

Reduce Costs and Speed Your Digital Transformation with IBM WebSphere Application Server on Cloud

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 **Cloud**

WebSphere



Executive overview

Businesses are always looking for ways to improve the customer experience. They need to connect with existing and new customers in innovative ways and deliver experiences that never disappoint. They also require technology-strengthened business strategies with the flexibility to adapt to new opportunities quickly. To achieve this agile state, many are using cloud-based solutions to create personalized customer experiences and harness existing enterprise applications, data, and services for a competitive advantage.

IBM® WebSphere® Application Server on cloud (WebSphere on cloud) helps businesses like yours take advantage of the cloud as a strategic environment to realize various benefits:

- ▶ Reduce costs by optimizing the entire application-related infrastructure.
- ▶ Create opportunities by rapidly creating and integrating cloud-based applications.
- ▶ Reap more value from existing applications by augmenting them with cloud services.
- ▶ Deliver compelling customer experiences across all channels.
- ▶ Speed time to market at a lower cost through rapid creation and deployment of APIs and microservices.
- ▶ Increase brand reach or drive new revenue by publishing APIs externally.
- ▶ Drive innovation by enhancing your Java applications with IBM Bluemix® services.
- ▶ Optimize existing workloads by *lifting and shifting* them unchanged to the cloud in just minutes, allowing you to take advantage of fast and flexible provisioning, and pay-as-you-go pricing.

This IBM Redbooks® Redguide™ publication introduces the WebSphere on cloud capabilities and highlights key concepts that are associated with this IBM WebSphere offering. The guide discusses the business value offered by WebSphere on cloud, provides a high-level architectural view, and explains three common entry points (Create, Connect, and Optimize) to cloud. The guide also identifies the IBM products that play important roles in those entry points. It includes real-world examples of how customers are using WebSphere on cloud to resolve business challenges and enhance return on investment (ROI).

Accelerate time to value and help reduce costs with WebSphere on cloud

WebSphere on cloud offers a simple, cost-effective approach to benefit from cloud technology. It is designed to help your organization thrive as a digital business, capture and retain customers, and increase revenue. In essence, WebSphere on cloud also provides an ideal foundation to capitalize on the digital economy. It allows you to harness both new technologies (such as APIs and microservices) and existing on-premises applications by adding unique hybrid cloud capabilities.

With the capabilities of WebSphere on cloud, IT organizations can accomplish these goals:

- ▶ Incorporate next-generation applications and technology

WebSphere on cloud provides an ideal platform for creating next-generation Java applications with microservices and APIs delivering robust, secure, and omni-channel user experiences. Developers can optimize APIs and mobile, Internet of Things (IoT), and web apps to meet the demand for new applications and services.

- ▶ Support continuous delivery to speed time to market

WebSphere on cloud enables developers to acquire the correct software and testing environment without delays. The cloud environment, microservices, and APIs let teams build and test their ideas with shorter cycle times, allowing new solutions and enhancements to existing applications to be put into production quickly.

- ▶ Extend investments in WebSphere Application Server while taking advantage of cloud

Java continues to be a preferred programming language for enterprise application development. WebSphere Application Server plays a major role in thousands of Java application-based operating environments. Many development teams have deep knowledge of both their existing server environment and Java, so preserving existing skills to support on-premises development is fundamental to the business. Adding skills, such as using APIs and microservices architectures, is essential for the future. WebSphere on cloud also accommodates other run times and languages such as Node.js and JavaScript. In fact, it provides a single management console for both Java and Node.js applications to securely and intelligently manage polyglot applications and servers.

For more information about Node.js, see the following website:

<https://nodejs.org/en/>

By supporting various run times and languages, WebSphere on cloud delivers the agility and accessibility developers need to innovate quickly. Figure 1 shows the IBM WebSphere Application Server family of products, including IBM WebSphere Application Server Liberty Core, IBM WebSphere Application Server, IBM WebSphere Application Server Network Deployment, and IBM WebSphere Application Server for z/OS® editions.

WebSphere Application Server Liberty Core	WebSphere Application Server	WebSphere Application Server Network Deployment and WebSphere Application Server for z/OS
<p>Light weight production runtime for rapid web and cloud-based application development and deployment</p> <ul style="list-style-type: none"> • Fast and easy download (<100 MB footprint) • 1 minute install and deploy • Full integration with Open Platforms • Java EE Web Profile for Web, Mobile, and OSGI applications • Ideal runtime for microservices 	<p>Flexible, secure Java server runtime environment for enterprise applications, provides advanced performance, redundancy and programming models</p> <ul style="list-style-type: none"> • Security and support for single, mid-size to large scale server deployments • Web tier clustering over multiple application server instances • IHS load balancing up to 25 servers • Includes Java Message Service; JDBC; Java Batch; Full EJB; and more 	<p>Advanced runtime environment for large-scale and mission critical application deployments, offers near continuous availability and Intelligent Management capabilities</p> <ul style="list-style-type: none"> • Unlimited server allowance for IHS load balancing • Centralized Management for Massive Scalability (thousands of servers) • Intelligent Management • Full Integration with Open and z/OS platforms • Full Caching Support (Session & Application)

Figure 1 WebSphere Application Server editions and capabilities

Reduce costs and extract more value from your Java investments

IBM has identified three common entry points to cloud (Create, Connect, and Optimize). Each entry point maximizes existing investments, frees resources by minimizing custom integrations, and enables new value creation to drive growth while reducing costs (see Figure 2).

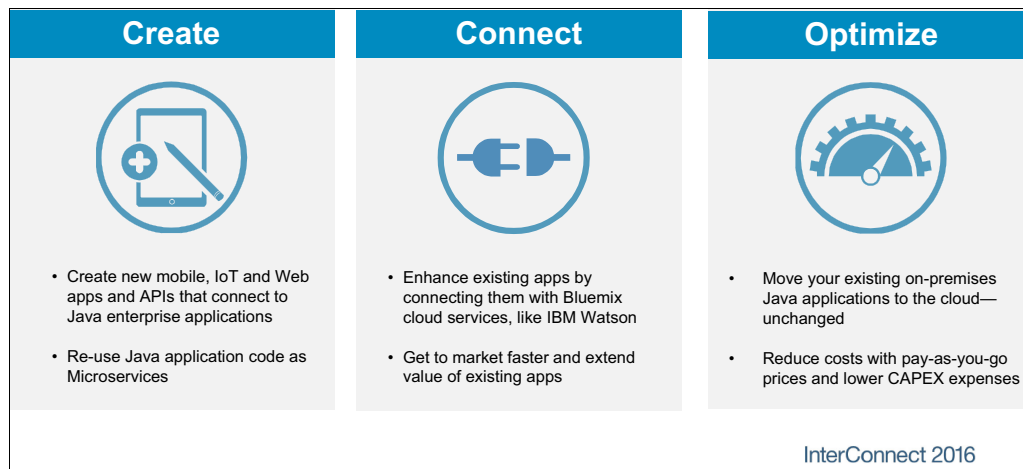


Figure 2 Common entry points for moving to the cloud

The three entry points (shown in Figure 2 on page 3) have these characteristics:

► **Create**

Create innovative applications and microservices quickly by using WebSphere Liberty and IBM Bluemix, a next-generation cloud platform for building, running, and managing apps and services with access to hundreds of cloud services. Build scalable APIs that connect mobile, IoT, and web apps to enterprise Java applications. Generate streamlined microservices by reusing existing Java application code.

► **Connect**

Extend the capabilities and value of existing applications by connecting them to technologies and cloud services on Bluemix. Choose from IBM, third-party, and community-created services. For example, developers could combine an order management application and an IBM Watson™ service that analyzes order data and provides insights into customer preferences to support more informed decision making.

► **Optimize**

Deploy on-premises Java applications where they best serve your business needs. In fact, with WebSphere you can deploy your application on any cloud and with any cloud container service using your existing WebSphere skills and resources. This entry point helps you to cost-optimize the management and deployment of your applications and resources. By moving on-premises applications to WebSphere on cloud, you can reduce costs with pay-as-you-go pricing and save 30% or more¹ on capital expenditures for hardware and software. IBM WebSphere provides pre-configured operating systems, any necessary middleware, and runtime environments on the cloud to aid in deploying Java applications.

The following sections examine the three entry points and their related tools and technologies in more detail.

Create new cloud-native applications quickly

Enhancing and creating applications to meet ever-changing business needs and requirements is essential in today's business environment. Developers can assemble, secure, test, and deploy a microservice in minutes by using IBM WebSphere Liberty. A single management interface for both Java and Node.js enhances DevOps efficiency, driving even greater value from the microservices architecture. Developers can also create cloud-based extensions for existing applications, bringing in new services and ultimately maximizing the value of existing investments and assets.

The following products play a major role in enabling the Create entry point.

IBM WebSphere Liberty

WebSphere Liberty is an application runtime environment that provides capabilities for creating cloud-based applications. It is a fast, dynamic, easy-to-use Java Platform, Enterprise Edition (Java EE) application server, and offers a convenient and capable platform for developing and testing web and Open Service Gateway Initiative (OSGi) applications. Any application that runs on WebSphere Liberty also runs on traditional WebSphere Application Server.

¹ Based on IBM customer experience with the IBM WebSphere Application Server Migration Toolkit.
<https://www.ibm.com/developerworks/websphere/downloads/migt toolkit/>

WebSphere Liberty has the following characteristics:

- ▶ Easy to configure: Configuration is read from an XML file with text editor-friendly syntax.
- ▶ Dynamic and composable: The run time loads only what your application needs and reestablishes the run time in response to configuration changes.
- ▶ Fast-starting: For a basic web application, the server starts in less than two seconds in many cases.
- ▶ Extensible: WebSphere Liberty supports user and product extensions. Teams can employ system programming interfaces (SPIs) to prolong the run time.

The fit-for-purpose nature of the WebSphere Liberty run time relies on the dynamic behavior inherent in the OSGi Framework and Service Registry. As bundles are installed to or uninstalled from the framework, the services in each bundle are added to or removed from the service registry. Similarly, the addition and removal of services cascades to other dependent services. The result is a dynamic, composable run time that can be provisioned with just what your application requires and responds to configuration changes as your application evolves.

With WebSphere Liberty, your IT team can perform the following activities:

- ▶ Grow from lightweight production environments to professional and enterprise class development and deployment capabilities using the same WebSphere platform.
- ▶ Complete projects fast with quick installation and deployment capabilities and integrated tooling. The platform adheres to open standards with broad programming model support.
- ▶ Make efficient use of computing resources by tailoring the server footprint to the features needed for the application and environment. Depending on the application, the footprint can be less than 50 MB.
- ▶ Easily create and optimize applications by adding custom features or third-party components. The platform is ideal for developing microservices and reusing existing Java application code to create cloud-native applications.

Developers can also use best practices for creating Java microservices by using GameON!, an exemplar application that explores microservices concepts. For more information about GameON!, see the following website:

<https://game-on.org>

For more details about WebSphere Liberty, visit the IBM Knowledge Center at:

http://www.ibm.com/support/knowledgecenter/SSAW57_8.5.5/com.ibm.websphere.wlp.nd.multipatform.doc/ae/cwlp_about.html

Forrester Consulting study: Open source versus WebSphere Liberty

A Forrester Consulting Total Economic Impact (TEI) study commissioned by IBM examined the potential ROI associated with migrating from open source Java EE application servers to WebSphere Application Server Liberty. A series of interviews with IBM clients who had migrated from an open source solution to WebSphere Liberty and IBM marketing and sales personnel, plus surveys with organizations that had migrated from open source application servers to WebSphere Liberty, revealed these conclusions:

- ▶ Developer productivity is an important and immediate benefit
- ▶ Standardizing on one development environment enables cost savings
- ▶ Cloud enablement is an important future benefit

According to the study, a composite organization based on the customer interviews and surveys would realize significant financial and productivity benefits (Figure 3). The study states “The financial analysis points to benefits of \$6,375,810 over three years versus costs of \$2,867,668, adding up to a net present value (NPV) of \$3,508,142.”

ROI: 122%	NPV: \$3,508,142	Payback: 16 months	Developer productivity: ▲12%+
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Figure 3 Benefits of the migration

The TEI study identified the following benefits of moving from open source to WebSphere Liberty:

- ▶ **Deployment time savings for monthly releases**
The organization is able to save one hour per application per release due to Liberty’s deployment manager features.
- ▶ **Startup time savings for local deployments**
Developers can save 40 minutes per day due to Liberty’s faster startup times compared with open source application servers.
- ▶ **Improved application development productivity by 12%**
Developers are able to access more current features, increase automation, and more easily manage configuration and code changes with Liberty.
- ▶ **Administration time savings of 3,600 hours per year**
Liberty’s administrative tools are more productive than those of the open source servers, which helps reduce the time that is needed to administer and manage application servers.
- ▶ **Infrastructure cost savings of up to \$350,000 per year by year three**
An organization is able to run its applications on fewer servers with WebSphere Liberty due to better resource utilization and smaller footprints, resulting in hardware and software savings. The organization also noted key impact areas that were not able to be quantified. These areas include a reduced mean time to resolve outages, a reduced number of incidents per year, and improved application performance that leads to improved user productivity and incremental revenue.

“With Liberty, one of the biggest benefits is you only configure the components you need. That makes the server startup time fast. With open source, we had presets and certain minimal standard configurations. That’s a huge time savings for developers.”

-Principal architect

“A key benefit with WAS Liberty is the feature set and technology changes, and how frequently those changes get incorporated. With WebSphere Liberty, we are getting more current feature sets that developers are looking for.”

-Lead architect

To read the entire Forrester TEI study, titled *The Total Economic Impact Of Migrating From Open Source Application Servers To IBM WAS Liberty: Cost Savings And Business Benefits Enabled By IBM WAS Liberty*, visit:

<http://www.ibm.com/common/ssi/cgi-bin/ssialias?infotype=SA&subtype=WH&htmlfid=APL12347USEN>

Jump-start development with WebSphere Liberty app accelerator

Creating or enhancing applications takes time, resources, and a lot of hard work. Liberty app accelerator is a web application automation tool that offers a faster start to Liberty application development. Hosted on IBM Bluemix and available as a no-cost download, Liberty app accelerator helps developers build microservices based on existing Java applications or create new services (see Figure 4). It provides a complete file system with Apache Maven build files. Using Liberty app accelerator, developers can build an application, run tests on a WebSphere Liberty server, and pull in the correct dependencies and features. This process helps improve productivity while lessening dependency on build scripts, which frees up time for developers to focus on other strategic activities, such as writing comprehensive tests.

To download the Liberty app accelerator, see this website:

<http://wasdev.net/accelerate>

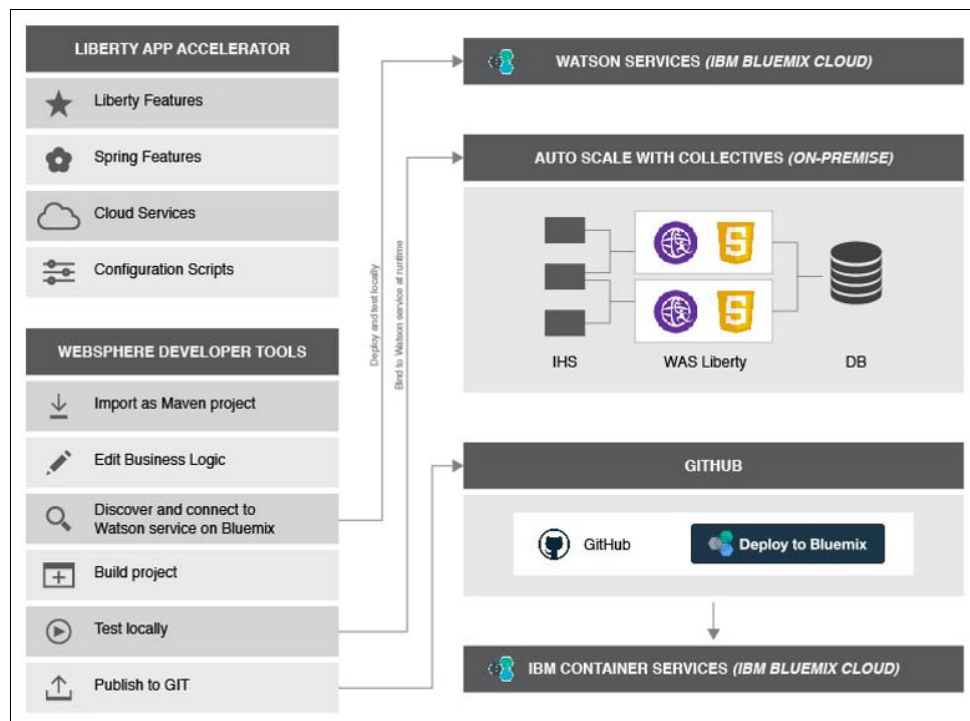


Figure 4 Liberty app accelerator schematic

The Liberty app accelerator provides these benefits, among others:

- ▶ Streamlined process to create microservices from start to finish
- ▶ Faster time to market for new functionality and apps
- ▶ Broader reach into new markets and customers

Developers and other interested workers can access Liberty app accelerator at:

<http://liberty-app-accelerator.wasdev.developer.ibm.com>

In addition, an IBM developerWorks® page dedicated to Java microservices provides a one-stop shop for all WebSphere Java microservices resources, including code samples, best practices, getting started guides, and lessons learned. Access the Java microservices web page at:

<https://developer.ibm.com/wasdev/docs/microservices/>

IBM Bluemix

Bluemix is an open-standard, cloud platform for building, running, and managing applications. It provides a hybrid cloud platform that runs cloud-based applications that consist of APIs from IBM, third-parties, and the enterprise development community. Bluemix offers a catalog of many services including IBM Watson cognitive services. WebSphere Application Server is available on Bluemix, which preconfigures the run time, middleware, and OS for WebSphere Application Server. This process allows developers to quickly *lift and shift* applications to the cloud. With Bluemix, developers can focus on building excellent user experiences with flexible compute options, choice of DevOps tooling, and a powerful set of IBM and third-party APIs and services.

Development teams of all sizes gain the flexibility to scale compute power at a granular level; seamlessly collaborate on source code; share APIs; and manage application performance, logs, and costs from a single dashboard.

To view a list of the services available on Bluemix, visit:

<https://console.ng.bluemix.net/catalog/>

IBM WebSphere Connect

WebSphere Connect is an API management solution supporting the API lifecycle for both on-premises and cloud environments. It is integrated with IBM API Connect™.

WebSphere Connect with API Connect speeds application development by assisting with the following tasks:

- ▶ **Creating new APIs:** Teams can use the Java API for RESTful Web Services (JAX-RS), a Java API for developing REST applications and servlets rapidly.
- ▶ **Socializing new APIs:** After new APIs have been fully vetted and tested, they can be cataloged and socialized. APIs must be fully documented and capabilities must be clearly stated. Swagger integration can simplify and speed this activity.
- ▶ **API discovery:** Developers can browse the catalog to find useful APIs. The APIs are listed by name, description, and capabilities.
- ▶ **API consumption:** Developers can add the appropriate API calls to their mobile, IoT, and web apps.

Figure 5 shows developers creating a solution and discovering APIs by using API Connect.

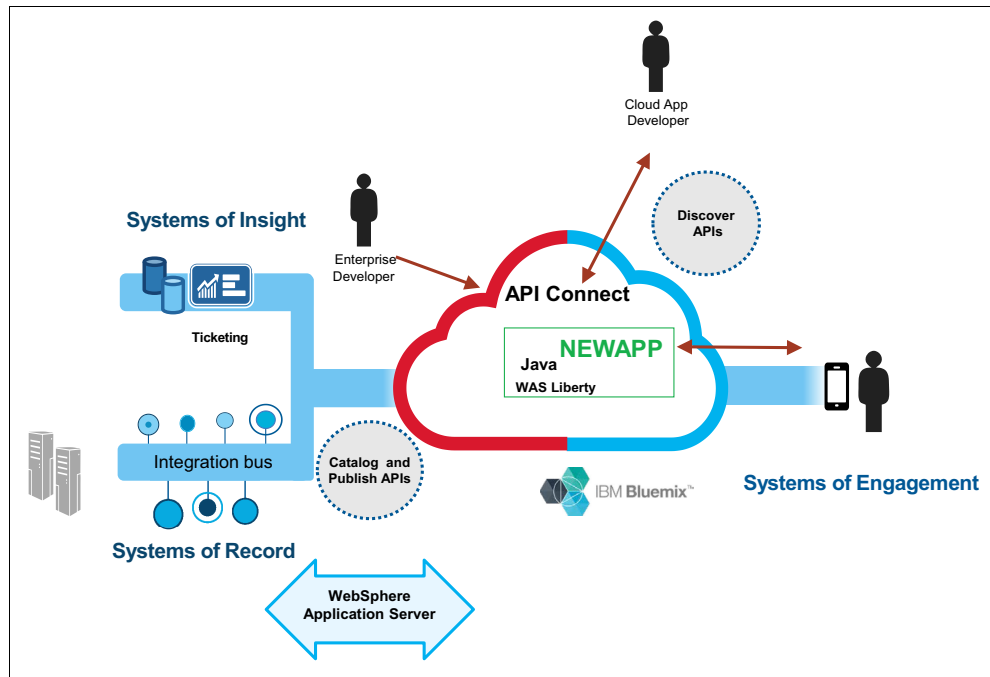


Figure 5 Creating a solution and discovering APIs by using IBM API Connect

Tools for developers

Two additional IBM development environments are designed to create WebSphere Application Server applications. These environments include tools that are intended for use with WebSphere Liberty.

IBM Rational Application Developer for WebSphere Software

IBM Rational® Application Developer for WebSphere Software is a development environment for building applications that run on WebSphere Application Server. This tool supports all Java EE artifacts that are supported by WebSphere Application Server and includes integration with the OSGi programming model. The workbench contains wizards and editors that help build standards-compliant, business-critical Java EE, Web 2.0, and service-oriented architecture (SOA) applications.

For more information about Rational Application Developer for WebSphere Software, go to:

<http://www.ibm.com/software/products/en/application>

WebSphere Application Server Developer Tools for Eclipse

The WebSphere Application Server Developer Tools for Eclipse development environment provides a platform for developing, assembling, and deploying Java EE, OSGi, Web 2.0, and mobile applications. It supports multiple versions of WebSphere Application Server. When combined with the Eclipse software development kit (SDK) and Eclipse Web Tools Platform, WebSphere Application Server Developer Tools for Eclipse provides a lightweight environment for developing Java EE applications. WebSphere Application Server and WebSphere Application Server Developer Tools for Eclipse editions are provided at no additional charge for developer desktops and are supported under production runtime licenses.

Although not as rich in features as Rational Application Developer for WebSphere Software, this development environment is an option for developers who use both WebSphere Liberty and WebSphere Application Server traditional edition.

For more information about WebSphere Application Server Developer Tools for Eclipse and access to the development environment, see this website:

https://www.ibm.com/developerworks/community/blogs/wasdev/entry/downloads_final_releases?lang=en

Connect to new services easily

Exposing your company's uniqueness is what makes you truly competitive. It is also your ticket to digital reinvention. APIs are important tools that enable your company's offerings to shine. Their connectivity to current applications and systems is vital to opening up new business models and monetization strategies.

To stay ahead in a market that expects organizations to adapt and meet customer demands dynamically, you need the ability to use your applications wherever they best support your business outcomes: On-premises, on the cloud, or both. IBM WebSphere Connect, in support of WebSphere on cloud, enables you to use APIs to quickly and easily connect apps and data to the cloud and derive more value from existing Java applications.

IBM WebSphere Connect

WebSphere Connect is a collection of capabilities provided by WebSphere Application Server traditional and WebSphere Liberty that helps you turn WebSphere business assets into APIs. You can use WebSphere Connect to easily produce and consume APIs, and connect to and from the hybrid cloud, rapidly extending the value of your application investments.

With WebSphere Connect, you can accomplish the following activities:

- ▶ Expose back-end applications and data as APIs, and connect to and from the cloud.
- ▶ Create and manage APIs and publish directly from WebSphere to IBM API Connect, which includes IBM support and extra API call limits.
- ▶ Capitalize on existing WebSphere skills for seamless implementation and management.
- ▶ Provide easy access to APIs for internal and external developers to foster new partner ecosystems.
- ▶ Apply end-to-end API lifecycle management to your WebSphere application infrastructure while maintaining a high quality of service and performance.

Pre-built integrations allow you to connect to the cloud in minutes without customization, added complexity, or disruptions that can occur when connecting through (and managing) a myriad of third-party alternatives. You can capitalize on your existing skills and resources, and manage everything within the WebSphere environment you already have and know.

Consider a hypothetical scenario where a major Mexico-based retailer uses WebSphere Connect capabilities to enhance its application with Bluemix cloud services (see Figure 6). Although the retailer is currently reaching its mobile users, market research indicates that a more interactive engagement experience would increase sales. The IT team develops a live-text chat app using WebRTC. However, the retailer's sales support team speaks only Spanish and must now communicate in real time with English speaking customers.

By using Watson translation services (based in Bluemix) to translate between languages, the retailer allows mobile customers to live-chat questions in English through the translation service, while the call service agents instantaneously receive the question in Spanish. The service representative's response to the customer is translated back into English without either party being aware of the translation process taking place.

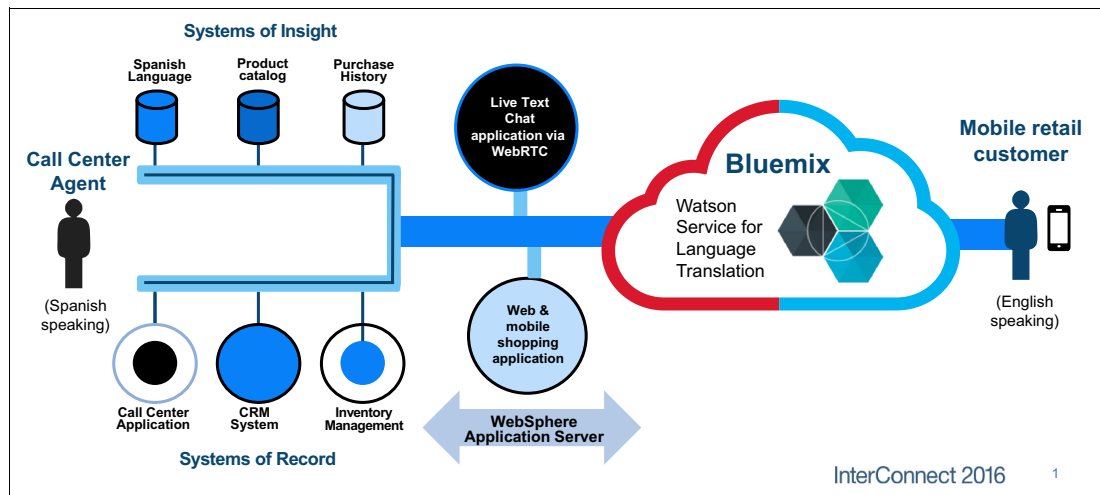


Figure 6 WebSphere Connect with IBM Watson services on Bluemix for cognitive apps

Optimize infrastructure for availability, flexibility, and security

WebSphere on cloud provides you with the flexibility to take full advantage of your application portfolio. Your organization can move in any direction relative to the platform you have:

- ▶ Maintain an on-premises strategy
- ▶ Move completely to cloud
- ▶ Move to a hybrid design and retain compatibility with your current infrastructure

You can accelerate your digital transformation by incorporating new starting points, rules of engagement, best practices, and tools into your development plans.

For IT managers, this approach extends the value of cloud even further by making the deployment of WebSphere Application Server components quick, easy, and seamless, while significantly reducing labor and management hours. Now you can move Java applications to the cloud unchanged within minutes and take advantage of flexible pay-as-you-go pricing to reduce capital expenditures (CapEx) and operating costs.

Choose your implementation

As you develop your application optimization strategy, it is helpful to position applications across a wide spectrum of topologies that support the move to the cloud (see Figure 7).

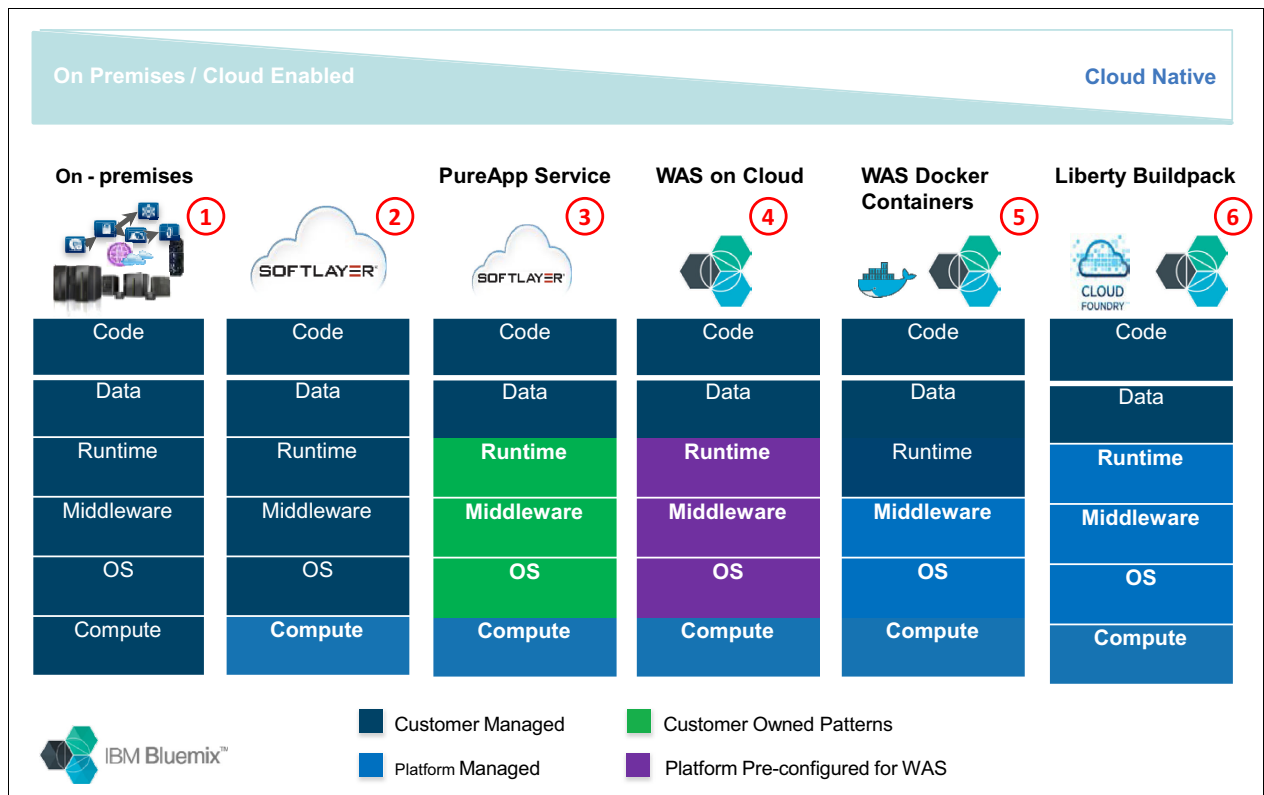


Figure 7 Spectrum of topologies (on-premises to cloud native)

As shown in Figure 7, the topology stacks are based on the business requirements and strategy of the organization. Stack 1 is the on-premises stack, where an IT organization manages every component down to and including the physical hardware. The IT organization would purchase or create each component in the stack. Stack 6 is the WebSphere Liberty buildpack that collaborates with Cloud Foundry and Bluemix to provide the run time, middleware, OS, and compute environments.

As you start moving into a cloud-based environment, other IBM cloud computing infrastructure options come into play. On top of Stack 2 through Stack 6 are examples of the IBM Cloud offerings that support cloud-enabled and cloud-native environments:

- ▶ IBM SoftLayer® (Stack 2)

In this configuration, you purchase the compute environment, which is pre-provisioned and set up for your needs. You need to add the OS, middleware, run time, data, and application code, and then manage and maintain the overall environment.

- ▶ IBM PureApplication® Service on SoftLayer (Stack 3)

In this configuration, the organization deploys the software version of the PureApplication deployment engine and management console by using one of the SoftLayer worldwide data centers for the off-premises option.

- ▶ WebSphere Application Server on cloud (Stack 4)

For this configuration, the WebSphere Application Server platform is pre-configured with the run time, middleware, operating system, and compute components. You add your application code and data to the stack.

- ▶ **WebSphere Application Server with Docker containers on Bluemix (Stack 5)**

This configuration uses IBM Containers to run Docker containers in a hosted cloud environment on Bluemix. Containers are virtual software objects that include all of the elements that an application needs to run, including WebSphere Application Server. A container has the benefits of resource isolation and allocation, but is more portable and efficient than a virtual machine. Containers help your developers build high-quality applications and apps swiftly.

A Docker-based container service delivered on Bluemix provides open Docker-native features and interfaces, including the latest Docker orchestration services. The IBM Containers service enables enterprises to launch Docker containers directly onto the IBM Cloud on bare metal servers from SoftLayer. With this technology, developers have a simple-to-manage environment that offers increased utilization and performance in a more flexible execution model. In addition, it expands the types of applications that can be supported on the IBM Cloud.

- ▶ **WebSphere Liberty Buildpack (Stack 6)**

This configuration provides the run time-as-a-service managed by Bluemix and you provide the application and data. Bluemix has become the largest Cloud Foundry deployment in the world² and provides a platform as a service (PaaS) environment for accelerating new application development. It offers DevOps tools with concepts, practices, tooling, and team organizational structures that enable organizations to swiftly release new capabilities to their clients.

WebSphere Liberty Buildpack enables you to stage Java applications on Bluemix and other cloud platforms, using capabilities from the lightweight and highly composable WebSphere Liberty. The buildpack makes it easier to build and deploy enterprise Java applications and to move existing applications to the cloud.

These example topology stacks offer a basic overview of the various IBM products that support moving to a cloud-based environment. Based on its experience with numerous clients, IBM considers the hybrid cloud to be the most effective and efficient way for organizations to realign their WebSphere Application Server business applications and business processes for digital transformation.

The case for a hybrid enterprise

The cloud offers ubiquitous network access to a pool of computing resources. Organizations can now move beyond their investment in traditional on-premises environments to produce more agile processes and use new cost models in the cloud. The hybrid cloud approach provides companies with much-needed flexibility and extensibility, and integrates with on-premises applications and resources.

The IBM hybrid cloud integration strategy centers on optimizing infrastructures for availability and scalability, providing cost-efficient deployment options, and delivering critical management capabilities to turn existing company IT investments into a competitive advantage.

Adopting a hybrid cloud model helps you perform the following activities:

- ▶ Provision and run cloud, hybrid, and on-premises environments with flexible runtimes and ready-to-run pattern-based deployments.
- ▶ Simplify movement of workloads across cloud or container services.

² "IBM Introduces New Bluemix Services to Help Developers Create Analytics-Driven Cloud Applications" IBM News room, <https://www.ibm.com/press/us/en/pressrelease/46810.wss>

- ▶ Scale infrastructure to match demand across multi-sourced and hybrid cloud models with workload scheduling and cloud brokerage services.
- ▶ Predict, detect, and automate fixes to IT and application performance issues.

IBM WebSphere Application Server and hybrid cloud

WebSphere Application Server works seamlessly across the entire hybrid cloud landscape (Figure 8). The hybrid cloud enables an enterprise to create solutions, connect to systems of engagement (such as web, mobile devices, and IoT), and optimize enterprise applications by moving appropriate applications to the cloud.

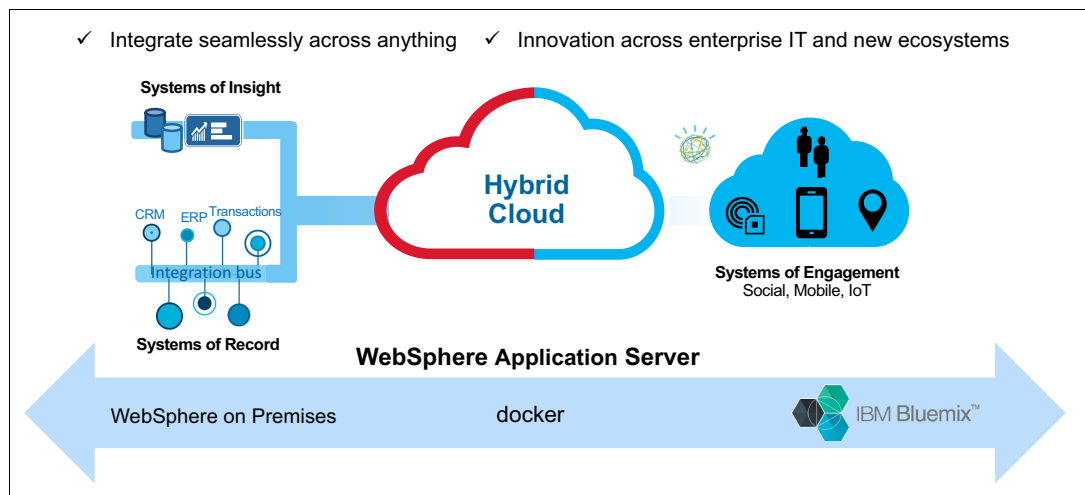


Figure 8 WebSphere Application Server hybrid cloud environments

Deploy applications anywhere with WebSphere on cloud

WebSphere on cloud offers you a compelling benefit: The ability to optimize your application infrastructure by quickly moving to the cloud. You can now adopt a *lift and shift* approach to replicate your in-house WebSphere Application Server environment in the cloud without redesigning the application. Shifting on-premises Java applications to the cloud allows you to take advantage of pay-as-you-go pricing, lowering both capital and operational expenses.

WebSphere on cloud helps organizations to achieve these goals:

- ▶ Reduce time and resource costs

You can reduce time and resource requirements by moving existing code, topologies, and applications to the cloud. This approach creates a huge cost advantage whether it is driven by current business need or a new business strategy.
- ▶ Save up to 30% with pay-as-you-go pricing

Some applications run only occasionally but require extra IT resources to handle the load when they do run. WebSphere on cloud offers a pay-as-you-go model that is a cost-effective way to support these applications. You pay for only the time you need, when you need it.
- ▶ Provide dynamic capacity management

WebSphere on cloud delivers enterprise-level scalability required for the most demanding workloads. Easily scale up or down on demand as the business dictates, minimizing the costs from unused capacity.

- ▶ Accelerate application delivery

Effective application delivery goes beyond deployment and availability. It incorporates the security, scalability, and management that are required to run and maintain applications properly. WebSphere on cloud accelerates delivery of critical business workloads between on- and off-premises environments. Adopting hybrid cloud best practices helps developers optimize application delivery and achieve business objectives.

- ▶ Deploy across a broad spectrum of environments

Combine public and private cloud environments for ultimate choice and flexibility.

Getting started: Lift and shift your application to the cloud

Complete the following steps to lift and shift your WebSphere Application Server application to the cloud:

1. Go to WASdev.net to download and install the Technology Evaluation Report in the WebSphere Application Server Migration Toolkit.
2. Run the Technology Evaluation Report. It scans your application for the Java technologies used to see whether the application is ready for WebSphere Liberty and Bluemix. If all the Java technologies (Java archive (JAR) files) are not available, they need to be added to the application JAR file.
3. If the Technology Evaluation Report does not identify any inhibitors to the move, export the selected application as an enterprise archive (EAR) file.
4. Deploy the application to WebSphere Liberty by dropping it into the `dropins` directory or by adding the application to the server configuration file. Now you can test and run the application.
5. If you do not already have a WebSphere Application Server for Bluemix configuration, create it now. Migrate the application from WebSphere Liberty to Bluemix.

After the application is in the cloud production environment, it is ready to be shared.

WebSphere Application Server Version 9

WebSphere Application Server V9, with its traditional and Liberty runtimes, continues to offer industry-leading, production-ready, standards-based Java EE 7-compliant architecture.

Version 9 includes the following highlights:

- ▶ Java EE 7 Web Profile and Full Platform certification of WebSphere Application Server traditional brings the traditional run time to the same Java EE level as the WebSphere Liberty run time. This capability supports deployment of any Java EE 7-based application that uses the most current industry standards for on-premises or in the cloud. Organizations can easily use HTML 5 to improve application responsiveness, increase developer productivity, and help meet the most demanding enterprise requirements.
- ▶ Java Platform Standard Edition (Java SE 8) support for WebSphere Application Server V9.0 traditional and WebSphere Liberty delivers enhanced developer productivity and significant application performance improvements. HTML 5 and Java applications help simplify the application architecture and deliver scalable applications. Greater platform currency also facilitates more efficient development and deployment.

- ▶ Docker container and Docker Data Center support accelerate delivery of modern applications by making it easier to integrate WebSphere Application Server into the DevOps tools chain. Using WebSphere Application Server with Docker Data Center enables seamless portability, so teams can deliver applications from development to test to production across a hybrid landscape. It also supports the management of WebSphere Application Server Docker containers as part of a broader Docker-centric ecosystem.
- ▶ Updated Docker images with the latest WebSphere Application Server Liberty binary files to help accelerate software deployment in hosts that contain Docker engines.
- ▶ A single management interface for managing and administering WebSphere Application Server Liberty Java and IBM StrongLoop® Node.js applications that are deployed across bare metal, virtual machines, and Docker environments in on-premises, cloud, or hybrid topologies.
- ▶ Enhanced WebSphere eXtreme Scale provides an easy-to-configure, easy-to-deploy, distributed caching solution for environments where business success depends on speed and high performance.
- ▶ Easy-to-deploy WebSphere Liberty applications for Red Hat OpenShift and Pivotal Cloud Foundry run in Bluemix, SoftLayer, Amazon Web Services, and Microsoft Azure. In addition, you can deploy these applications in on-premises environments, where subcapacity charging for suitable configurations might apply.
- ▶ An enhanced portability option for VMware clients enables them to take better advantage of the speed and economics of the cloud. VMware clients can extend their existing workloads to the cloud unchanged from their on-premises, software-defined data center (SDDC). A jointly designed architecture by VMware and IBM automatically provisions pre-configured VMware SDDC environments, which consist of VMware vSphere, VMware NSX, and VMware Virtual SAN on the IBM Cloud. Users can deploy workloads into this hybrid cloud environment without modification due to the common, VMware-based security and networking models in the VMware SDDC.
- ▶ Support for IBM API Connect Essentials and the API Management solution helps developers easily create, discover, publish, and integrate APIs, delivering a turnkey solution for organizations that are looking to enter the API economy.

Help for developers

IT managers are always looking for ways to boost developer productivity and the quality of the deliverables that they produce. Two targets for improvement are the application development lifecycle and the developers' toolsets.

DevOps and IBM Bluemix Garage

DevOps streamlines and accelerates software development by bringing together all stakeholders in the application delivery process. DevOps enables teams to communicate and collaborate more effectively, automate manual processes, and quickly incorporate feedback. For example, adopting DevOps practices can lead to these benefits:

- ▶ Tighter traceability from requirements planning to production and automation of manual processes help reduce time to solution delivery.
- ▶ Continuous feedback facilitates high-quality deliverables.
- ▶ Operations and customer feedback are part of the development process, so gathering and processing them takes less time.
- ▶ Better monitoring of system usage supports increased service levels.

IBM has encapsulated these ideas in the IBM Bluemix Garage Method (Figure 9), a robust set of practices that are designed to help organizations rapidly build, execute, and scale innovative cloud applications. The Bluemix Garage Method combines industry best practices on design thinking, lean startup, agile development, DevOps, and cloud. It integrates the learning fostered in the collaborative and creative environments of the IBM Bluemix Garage to help enterprise organizations accelerate all phases of app design, development, and delivery. These phases include identification of feature priorities, ideation, deployment, and iteration.

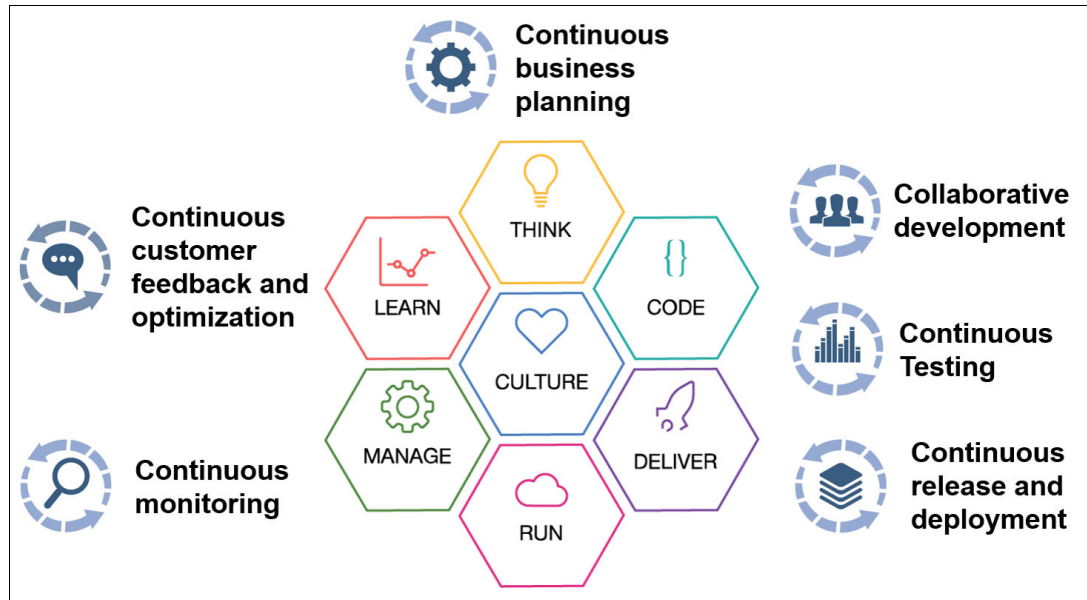


Figure 9 DevOps lifecycle development approach as defined in the Bluemix Garage Method

Application release and deployment automation for WebSphere Application Server

Today's IT organizations are automating their builds, tests, infrastructure deployments, and application deployments in an attempt to align with continuous delivery practices. Managing the environments for these activities requires going beyond the application layer.

DevOps requires best practices and development tooling to be put into place to address the needs of software delivery teams. Many IBM clients and IBM internal delivery teams employ IBM UrbanCode™ Deploy, a deployment automation tool. It deploys configured topology stack environments and automates configuration and application deployments through development, test, staging, and production environments. UrbanCode Deploy is also designed to facilitate rapid feedback and continuous delivery in agile development while providing the audit trails, versioning, and approvals needed in production.

For more information about IBM UrbanCode Deploy, see this website:

<https://developer.ibm.com/urancode>

For WebSphere Application Server, UrbanCode Deploy provides the following capabilities that help make the lives of WebSphere Application Server administrators easier and improve an organization's ability to deliver products and services to market swiftly:

- ▶ WebSphere Application Server: Configure Plugin

This plug-in supports migration from WebSphere Application Server V7 and V8 to later versions. It captures the configuration of WebSphere Application Server cells and provides

automation capabilities to migrate them to newer versions of WebSphere Application Server running on-premises or on Bluemix. By using UrbanCode Deploy, you can drastically cut down the time that is associated with configuration migrations, reduce the risk of outages, and eliminate configuration errors. UrbanCode Deploy also makes it easy to stand up fully configured WebSphere Application Server instances and deploy applications. This is possible because UrbanCode Deploy stores configurations as code, making it possible to compare and determine the version of configurations for reuse.

- ▶ **WebSphere Application Server: Deploy Plugin**

This plug-in provides a number of steps for performing administration tasks and deploying application binary files to WebSphere Application Server. It also contains steps that are related to configuration management, such as creating data sources, JMS requests, and so on.

- ▶ **WebSphere Application Server: Install Plugin**

This plug-in includes a sample application that automates a standard installation of WebSphere Application Server Network Deployment and steps related to installing WebSphere Application Server. It must be modified or used as a guide for creating your own installation process.

Case studies: WebSphere on cloud

Around the world, organizations of all types have long depended on WebSphere Application Server for their application infrastructure. This section includes a few examples of clients who realized significant benefits with WebSphere in the cloud.

AnswerHub

AnswerHub is a knowledge management software platform that helps organizations create online communities for private or public use. To keep up with changing demands, AnswerHub relentlessly searches for new technology to improve its new product development.

The company selected a solution that uses an IBM Cloudant® database for information storage and retrieval, WebSphere Liberty software for rapid application development on the cloud, and Memcached software for storing small chunks of data and speeding dynamic web applications. As AnswerHub used and explored the capabilities of the Bluemix environment, the company found even more tools and services within the Bluemix catalog that could support new business and product development, testing, and deployment efforts.

For more details about this case study, visit:

<https://www.ibm.com/software/businesscasestudies/us/en?synkey=M967161X84121R62>

KLM Open

Founded in 1912 and originally called the Dutch Open, the KLM Open is one of the oldest golf tournaments on the European Tour. The KLM Open wanted to provide fans who attended its tournament with a new and more interactive mobile application, but lacked the infrastructure and expertise that are needed to develop and deploy such a solution.

A new mobile application was created to help KLM Open improve the live experience for fans. Each flight (a term for a group of golfers) is assigned a GPS tracker to carry during the tournament. The flight's location data is transmitted to a cloud infrastructure and combined

with the scores and other media content. This system provides real-time access to the leaderboard, players' locations, and maps that show the user's current location and how to get to various points of interest.

The solution components included IBM Bluemix, IBM DevOps for Bluemix, IBM MobileFirst™ Platform Foundation, IBM SDK for Node.js for Bluemix, and WebSphere Application Server Liberty Core.

For more details about this case study, visit:

<https://www.ibm.com/software/businesscasestudies/us/en?synkey=Q546287R07516H79>

Conclusion

The cloud empowers businesses to create solutions to connect to systems of engagement, such as the web, mobile devices, and IoT, and to optimize enterprise applications by moving the appropriate applications to the cloud. IBM WebSphere on cloud enables your organization to rapidly create, move, and deploy your applications in whatever environment best suits your organizations' needs (on premises, off premises, or both):

- ▶ Extend your infrastructure to take advantage of the high performance, cost efficiency, and convenience of cloud-based resources and services.
- ▶ Streamline access and connections to cloud services such as IBM Watson.
- ▶ Facilitate the creation, discovery, and management of APIs with included API Connect capabilities.

With all of these features in one place, WebSphere on cloud makes it easy for your organization to explore the value of new architectures as you move to become a digital enterprise.

IBM has extensive experience supporting organizations on this journey. It understands workload optimization and the cloud-based platforms that enable you to effectively execute both new and existing applications. Whether you are considering a new cloud implementation, want to incorporate existing APIs and microservices, or want to optimize your WebSphere Application Server-based applications by moving to the cloud, IBM expertise and technology can help you deliver an ideal solution.

Resources and more information

See the following IBM Redbooks publications (listed by product) for more information:

- ▶ *IBM WebSphere Application Server V8.5 Administration and Configuration Guide for Liberty Profile*, SG24-8170
- ▶ *WebSphere Application Server: New Features in V8.5.5*, REDP-4870
- ▶ *WebSphere Application Server V8.5 Administration and Configuration Guide for the Full Profile*, SG24-8056
- ▶ *WebSphere Application Server V8.5 Concepts, Planning, and Design Guide*, SG24-8022
- ▶ *WebSphere Application Server V8.5.5 Technical Overview*, REDP-4855
- ▶ *Configuring and Deploying Open Source with IBM WebSphere Application Server Liberty Profile*, SG24-8194
- ▶ *Development of Advanced Applications with IBM WebSphere Application Server Liberty Profile*, TIPS1314

- ▶ *IBM WebSphere Application Server Liberty Profile Guide for Developers*, SG24-8076
- ▶ *Liberty in a DevOps Continuous Delivery Environment*, REDP-5269
- ▶ *Using Liberty for DevOps, Continuous Delivery, and Deployment*, SG24-8286
- ▶ *Creating Applications in Bluemix Using the Microservices Approach*, REDP-5271
- ▶ *IBM Bluemix: The Cloud Platform for Creating and Delivering Applications*, REDP-5242
- ▶ *Microservices from Theory to Practice: Creating Applications in IBM Bluemix Using the Microservices Approach*, SG24-8275
- ▶ *The Power of the API Economy: Stimulate Innovation, Increase Productivity, Develop New Channels, and Reach New Markets*, REDP-5096
- ▶ *Stepping Forward into the API Economy*, REDP-5164

You can search for, view, download, or order these documents and other books, papers, Web Docs, drafts, and additional materials, at the following website:

<http://www.redbooks.ibm.com/>

See the following online resources for more information:

- ▶ WebSphere Application Server - product page
<http://www.ibm.com/software/products/en/appserv-was>
- ▶ WebSphere Application Server 8.5.5 at the IBM Knowledge Center
https://www.ibm.com/support/knowledgecenter/SSEQTP_8.5.5/as_ditamaps/was855_welcome_base_dist_iseeries.html
- ▶ IBM WebSphere on cloud
<http://www.ibm.com/middleware/us-en/products/application-platform/websphere-on-cloud.html>
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- ▶ Transform Your Business with Dynamic, Enriched Cloud-Powered Apps
http://qa.ziffdavisb2b.com/ibm/cloud_apps/
- ▶ Getting started with IBM WebSphere Application Server for Bluemix
<https://console.ng.bluemix.net/docs/services/ApplicationServeronCloud/index.html>
- ▶ WebSphere Application Server - IBM Bluemix
<https://console.ng.bluemix.net/catalog/services/websphere-application-server/>
- ▶ Deploying applications on Bluemix and WebSphere Application
http://www.ibm.com/support/knowledgecenter/SSRTLW_9.1.1/com.ibm.etools.iwd.doc/topics/tcreatejavabluemixapp.html
- ▶ WebSphere Application Server - IBM Bluemix
<https://new-console.ng.bluemix.net/catalog/services/websphere-application-server/>

- ▶ IBM Bluemix - Next-Generation Cloud App Development Platform
<https://console.ng.bluemix.net/>
- ▶ IBM Bluemix - The cloud platform to accelerate innovation
<http://www.ibm.com/cloud-computing/bluemix/>
- ▶ Catalog - IBM Bluemix
<https://console.ng.bluemix.net/catalog/>
- ▶ WebSphere Liberty Repository
<https://developer.ibm.com/wasdev/downloads/>
- ▶ About WebSphere Liberty - WASdev
<https://developer.ibm.com/wasdev/websphere-liberty/>
- ▶ Liberty for Java - IBM Bluemix
<https://console.ng.bluemix.net/catalog/liberty-for-java/>
- ▶ Get started with Liberty - WASdev
<https://developer.ibm.com/wasdev/getstarted/>
- ▶ IBM API Connect - product page
<http://www.ibm.com/software/products/en/api-connect>
- ▶ API Connect | Learn about APIs, the API Economy, and IBM API
<https://developer.ibm.com/apiconnect/>
- ▶ IBM API Connect Version 5.0.0, and later, documentation
https://www.ibm.com/support/knowledgecenter/SSMNE5_5.0.0
- ▶ Introducing IBM API Connect: Every WebSphere IT operations manager's dream
<https://www.ibm.com/blogs/systems/introducing-ibm-api-connect-every-operations-managers-dream/>
- ▶ Getting Started | API Connect - API Connect Developer Toolkit
<https://developer.ibm.com/apiconnect/getting-started/>
- ▶ IBM Cloud Accelerating digital transformation with IBM API Connect data sheet
<http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=SP&infotype=PM&htmlfid=APD12345USEN&attachment=APD12345USEN.PDF>
- ▶ The Total Economic Impact Of IBM UrbanCode: Achieving Velocity In An Enterprise DevOps Environment
<http://public.dhe.ibm.com/common/ssi/ecm/ra/en/ra114126usen/RAL14126USEN.PDF>
- ▶ IBM UrbanCode Deploy product pages
<https://developer.ibm.com/urbancode/>
- ▶ Deploying to and Configuring WebSphere Application Server with UrbanCode Deploy (webcast)
<https://developer.ibm.com/urbancode/docs/may-17-webinar-deploying-to-and-configuring-websphere-application-server-with-urbancode-deploy/>

The following resources from outside consultants are useful for further information:

- ▶ Migrating From Open Source Application Servers to IBM WAS Liberty
https://www.ibm.com/marketing/iwm/iwm/web/signup.do?source=ibm-mw-application_platform&S_PKG=ov46983&S_TACT=C432096W

- ▶ The Truth about Cloud Price-Performance
https://www.ibm.com/marketing/iwm/dre/signup?source=ibm-cloud-weborganic&S_PKG=ov38505&dynform=20109
- ▶ The Total Economic Impact Of Migrating From Open Source Application Servers To IBM WAS Liberty
https://www.ibm.com/marketing/iwm/iwm/web/signup.do?source=ibm-mw-application_platform&S_PKG=ov46983&S_TACT=C432096W
- ▶ The Total Economic Impact of Migrating From Open Source Application Servers To IBM WAS Liberty - a Forrester Total Economic Impact Study (Webcast)
<https://engage.vevent.com/index.jsp?eid=556&seid=83862>
- ▶ How Node.js Fits into a Microservices Application Architecture using WebSphere Application Server (Webcast)
<https://engage.vevent.com/index.jsp?eid=556&seid=83783>
- ▶ Disrupting in the Digital Economy with WebSphere and API Connect (Webcast)
<https://engage.vevent.com/index.jsp?eid=556&seid=83768>
- ▶ Hybrid Cloud Initiatives- Leveraging WebSphere Application Server for Cloud (Webcast)
<https://engage.vevent.com/index.jsp?eid=556&seid=83785>

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