Integration Patterns
IBM Redbooks Solution Guide

Today's customers expect you to be relevant to their life. Relevancy is not generic; it is specific to the customer in the moment. To remain relevant, enterprises must expand and engage with the customer and with third parties (developers) to support the customer. It is time for innovative solutions (see Figure 1).

Application programming interface (API) management delivers the business centricity and business model that many service-oriented architecture (SOA) initiatives historically have lacked, and SOA delivers the experience and engineering discipline that drives good API design and provides robust integration to systems of record. API management and classical SOA governance are highly synergistic. API management refocuses on the business aspects of human and software interactions. The advent of APIs allows you to separate the business concerns of making an API a successful product from the IT concerns of providing the service that implements the API. The journey from IT-centric web services to business-centric API management is necessary for enterprises that build systems of interaction spanning beyond their enterprise walls. API management solutions provide can define an API and project that API into an ecosystem that the enterprise cannot effectively reach through its own user solutions.

Figure 1. Opportunities for businesses to innovate

Did you know?

Mobile users are intrinsically impatient and always on the move; in fact, the average mobile user spends around 60 seconds in a mobile app before moving to something else. This means that mobile interactions must be personal to be relevant. They must be in the here and now. The modern user expects you to know who they are and what they need now. These characteristics represent an opportunity for enterprises that understand how to embrace them and provide a differentiating customer experience.

Business value

What is called the *Nexus of Forces* (http://www.gartner.com/technology/research/nexus-of-forces/) by Gartner is the confluence of mobile, social, cloud, and big data analytics. The Nexus of Forces implies an experience where context is key and important interactions might not be directly related to business transactions but rather focused on building social relationships and ecosystems. Social interactions of interest to the business can and will happen between two third parties (such as viral content).

Many interactions are mobile and happen in a real-time context. You can access information, accounts, or contact a friend dynamically. The growth of social media created a consumer who expects their opinion to matter and chooses the mobile device as the way the consumer interacts with the world. These characteristics change the scope of what is considered business relevant.

For businesses that are ready to grow beyond the enterprise, the Nexus of Forces raises some key questions and challenges around defining a business model and engineering the business solutions that support it:

- Where do transactions happen? Anywhere and anytime; this is the essence of mobile and cloud.

- Who can influence your business? Anyone that publishes an opinion, positive or negative; this is the essence of social.

- Who can access your information? Anyone that you can legally provide it to, whether in exchange for money, influence, or improved relationships. Applying big data analytics to vast amounts of available information sources lets you provide unique value and insight (particularly in the context of the Internet of Things).

- What is an application? Any piece of software that provides value (including mobile apps, software that is embedded in appliances or cars, cloud services, and so on).

- Who is your developer? Anyone that builds business solutions by using your information or services. In an open ecosystem, it is often someone who is not employed within your own enterprise.

More engaging applications and processes intelligently use the context of a business interaction to optimize the experience. Context is crucial to optimizing the offers that are made to a particular customer, and context is a necessity for making that customer feel like they are being treated as a person rather than just a general business opportunity (see Figure 2). Human society is accustomed to people taking into account everything they know about us as a factor in how they choose to interact.
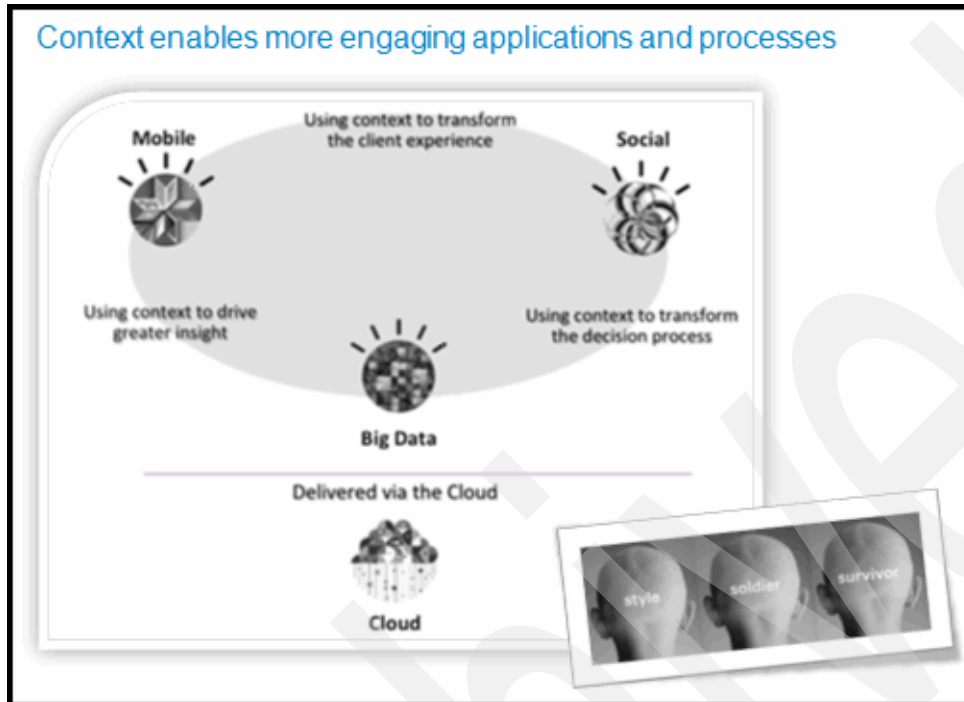

Figure 2. Engaging applications and processes

You generally do not interact in the same way with a person who is bald by style, a person who is a soldier, and a person who is a survivor. Just knowing their physical appearance is not sufficient; you must know who they really are to make the optimal choice of how to interact. In the world of software and processes, the Nexus of Forces changes the way that your business operates by allowing you to apply the same type of contextual reasoning that you apply in the physical world.

Solution overview

To be an engaging enterprise requires embracing an open ecosystem, using sound SOA principles while delivering APIs as part of a business product, carefully promoting and managing your external business persona, and creating a fundamental topology that aids in understanding the different roles and purposes of integration middleware products. The separation of capabilities (into messaging, integration, and gateway) forms that fundamental topology.

Classical SOA middleware focuses on creating and managing software services. The other three middleware ingredients of the API and service economy (Figure 3) are centered around the following concepts:

- Designing and optimizing a business persona through the definition and management of easy to consume APIs.

- Providing developer portals and participating marketplaces to make potential consumers aware of your APIs and the support of onboarding and self-service in a controlled fashion.

- Making the consumption of APIs as easy as possible, including supporting uniform hybrid composition across a multitude of providers, environments, and technologies.
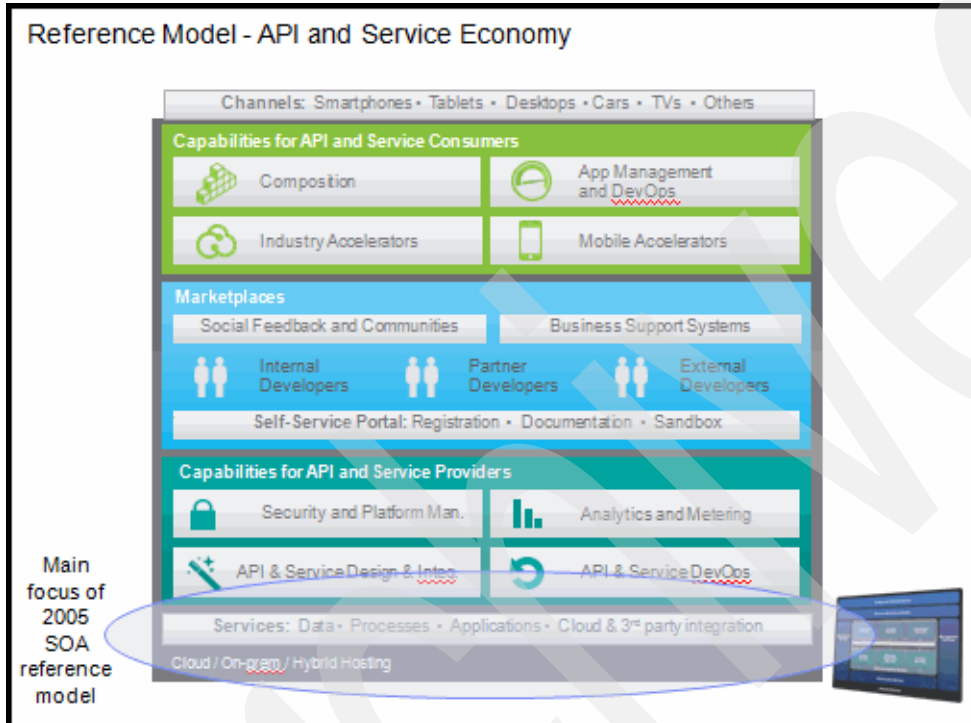

Figure 3. API and service economy

Many of these capabilities are known in isolation but must be integrated in new ways. Other elements require fundamental innovation and a different approach to delivery. IBM® has a recipe for more engaging and innovative business processes (see Figure 4).
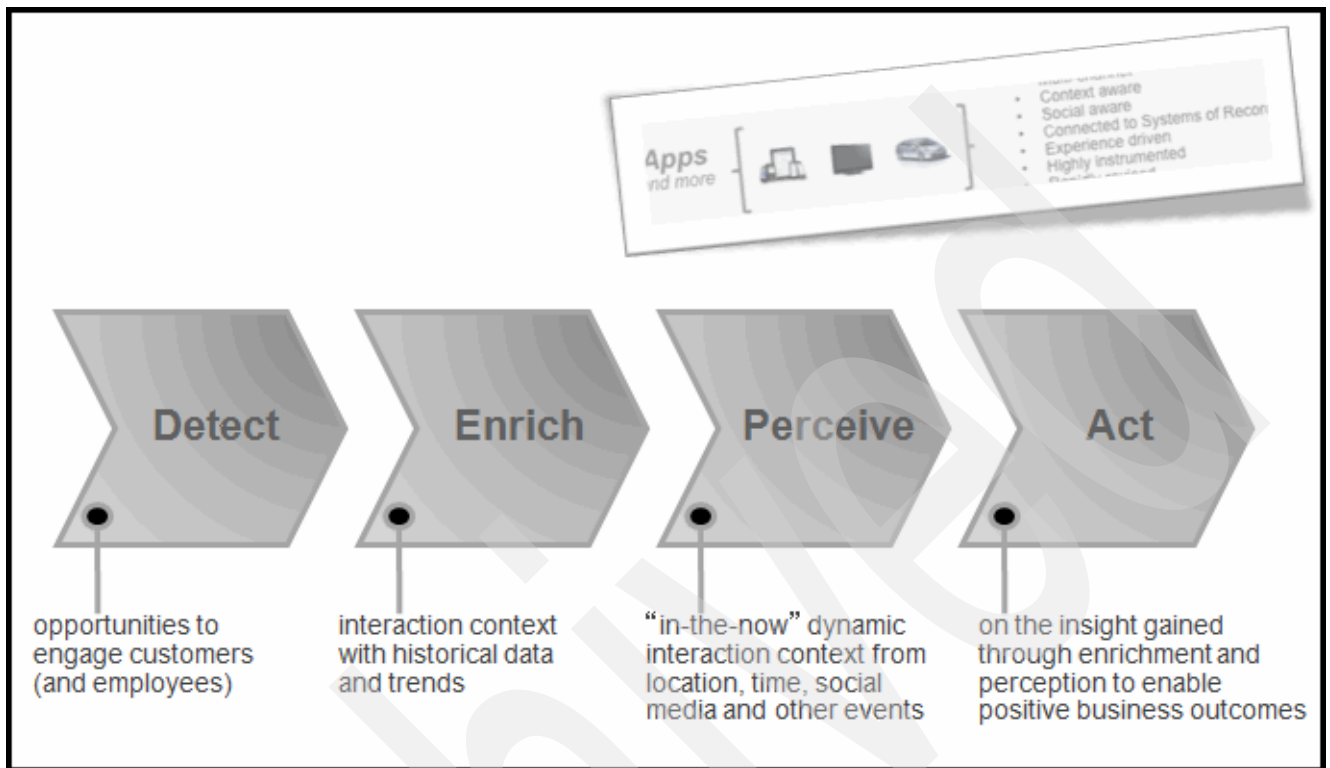

Figure 4. Business process innovation

To cover the four ingredients in the recipe, consider them from a retail perspective:

- Detect: A customer is detected walking down the street close to one of your stores.
- Enrich: Deepen the understanding of the situation through knowledge about that customer's previous buying behavior.
- Perceive: This particular customer tweeted last night about going on a beach vacation soon.
- Act: Send an SMS with a promotion on swim wear.

In only a few seconds, you created a unique and personalized experience. This more personal experience for the customer improved the chance of generating business, and might have strengthened the long-term relationship with the customer.

Solution architecture

Systems of interaction drive more engaging applications and processes by seamlessly and intelligently integrating systems of engagement with systems of record. This is an integration that crosses the boundary between the controlled enterprise environment and the uncontrollable Internet of Things (see Figure 5). This integration reaches from the mobile device to the corporate back end. Direct connections across this boundary are inappropriate and dangerous. Personal information typically is involved, which requires a secure and managed connection, and the traffic originating outside the boundary is internet scale in terms of both volume and spikes. So, traffic must be controlled and optimized to prevent bringing down the enterprise IT infrastructure.
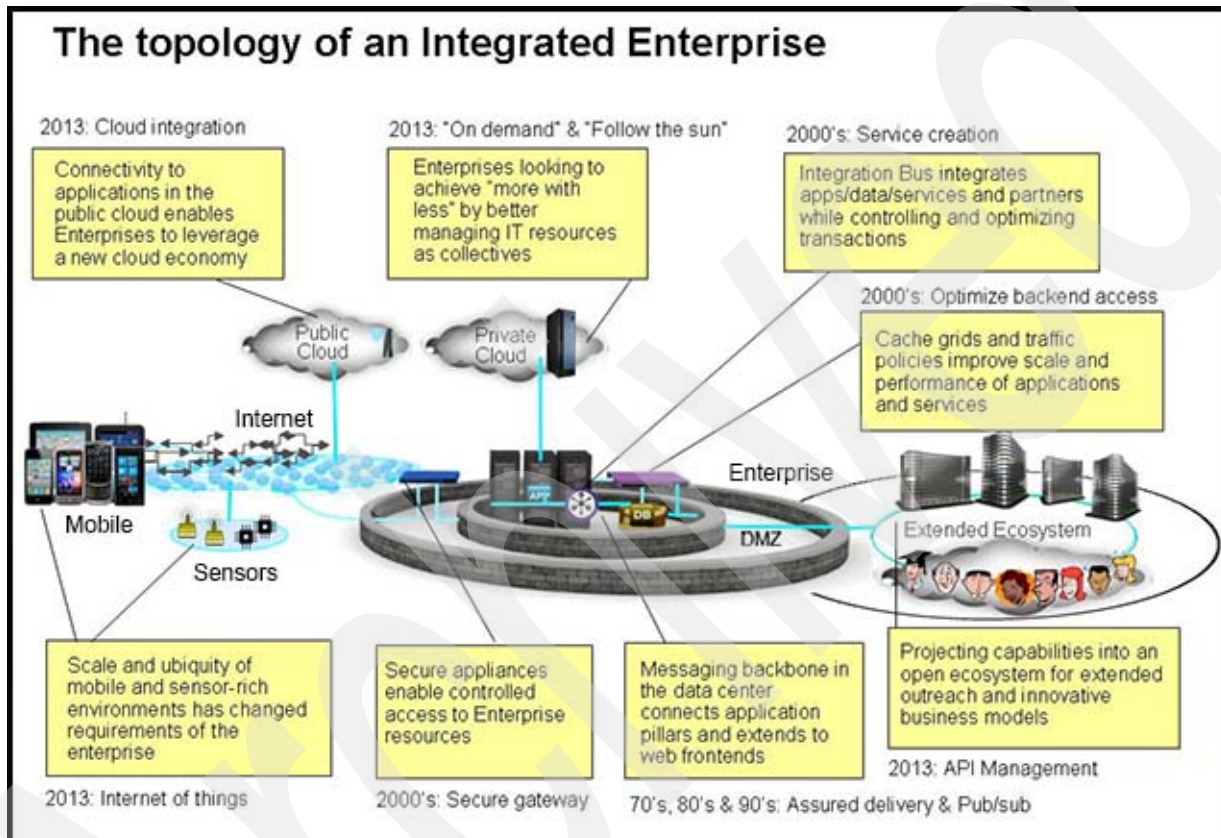

Figure 5. Interaction and the changing world

In the context of integration throughout and beyond the enterprise, this situation implies an important distinction between the fundamental parts of your topology:

● Messaging: Moving information payloads from A to B in a reliable fashion. At the heart of messaging is the ability to move an information payload from origin to destination in a controlled and reliable fashion.

● Integration Bus: Creating structured assets and services that are based on existing data and functionality. At the heart of an Integration Bus is the ability to create reusable assets. The Integration Bus is the topology component that is closest to the classical notion of an enterprise service bus (ESB). The ESB is a general pattern embodying the SOA concept of consumers and providers that is mediated in a loosely coupled fashion. An Integration Bus is a particular embodiment of the ESB pattern that is centered around integrating resources within a zone of control. Although an Integration Bus provides mediation and composition of any conceivable type of resource, it does not provide the advanced security and traffic controls that are necessary for a gateway.

- Gateway: Exposing APIs and services across a boundary in a controlled and optimized fashion. The concept of a gateway represents the topology component sitting on the boundary between systems of engagement and systems of record, or any other boundary of interest. Even though a gateway, by its nature, does support some amount of mediation, it is different from an Integration Bus. The difference stems from the fact that the gateway architecture is optimized towards control and throughput rather than towards aggregation of data and functionality (which is the focus of an Integration Bus). Gateways have advanced security and traffic control (a smart and efficient pipe), but no composition and limited mediation. Gateways typically are limited to a few standard protocols, such as SOAP and REST.

The Nexus of Forces drives new business agendas and information needs. However, what drives the design to support such business innovation? SOA design principles are a key ingredient in building systems of interaction that are flexible, robust, and extensible.

Three fundamental aspects (Figure 6) are part and parcel of SOA:

- Service: A repeatable business task (such as checking customer credit or opening an account)
- Service orientation: A way of thinking about your business through linked services and the outcomes they provide
- Service-oriented architecture (SOA): A business-centric architectural approach that is based on service-oriented principles

Figure 6. Service-oriented architecture

A service as an abstract representation is important; it allows the service to be projected and accessed beyond the boundary of a physically controlled environment. A service as a representation of a business task is important for designing collaborative business systems beyond pure software integration. Finally, mediation, which is an intrinsic part of the enterprise service bus pattern and a fundamental building block of SOA, supports intelligent pairing of consumers and providers of services. This mediation functions whether those consumers and providers are software or people (see Figure 7).

Figure 7. SOA between consumers and providers

The design principles that aid building such collaborative systems must be broader than the criteria for what constitutes a good service. IBM believes that the following SOA design principles are also fundamental to building systems of interaction:

- Service orientation at the core: Thinking about business solutions in terms of interacting processes and services.

- Process integration at an internet scale: Ensuring integrity of interactions and information across time and location.

- Integration with enterprise capabilities and back-end systems: Providing a unified experience across channels and systems, which maximizes existing capabilities to drive new innovative processes.

- A basis in industry standards: No single player or vendor can dictate protocols or information standards.

- Providing the platform for a growing ecosystem: As the business ecosystem grows beyond the walls of the enterprise, so does the ecosystem that delivers and manages business solutions.

The last bullet is what the excitement around web APIs is about: growing the development ecosystem beyond the enterprise as a means for extended business outreach.

Usage scenarios

An online store and a social networking service, although adopting different business models, are both examples of early adopters of a computing model that is open by design and where the product is based on APIs and services that are projected into an extended ecosystem. Without its open merchant platform, the online store cannot be the one-stop shop for various goods and might not have become one of the dominant internet retail portals. Without the open interface to its communication servers, the social networking service cannot rely on a myriad of smart clients being provided for, at no cost, by various open source communities, and might not have achieved the popularity that it enjoys today. These are just two examples of a trend across all industries where solutions are first designed for an open ecosystem, whether those solutions are deployed internally, externally, or in a hybrid fashion. It is no coincidence that "mobile first" and "cloud first" are some of the mantras of this new age of computing. This new age is marked by designing for a different experience and environment yet allowing solutions, where appropriate, to still run within the enterprise or using traditional channels.

Integration

IBM has a sophisticated set of products that simplify integration and quickly solve a wide range of problems:

- IBM WebSphere® Cast Iron® and IBM WebSphere DataPower® XH40: Connecting to applications in the public cloud enables enterprises to use a new cloud economy.

- IBM Workload Deployer and IBM PureApplication® System: Enterprises looking to achieve more with less by better managing IT resources as collectives.

- Integration Bus (IBM WebSphere Message Broker): The enterprise service bus integrates apps, data, services, and partners while controlling and optimizing connections.

- IBM WebSphere eXtreme Scale (WXS) and IBM WebSphere DataPower XC10: Cache grids improve scale and performance of applications and services.

- IBM Mobile Foundation Worklight®: A mobile utility that can deal with the scale and ubiquity of mobile and sensor rich environments that have changed requirements of enterprises.

- IBM WebSphere DataPower XG45: Secure appliances enable controlled access to enterprise resources.

- IBM WebSphere MQ: A messaging backbone in the data center that extends to external clients that are connected through the internet.

- Sterling Commerce, IBM WebSphere DataPower XB62, and IBM WebSphere Cast Iron Live: These business-to-business partners open channels and collaboration where a new genre, "App Developer Partner", is emerging.

For more information, see *Integration Throughout and Beyond the Enterprise*, SG24-8188-00, which can be found at the following website:

https://www.redbooks.ibm.com/Redbooks.nsf/RedpieceAbstracts/sg248188.html?Open

Supported platforms

For detailed system requirements, a list of supported operating systems, prerequisites, and optional supported software, with component-level details and operating system restrictions, go to the following websites:

- More information and requirements for IBM Worklight Server can be found at http://www.ibm.com/support/docview.wss?uid=swg27024838.

- More information and requirements for IBM Integration Bus can be found at http://www-01.ibm.com/software/integration/wbimessagebroker/requirements/.

- More information and requirements for IBM WebSphere MQ can be found at http://www-01.ibm.com/support/docview.wss?uid=swg27006467#7.5.

- More information and requirements for IBM WebSphere DataPower Service Gateway XG45 can be found at http://www-03.ibm.com/software/products/en/datapower-xg45/.

- More information and requirements for IBM WebSphere DataPower B2B Appliance XB62 can be found at http://www-03.ibm.com/software/products/en/datapower-xb62/.

- More information and requirements for IBM WebSphere Cast Iron can be found at http://www-01.ibm.com/support/docview.wss?uid=swg27022431.

- More information and requirements for IBM WebSphere DataPower Integration Appliance XI52 can be found at http://www-03.ibm.com/software/products/en/datapower-xi52/.

Ordering information

Table 1 shows ordering information for the products of this solution.

Table 1. Ordering information

Program name	PID number	Charge unit description
IBM Worklight	5725-I43	Client device installation application
IBM WebSphere DataPower Service Gateway XG45	7198-32X	Per appliance
IBM WebSphere DataPower B2B Appliance XB62	5725-K54	Per appliance
IBM WebSphere DataPower Integration Appliance XI52	7199-42X	Per appliance
IBM WebSphere DataPower Cast Iron Appliance XH40	7198-8FX	Per appliance
IBM WebSphere MQ for Multiplatform	5724-H72	Per Processor Value Unit (PVU) for Linux on IBM System z® Per PVU PROCESSOR-Day
IBM Integration Bus	5724-J05	PVU: Available through IBM Passport Advantage® only

Related information

- The Nexus of Forces by Gartner is the confluence of mobile, social, cloud, and big data analytics. For more information, go to the following website:
  http://www.gartner.com/technology/research/nexus-of-forces/

- For a more detailed analysis of these SOA design principles and their importance in the context of the nexus of forces, see "SOA Design Principles for Dummies" at the following website:
  http://www-01.ibm.com/software/solutions/soa/

- Applying big data analytics to vast amounts of available information sources lets you provide unique value and insight (particularly in the context of the Internet of Things). For more information, go to the following website: http://www.ibm.com/smarterplanet/us/en/overview/article/iot_video.html

- The IBM SOA reference model is available at the following website:
  ftp://ftp.software.ibm.com/software/soa/pdf/SOA_g224-7540-00_WP_final.pdf

- For more information about systems of interaction, go to the following website:
  http://www-01.ibm.com/software/solutions/systems-of-interaction/

- For more information about systems of engagement, go to the following website:
  http://www-01.ibm.com/software/ebusiness/jstart/systemsofengagement/

- For the formal standard definition of service, see the Open Group SOA Ontology at the following website: http://www.opengroup.org/soa/source-book/ontology/

- IBM Integration Bus product page:
  http://www-03.ibm.com/software/products/en/ibm-integration-bus

- *Integration Throughout and Beyond the Enterprise*, SG24-8188-00, found at:
  http://www.redbooks.ibm.com/abstracts/sg248188.html?Open

- IBM Offering Information page (to search on announcement letters, sales manuals, or both):
  http://www.ibm.com/common/ssi/index.wss?request_locale=en

  On this page, enter any of the following terms (IBM Integration Bus, IBM Worklight, IBM WebSphere DataPower Service Gateway XG45, IBM WebSphere DataPower B2B Appliance XB62, IBM WebSphere DataPower Integration Appliance XI52, IBM WebSphere DataPower Cast Iron Appliance XH40, WebSphere MQ for Multiplatform, IBM WebSphere Message Broker), select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service. IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law : INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you. This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you. Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurement may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

This document was created or updated on April 29, 2014.

Send us your comments in one of the following ways:
- Use the online **Contact us** review form found at:
  ibm.com/redbooks
- Send your comments in an e-mail to:
  redbook@us.ibm.com
- Mail your comments to:
  IBM Corporation, International Technical Support Organization
  Dept. HYTD Mail Station P099
  2455 South Road
  Poughkeepsie, NY 12601-5400 U.S.A.

This document is available online at http://www.ibm.com/redbooks/abstracts/tips1076.html .

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the web at http://www.ibm.com/legal/copytrade.shtml.

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

Cast Iron®
DataPower®
IBM®
Passport Advantage®
PureApplication®
Redbooks®
Redbooks (logo)®
System z®
WebSphere®
Worklight®

The following terms are trademarks of other companies:

Sterling Commerce, and N logo are trademarks or registered trademarks of IBM International Group B.V., an IBM Company.

Worklight is trademark or registered trademark of Worklight, an IBM Company.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.