Executive Summary

Despite growing investments in technology and the expertise to apply it, organizations of all sizes are questioning the ROI received from technology initiatives. For many organizations, a labyrinth of systems built up over the years now seems to be inhibiting growth rather than facilitating it.

Various technologies have been touted as solutions to the paradox, with little enduring success. For years, technology innovators have worked on the concept of simplifying application development and maintenance by building a library of reusable programs and using them as enterprise-wide “building blocks” – not only for system re-development, but also to encourage process improvement.

One manifestation of that concept is finally gaining traction. In business language, with minimal use of IT jargon, this white paper explains service oriented architecture (SOA) as a way to get more “bang” from the IT buck.

SOA can be defined as a set of business practices that encourages sharing and reuse of application functions throughout a network. When SOA’s tenets are followed, it encourages developers to look beyond the immediate project for enterprise-wide payoffs.

Most large organizations have either started SOA initiatives or plan to within a few years. According to Aberdeen Group, companies adopting SOA can save 25% of application development costs over a project’s lifecycle.¹

Readers of this paper will find:

- An explanation, in layman’s terms, of what SOA is and how SOA works, including some of the preferred technologies companies are using in implementation.
- Insights into why analysts believe that SOA has the potential to transform installed software from an inhibitor to a facilitator of rapid business change.
- An overview of the benefits that SOA can deliver for an organization.
- Equifax case studies and practical tips on implementing and managing an SOA approach.

¹ According to Aberdeen Group, companies adopting SOA can save 25% of application development costs over a project’s lifecycle.
SOA: a way to get more out of the IT budget

For most organizations, the high cost of maintenance leaves little left of the IT budget for innovation and development. In fact, experts say, many firms allocate as much as 80% of their IT budgets to maintenance. Efforts to modernize the business get scant attention when heavy resources are focused on keeping legacy systems running.

Over the years, developers have tried a variety of approaches to make development projects less grandiose and expensive. However, in spite of a plethora of technologies, methodologies and standards, nothing has proved to be the silver bullet that reduces waste, inflexibility and complexity. Each new trend seems to solve one set of problems only to create a host of new ones.

Now the buzz is service oriented architecture, or SOA. It promises to have staying power, experts say.

SOA is not new but has only begun to gain popularity in recent years. Long before its “cousins” XML and Web Services existed, organizations could build and deploy applications using SOA’s tenets.

SOA is not a standard or a technology. Rather it is a set of business practices for linking resources on demand. More specifically, SOA is a business planning method and software architecture approach that encourages sharing and reuse of application functions throughout networks.

As DMReview.com columnist Jeremy Westerman explains, SOA is “a way of architecting and organizing IT infrastructure and business functionality.” He further defines SOA as “a paradigm for designing, developing, deploying and managing discrete units of logic (services) within a computing environment.”

SOA is most effective when planners and developers take a long range view before initiating a project. Because designers must plan SOA applications as a collection of services, Westerman says, developers need to “think beyond the boundaries of their application and consider reusing existing services or examine how their services can be reused by their colleagues.”

Mark Hall, Computerworld: “… you’d better get cracking, because your company’s competitors are already embracing the SOA mind-set.”

SOA is ‘catching on fast’

Mark Hall, Computerworld’s editor at large, sees SOA as much more than a trendy IT development technique. “Done right, it’s a state of mind for your entire business. And it’s one that’s catching on fast,” Hall wrote in a recent column. “So you’d better get cracking, because your company’s competitors are already embracing the SOA mind-set.”
Yankee Group surveyed 306 U.S. organizations in fall 2005 and found that 100% of them had started or planned to start SOA initiatives within two years.4

According to a 2005 Gartner report, 80% of enterprise development projects will be based on SOA by 2008. Gartner noted that SOA shifts developer focus from software to business functions. This creates the potential to transform installed software from an inhibitor to a facilitator of rapid business change. Instead of relying on monolithic, single-vendor suites, organizations gain freedom to use a best-of-breed approach with modular offerings from multiple vendors.

Aberdeen Group, found that 68% of the companies it surveyed in 2003 were engaged in SOA projects—and 98% were planning to be engaged in SOA projects by 2007. Aberdeen estimated that SOA adoption can save 25% of application deployment costs over a project’s full lifecycle. Global 2000 companies can therefore potentially save $53 billion in IT costs if their SOA plans materialize.

Aberdeen sees far-reaching implications to SOA’s momentum. One result, Aberdeen predicts, is a stronger alignment between IT and the business. “Ultimately, the SOA promise is about giving IT a higher level of predictability in delivering IT, from technical capabilities to business value,” states the report.5

The ABCs of SOA

Any novice to SOA will soon encounter a host of acronyms and definitions. This paper attempts to hold those to a minimum, but here are a few of the basics.

The focal point of SOA-based development is the service concept. A service is a logical grouping of components to satisfy a business requirement. Services are building blocks that can be logically grouped to create composite applications. The logic of a business process can be changed by adding an additional component to the service without requiring changes to the composite application.

Components are executable programs comprising a service. The greater the granularity of components, the stronger the developer’s ability to reuse and leverage them.

- **Business components** handle specific tasks based on business rules. Examples: Credit rating and fraud detection.
- **Technical components** manage data and handle other chores necessary for application development but independent of business processes. Examples: Data compression and password management.
Web Services, XML and SOAP have emerged as preferred ways to implement SOA.

- Web Services are the middleware that enables and simplifies Web application-to-application connectivity. They allow applications to share data. A Web Service in Application A can call a service in Application B without regard to the applications’ operating systems, platforms or programming languages.

- XML (eXtensible Markup Language) is a standardized set of rules that enables automatic manipulation of data without needing advance knowledge of the structure. XML allows Web Services to link up on demand using loose coupling. Even if loosely coupled services are technically incompatible, they can still be joined together to create composite services.

- SOAP (Simple Object Access Protocol) is an XML-based scheme that allows computers to talk to each other over a network such as the Internet, typically as part of a Web Service. SOAP can send any type of data between applications, even if the applications are built on different platforms. When SOAP messages are encapsulated in HTTP, they can be sent through firewalls and across the Internet.

How does SOA work?

The four diagrams below illustrate the relationships of components and services and how applications request and deliver them via the Internet.

A library of components, whether public or proprietary, is called a registry. The registry tracks the various service components available for reuse and publishes them to potential consumers.
In this simple example, components provide the building blocks for two services. Note that the second service, Loan Acceptance, is created simply by adding another component to the two components that comprise the Loan Worthy service.

Here, a client application requests both services.

4: Internet Connectivity of Client Applications

For easy connectivity across applications and the Internet, the request for a service and the response are encapsulated in HTTP as SOAP messages.
How SOA delivers business value

The hallmarks of a sound SOA implementation are:

- Simplicity
- Flexibility and ease of maintenance through decoupling of functionality and technology
- Reusable services
- Operational sustainability

From a business perspective, the growing adoption of SOA can be attributed to several of its key advantages:

**SOA is evolutionary.** Existing applications and IT environments can remain intact. Developers can unify business practices without disturbing the code of legacy systems. Key business processes are “wrapped” and redeployed as “services,” and key user interfaces as “portlets,” and both can then be reused by other applications.

**SOA is a way of doing more with less.** By fostering code reuse and simplifying maintenance, SOA increases productivity and cuts development cycle time and risk. Developers can build a business process component, a data handling component, or a user interface once and then reuse it many times throughout the enterprise without redevelopment or retesting.

**The value of SOA grows geometrically over time.** As services and portlets accumulate, applications can be built more quickly and incrementally by reusing existing assets. This cumulative inventory improves development productivity, makes IT estimating and budgeting more precise, speeds time to market, and slashes maintenance costs.

**SOA is a catalyst for business process improvement.** Reuse is SOA’s low-hanging fruit, but it may be just the tip of the iceberg. Many experts believe the greatest gains from SOA are generated by process improvement.

Once an enterprise embraces SOA and makes it part of the corporate culture, end users will join IT professionals in creating major business value.

“Rather than talk about SOA as allowing ‘reuse’ of services, I view it as a layer that will facilitate ‘repurposing’ of existing corporate assets. It is the layer that will enable the layer of process management above it.”

*Duane Nickull,*
Senior Systems Strategist, Adobe Systems
Chair, OASIS SOA Technical Committee
Managing SOA

To operate effectively, any enterprise-wide IT initiative must have some mechanism for monitoring results and assuring adherence to management’s plans. Implementing an SOA approach is no exception.

SOA increases the level of cooperation and coordination required between business and information technology, as well as among various IT departments and teams. An organization courts disaster if it fails to manage all SOA initiatives throughout the enterprise.

_Governance_ refers to the internal management and communications ingredients of these initiatives. Without strong governance, it will be virtually impossible for SOA initiatives to take root in the enterprise and flourish as a catalyst for innovation, productivity and process improvement.

Governance establishes mechanisms and policies used to measure and control the way IT decisions are made and carried out within an enterprise. For SOA, governance controls the monitoring, definition, and authorization to change existing services. Governance creates guidelines for reusable services—in particular, how services will be designed and developed and how those services will change over time. These governance roles include rules, policies and guidelines for:

- Assuring that people who need SOA services can find them
- Protecting the integrity and visibility of services
- Documenting the inter-relationships of services
- Assuring that services comply with enterprise standards and practices
- Mapping business processes with enterprise applications
- Establishing agreements between the providers of services and the consumers of those services
- Informing recipients what they can expect, and providers what they are obligated to deliver

In short, governance gets everyone working together toward common goals by maintaining oversight and accountability.

In most organizations, the CIO should be responsible for implementing governance for SOA initiatives. Aberdeen Group, reporting its survey of SOA implementation in Global 2000 companies, found that 41% of survey respondents cited “limited visibility for SOA value” as the top challenge to SOA adoption. Aberdeen called for CIOs to “more fully embrace SOA as a strategic blueprint for the IT organization” and to take key steps for effecting change within their organizations.
Recommended actions for implementing SOA practices include establishing strategic planning and dedicated budgets for SOA, elevating the role of business analysts, developing SOA metrics, and mastering new technologies that facilitate SOA.

In addition, experts recommend establishing a center of excellence for SOA. Such a center would establish governance policies, implement SOA best practices, and mentor teams responsible for developing services and applications.

**Show Me the Money**

Few industry observers paint SOA as a panacea. In fact, most experts candidly point out that implementing SOA in an enterprise takes time, money and management commitment.

However, unlike some enterprise-wide technology crusades that required massive restructuring and multi-year implementations before benefits materialized, SOA lends itself to a “walk before you run” approach. As noted earlier, SOA initiatives are typically evolutionary, not revolutionary, so mission-critical legacy applications do not have to be ripped out and replaced before benefits appear.

**Equifax and SOA**

Equifax has been gaining experience with—and value from—SOA since 2002. Four examples of successful SOA initiatives at Equifax are described in the remainder of this paper. Briefly, the projects are:

**Case Study A: Office Accounting**

_Linked credit reports to Microsoft Office Accounting 2007_

Frictionless communications is the buzzword for what’s happening here. Learn how Equifax and Microsoft used Web Services to seamlessly integrate Equifax commercial credit products into Microsoft Office Accounting 2007.

**Case Study B: eQuiCom**

_Migrating legacy applications to an eBusiness framework_

When Equifax built an SOA-based platform to assist internal developers, some of the biggest beneficiaries turned out to be external users.

**Case Study C: InterConnect®**

_Improving business decisioning processes_

When SOA is astutely employed, end users gain immense power to add value to the business. That’s what happened when Equifax developed InterConnect.
Case Study D: APPRO®

Designing an SOA-based loan origination application “from the ground up”
Why replace an industry-leading loan origination and management application that has high customer satisfaction? Because SOA makes the APPRO application even better.

Case Study A: Office Accounting
Linking credit reports to Microsoft Office Accounting 2007

In 2006, Microsoft and Equifax collaborated to include a set of integrated, easy-to-use commercial credit reporting services for small business users of Microsoft Office Accounting 2007. Businesses will be able to continually and cost effectively monitor the credit worthiness of their customers, vendors, and their own business directly from within their accounting software package.

Office Accounting users install this application on their desktop and the application accesses Equifax commercial credit information using Web Services over the Internet. Through an interface with Office Accounting 2007, Equifax provides commercial credit data products and credit monitoring services. Small businesses can access summary business credit profiles on their customers, suppliers, and vendors as well as monitor these profiles for adverse credit changes. They can also receive a complete Business Credit Report with credit score on their own business. When a change to a business profile occurs, Equifax will notify the Office Accounting end user, who can then view the change and take appropriate action, all from within the Office Accounting package.

Overview of the architecture

The Office Accounting software, which is part of the Microsoft Office 2007 suite, is a “thick client” installed on the desktop of an individual small business owner. This software communicates with Equifax via a Web Service to provision the small business credit report and monitoring products. The Web Services invoked include Registration, Login, Get Account Information, Account Update, Get Credit Report, SKU Maintenance and Cancel Account. The Web Services layer between Microsoft and Equifax is used to manage and fulfill small business credit information using components of eQuiCom, an SOA-based platform Equifax uses to spur development of consumer services (additional details are covered in the following Case Study B).
In this solution, both Microsoft and Equifax are Web Service providers and consumers. The architecture diagram below details the Web Services interaction.

The Equifax portion of the solution uses Web Services to provide two key capabilities: authentication and verification of the user, which allows them to access Equifax products, and delivery of Equifax products through Microsoft Office Accounting 2007. The Equifax application’s Web Services validate the Office Accounting user, then call another Web Service for Microsoft Passport. Users can then sign on to the Equifax application to manage their account and order Equifax credit products.

Equifax’s solution for Microsoft Office Accounting 2007 illustrates three benefits of SOA:

1. **Interoperability**
   While the Office Accounting application uses Microsoft .Net technology, the Equifax application uses J2EE technology. The Web Service solution provides a relatively easy way to integrate these disparate technology platforms so both companies can easily share data.

2. **Loose coupling**
   SOA and Web Services enable friction-free linking of services. Information is discovered at the time it is needed. Once an application learns of a service’s existence, it has immediate access to the service’s capabilities, location, policies, interfaces and supported protocols.

3. **Reduced complexity by encapsulation**
   The Equifax application is encapsulated by providing only the required Web Services. The eQuiCom platform provides customer management, order management, billing and provisioning of the products. The few tasks Microsoft Office Accounting requires from eQuiCom are exposed as Web Services.
Case Study B: eQuiCom

Migrating legacy applications to an eBusiness framework

Credit information services are provided to consumers through Equifax Personal Solutions. The product line includes a current, snapshot view of the consumer’s Credit Report as well as subscriptions providing ongoing credit monitoring with alerts of any changes to an individual’s file.

The company was incurring significant costs in developing, deploying and maintaining multiple versions of the legacy applications supporting this product line. Separate applications were needed for different countries. Each application also encapsulated all of its components into one deployable unit. Any changes or enhancements to data sources, payment providers and sales/delivery channels required costly redeployment of the entire application.

In 2002, Equifax launched a project to migrate all Personal Solutions to eQuiCom, a new SOA-based platform intended to support the entire product line, both in the US and international markets. The project team designed a layered architecture to facilitate some critical business goals:

- Promote reuse of services and quick development of applications across business units and geographies
- Support common functions while facilitating required customizations for different business units
- Simplify development of new consumer products to extend the product line
- Manage consumer orders for credit services across various channels and geographies

The developers overcame several challenges: Legacy application code had to be analyzed for reuse; key legacy modules were “wrapped” as Web Services with an SOA approach. A design was created for developing, maintaining and deploying common services. Throughout the initiative, multiple data integration and migration issues were identified and resolved.
Overview of the architecture

Only four months after gaining approval on the eQuiCom business case, the developers had completed and deployed the new platform. eQuiCom’s architecture includes a payment module to communicate with internal and external payment sources and a fulfillment manager linked to internal and external data sources. In addition, the architecture incorporates a service distribution hub serving consumers and partners through Internet, off-line, and application-to-application channels. Common services, such as Order, Catalog, Authentication and Billing, are supported through a common data structure, or the Shared Information Model. This is also commonly referred to as a Common Object Model for SOA services-based data structures.

Developers also created a data integration service to integrate existing data sources and to provide the ability to add new data sources. Existing business logic targeted for reuse was encapsulated into business services and implemented using Enterprise Java Beans with J2EE as a wrapper. All services were implemented as Web Services so that they can be used externally if desired.

Using eQuiCom’s Software Developer Kit (SDK), developers can quickly configure new products. For example, the SDK provides capabilities to build alert-oriented subscription products and to customize business services for individual applications. In addition, eQuiCom has its own Solution Developer Portal, which provides all necessary documentation to build new applications.

eQuiCom illustrates the following SOA benefits:

1. **Shorter development/deployment cycles**
   The project team assembled a Personal Solutions suite for Equifax U.K. using the new eQuiCom platform within 90 days – concept to production. SDKs facilitated concurrent development of new applications by geographically isolated resource teams.

2. **Skill set expansion**
   SOA opens new career doors for IT professionals by giving them new skills and perspectives to accomplish more with finite resources. Equifax parlayed this opportunity in several ways—notably, the SDKs and the Solution Developer Portal.

3. **Extension of internal value to external partners and customers.**
   Although the business case for eQuiCom was based on internal benefits, Equifax customers and partners share in those benefits through faster deployment, more frequent updates, and better matching of capabilities to their needs.
Case Study C: InterConnect
Improving business decisioning processes

Since the 1980s, Equifax has been a leading innovator of automated credit risk decision solutions, and has continually expanded its product line to meet increasingly complex market needs. With more than 600 customers relying on Equifax to support the decisioning process of their credit operations, Equifax was challenged with soaring demand for custom changes and unique features.

To reduce development, deployment, and ongoing maintenance costs, Equifax sought to minimize the proliferation of redundant services and custom code. New technologies were available that enabled developers to offer applications that could be easily used and changed by nonprogrammers. To handle requests for customization in an efficient and timely manner, Equifax developed a new decisioning platform, InterConnect, that can:

- Respond dynamically to changing workflows, market needs, and regulatory requirements
- Streamline the deployment and change management processes
- Integrate a significant inventory of decisioning and process management capabilities into one integrated platform
- Enable products and services to be leveraged individually or in aggregate to support customer business needs

Overview of the architecture

InterConnect developers elected to use a business rules management (BRM) system to empower end users with the abilities to test, change, and control rules used throughout the decisioning process. By enabling business rules to be stored and managed separately from other application logic, a BRMS is a key supporting technology for SOA and business process management.

Without the BRMS approach, InterConnect’s SOA foundation would have been severely weakened. The conventional alternative — using hard-coded decision logic wrapped into a Web Service — hampers maintenance, reuse, agility, auditing and governance, and documentation. By putting the design and maintenance of decisioning rules into the hands of end users, InterConnect’s BRMS frees SOA-savvy developers to maximize SOA’s value to the enterprise. Moreover, end users gain greater insight into the workings of mission-critical decisioning processes.

InterConnect’s BRMS is integrated with IBM WebSphere Process Server, a key element of IBM’s SOA offering. The BRMS extends the WebSphere business integration platform, offering enterprise rule repositories, decision tree support, and tools for rule simulation and testing.
InterConnect illustrates several additional benefits of SOA:

1. **High flexibility and maintainability.**
   InterConnect creates a powerful rule-authoring environment for business users. Customers gain agility, insight and control in managing the business rules of their credit policy. By decoupling functionality (business rules) from hard-coded programs, InterConnect encourages product and process innovation, dramatically simplifies maintenance, and frees IT professionals for other tasks.

2. **Service transparency**
   Standard programming techniques, such as Java and C++, tend to create “black box” modules of code that are virtually undecipherable by anyone not involved in their initial creation. InterConnect, by embracing the reuse value proposition of SOA, enables service transparency. Business rules and other services are truly understandable, reusable, and easily adapted to new environments or requirements.

3. **Reuse**
   No longer must lenders hard-code their decisioning rules into multiple applications and then try to keep them all in sync. Credit applications that use the same decisioning can share the same rules, regardless of channel. Business rules can be edited on the fly without the need for IT programming support.

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**Case Study D: APPRO**

**Designing an SOA-based loan origination solution “from the ground up”**

When Equifax announced a new Web-based loan origination system in early 2006, at least 200 lenders raised interested eyebrows. Even though the company’s LoanCenter™ product line, which included solutions for originating business and consumer loans, enjoyed a strong user base and high customer satisfaction, Equifax developed APPRO 3.0, a new system designed for optimum flexibility in usage and deployment.

Using this single platform for all business and consumer loan processing needs, lenders can reduce complexity, cut costs, speed up enhancements, and adapt rapidly to internal and market-driven changes.

**Overview of the architecture**

Equifax opted for Microsoft’s .NET as the new platform’s technical foundation and SOA as its development philosophy. SOA was selected because it provides maximum agility in meeting business needs and opportunities. To achieve SOA’s full benefits, IT management specified that the application’s design must follow SOA principles “from the ground up.”
APPRO 3.0 is designed as a single platform underlying multiple editions of the product. The first two editions launched were APPRO Business lending and APPRO Consumer lending.

The diagram on the next page describes the system starting at the lowest tier and working up through the technology layers.

- The Integration Layer manages external system-to-system interactions — exposing the extensive capabilities of the APPRO service to other systems in a high-performance, secure and controlled manner (e.g., respecting data validation rules, security access rights, and exception handling).

- APPRO has a Data Access Layer that abstracts the physical structure of the database from the upper-tiers and also provides optimized read-write access to all information sources.

- Over the Data Access Layer is the Business Layer that contains the functional capabilities and rules of the system. These elements are fine-grained objects that are designed for reuse.

- A Service Layer overlays the Business Layer and controls the overall workflow and orchestration of its components, while providing a simplified programming interface to the User Interface or system-to-system Integration Layer that exposes core business features.

- The Presentation Layer uses the Service Layer to request business activities and control workflow and system state changes based on user requests (such as pulling a credit history for an applicant) and system activities (such as creating adverse action letters after the user configured number of days has elapsed).

APPRO 3.0 illustrates several benefits of SOA:

1. **Easy to understand, test, change and reuse**
   All APPRO product editions that need a specific decision type or evaluation of data can use the same decisioning rules. The rules are driven by parameters that can be adjusted by the customer.

2. **Loose coupling**
   APPRO 3.0 uses SOA-based services to link with dozens of data sources, applications and third-party vendors. With friction-free linking of services and applications, true integration can be achieved based on the workflow of the institution across systems.

3. **Maximum agility in meeting business needs and goals**
   APPRO 3.0 leverages SOA’s common approach to service creation and definition, which lets Equifax quickly construct or modify services as needed. This enables services to be used as building blocks with predictable performance and costs.
Diagram of Technology Layers of APPRO 3.0 System
Our Take on SOA

The Equifax experience to date with SOA has been positive. Its promise has been borne out in practical terms, and its evolutionary approach is consistent with our overall corporate goal of profitability. SOA allows IT to keep existing applications intact while selectively re-deploying key business processes as services that can be reused by other applications.

As an early adopter of SOA, Equifax is experiencing on-going expansion of its benefits, internally and externally. We continue to put SOA’s tenets into practice, and once-skeptical developers now are enthusiastic SOA proponents. The more SOA-based initiatives we undertake, the greater the gains produced for both Equifax and our customers.

6. An important terminology distinction: The term Web Services refers to the technologies that enable you to make connections. Services are what you connect together using Web Services.
9. “Wrapping” refers to making legacy code SOA-enabled by surrounding it with a software layer that hides the program’s unwanted complexity.
Contributing Authors

Tom Lenahan, a vice president of Equifax, has over 24 years of experience in marketing, enterprise software product management and software engineering management. Mr. Lenahan is currently responsible for Enterprise Services, which are core software assets that are defined, developed and delivered as common services or shared components for use across the Equifax product portfolio.

Rashid Desai, a vice president of Equifax, is responsible for leading the development of business and consumer data products and platforms. In his previous role in Equifax, he set up a Global Project Management Office, which established an application portfolio based project planning and management methodology for IT. He also established overseas software development centers for Equifax.

Jeff Milne, assistant vice president of product development for Equifax, has more than 22 years of experience pioneering complex, global commercial software applications with such companies as Oracle, Deloitte Consulting, and Bell Labs. He has a BS degree in Computer Science and an MBA degree. He is certified as a Project Management Professional (PMP®).

About Equifax

Equifax Inc. is a global leader in information technology that enables and secures global commerce with consumers and businesses. We are one of the largest sources of consumer and commercial data. Utilizing our databases, advanced analytics and proprietary enabling technology, we provide real-time answers for our customers. This innovative ability to transform information into intelligence is valued by customers across a wide range of industries and markets. Headquartered in Atlanta, Georgia, Equifax employs approximately 4,700 people in 13 countries throughout North America, Latin America and Europe. Equifax was founded 107 years ago, and today is a member of Standard & Poor’s (S&P) 500® Index. Our common stock is traded on the New York Stock Exchange under the symbol EFX.

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