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**ColdFusion MX:  
Raising the Return on  
Investment of Internet  
Application Development**

**An Executive White Paper**

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Aberdeen Group, Inc.  
*One Boston Place  
Boston, Massachusetts 02108 USA  
Telephone: 617 723 7890  
Fax: 617 723 7897  
[www.aberdeen.com](http://www.aberdeen.com)*

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# ColdFusion MX: Raising the Return on Investment of Internet Application Development

## **Preface**

While the ideal infrastructure for e-Business will likely be debated for years, Information Technology (IT) has a current mandate to adapt systems and strategies to a landscape already transformed by the Internet. In a half decade, Web technology and Web culture have become pervasive, inspiring IT to reorder the enterprise around open standards and just-in-time development cycles. Starting at the foundations of the data network — from the transport layer (TCP/IP), to application-oriented protocols such as HTTP (Hypertext Transfer Protocol) and SMTP (Simple Mail Transfer Protocol) — Internet standards have swept away earlier, proprietary offerings and enabled businesses to communicate with unprecedented ease and efficiency.

Today fundamental Web and Internet protocols have become universally supported commodities. Standards for application interoperability have been slower to emerge but, in the past 18 months, the foundations for a common Internet application platform have begun to settle, promising a new wave of cross-system functionality. The majority of organizations now view Java 2 Enterprise Edition (J2EE), Microsoft's .NET framework, or both as the future foundation of their applications. At the same time, XML (eXtensible Markup Language) and Web services have gained near-universal acceptance as the building blocks for application and data interoperability.

But, although these foundations are now falling into place, much work remains to be done before businesses can reap the full benefits of their investments in Internet infrastructure. This Aberdeen *Executive White Paper* examines some of the major challenges companies face in seeking to take advantage of the Internet infrastructure for business advantage. The paper then applies this perspective to an evaluation of Macromedia ColdFusion MX.

## **Requirements for a Next-Generation Platform**

Recent surveys of IT managers and system architects consistently rank the need to streamline development and shorten time-to-benefit in the top three concerns. (Security, standards-compliance, and application integration occupy other top slots.) Yet, while speed is a tenet of Internet time, it competes for IT's attention with a number of equally important agendas. Raising productivity by accepting vendor lock-in, for example, is a 21st-century no-no. More than ever, solutions must cleave to Internet and de facto industry standards to mitigate risk.

At the same time, ROI (return on investment) concerns dictate the need to leverage existing assets, whether back-end components, databases, or packaged applications. Moreover, solutions must emphasize quality of experience, reflecting a renewed focus on the user as a key presence in the value chain. Finally, meeting

these goals in the present is all well and good, but IT is in it for the long haul; so solutions must participate in a robust ecosystem of technologies, services, and tools that promise value throughout the lifecycle.

The following section organizes these multidimensional needs into the following four areas of focus: native support for standards, productive development and deployment, emphasis on great user experiences, and robust ecosystem. A next-generation Internet platform will meet or exceed them all.

### *Native Support for Standards*

As mentioned, in the past decade the ground has been shifting faster than usual beneath the feet of most IT executives and enterprise architects. However, more recently, the tremors have begun to subside, and a number of key standards have coalesced as cornerstones of the emerging enterprise infrastructure. These include the following:

- *XML*: At a minimum, this family includes XML itself, XPath (a syntax for navigating documents), XSLT (a style transformation language), and related processing standards such as the Document Object Model (DOM). In addition, support for XML Schemas, a standard for specifying data models in XML, will take on increasing importance as XML Web services mature.
- *J2EE*: The Java 2 Enterprise Edition platform has become the de facto standard for component-based development in the enterprise. Comprising a powerful programming language, extensive programming libraries, and a portable runtime for cross-platform deployment, J2EE has enjoyed unprecedented support among the major infrastructure vendors. Each of the market-leading J2EE application servers features particular strengths, but all enjoy Java's stability, interoperability, and growing pool of developer resources.
- *.NET*: Microsoft's next-generation server strategy offers a programming model and runtime infrastructure that closely follows the success of the J2EE platform and brings with it the powerful arsenal of Microsoft development tools, servers, and operating systems.
- *Web services*: The ferment surrounding XML Web services may be excessive, but the technology is real, with key standards like SOAP (Simple Object Access Protocol) 1.2, WSDL 1.1, and UDDI 1.0 bringing an unprecedented level of interoperability to the enterprise applications infrastructure.

Support for these key standards and technologies should be the starting point for any long-term technology choice, yet Aberdeen finds that most vendor solutions are sectarian, offering native support for either Java *or* Microsoft .NET servers

(such as SQL Server, IIS, and Exchange), or focusing on a single dimension of the overall solution, such as Web services. Such partisanship flies in the face of IT's need for fully integrated solutions that meet user — not supplier — needs. A responsive solution must be able to leverage assets on both Microsoft and Java servers. Ideally, access to components should not just be via Web services, but should enable tight-coupling to binary components where design dictates.

In addition to these infrastructure standards, there are several technologies that by virtue of their functionality, staying power, and ubiquity can be considered valuable enhancements to the Internet application stack. Examples of these include Macromedia Flash, Adobe Acrobat, and RealNetworks' RealPlayer. Standardization around these and other rich-media formats can offer IT the same kind of advantages at the presentation layer, across clients, that infrastructure standards provide at the back-end. The ideal platform will therefore support — or at least not inhibit — integration with these de facto standards.

### *Productive Development and Deployment*

Streamlining development is a matter of increasing developer productivity, a goal opposed by the complexity of today's standards-based application platforms. The low-level APIs (application programming interfaces) of Java and complex component architecture underlying .NET — though tremendously functional — tend to frustrate rapid, cost-effective development on a number of levels, such as the following:

- Coding with low-level languages is slow, and time spent debugging substantial — analysts estimate one bug per 50 lines of source code;
- Resources are bottlenecked, with only a fraction of developers having the requisite skills to produce robust Java, C#, or VB.NET applications;
- Even experts require continual retraining to keep abreast of new and rapidly evolving standards; and
- Where experts are unavailable, IT must go outside — with attendant costs, risks, and project management overhead.

Nor does the pain stop when an application goes into production. Extensive research by the Department of Defense and other large organizations indicates that up to 80% of the total cost of ownership (TCO) of a software system is incurred in maintenance, after initial production. Furthermore, cradle-to-grave lifecycle costs scale with code complexity. The message to IT is clear: Enabling a wider range of developers to build more maintainable systems is the key to application ROI.

In the Web era, the greatest boon to developer productivity has been server-side scripting — the technique of writing script-based applications that run on the server and generate client-side HTML (Hypertext Markup Language) and other Web page content. Scripting is the 4GL of the Internet, furnishing access to pro-

found back-end functionality in a compact, intuitive syntax. Compared to source code written in Java or C#, server scripts are much more approachable and productive. How much more depends on the type of application being produced. Data publishing and transaction processing benefit the most, whereas graphic-intensive applications such as online games benefit less. A factor of 5 to 10 reduction in total lines of code (complexity) and project duration is typical, according to Aberdeen research.

The ideal scripting development system should provide access to a wide range of enterprise assets, including databases, existing code libraries, back-end components, and Web services. Integration with supporting tools is another productivity lever. With integrated visual design tools, debuggers, and other productivity aids, developers experience less context switching, resulting in faster deliverables. In addition, the scripting platform should offer libraries of commonly used functions such as site search, security, data visualization, and role-based personalization. The less custom coding developers have to do to instantiate these functions, the better.

If scripting, tool integration, and reusable services are the keys to productive development, features that streamline deployment are next up on the critical path. Robust server environments typically involve a cluster of application (and perhaps Web) servers to provide load balancing and failover. Deploying to a clustered setup is no picnic — particularly if complex configuration files are required on each target machine. To avoid sacrificing the productivity gained through scripting, an effective platform must aid in application deployment and administration, whether through a wizard-driven process, drag-and-drop installation, or other techniques that mask server-side complexities.

### *More Effective User Experiences*

While Internet technology has brought unprecedented “reach” to the development world — enabling applications to be deployed across corporate networks and even across the world with the click of a mouse — to date it has done much less for the overall user experience. In fact, compared with the world of desktop and client-server applications, the Web has been a step backward, limited by the capabilities of the HTML interface and the document-centric world of the Web page. Today’s Internet user is challenged by e-Business applications that offer increasingly rich data without providing commensurately rich functionality to visualize and interact with that information.

According to the 2001 *Intranet Design Annual* published by design guru Jakob Nielsen’s consulting firm, Nielsen Norman Group, “Companies can approximately double the benefits from their intranet investment if they spend a small amount of that investment improving the design’s usability.” Still larger increments hold for inter-enterprise Web applications, where the user base is less constrained — and

likely to be less tolerant of poor interface design. While attention paid to good design principles can do much for a Web site, as long as HTML rendered in a Web browser is the dominant output of e-Business applications, users of all types — from Internet consumers to executives reliant on portals for decision support — will suffer, and revenue with them.

Repairing this situation is a priority for next-generation Internet systems. Getting the middle tiers right, though crucial, is not enough. An effective platform must bring together responsive, engaging client technology with server-side functionality capable of delivering data on demand. For IT, that means giving developers the tools they need to construct state-of-the-art presentation layers coupled to robust server technology, without sacrificing productivity, standards, or reach. Thus, a productive solution implies close integration between the server scripting environment and the client design tools. Moreover, reaching the mass of users without expensive custom installations implies leveraging client technology that is already prevalent on the millions of Internet-connected desktops and devices.

### *Robust Ecosystem*

Productivity is one thing, but IT's womb-to-tomb perspective brings its own set of requirements. Standards-based technology, rapid server scripting, and an emphasis on user experience are necessary requirements for building the next generation of rich Internet applications, but they are not sufficient. To be truly viable, a vendor's solutions must also do the following:

- Feature productive integration with a feature-complete set of design and management tools;
- Demonstrate a track record of responsible technical innovation; and
- Tie into a viable industry value chain through respected integrator and technology partnerships.

In other words, the risk of having a startup or low-cost provider disappear a year into a project needs to be taken into account. The ideal platform will be affordable but not at the cost of industry depth and breadth.

### **ColdFusion MX: Approaching the Ideal**

When Macromedia acquired Allaire Corporation in 2001, industry analysts — including Aberdeen — initially puzzled over the move. Macromedia's portfolio of best-of-breed client technologies includes Flash, the Web's leading vector graphics format; Dreamweaver, the site-design tool of choice for creative professionals; and other acclaimed rich-media brands. Allaire, by contrast, had built its reputation in application development, first with its pioneering ColdFusion server scripting platform and, more recently, with the highly popular J2EE application server, JRun.

The challenge facing Macromedia was to combine these dissimilar assets and form a strategy that provided a valuable solution exceeding the sum of its parts.

Today, with the April 2002 introduction of Macromedia's MX strategy, the company's vision and ability to execute have come clear. Anticipating the priority that e-Businesses would place on rapid development, infrastructure standards, and user experience, Macromedia has accomplished with MX more than a successful product integration. MX is a re-imagining of the development process that gives creative, technical, and IT stakeholders their due.

The strategy's flagship server is ColdFusion MX, a new version of the rapid server scripting environment that will be familiar to users of ColdFusion 5 yet transcends its predecessor in important ways. Under the hood, the platform has been completely rearchitected around J2EE to be singularly standards compliant and feature rich. At the same time, Macromedia has added powerful new capabilities to ColdFusion that will increase its value as a rapid application development solution as well as enable a new generation of rich Internet applications capable of delivering a more effective user experience.

### *Taking Standards Seriously*

With its new architecture and integrated support for Web services and XML, ColdFusion MX fully supports IT's essential checklist standards. In addition, ColdFusion MX is compatible with all major Web servers and operating systems, as well as Microsoft server technologies such as .NET, COM, and Exchange. Deep, accessible support for Microsoft technologies in a J2EE-based platform is emblematic of the nonsectarian solutions focus that makes ColdFusion MX (and Macromedia's MX strategy in general) so refreshing from an analyst perspective — and so valuable to developers.

Standards support in ColdFusion MX starts with Java. As Figure 1 shows, the platform rests atop J2EE 1.3-compliant infrastructure services. These can either be provided by an embedded server (in the ColdFusion MX Server product line) or by deploying ColdFusion MX on an existing J2EE server, such as JRun, IBM WebSphere, BEA WebLogic, or Sun iPlanet (in the ColdFusion MX for J2EE Application Servers product line).

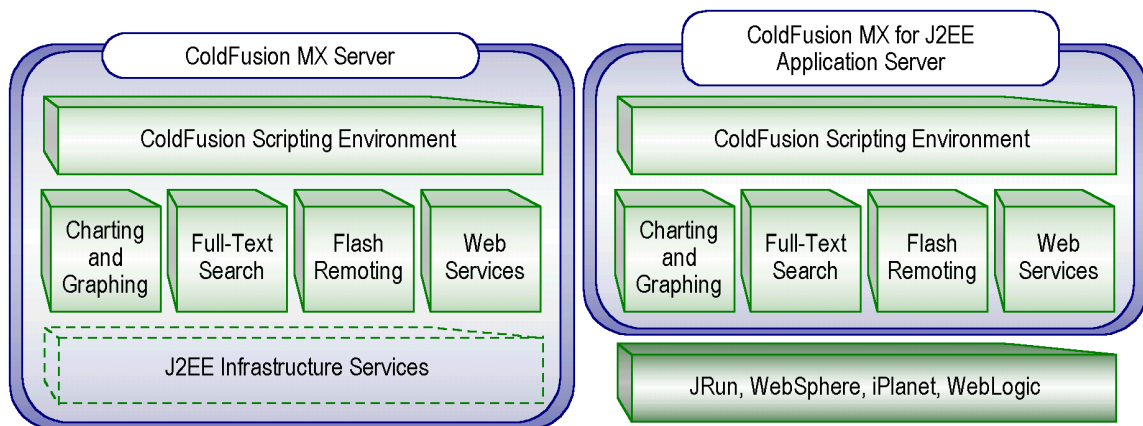
It is important to note that, although Java is at the heart of ColdFusion MX, developers generally work at the level of the scripting engine, enjoying greater productivity than that provided by Java development tools. Think of the platform as a rapid application development (RAD) system for the Internet. Programmers can work in Java or other lower level programming languages when necessary (or preferred) and then consume those components from within ColdFusion. However, the majority of programming tasks do not require developers to leave the high-productivity ColdFusion environment.

If Java is the platform’s foundation, XML is its industry-standard messaging infrastructure. As with Java, tag-based scripting in ColdFusion MX insulates developers from the tedium of directly manipulating XML documents. A built-in parser (Apache Axis) handles the low-level operations, while developers treat XML objects just like other ColdFusion data types. Scripting eliminates the need for the kind of node-by-node processing typical of DOM-based XML environments. ColdFusion MX also supports XSLT and XPath, standard technologies for navigating, filtering, and transforming XML data.

Native support for XML provides the basis for ColdFusion’s highly productive Web services implementation. Whereas development tools such as Sun’s Forte for Java and Microsoft Visual Studio .NET provide basic Web services functionality (essentially, SOAP with automated WSDL file generation), these environments require developers to micromanage most of the service creation, deployment, and consumption process. Working with Namespaces and Schemas — complex XML technologies required by Web services — can be particularly painful.

ColdFusion MX abstracts away much of this complexity, letting developers consume and publish Web services using the same concise scripting methodology as for other Internet programming tasks. Although the platform cannot perform magic — developers must still target (and correctly spell) methods and parameters when invoking a service — ColdFusion significantly reduces the labor entailed. Enterprises committed to building Web services and those at the pilot stage will benefit from this RAD approach to an emerging standard. Perhaps the most important aspect of ColdFusion’s Web services support is the uniform syntax it provides for both component-based and service-oriented development, discussed further in the next section.

**Figure 1: ColdFusion MX Architecture**



Source: Aberdeen Group, April 2002

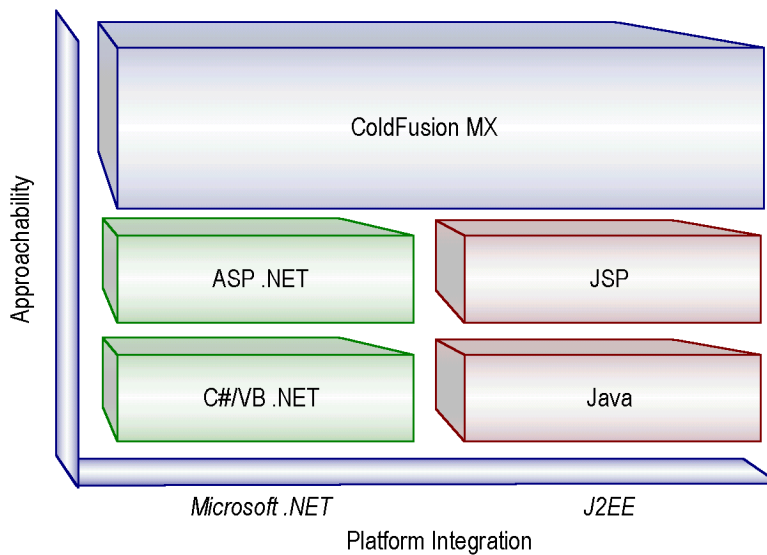
*Bringing Components and Web Services to the Mainstream*

As mentioned previously, scripting is the solution to two of IT's thorniest problems: complexity and productivity. The more complex a technology, the fewer developers will be able to master it and the greater the cost of retaining those resources becomes. Scripting is inherently simpler than low-level coding in languages such as Java, and the functionality of each line of code — in terms of value-added at the user interface, where it counts — is much greater for scripts than for source code. Accordingly, ColdFusion's scripting environment enables developers from a broad class of backgrounds to rapidly construct highly functional Internet applications.

Few companies understand server-side scripting the way Macromedia does. ColdFusion was among the first server scripting environments for the Internet; it was introduced by Allaire Corporation in 1995 as a means of streamlining database access via the Web. Both Microsoft's Active Server Pages (ASP) and Sun Microsystems' Java Server Pages (JSP) architectures are descendants of ColdFusion Markup Language (CFML). However, where ASP and JSP remain platform-dependent (on Microsoft and Java, respectively), ColdFusion abstracts the functionality of both to provide a vendor-neutral superset of scripting capabilities (Figure 2).

Moreover, ColdFusion MX extends the de facto standard CFML scripting language with new support for XML handling, Web services integration, internationalization (I18N), and the new ColdFusion component architecture. As a result, developers

**Figure 2: ColdFusion MX Bridges J2EE and .NET Technologies**



Source: Aberdeen Group, April 2002

of any skill level — both business developers with a Web design background and systems programmers skilled in Java or C# — enjoy access through ColdFusion to the gamut of enterprise functionality.

ColdFusion Components (CFCs) bring together the productivity benefits of rapid server scripting with the reusability benefits of component-based development. Like traditional ColdFusion pages, CFCs are simply files containing CFML code. They can be invoked via CFML in a Web page, from within Flash, or as a standard Web service. Indeed, to convert a component to a Web service in ColdFusion MX, a developer need only add the keyword “remote” to the component definition. That triggers automatic generation of WSDL (Web Services Description Language) files for the method, which can then be introspected and consumed by any SOAP client.

ColdFusion’s ability to expose any ColdFusion component as a Web service radically expands the platform’s ability to integrate with other technologies. Because there are CFML tags for invoking JSP tag libraries, Enterprise JavaBeans (EJB), and Microsoft COM objects, enterprise functionality encapsulated in these objects can be exposed, through CFCs, as a Web service. Aberdeen notes that, at the time of this writing, ColdFusion appears to be unique in its ability to surface eclectic combinations of back-end data and functionality, productively, through the platform-independent medium of Web services.

### *Usability and the Flash Connection*

Well known for its capabilities as an animation and design environment, Macromedia Flash, with its deep penetration in the browser and device market, has become a de facto standard for Internet content. Less widely known is the fact that Macromedia has steadily been evolving Flash into a robust client programming environment, culminating in the release of Flash MX. With the addition of a powerful client-side event model, prebuilt application components, and efficient new debugging tools, Flash MX is poised to stake a claim in the application development world.

ColdFusion MX supports tight coupling to Flash during design, debugging, and runtime. Specifically, the Flash Remoting Service, a native feature of the ColdFusion MX environment, provides a high-performance connection that runs over HTTP and enables Flash clients to communicate with components and services running on the ColdFusion server.

Used judiciously, Flash’s animation and interactivity can be the key to presenting more information, in more manageable chunks, while preserving intuitive navigation. Moreover, optimizing anything is an iterative process, and a tool that makes it easier to build, test, and rework application screens can directly feed the bottom line by raising user gratification, retention, and success. By shortening design cycles at both the presentation and business logic tiers, bidirectional Flash-to-

ColdFusion integration helps put designers, business developers, and end-users on the same page.

An example of the kind of rich ColdFusion application made possible by Flash is iHotelier, an interactive, data-driven online reservation system developed by system integrator Webvertising, Inc. Deployed by more than 30 hotels, to date, iHotelier compresses the normally multipage reservation process down to a single screen. Each user action — e.g., clicking on dates in a calendar — invokes a behind-the-scenes interaction with the server, giving the user immediate feedback on room availability and costs without refreshing the page and forcing them to reorient themselves. The overall experience is dynamic and gratifying.

In addition to Flash connectivity, ColdFusion MX sports other productivity features that contribute to usability as well, including the following:

- *Built-in charting and graphing:* Aberdeen research shows definitively that while superfluous graphics waste bandwidth and screen real estate, effective visualization aids are worth, at least, the proverbial 1,000 words. ColdFusion's integrated, high-performance charting and graphing engine eliminates the need to go outside Macromedia's tool set to script data-driven visuals.
- *Full-text, multilingual search:* ColdFusion's integrated search functionality ensures that the gamut of enterprise content — not just HTML but database content, and native file formats such as Microsoft Office — is fully accessible to users.

### *An Ecosystem of Tools and Integrators*

As one of the Internet's pioneering application platforms, ColdFusion brings not just technical infrastructure but also extensive complementary resources including a vibrant developer community, thousands of reusable CFML tags and other assets, integration with the award-winning Dreamweaver MX and Flash MX design tools, and Macromedia's extensive integrator network.

ColdFusion's integration with Dreamweaver and Flash is more than skin deep. A key feature of the new MX strategy is to give developers access to ColdFusion's powerful scripting features, including ColdFusion Components, XML handling, and interactive debugging, from within Macromedia's best-of-breed visual design and development tools.

From the first, Dreamweaver has been distinguished by industry-leading markup generation technology, which enables designers to build pages visually while preserving the quality and readability of underlying code. Dreamweaver MX extends this capability to the server side, giving developers full access to ColdFusion's powerful capabilities. Developers can define components directly within Dreamweaver, as well as introspect CFCs and Web services already published. Using

components or, equivalently, Web services is a matter of dragging the appropriate method onto a page and letting Dreamweaver generate the server-side script for invoking it. Component-based software development has never been this productive.

Both Dreamweaver and Flash now support ColdFusion's fine-grained debugging information, including round-trip execution times, variable values, exceptions, and template stacks. This data, exchanged behind the scenes via XML, is hyperlinked in the tool environments, enabling developers to navigate instantly to problem areas. Together, the troika of ColdFusion MX, Dreamweaver MX, and Flash MX radically expedites the development and debugging of rich Internet applications.

In addition to having a world-class reputation with developers, Macromedia extends IT's options through a range of solution and technology partners. Among the former are Computer Sciences Corporation, Booz, Allen & Hamilton, PricewaterhouseCoopers, Razorfish, and Deloitte & Touche — names that build confidence in the ColdFusion brand through investment in its continued success.

Augmenting these integrator partners are two newly announced technology partnerships with IBM and Sun Microsystems. Macromedia and IBM will partner on engineering, marketing, and sales to evangelize the highly productive combination of ColdFusion MX on IBM's WebSphere application platform. Similarly, Macromedia and Sun will jointly engineer and market ColdFusion MX for the Sun ONE platform (formerly iPlanet). Support from these major Java vendors reinforces the need for a solution like ColdFusion MX that can provide a more accessible and rapid development environment for the Java platform. The upshot for Macromedia customers is knowing that ColdFusion's technology and value proposition has been validated and is being leveraged by leading e-Business suppliers.

### **Aberdeen Conclusions**

Rapid application development through server-side scripting enables IT to realize the promise of industrial-strength platforms like Java and .NET without taking the productivity hit typical of component-based development. ColdFusion's strong, script-based support for XML and Web services brings the same degree of productivity savings to these emerging technologies, despite their being more complex under the hood than advertised. Moreover, Macromedia's focus, in the MX strategy, on enhancing user experiences is a key enabler of the next generation of Internet applications. ColdFusion's close integration with Flash and Dreamweaver gives both visually focused designers and code-focused business developers the tools they need to create and support these rich new applications.

Concerned that the productivity gains of scripting might come at the expense of performance and scalability, Aberdeen found instead that ColdFusion's J2EE foundation, based on JRun technology, is among the fastest in the industry. Evidence of ColdFusion's scalability can be found among the many prominent Web sites built on it — eBay's Half.com, Hertz, Victoria's Secret, UPS, Williams-Sonoma, Pottery Barn, and Bank of America, to name a few. In all, ColdFusion underlies mission-critical e-Business applications at 75 of the Fortune 100, attesting to the platform's strong and enduring industry acceptance.

Finally, through its seat on the Java Community Process (JCP) Executive Committee, as well as its participation in key working groups at the World Wide Web Council (W3C) and the Apache Software Foundation, Macromedia is in a position to exert a continuing positive force on the evolution of key Internet development standards. ColdFusion MX and JRun customers can be assured that their interests are well represented.

Aberdeen finds that ColdFusion MX, together with the rest of the Macromedia product family, provides one of the most productive e-Business platforms on the market. Organizations looking to ensure a favorable ROI by building on standards, leveraging resources, enhancing user experiences, and raising productivity for all classes of developers should thoroughly investigate ColdFusion MX.

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*Aberdeen Group, Inc.  
One Boston Place  
Boston, Massachusetts  
02108  
USA*

*Telephone: 617 723 7890  
Fax: 617 723 7897  
[www.aberdeen.com](http://www.aberdeen.com)*

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