Adopt a hybrid cloud model using Bluemix

See how an IBM team implemented hybrid cloud for their sales Quote-to-Cash application

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Using a composable services approach, our team built a sales Quote-to-Cash application and deployed it on a hybrid cloud. Our hybrid cloud consists of IBM® Bluemix®, IBM Bluemix Dedicated, IBM DB2® on Cloud, IBM FileNet® Content Manager, and the API Management platform. We review the architecture, decisions, and benefits of adopting a hybrid cloud model, and explain why we chose this model to deploy our sales Quote-to-Cash application.

This tutorial was written using a previous version of the IBM Bluemix® interface. Given the rapid evolution of technology, some steps and illustrations may have changed.

Using a composable services approach, our team built a sales Quote-to-Cash application and deployed it on a hybrid cloud. Our hybrid cloud consists of a public cloud (IBM® Bluemix®), a private cloud (IBM Bluemix Dedicated), a database (IBM DB2® on Cloud), content management (IBM FileNet®), and the API Management platform to invoke APIs on systems of record residing inside the corporate firewall. In this article, we share the architecture and benefits of adopting a hybrid cloud model, and explain why we chose this model to deploy our sales Quote-to-Cash application.

Overview of cloud deployment models

International Data Corp (IDC) predicts that more than 80% of enterprise IT organizations will commit to hybrid cloud architectures by 2017. Let's first review the three cloud deployment models: public, private, and hybrid.

Public cloud

The public cloud model uses public network and shared compute, storage, and network resources to serve all customers. Security configurations and infrastructure are shared, and your organization generally cannot tailor them to your specific requirements.
Private cloud
The private cloud model relies on a dedicated infrastructure that's built to act as a cloud environment supporting a specific organization. This model allows your organization to use your own specific infrastructure, security, and connectivity requirements.

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Hybrid cloud
The hybrid cloud model is a cloud computing environment that lets you combine your on-premises environment, private cloud, and public cloud services with orchestration between these platforms. Figure 1 shows a simplified version of the hybrid cloud model. With greater flexibility and more deployment options, the hybrid cloud model can lead to lower total cost of ownership and can help you deliver new business capabilities to market faster.

Figure 1. Hybrid cloud model

The hybrid cloud model allows your enterprise to retain control over your IT environments while sending some workloads to the public cloud to take advantage of its flexibility and scalability. Creating a hybrid cloud is complex, so you need to deal with issues like integration, visibility, control, security, portability, data management, and governance. With hybrid cloud, you to get the best of private cloud, public cloud, and on-premises environments.

About our sales Quote-to-Cash process and application
We developed a sales Quote-to-Cash application for business partners and sellers of products and services. The sales quote-to-cash process is an important end-to-end business process that covers the sales lifecycle from quote creation, pricing, contract creation, negotiation, and signing to invoicing and cash collection. The application lets users manage the pre-sales process or request back-office support to move a sales transaction from the quote stage to the cash collection stage.

Figure 2. Quote-to-Cash process
The Quote-to-Cash application provides the following capabilities:

- **Supports self-service bid management**: enriches opportunities, performs pricing, manages approvals, prepares contracts, and so on
- **Submits request for back-office support**: engages support teams for proposal preparation, pricing support, approvals, contract validation, order placement, and so on
- **Assigns support requests** to the correct support team member using advanced analytics
- **Creates price quotes**: works with systems of record to prepare price quotes based on product configuration
- **Registers the contract**: validates contract information and registers in systems of record to trigger billing and invoicing
- **Submits order alterations**: requests changes to existing orders such as updates or cancellations
- **Tracks cash collection**: reconciles accounts receivable with won deals and signed contracts
- **Analyzes data** using advanced analytics capabilities: identifies common pricing scenarios, cycle times, cognitive analytics using Watson APIs, and more.

As shown in Figure 3, the application can be used on traditional web browsers or mobile devices to request support or self-serve the progression of a sales transaction. The Quote-to-Cash application supports sellers of products and services, lines of business users, back-office support teams, and business partners.

Using the Quote-to-Cash application, a seller or business partner submits a request for support. The request is assigned to the appropriate support staff using advanced analytics. The support staff acts on the support request, the request is tracked, appropriate notifications are sent, and cycle time is measured.

Combining services on the **IBM Bluemix** platform enables rapid creation of these business capabilities. These services then integrate with services on other clouds such as a private cloud on Bluemix, a database on the cloud, content management on the cloud, or an API management platform to invoke APIs on systems of record residing inside the corporate firewall.

**Open toolchains in IBM Bluemix Continuous Delivery** enable developers to develop, track, plan, and deploy software in one place. Once the app is built, it can be deployed to Bluemix. In minutes, you can go from source code to a running app.
There are different types of hybrid workloads, as you can see in Figure 4. The Quote-to-Cash application relies on an integrated systems of record (SOR) and systems of engagement (SOE) hybrid cloud. With this hybrid model, the systems of engagement are hosted on a public cloud, and the systems of record are hosted on a private cloud or behind the corporate firewall.

How we built the app: the composable services approach

We adopted a composable services approach to building our solution. With this approach, business functions are deployed as services or APIs that can be independently executed through
clearly defined interfaces. We created business capabilities by taking a building block approach and combining these services with other services from a rich ecosystem of companies, business partners, internal teams, and open source providers. The Bluemix cloud platform is an ideal environment for adopting the composable services approach. We used the microservices architecture for the actual implementation of the composable services.

Figure 5 shows how sellers of products and services can request help from a back office, or self-serve a pricing request, contract creation, and registration request from a client. The solution is created by taking a building block approach to combining services and APIs to validate client information, create pricing, create and register contracts, and gather all approvals. As you can see in Figure 5, these services are composed and orchestrated to deliver business functionality, but they are hosted in public and private clouds as well as on on-premises IT. The composable services approach gave us faster time to market, a quicker pace of innovation, and the flexibility to adapt to new market demands.

**Figure 5. Orchestration of composable services across cloud platforms**

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**Why we changed our initial on-premises model to hybrid cloud**

The Quote-to-Cash application has to support thousands of internal users and business partners around the world, so it requires a highly available infrastructure. Our initial deployment started with an on-premises model that used a vertical cluster of three web application servers, a load balancer with an HTTP server for static content, a two-mirrored database for disaster recovery, and a demilitarized zone (DMZ) integrated with other systems of record — all behind the corporate firewall.
This deployment architecture was good enough to get us started, but with increased business demands, global scale, and user growth, we quickly identified several reasons to adopt hybrid cloud computing.

**Isolation of sensitive data**
Because all of the systems of record are deployed inside the corporate firewall, the sensitive data associated with these systems needs to be isolated. Private cloud provides additional isolation for your sensitive data while leveraging public cloud services.

**Compliance with U.S Federal and European data privacy requirements**
Deploying an application globally requires specific attention to individual country policies about data privacy. Certain countries inside of the European Union have very strict rules about data storage: They require that databases, backups, content, and documents be encrypted and stored on European soil. Others, like the U.S., require that data — especially government data — be stored on that country's soil. This often requires additional infrastructure and support in different geographical locations.

**Access from outside the firewall for business partners and clients**
To allow external access to the application, we needed to set up a new DMZ and an additional firewall to protect the internal network. This usually means adding new infrastructure and additional support staff, which can result in increased total cost of ownership.

**Scalability**
We needed to scale quickly due to new business demands and rapid growth in the number of users. In most environments, there is a direct correlation between the numbers of users and the capacity of the servers: The more users there are in the system, the more resources they consume. With an on-premises environment, the volume of users is limited to the amount of servers available in the architecture. If the number of users increases significantly, it's very likely that you'll need to add more resources (memory, disk, bandwidth) or new servers to the landscape.
Reduced cost of ownership
With the on-premises model, we hosted database, document management, and web application servers in multiple geographies and used local support staff to manage the local infrastructure. This resulted in significant costs for both IT infrastructure and labor. Hybrid cloud adoption helped us to reduce the total cost of ownership.

Reduced time to market and innovate rapidly
The sales Quote-to-Cash application is an enterprise app that supports various brands with a global audience. As business models change or new businesses are acquired, the application must respond rapidly to changes and provide new business capabilities in days or weeks. The services ecosystem and DevOps tooling available in Bluemix helped us to innovate rapidly and reduce time to market.

Benefits of microservices architecture
We originally implemented a monolithic application architecture and wanted to transform to a microservices architecture. The main idea behind the microservices architecture is to have fine-grained, loosely coupled services that achieve better flexibility, deployability, and scalability. With the on-premises model, it can be difficult to adopt the microservices approach due to the lack of readily available services like NoSQL databases or DevOps services that can realize the promise of microservices architecture.

Why we chose Bluemix for our hybrid cloud platform
We used the following criteria to select the type of cloud platform:

- Data centers in various parts of the world
- Public and private clouds that can be connected via secure channels
- Capable of supporting elastic runtimes, containers, and virtual machines
- Availability of an extensive catalog of APIs
- DevOps tooling available for rapid deployment
- Rich ecosystem of services from companies and open source providers
- Support for diverse runtimes and technologies

Bluemix met the selection criteria, so we adopted the Bluemix public cloud and Bluemix Dedicated (private) cloud, along with DB2 on the cloud, FileNet on the cloud, and the API Management platform. Figure 8 shows the different components of the hybrid cloud model and the interactions between them.

**Figure 8. The Quote-to-Cash application's hybrid cloud model**

Our hybrid cloud components

The various components of the hybrid cloud model that we implemented for our application are described below.

**IBM Bluemix**

Bluemix is IBM's Platform as a Service offering. It provides virtual containers to host applications and services using SoftLayer. Built on CloudFoundry technology, Bluemix provides the tools and services needed to simplify the development and delivery of applications.

The public version of Bluemix includes a variety of pre-built capabilities and services that facilitate the end-to-end implementation of mobile and web applications. It is accessible from the Internet, so any user, customer, developer, or business partners can leverage the capabilities in the ecosystem.

Because business partners require access to the Quote-to-Cash application from outside the firewall, we decided to provide the required functionality in the public cloud as follows:

- The application was split into four Liberty profile instances with a specific set of memory allocated for each, and redundancy based on utilization.
• The session is handled using the Secure Gateway service and shared across those four instances with the Data Cache service provided by Bluemix.

• The applications connect to DB2 on Cloud, which stores the transactional data using an adapter to send the data to the appropriate database instance (Europe or Americas) based on the country of the transaction. This approach minimizes the need for separate DB2 instances and movement of data between those instances.

• Data configuration and dynamic content are stored in Cloudant, a NoSQL database as a service with an adapter that stores data in multiple SoftLayer regions.

• We use several services from the Bluemix public ecosystem, offered by IBM and third-party providers to compose the required capabilities.

• Emails are sent through a third-party service called SendGrid.

• The authentication is via IBM One ID, and authorization is done using a cloud integration service to call an API hosted in the API Management platform inside the firewall.

FileNet SaaS (content management)

The Software as a Service FileNet offering in SoftLayer provides a full FileNet instance with up to 500 GB of storage. This instance is in Amsterdam with full encryption, backup, and maintenance services. It offers the complete set of features from FileNet, such as full text search, meta-data search, API access, security at a folder or document level, and reporting.

DB2 on Cloud

DB2 on Cloud provides database instances on the SoftLayer global cloud infrastructure. This database is a full DB2 instance similar to on-premises without the cost, complexity, or risk of managing the infrastructure. We created two highly available instances: one in the UK and one in the US. Each instance has two databases (one primary and one mirror for high availability) in order to comply with the specific country regulations.

Bluemix Dedicated

Bluemix Dedicated is a private cloud that includes a catalog of services that are made available specifically to meet the needs of an enterprise, including some additional services that are syndicated from the Bluemix public cloud. Bluemix Dedicated is a single-tenant Bluemix environment built on SoftLayer with the same level of security standards as the public platform, but developer access is controlled by company-specific LDAP policies.

The Quote-to-Cash application on the Bluemix Dedicated private cloud contains services that are syndicated from the public version, as well as a set of capabilities that are created specifically to access services within the internal network. The deployment in the dedicated environment is as follows:

• As in the public cloud, the application is split into four Liberty profile instances with a specific set of memory allocated for each, and redundancy based on utilization.

• The session is handled using the Secure Gateway service and shared across those four instances with the DataCache service syndicated from the Bluemix public cloud.

• The applications connect to DB2 on Cloud to store the transactional data using an adapter to send the data to the appropriate database instance (Europe or Americas) based on the
country of the transaction. This approach minimizes the need for separate DB2 instances and movement of data between those instances.

- Data configuration and dynamic content are stored in Cloudant, a NoSQL database as a service with an adapter that stores data in multiple SoftLayer regions.
- An ecosystem of services is created on the private cloud to enable the composability of new business capabilities.
- Emails are sent through an internal enterprise service called BlueMail.
- Users are authenticated against an internal LDAP server through the API Management platform, which acts as a proxy to leverage the internal APIs of back-end systems of record.

**API Management platform**

**API Management** enables users to create, assemble, manage, secure, and socialize web APIs. It provides a developer portal to attract and engage application developers, and fosters the use of published APIs. An administration portal helps establish policies for critical API attributes, such as self-registration, quotas, key management, and security policies. An analytics engine provides role-based insight for API owners, solution administrators, and application developers in order to manage APIs and ensure that service levels are being achieved.

**Hybrid cloud architecture for the Quote-to-Cash application**

Figure 9 shows the interaction between the different cloud environments involved in the hybrid cloud model. The red box represents the Bluemix public cloud, including some of the most-used services available, such as **Single Sign On**, **SendGrid**, and **Session Cache**. The yellow boxes represent the private clouds that are enabled in the environment for document management, databases, and the application. We have separated the private clouds because the document management and databases are offered in different private clouds. The blue box represents the enterprise network where the APIs are enabled on diverse systems of record and accessed via the API Management platform.

**Figure 9. Hybrid cloud architecture**
Benefits of the hybrid cloud model

Adopting the hybrid cloud model helped us speed up our transformation to a digital enterprise and optimize our existing IT investments. We achieved clear business outcomes of speed and agility.

There are quantifiable benefits to the hybrid cloud model. By connecting on-premises resources with our private cloud and the Bluemix public cloud, we have reduced our total cost of ownership by 22%. With the hybrid cloud model, we significantly improved our ability to drive innovation without huge up-front costs, while balancing isolation and scaling requirements. We achieved rapid time to market for new business capabilities by using the ecosystem of services in the public Bluemix cloud and private Bluemix Dedicated cloud, while achieving compliance with US Federal and European data privacy laws. In essence, we achieved a composable enterprise vision by making the sales Quote-to-Cash application adaptable and scalable to changing demands. Here's a detailed breakdown of how moving to a hybrid cloud model helped us reduce our IT costs.

Financial benefits of a hybrid cloud model compared to traditional on-premises IT

<table>
<thead>
<tr>
<th>IT component</th>
<th>Reduction in costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web application server on the cloud</td>
<td>25%</td>
</tr>
<tr>
<td>Database on the cloud</td>
<td>30%</td>
</tr>
<tr>
<td>Content management on the cloud</td>
<td>10%</td>
</tr>
<tr>
<td>Support staff</td>
<td>25%</td>
</tr>
<tr>
<td>Service/APIs</td>
<td>20%</td>
</tr>
<tr>
<td>Total cost of ownership</td>
<td>22%</td>
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</tbody>
</table>

Conclusion

If, like most companies, you're trying to drive continuous and sustainable operational improvements that lower costs and reduce complexity, consider hybrid cloud computing. It gives you a way to reinvent IT for the next phase of growth and innovation. The hybrid cloud model that we implemented provides cost-effective computing that balances security, scalability, reliability, and flexibility. It also enables rapid time to market with new capabilities while complying with US Federal and European data privacy laws.

Related resources

- The IBM Redbook "Hybrid Cloud Data and API Integration" shows you how to integrate your enterprise and cloud with Bluemix Integration Services.
- Learn more about DB2 on Cloud, which provides a database on IBM's SoftLayer global cloud infrastructure.
- Read the Bluemix overview for more information on IBM's open cloud platform, which gives mobile and web developers access to IBM software for integration, security, transaction, and other key functions, as well as software from business partners.
- Learn how to "Move your Java application into a hybrid cloud using Bluemix" (developerWorks, October 2015) in this three-part tutorial series.
• In his blog post, Sam Lightstone reveals *nine ways that hybrid cloud delivers real IT and business benefits.*
• Learn more about the **Composable enterprise**, a great article by Jonathan Murray, CTO of Warner Music.
Related topics

- Bluemix architecture
- Explore IBM Bluemix
- Implement a microservice-based architecture in Bluemix

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