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Department of Homeland Security

Report on Messaging Middleware and Integration Infrastructure Solutions

Based on the Federal Enterprise Architecture Framework Technology and Service Reference Modules

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REPORT ON MESSAGING MIDDLEWARE AND INTEGRATION INFRASTRUCTURE SOLUTIONS

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Executive Summary

"When we award contracts and grants, we are not going to buy anything anymore that is proprietary and doesn't interoperate and doesn't intercommunicate."

The CIO council has released the Federal Enterprise Architecture Framework seeking to develop, maintain and facilitate the implementation of top-level enterprise architecture for the Federal Enterprise.
Steve Cooper, CIO, Homeland Security Department

This document presents an overview of Fiorano solutions that specifically address the current and future requirements of the FEA framework. Fiorano's infrastructure products and tools have a decentralized, distributed architecture that maps well to FEA requirements by easily scaling to thousands of geographical end-points. Based on standards including Web Services, XML and Java Messaging technology, Fiorano infrastructure solutions allow easy integration with existing legacy infrastructure that abounds within current organizations, significantly reducing the costs of solution deployment and maintenance. Finally, Fiorano solutions are built ground-up on top of the latest standards for event-based distributed computing, making them inherently more integrated and easy to use than incumbent solutions. These solutions can be implemented incrementally and in a non-intrusive manner.

Making the Federal Enterprise Architecture (FEA) Vision a Reality using Fiorano Solutions Meeting Federal Enterprise Architecture Requirements and Goals It is our belief that achieving complete coordination and instant information sharing between various Intelligence Agencies and Enforcement Agencies of the government holds the key to the success of this initiative. E-Gov solutions often require data that come from multiple back end systems and databases associated with multiple organizations and functional areas. Addressing the Technology Reference Model (TRM) and Segment approach. We list below some of the key requirements listed under the Technical Reference Model of the Federal Enterprise Architecture initiative followed by a brief description of how Fiorano technology and products meet these initiatives:

1. FEA Initiative: Standards-based Interoperability

Eliminate use of proprietary software dependencies - The Federal Government should try to adopt and use voluntary industry standards in which the interrelationships of components are fully defined by interface specifications available to the public and maintained by group consensus. The Federal Government should acquire and integrate preponderantly only those components conformant to these standards specifications.

Fiorano Solution:

Fiorano ESB (Fiorano Enterprise Service Bus) supports multiple industry standards, including JMS, XML, XSLT, JCA, J2EE and .NET technologies. In addition to this, Fiorano is a member of leading standards organizations such as the EAI Industry Consortium, BPMI.org & one of the first implementers of the Sun Microsystems' Java Message Service. Enterprise messaging is now recognized as an essential tool for building enterprise applications. By combining Java technology with enterprise messaging, the JMS provides a new, powerful tool for solving enterprise computing problems. Fiorano has established itself as the leader in the JMS market by creating the most scalable, reliable & fastest JMS on Sun's specifications. Fiorano's latest released JMS; FioranoMQ 7.1 is compliant with the latest JMS 1.1 specification and is dedicated to continue its leadership position by complying with the standards.

2. FEA Initiative: Data Standardization

A common organization and vocabulary eliminates redundancy and ensures data consistency. This is particularly important for E-Gov solutions that cross-traditional organizational and functional boundaries that previously represented separate islands of data.

Fiorano Solution:

Fiorano ESB provides for visual data mapping and transformation tools that allow data of one format to be mapped to a target system or transformed to another data type. Visual XSL Style sheet development tool for developers to quickly and easily defines transformations. The transformation tool provides a complete graphical environment for creating; managing and testing XSL Style sheets. Database replication is supported via Standard DB adapters available from Open Adapters (which are shipped with the Fiorano ESB platform). These include industrial-strength adapters being widely used for Oracle, SQL, Sybase, etc. Fiorano ESB ships with built in native INBOUND and OUTBOUND adapters for Oracle, SQL, Informix, Sybase as well as DB2.

3. FEA Initiative: Security

The goal is to secure Federal information against unauthorized access. Appropriate security monitoring and planning, including an analysis of risks and contingencies and the implementation of appropriate contingency plans, must be completed to prevent unauthorized access to Federal information.

Fiorano Solution:

Both FioranoMQ and Fiorano ESB provide standards-based Security. The suite's ACL-Based, J2EE and LDAP compliant security gives administrators fine-grained control over the execution of Fiorano applications and services on machines across the network. Administrators have complete control for implementing security at both the server and component level. Fiorano ESB implements JAAS (Java Authentication and Authorization Services) for interfacing with third party JAAS compliant tools and security databases. The authentication module ensures identity verification of security principals and authorization using ACL's (Access Control Lists). A two level grouping mechanism is also provided for simpler administration of permissions for a group of related principals. Additionally, each Fiorano service can be digitally signed. Fiorano ESB also provides SSL-based transport level security, employing RSA and DSA encryption. Fiorano ESB also provides authentication realms based single sign-on ability. Fiorano's highly configurable, comprehensive security system allows application security to be easily configured by an external visual Administration tool. The FioranoMQ security system is completely standards-based and implements the Java security API.

4. FEA Initiative: Component Reusability

The goal is to take advantage of standardization based on common functions and customers. Federal Agencies should develop or design reusable components, or purchase architecture components, recognizing that these items are designed to obtain a particular functionality. Standardization on common functions and customers will help Federal Agencies implement change in a timely manner. For E-Gov solutions, this applies both to components that support common E-Gov functions across Agencies, and components that are needed to support multiple E-Gov functions.

Fiorano Solution:

Fiorano ESB is based on the notion of components that are high-level software applications that include Web Services. Users compose business processes by connecting multiple component instances using visual tools, while the Services Operating Platform provides the run-time deployment infrastructure across the network for the execution of the resulting business process. Fiorano ESB platform incorporates a component-based architecture that supports visual tools for the composition and dynamic deployment of business processes. Within the Fiorano ESB framework, instances of the same component can easily be reused in different distributed applications because each instance is completely independent of and has no dependencies on other instances of the same component. Data routing being external to the component instance itself, allowing easy reuse of components across applications.

5. FEA Initiative: Proven Technologies

The goal is to select and implement proven market technologies. Systems should be developed based on global data classes and process boundaries. Systems should be decoupled to allow maximum flexibility. Incorporating new or proven technology with full consideration to risk mitigation strategies will help Agencies to cope with change. This principle is particularly challenging in the E-Gov environment where technologies change and proliferate constantly.

Fiorano Solution:

Fiorano's JMS Server was chosen to implement the Justice .NET project of the Commonwealth of Pennsylvania. The world's leading companies including Lockheed Martin, NASA, AT&T Wireless, American Express, Motorola, Federal Express, Boeing, Qwest Communications, KPMG, JP Morgan, and Pohang Steel Company (POSCO) rely on Fiorano's solutions that help integrate their business applications reliably and securely. Our standards-based solutions provide seamless interoperability across diverse applications and systems that help your business maximize operational efficiencies. FioranoMQ is the leading JMS-compliant messaging server on the market today, with over 250 deployments. Fiorano's products and solutions eliminate the use of proprietary software dependencies. All of these will help isolate agencies from traditional interoperability issues of the underlying hardware and software platforms because Fiorano products are based on standards. Our customers choose Fiorano based on our proven, comprehensive, interoperable and affordable solutions. Fiorano's products are backed by a 24x7 technical support team that ensures a higher level of customer satisfaction. Fiorano-certified partners provide solutions built on top of Fiorano's products into diverse verticals ranging from Financial Services, e-Gov, Manufacturing and Telecommunications OSS systems.

6. FEA Initiative: Integrating Legacy Applications

Legacy Applications abound in existing installations requiring a massive integration effort. Legacy Applications contain the vast majority of the Federal Government's detailed business logic and operational data. Integrating the business functionality and/or data from these systems will be the key challenge facing many E-Gov Initiatives.

Fiorano Solution:

FioranoMQ provides for Bridges to interact with other legacy messaging systems like MSMQ and MQSeries. Fiorano also solves the problem of integrating Legacy Systems (with non-TCP/IP) protocol with the new breed of PC's through a Gateway server. Fiorano ESB can also be used to build easy-to-modify business processes with loosely coupled, business components derived from existing J2EE, .NET, C/C++/Legacy applications and Web Services.

7. FEA Initiative: Platform and Language Independence

The Federal Government should adopt open system standards in which the interrelationships of components are fully defined by interface standards available to the public and maintained by group consensus. The Federal Government should adopt, acquire, and integrate those components that conform to specification. Open system architecture is the goal; however, initially only partially open systems will be attained. This principle could lead to use of JAVA and future JAVA-like protocols, which give a high priority to platform.

Fiorano Solution:

Fiorano develops multi-platform integration infrastructure solutions addressing the needs of enterprises that need to rapidly compose and deploy easy-to-modify business processes. Fiorano ESB is platform-independent and can run on any of the Agencies' existing Operating Systems including: Win 32, AS/400, Macintosh, Solaris, OS-390, VAX-VMS, Linux, HP- UX, and UNIX

Fiorano ESB can run on any platform and language to offer increased applicability:

- Application Server Neutral - Compatible with Weblogic, Websphere, Jboss and others
- Re-usable Components can be developed in multiple languages including C, C++, Java, COM, .NET (C#), Visual Basic, Active X, and Scripting Languages, etc.

- Enhanced support for multiple Data stores and RDBMS's like MSSQL Server, Oracle 7.x onwards, Btrieve, MS-Access, Sybase, DB2 and others.

8. FEA Initiative: Risk Mitigation

In order to properly manage security, a risk assessment and risk mitigation strategy should be developed, and the owner at each level of the enterprise architecture needs to understand and accept the residual risk. This process should be an integral part of the certification and accreditation of all E-Gov solutions.

Fiorano Solution:

Fiorano defines a new breed of Component-based programming as the process of creating software applications by visually connecting objects together on a screen. Component-based programming is performed at a level of abstraction that is higher than the normal level of algorithms and data structures employed by programmers building solutions using various programming languages. The power of synthesizing business processes from pre-built, pre-tested software components is akin to the power of using spreadsheets to create financial models. This not only allows for components to be shared globally between different Federal agencies but also reduces the risk associated with IT projects not getting completed in time. The unique brokered peer-to-peer architecture enables an incremental spending model with a low price of entry for Enterprise Integration solutions reducing the risk tremendously. The addition of each Fiorano Peer Server automatically increases overall availability and enhances load balancing within a distributed environment. Fiorano ESB thus enables a "Build as you grow" business model. Fiorano ESB comes with 100+ Packaged and Legacy Adapters and can work with other Messaging Oriented Middleware (MOMs) such as IBM's MQ Series, Microsoft's Message Queue, and TIBCO's Rendezvous etc.

9. FEA Initiative: Reduced Costs

The Federal Enterprise Architecture vision and principles are based upon recent laws that address the importance of getting results, obtaining maximum return-on-investment and cost efficiency of operations, providing quality information and technology, protecting privacy, maintaining secure information, and providing service to the public.

Fiorano Solution:

Fiorano's solutions enable a fine-grained control over scalability. Entry level costs are significantly lower than the competition. Architectural-level innovations enable a linear build-as-you-grow scalability, which ensures optimum performance that meets rapidly changing business demands. Enterprises consist of distributed computational resources. Fiorano's distributed solutions enable leveraging all the power available at the endpoints of the network. Businesses can meet dynamic surges in demand without having to provision new systems, deliver undisrupted services and increase customer satisfaction. Reusability means lesser costs of hiring an army of consultants to re-write monolithic blocks of code. Fiorano ESB thus offers a far more scalable approach with its brokered peer-to-peer architecture, decreasing costs with the reuse of each service. Unlike incumbent solutions which are a patchwork of products, Fiorano ESB provides a truly distributed architectural framework developed from ground up allowing organizations to fully leverage their existing IT infrastructure investments.

10. FEA Initiative: Intra/Inter Agency Integration

Intra/Inter Enterprise Integration provides the backbone linking E-Gov solutions to other E-Gov solutions and legacy applications and data both within and outside the Federal Government. Many E-Gov Initiatives involve value chains that cross existing functional, organizational (including outside organizations such as State Government or Industry), and system boundaries. This may require integrating multiple systems (in multiple organizations) on a near real time basis, and with transactional robustness. The resulting E-Gov solution is really a composite application that combines processing and data capabilities of multiple systems into one end-to-end solution.

Fiorano Solution:

Fiorano ESB solves the problem of integration between Enterprises, especially where high volumes of transactions were required. These services also include request/reply mechanisms like Web-Services.

Web Services are an emerging Intra/Inter Enterprise Integration approach to allow one application to discover and use the capabilities of another application. Fiorano's products are based on a service-oriented architecture where loosely coupled software components allow seamless integration with web-services and have support for SOAP, WSDL & UDDI. Using Fiorano ESB one might deploy three different adapters as Web-Services and have them communicate with each other to solve a business problem. In addition Fiorano ESB also helps integrate these Web-Services with other Services.

Fiorano Integration Middleware – Enabling Real Time Agency Interoperability

We believe Fiorano's Middleware Integration Products – FioranoMQ (JMS Server) and Fiorano ESB (Enterprise Service Bus) would meet Homeland Security's process and technical requirements. Fiorano ESB is a brokered Peer-to-Peer integration platform that provides an "Application Management Framework" for messaging based applications. Fiorano ESB, which sits on top of FioranoMQ, provides the real-time Event management, Control and deployment infrastructure interfacing with the existing JMS Applications deployed on top of FioranoMQ. FioranoMQ provides the underlying high-performance, high-volume messaging infrastructure for transporting data and files.

Fiorano powers Justice NET project in State of Pennsylvania One installation, which is one of the earliest large-scale deployments of JMS, is the criminal justice system in Pennsylvania. In August 1996, the governor's office launched Justice Network (JNET), a project linking law enforcement departments to keep them informed of material events. In 1998, FioranoMQ was chosen to implement the JNET Criminal Justice System at the State of Pennsylvania for real time information exchange by Intelligence Agencies. JNET executive director Linda Rosenberg said, "We wanted to tie in the motor vehicles agency, the parole department and other agencies so that when an arrest was made, for example, anyone looking for the suspect would be immediately notified."

To do this, Rosenberg hired KPMG Consulting to design a solution. KPMG's chief architect on the project, Dave Woolfenden, explained the central problem in the design: "The traditional approach to this problem was to create a centralized database that would be used by all agencies, and to force the agencies to migrate to it. But experience has shown this does not work well. The records used by the department of transportation, the courts and the police have very different formats and layouts, so creating a master database would be almost impossible. Likewise, creating a database that would abstract the data from various departments is unworkable. Then, departments would have to update the master database each in their own way and on their own schedule resulting in a database that was not always current".

"Ultimately, we settled on publish/subscribe messaging; where departments could subscribe to any individual they were interested in. Should the suspect show up at a welfare agency or be pulled over for a traffic stop, this information would be published to all subscribing parties in real time."

KPMG's Chief Architect on the Project, Woolfenden said, "Once we were on to this idea, we looked at a lot of technologies. While investigating CORBA-based solutions, we came upon JMS, and since we were already using Java, its use in JNET made a lot of sense." JNET chose a package from Fiorano Software.

Zemin Luo, the chief architect of infrastructure for JNET, said, "We chose Fiorano because they had shipping product and because Fiorano had PKI implemented in its package. And we definitely needed PKI security." Once Fiorano was brought in, the JNET team wrote an API layer above JMS.

Today, JNET allows real-time notification of any events of interest for anyone that Pennsylvania law enforcement is tracking. The detailed case study for the JNET implementation may be viewed at http://www.fiorano.com/resources/successstories/successstories.php

Linking Multiple Agencies in Homeland Security

Fiorano's products can be used to link up various Federal department Applications like FBI, INS, Customs, Border Patrol, Coast Guard and the Local Police. Using Fiorano's products it would be possible for these various departments to seamlessly exchange valuable information that would significantly reduce data redundancy and error-occurrence, and improve operational efficiencies.

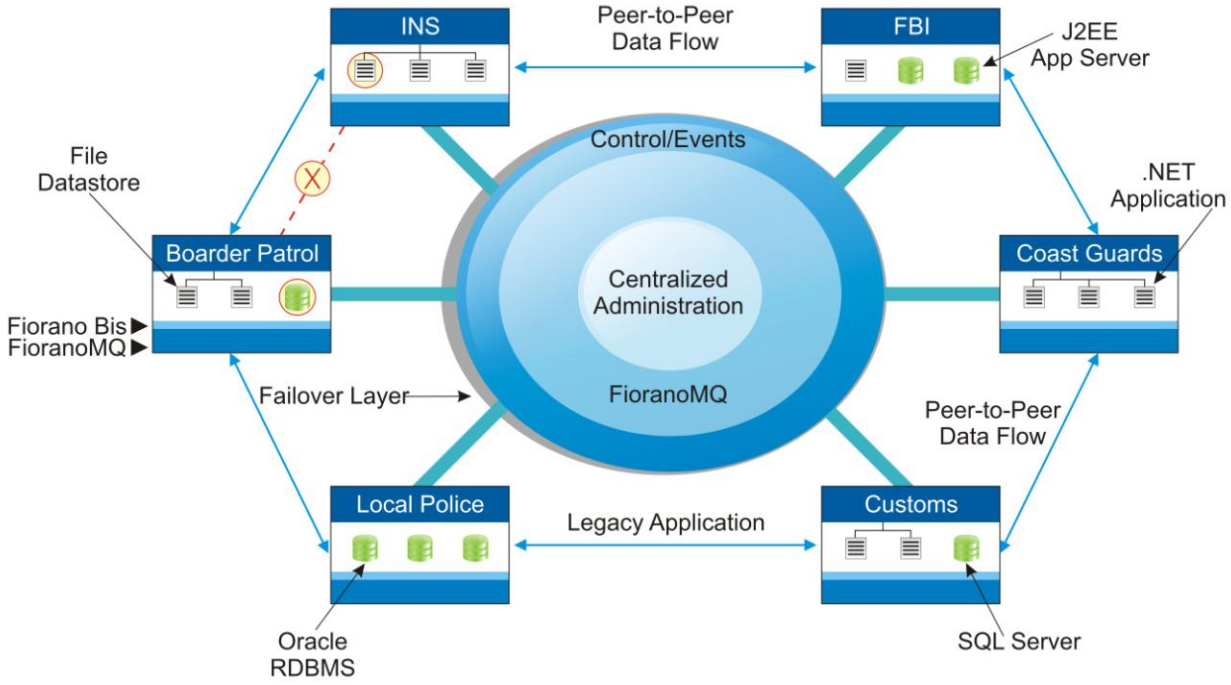


Figure 1: Fiorano Distributed Architecture In Action - Real Time exchange of information flows between Agencies across multiple platforms

- Advantages to e-Gov solutions with Fiorano middleware
- High-Performance Guaranteed Message Delivery

FioranoMQ software implemented at each network node guarantees message delivery with no loss of information, while also providing optimal performance because of its file-based data store. End-to-end latency is also minimized.

Centralized Administration and Control

All of the FioranoMQ as well as Fiorano Peer Servers can be administered centrally, allowing a single network operations center to monitor and control the overall implementation.

Service-Oriented Architecture enabling Re-usability

Fiorano's products are based on a service-oriented architecture where loosely coupled software services can be easily and quickly integrated. Fiorano enables a simpler, affordable and scalable approach that enables Component-based Business Process Composition. Using the notion of coarse-grain programming techniques to create a palette of reusable components, the creation, prototyping, production and ongoing management of composite applications can be made as simple as manipulating numerical macros in a spreadsheet as used today. Integrated Monitoring, Tracing, Logging and Dynamic Deployment Fiorano ESB is the first solution that allows enterprise managers to achieve the above in a non-intrusive manner, by allowing the actions of people and individual applications to be easily monitored and tracked. With Fiorano ESB, the impact of creating a monitoring solution is minimal, since existing applications can simply interact with Fiorano ESB via HTTP post operations with no complexity. There is no change to existing processes - it's just that using a simple Fiorano-based solution, the enterprise gets to know about their precise business flows and can closely monitor the interaction of people with enterprise business processes. This allows the enterprise to built accountability between people and processes by tracking their activities non intrusively. The component- based infrastructure incorporates built-in monitoring and remote tracing and logging, allowing the time for deployment of new services to be reduced dramatically (typically by 25%-30%). FioranoMQ is the leading JMS-compliant messaging server

on the market today, with over 250 deployments and sites that include AT&T Wireless, Macromedia, Martha Stewart, ABWatley, Lockheed Martin and many other companies, with many customers delivering over 5M messages per day.

Comprehensive Security

Fiorano ESB provides comprehensive Security Management. Fiorano ESB is designed to easily and seamlessly integrate with enterprise security policies. Role-based access control for multiple principals including nodes, users and services is built into Fiorano ESB. J2EE standards-based security is provided at the infrastructure layer (consisting of messaging, peer servers and transport layers) and at the services layer - both inside and outside corporate firewalls. Transport layer security is provided using SSL.

Architectural Limitations of Current Solutions

The following sections discuss the architectural limitations of current infrastructure solutions like “Hub and Spoke Systems” and the “Peer to Peer” systems.

Hub and Spoke Systems

Currently available platforms for distributed computing, including Application Servers and Messaging platforms are based predominantly on a hub-and-spoke architecture. In this architecture, most computations including data-transformation, message routing and transaction commits and rollbacks are typically performed at a central ‘hub’, with results being distributed to the ‘spokes’ as required. Hub-and-spoke systems are easy to administer, since all important information traverses the hub, where it can be easily inspected, allowing appropriate actions to be taken. Unfortunately, hub-and-spoke systems tend to scale poorly. Since all communication between the spokes has to traverse the hub, the hub quickly becomes a communication bottleneck as more spokes are added to the system. As data rates increase, the hub gets saturated, eventually requiring additional load to be handled by additional hubs. Clustering hubs is one way to get around the scaling problem, but it is inelegant and difficult at best and is not a solution that maps naturally to most distributed systems.

Peer to Peer Systems

In direct contrast to hub-and-spoke systems are peer-to-peer (more simply, P2P) platforms, in which computation is performed at the endpoints of the network, with data flowing directly between nodes as required without traversing any central hub. P2P platforms allow the components of a distributed application to exchange data in parallel. For instance, the order management system in a manufacturing plant can check inventory status at the same time as the sales-force management system is updating the order database. Further, data transformations and other computations required by the distributed application are performed (in parallel) directly at the endpoints of the network as far as possible. With dispersed computation and parallel data flow between nodes, P2P systems scale naturally and seamlessly with the addition of new peer nodes across the network. The efficiency and scalability of P2P systems, however, come at the price of increased administrative complexity. Multiple peer-nodes across the network need to be administered separately, and state information may often be spread through the network, making state tracking and transaction management more difficult.

Combining the elements – Brokered peer-to-peer systems

An ideal distributed computing platform combines the ease of administration and conceptual simplicity of a hub-and-spoke architecture with the efficiency and scalability of a symmetric P2P architecture. The Fiorano ESB architecture follows this approach, using a brokered peer-to- peer approach. In Brokered P2P architecture, key operations such as data routing and service deployment are performed directly between network end-points; while other operations (including workflow processing, event-handling and long-lived transactions, for instance) are performed by centralized servers. While remote deployment and external peer-to-peer data routing (without involving any centralized message bus) leads to easier configuration management and higher scalability, the centralized controller modules provide single-point administration and management support to the entire business, defining rules for coordination within and across business units. The Brokered P2P approach thus combines the benefits of both peer-topper systems and hub-and-spoke systems in a single cohesive architecture for scalable distributed computing.

While this architectural approach is clearly appealing, it has many subtle implementation and design challenges, which we believe has been a Myth versus Reality – Messaging & Integration Infrastructure.

Table 1: Myths versus Realities with a Message-Driven ESB

Myths endorsed by current process-driven Integration solutions	Reality: The Message-Driven ESB Effect
Adding a new service takes 2-4 weeks	Zero-latency service modifications enabled by re-usability of message-driven Services
'Certified Delivery' of messages consumes valuable networking bandwidth	Peer-to-peer data transport obviates any penalties of networking bandwidth
Process changes necessitate service downtime and hence lost productivity	Dynamic service replacements without downtimes – no productivity disruptions
typically tied to particular platforms - Java or Microsoft's .NET	Standards-based, interoperable with either Java or .NET platforms
Expensive solutions, often over $1,000,000	Equivalent benefits at a fractional cost, typically less than $200,000

For more details on Fiorano ESB Architecture, please refer to the following link
http://www.fiorano.com/products/fesb/products_fioranoesb.php?src=homelandsecurity_wp

For more details on Super-Peer Architectures, please refer to the following link
http://www.fiorano.com/whitepapers/dc/fiorano_superpeer.php?wp=dc?src=homelandsecurity_wp

Benefits to Department of Homeland Security

Today it is more critical than ever for government agencies at the federal, state and local levels to efficiently collect and analyze information from a wide variety of sources, and to redistribute that information as quickly as possible to other organizations that may need it. Due to the large volume of data that government agencies work with, the varying sensitivity of that data, and the large number of disparate legacy technologies used to manage that data, it can be very difficult for government agencies to efficiently distribute information internally and across organizational boundaries.

Fiorano technologies can effectively meet the FEA initiatives of the CIO council and provide the DHS with the following benefits:

Promote Federal Interoperability:

Fiorano's Integration middleware can immensely enhance Interoperability between various departments by effective data exchange at real-time. Fiorano's products are interoperable with either J2EE or .NET platforms. Fiorano ESB can co-exist with any J2EE (compatible with Weblogic, Websphere, Jboss and other application servers) platform to offer increased applicability. Using Fiorano ESB, re-usable components can be developed in multiple languages including C, C++, Java, COM, .NET (C#), Visual Basic, Active X, Scripting Languages Also, Fiorano ESB also provides enhanced support for multiple Data stores and RDBMS's like MS-SQL Server, Oracle 7.x onwards, Btrieve, MS-Access, Sybase, DB2.

Promote Agency Resource Sharing:

Within the Fiorano ESB framework, instances of the same component can easily be reused in different distributed applications because each instance is completely independent of and has no dependencies on other instances of the same component. Data routing being external to the component instance itself, allowing easy reuse of components across distinct Federal and State agencies.

Provide potential for Federal and Agency Reduced Costs:

Entry-level costs for Fiorano's are significantly lower than the competition. Architectural-level innovations enable a linear build-as-you grow scalability, which ensures optimum performance that meets rapidly changing business demands. In addition to this, increased component re-Improve ability to share information and in Real Time Fiorano can effectively enable government agencies to more effectively manage and distribute information by connecting incompatible applications and coordinating the flow of

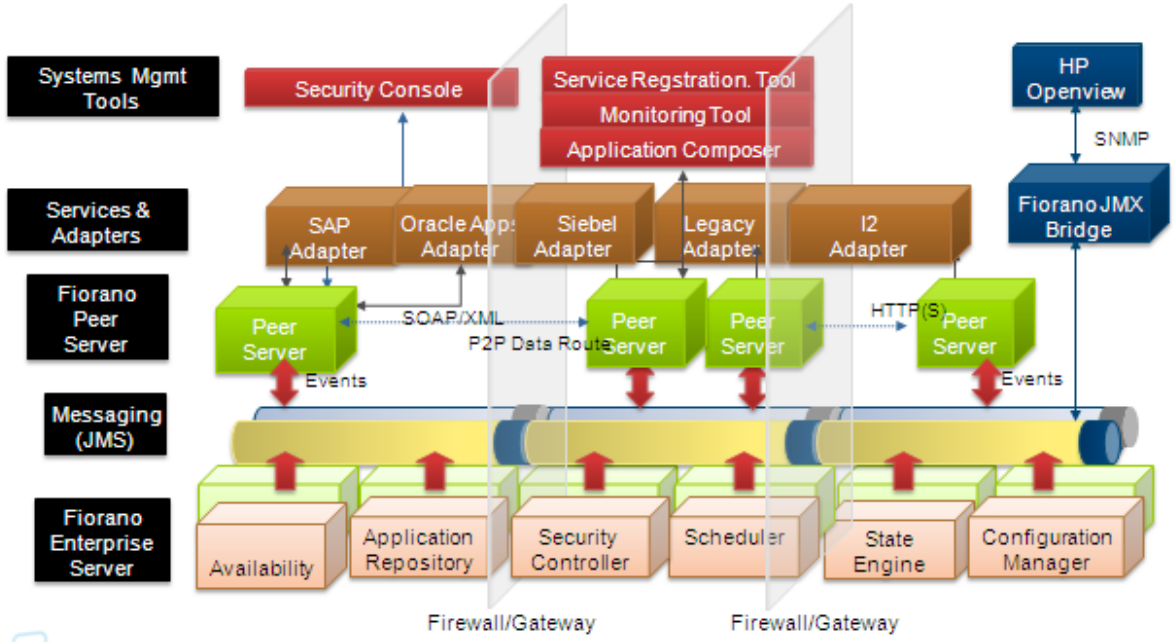
information and processes that span them. These solutions can improve the way government agencies collect, analyze and redistribute data, which eliminates redundancies and disconnects across and between organizations. Mitigate risk through a segment approach and realize returns quickly Fiorano's solutions provide decision-makers an easy-to-use framework to design and deploy business processes, while simultaneously providing detailed visibility and debugging support for business process developers. Decision makers can focus on scenario analyses, risk mitigation and better decision-making without having to burden their core developers for routine process modifications and changes.

Appendices

Appendix A: Fiorano Software – GSA Approved

Fiorano - GSA Approved and Department of Defense registered Fiorano is a qualified Small Business and an approved vendor on the General Services Administration List, registered with the Central Contractor Registration of the Department of Defense (DOD).

Appendix B: Fiorano ESB – Architecture Diagram



About Fiorano Software

Fiorano Software (www.fiorano.com) is a leading provider of enterprise class business process integration and messaging infrastructure technology. Fiorano's network-centric solutions set a new paradigm in ROI, performance, interoperability and scalability. Global leaders including Fortune 500 companies such as Boeing, British Telecom, Credit Agricole Titres, Lockheed Martin, NASA, POSCO, Qwest Communications, Schlumberger and Vodafone among others have used Fiorano technology to deploy their enterprise nervous systems.