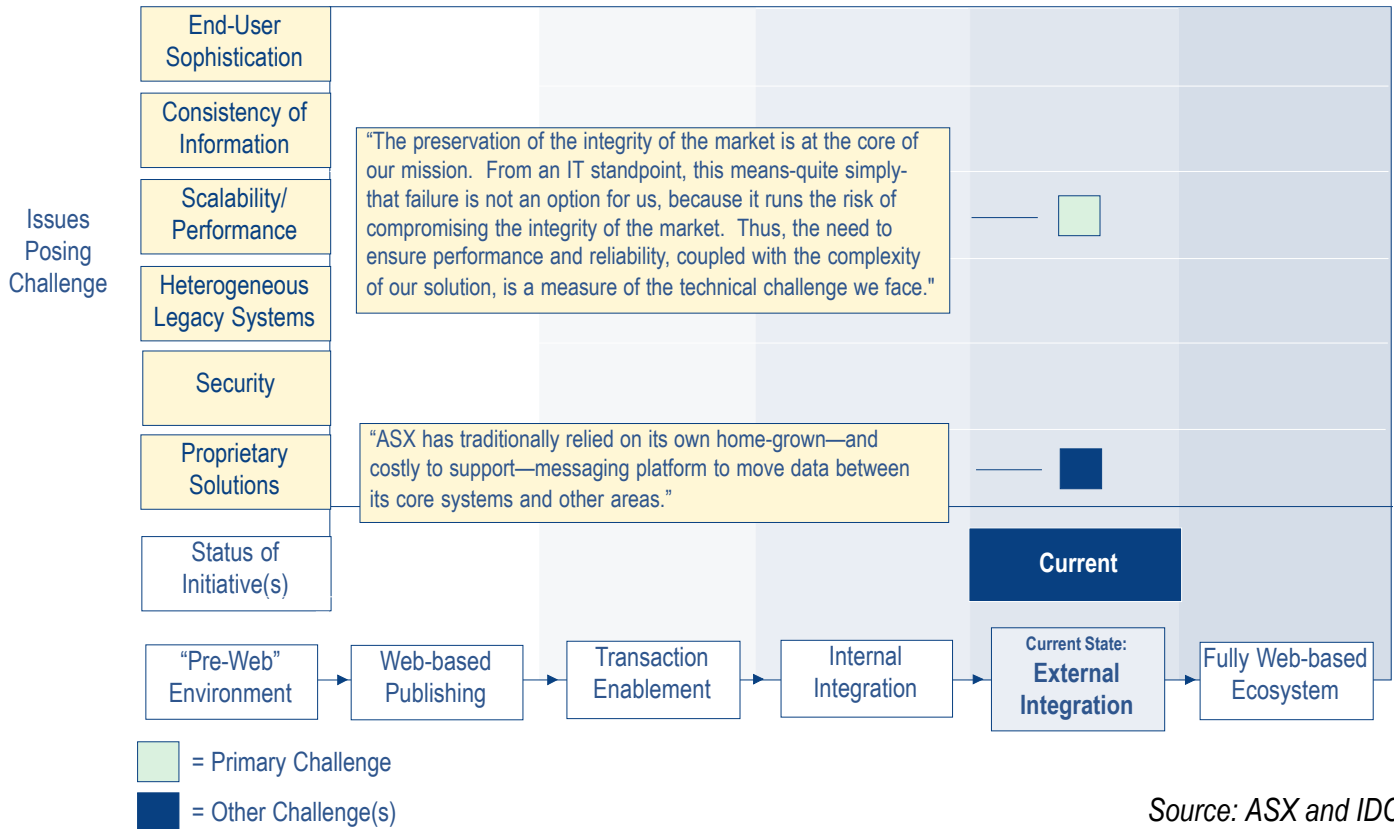
— Marg Williams

Soon after selecting MQSeries, the ASX team selected WebSphere Application Server to underpin the electronic announcement lodgement system, the first of what would become a stream of B2B initiatives powered by WebSphere. An important product-specific criterion cited by ASX was WebSphere's performance and reliability. This included the ease with which it can be clustered for maximum scalability—a must given the need to accommodate spikes in site activity related to trading volume. Other attributes that were critical to ASX's decision were the strength of WebSphere's development tools and transaction services, its state and session management capabilities, and its multiplatform support. In addition to the platform's individual strengths, Williams saw the integration between MQSeries and WebSphere providing far-reaching benefits down the road. "We see WebSphere and MQSeries as highly synergistic tools for building complex, scalable solutions that leverage data from a wide variety of sources," adds Williams. "The opportunity to have a partner with IBM's expertise in building these solutions—and the support resources to back them up—made our decision clear."

► Challenges

ASX identifies its most significant challenges related to the aforementioned e-business initiatives as technical in nature. Given the critical importance of ASX's data flow to its key stakeholders—and the dire consequences of failure—it's not surprising that Williams ranks the need to meet customers' demands for high performance and bullet-proof reliability at the top of her list of challenges. "The preservation of the integrity of the market is at the core of our mission," says Williams. "From an IT standpoint, this means—quite simply—that failure is not an option for us, because it runs the risk of compromising the integrity of the market. Thus, the need to ensure reliability, coupled with the complexity of our solution, is a measure of the technical challenge we face."

Challenges at Various States of ASX's e-business Evolution

Issues Posing Challenge		
End-User Sophistication		
Consistency of Information		
Scalability/ Performance	"The preservation of the integrity of the market is at the core of our mission. From an IT standpoint, this means-quite simply- that failure is not an option for us, because it runs the risk of compromising the integrity of the market. Thus, the need to ensure performance and reliability, coupled with the complexity of our solution, is a measure of the technical challenge we face."	▫
Heterogeneous Legacy Systems		
Security		
Proprietary Solutions	"ASX has traditionally relied on its own home-grown—and costly to support—messaging platform to move data between its core systems and other areas."	■
Status of Initiative(s)		**Current**

"Pre-Web" Environment	→	Web-based Publishing	→	Transaction Enablement	→	Internal Integration	→	**Current State: External Integration**	→	Fully Web-based Ecosystem

▫ = Primary Challenge

■ = Other Challenge(s)

Source: ASX and IDC

Solution Profile and Implementation Strategy

▶ An Overview of ASX's Solutions Today

ASX targets its e-business solutions to two broadly defined audiences, each with its own set of distinct information needs. The company's B2C solution, www.asx.com.au, is targeted to Australian retail investors. The site—whose average volume of 600,000 hits per day places it among the top 10 banking and financial Web sites in Australia—delivers 20 minute delayed stock prices, company announcements, and general stock market information. ASX's B2B solution is targeted to the smaller universe of market participants (e.g., brokers, third-party service providers) and companies listed on the exchange. Featured services include:

- *Electronic Lodgement Service*—allows listed companies to place their company announcements electronically instead of having to fax or hand deliver them.

- *ASX World Link*—facilitates cost effective trading, settlement and

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holding by Australian investors of securities traded in an overseas market (and, conversely, assists overseas investors in trading, settlement and holding of ASX quoted securities).

- *Sample ASX Broker Exam*—an online tool to assist potential candidates to prepare for the ASX Broker Exam, a requirement for people wishing to apply to become an Affiliate, Responsible Executive or Approved Representative.

- *Exchange Traded Funds Service*—an operational platform to facilitate the creation, redemption and trading of units in Exchange Traded Funds (ETFs).

The most recent addition to ASX's B2B offering—an online stock transfer system and processing service developed for ASX Perpetual Registrars Limited (50% owned by ASX)—exemplifies ASX's strategy of entering new market areas. [Transfer agents are hired by public companies to provide a variety of services for their shareholders, including maintenance of shareholder records, operating employee share ownership plans, and distribution of proxies, dividends and annual reports.]

▶ Solution Development Approach and Software Architecture

As discussed previously, ASX designed its B2C solution primarily as a tool to inform and educate the retail investor. After first implementing dynamically displayed pricing information on the B2C site in January 2000, ASX conducted a thorough revamp of the site in August 2000, focusing on look-and-feel and navigational issues. In September 2001, ASX completed the migration of the B2C site to WebSphere Application Server, resulting in a substantial improvement in the performance of the site.

Development Timetable for ASX's B2C and B2B Solutions

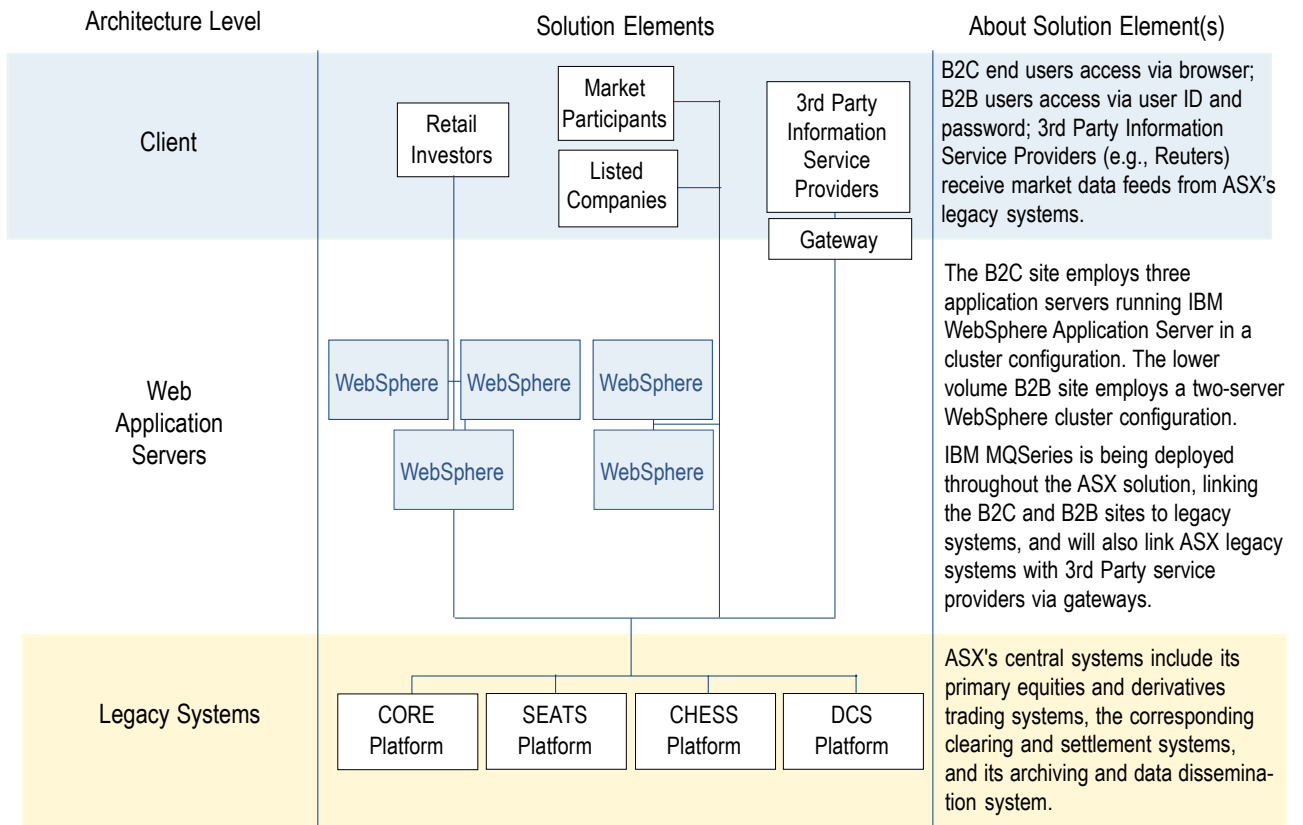|	January 2000	June 2000	August 2000	September 2001
ASX introduces realtime pricing and company announcement delivery capability on its B2C Web site.	■			
ASX and IBM begin development of online announcement lodgement solution and redesign of B2B site; ASX recognizes the need for a new application server platform.		■		
ASX and IBM begin development of the Transfer Agency solution; revamp of the B2C site completed.			■	
Development of the Transfer Agency solution completed; B2C solution migrated to WebSphere Application Server.				■

Source: ASX and IDC

IBM's Application Integration Middleware (AIM) Services Asia Pacific Group worked with ASX on various phases of its implementation process. In the B2C area—which features IBM WebSphere Application Server as its core platform—the AIM Group assisted in the architectural design, sising and implementation of the solution. As part of this effort, the AIM Group tuned the performance of WebSphere within the B2C solution, more than doubling the solution's throughput. The AIM Group also provided architecture design and implementation assistance for ASX's B2B solution, working specifically on the design of the B2B site and the development of the electronic lodging system (both begun in June 2000 and completed in 4Q2000). One example of the site's new capabilities is the ability of market participants and listed companies to self-manage their corporate information online, including addresses and contact details.

The core architecture of ASX's B2C solution—three Windows NT servers running IBM WebSphere Application Server in a clustered configuration—is designed to provide both scalability to accommodate peak demand, as well as to provide failover capability. Prior to the deployment of WebSphere, each server in the B2C solution typically operated at approximately 80 percent capacity, leaving it vulnerable to performance problems in times of peak volume. Under the current WebSphere-based architecture, each node in the cluster now operates at approximately 15 percent capacity, leaving ample "headroom" to accommodate spikes in site volume. The architecture of ASX's B2B solution is built around IBM WebSphere Application Server running on two UNIX servers, also running in clustered configuration. Although the B2B site is characterized by much lower volume than the B2C site, the critical importance of guaranteeing site availability led ASX to employ WebSphere in a clustered configuration.

> The most important points of integration within ASX's architecture are external—between its core systems and the third-party information service providers that rely on its market data feeds.

ASX's backend trading and settlement platforms—a collection of some 20 servers running in a data center environment—represent the backbone of its operations. Not surprisingly, establishing and maintaining tight integration between this platform and other parts of its e-business solution is a key element of ASX's architectural strategy. The most important points of integration within ASX's architecture are external—between its core systems and the third-party information service providers that rely on its market data feeds. Of increasing importance is the linkages between ASX's core systems and its B2C and B2B solutions. While ASX has traditionally relied on its own home-grown—and costly to support—messaging platform to move data between its core systems and other areas, IBM MQSeries is now poised to assume and expand that role.

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Basic Architecture of the ASX Solution

Architecture Level	Solution Elements	About Solution Element(s)
Client	Retail Investors · Market Participants · Listed Companies · 3rd Party Information Service Providers · Gateway	B2C end users access via browser; B2B users access via user ID and password; 3rd Party Information Service Providers (e.g., Reuters) receive market data feeds from ASX's legacy systems.
Web Application Servers	WebSphere · WebSphere · WebSphere · WebSphere · WebSphere	The B2C site employs three application servers running IBM WebSphere Application Server in a cluster configuration. The lower volume B2B site employs a two-server WebSphere cluster configuration. IBM MQSeries is being deployed throughout the ASX solution, linking the B2C and B2B sites to legacy systems, and will also link ASX legacy systems with 3rd Party service providers via gateways.
Legacy Systems	CORE Platform · SEATS Platform · CHESS Platform · DCS Platform	ASX's central systems include its primary equities and derivatives trading systems, the corresponding clearing and settlement systems, and its archiving and data dissemination system.

Source: ASX and IDC

Business Results

The infrastructure initiatives ASX began in mid-2000—centered around IBM WebSphere Application Server and MQSeries—sent an unmistakable message about the importance of Web-based services within its overall strategy. One of the central strategies within ASX's business model is to grow revenue and profitability by introducing a steady stream of new services to both existing and new customers. On the business side, this entails leveraging its customer relationships, its enviable position at the hub of the financial markets value chain, and its institutional knowledge base. But as Marg Williams points out, a flexible, scalable IT infrastructure—one that facilitates rapid, low cost application development—may be the most critical ingredient of all. "The success of our model will largely depend upon our ability to move rapidly to seize market opportunities," says Williams. "With IBM WebSphere Application Server and MQSeries as part of our architecture, we're in a better position to develop and support applications rapidly, efficiently, and cost effectively."

Overview of ASX's Business Results Achieved

Business Process/Issue	Nature of Benefit	Description or Metric
Application Development	Faster Development Cycles	By moving toward a more standardized e-business infrastructure, ASX expects to speed its application development cycle—thereby improving speed to market.
Application Support	Lower Costs	As a result of its eventual move from proprietary messaging platforms to IBM MQSeries, ASX expects to achieve significant reductions in application support costs.
Application Performance	Faster Throughput, Page Presentation	After deploying IBM WebSphere Application Server in its B2C solution, the time to present a cached Web page fell by more than 40% (from 4.7 to 2.8 seconds).
Infrastructure Scalability	Increased Capacity	By migrating the B2C solution to WebSphere Application Server, ASX's servers now run at a 15% average utilisation rate, compared to an 80% rate with comparable load under the previous platform.

Source: ASX and IDC

Angus Richards also sees the potential for significant and ongoing cost savings resulting from ASX's move to WebSphere and MQSeries, driven by the inherent benefits of a standardized architecture and tightness of integration between the two platforms. "We also expect both WebSphere and MQSeries to make it faster and easier for us to integrate Web applications with our backend data," notes Richards.

While application development and support issues rank high in importance for the ASX team, performance and reliability—on both the B2B and B2C side—are their top priority. Take the case of ASX's B2C site, which historically has been most vulnerable to performance degradation during periods of high trading volume. To improve its scalability and performance, ASX has migrated its B2C site to WebSphere. "If we purport to make pricing information available with a 20-minute delay—but that delay ends up being 120 minutes—we're not meeting our responsibilities well," adds Richards. "Our moving the B2C site to WebSphere should be taken as a clear statement of how seriously we take our commitment to our stakeholders."

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Case Epilogue

ASX's recent Web-based service initiatives—ranging from online announcement lodging to its new transfer agency system—are a testament to the success of an e-business strategy built on IBM technology. As the company tackles a new and increasingly complex range of e-business challenges, Williams expects ASX's e-infrastructure to become an even more strategic asset. "We as a company—and we in the IT organization—are in a continuous cycle of adding new products and services, and we're always being asked to do things faster, cheaper, better," explains Williams. "Our recent experience with IBM WebSphere Application Server and MQSeries have allowed us to do just that."

ASX views the addition of WebSphere Application Server and MQSeries to its portfolio of e-business tools as the first steps in a continual movement toward a more standardized infrastructure. Examining the company's recently developed Transfer Agency solution shows how its migration to standardized technology has already helped ASX adhere to its dictum of "faster, cheaper, better." By adopting IBM MQSeries, ASX was able to accelerate the development of the solution (faster), while at the same time reducing the need for scarce and costly support resources (cheaper). Moreover, on the strength of MQSeries's vaunted integration capabilities, ASX was able to better facilitate the complex integration requirements of the Transfer Agency solution (better). This included the need to move data back and forth between application server front ends and backend database processors. "We see IBM's technology and depth of expertise as key strategic assets as we pursue emerging service opportunities in this dynamic sector," says Williams.

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