IBM z Systems
The Beating Heart of the Mobile and API Economy

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Mobile

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Point-of-View

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Modern APIs and enterprise systems: Friend or foe?

Highlights

The digital economy forever changed how consumers, businesses, and employees interact. As your organization's strategy shifts to embrace this new market, consider the following facts:

- ▶ Mobile, web, and cloud technologies are enabling new kinds of business models in which innovative services can be created in a matter of hours from a palette of easy-to-consume application programming interfaces (APIs).

- ▶ In this API-driven world, organizations can monetize the value of their corporate data and enrich the user experience with third-party APIs. This ability offers more personalized, concierge-style services.

- ▶ IBM z Systems platforms have a central role to play in the API economy by hosting the most critical and valuable business services and data in the enterprise.

- ▶ New technologies were recently introduced that make the mainframe fully conversant with REST APIs, which puts z Systems platforms at the heart of the API economy.

- ▶ Now, contemporary mobile, digital, and cloud applications can directly and securely use z Systems business applications as an equal partner in the API world.

Digital channels are the primary way to start consumer and business engagements by providing accessibility to a global audience and a cost-effective means to conduct business. In recent years, mobile devices became the preferred way in which consumers, business partners, and employees interact with companies and each other. The *hyper-connectivity* of mobile users sets the expectation that information is at their fingertips whenever they require it. Increasingly, this information must be the right information, delivered in context, and almost certainly drawn from multiple sources to enhance the mobile user's experience.

Take the example of a banking mobile app. It commonly offers access to account information, the ability to make payments, and perhaps the user can deposit a check by using the device's camera. All of these activities require information that comes directly from the bank.

Many banks now augment their mobile apps with third-party services, such as Google Maps, to combine geolocation data and mapping tools that help the mobile user find the closest branch. More sophisticated services are emerging in these apps that allow bank customers to transfer money to friends and colleagues based on their Twitter accounts. These new capabilities offer innovative and convenient ways to transact business through the bank, and many of these services rely on integrating the bank's systems with sources beyond the boundary of the traditional enterprise.

Currently, there is a shift in the market as traditional businesses realign to offer these new value-added services by collaborating across multiple market segments. For instance, banks hold a significant amount of personal data and are poised to tap into this information to offer more personalized, concierge-style services. These services offer convenience to the individual, brand loyalty, and new revenue streams to the bank as they combine their own data with services from retailers, insurers, utility companies, and social media providers.

To create powerful and useful mobile apps, the use of application programming interfaces (APIs) becomes essential. Although not exclusively built for the mobile world, APIs are becoming a significant part of successful mobile apps. It is estimated that by 2018, some 68% of all mobile apps will be powered by APIs.[1]

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[1] *IBM API Management and IBM Worklight: Enabling Mobile in the API Economy*: https://www.youtube.com/watch?v=KuVs9-qETtQ

1

APIs can help quickly address new market opportunities, which empower developers to use core business services to continuously build, refine, and deploy apps at top speed. Moreover, organizations that enable their assets with APIs can monetize investments in their application logic and business data.

In this rapidly evolving mobile and API world, IBM® developed and adopted new technologies to accomplish the following key objectives:

▶ Surface enterprise resources as a set of secure and scalable APIs quickly and simply by using IBM z/OS® Connect Enterprise Edition.

▶ Establish a developer ecosystem that is used to socialize and use these new APIs that use IBM API Connect™.

▶ Create, run, secure, and manage these APIs that offer per-use charge-back models and draw analytical insight into their use with IBM API Connect.

This IBM Redbooks® Point-of-View publication gives a perspective on the role of IBM z Systems™ platforms as a powerful contributor in the API economy. In this paper, we describe the technology enablers that allow traditional mainframe environments to be used as a set of RESTful business services and participate as a provider of contemporary mobile and cloud-based services.

A successful mobile and API strategy centers on z Systems environments

Most IBM z Systems™ environments deliver business-critical applications and data to the enterprise. Given that nearly 70% of all enterprise transactions touch a mainframe,[2] that fact ultimately makes it the most prolific contributor of services that are needed to power APIs for mobile and digital services. However, z Systems platforms are not immediately thought of as API powerhouses. Why?

The answer is probably because the predominant access routes to these platforms are via messaging or web services; whereas, the wider industry is moving toward open, discoverable Representational State Transfer (REST) APIs, which are the de facto standard for creating the mobile and cloud apps that are used by the fastest-growing digital startups.

The recent introduction of IBM z/OS Connect Enterprise Edition makes the mainframe fully conversant with REST APIs and puts z Systems environments at the center of the API economy. Applications that are developed with IBM CICS®, IBM IMS™, IBM WebSphere® Application Server, and IBM DB2® for z/OS can now be accessed as a RESTful service thanks to z/OS Connect. The design principle for z/OS Connect is to provide configurable services (zero coding is necessary), which enables developers to self-discover and use mainframe applications as REST APIs with no change to the underlying application. The tantalizing prospect here is that CICS, IMS, and IBM DB2 services can be used in the same way as a Google or Twitter API.

Although z Systems platforms support many of the most sophisticated enterprise applications and data today, the value increases exponentially when harnessed with an enterprise-wide suite of APIs. The challenge then becomes governing potentially thousands of APIs across and beyond the enterprise. The initial focus is often to secure and throttle these APIs, especially because many are published beyond the boundaries of the organization. However, scratch the surface and there is a clear need to have a central point for APIs to be located so that they are socialized within a large community.

IBM API Connect offers the complete lifecycle solution for the API economy. It provides a single location for APIs to be created and then surfaced in a portal through which developers can discover and invoke APIs. Security is deeply embedded in API Connect, which enables restricting and throttling access to APIs based on policy agreements between the API user and service provider. This capability is critical as organizations monetize their business services as part of this pay-as-you-use utility model that is now being promoted.

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[2] *IBM z Systems Integration Guide for the Mobile and API Economy*:
http://www.redbooks.ibm.com/redpieces/abstracts/redp5319.html?Open

Another key aspect to API Connect is the analytics engine. This engine offers insight into the consumption pattern of APIs, which enables organizations to refine their business services.

The combination of z/OS Connect Enterprise Edition and API Connect provides a holistic solution to share and manage core business services from z Systems environments and the wider enterprise to internal and external development communities. These technologies elegantly integrate to surface z Systems APIs directly into the creation and management phases of the API lifecycle.

IBM z/OS Connect Enterprise Edition: The strategic API gateway into z Systems environments

Contemporary developers of mobile, web, and cloud applications expect to use business services quickly as a set of intuitive, self-describing APIs. Details about the underlying systems, data models, or operational models are irrelevant and of no concern to the developer, if the service fulfills the expected functional and non-functional requirements.

IBM z/OS Connect Enterprise Edition provides precisely this level of abstraction for APIs into the core business services and data that is on z Systems platforms. z/OS Connect Enterprise Edition delivers the capabilities that are shown in Figure 1.
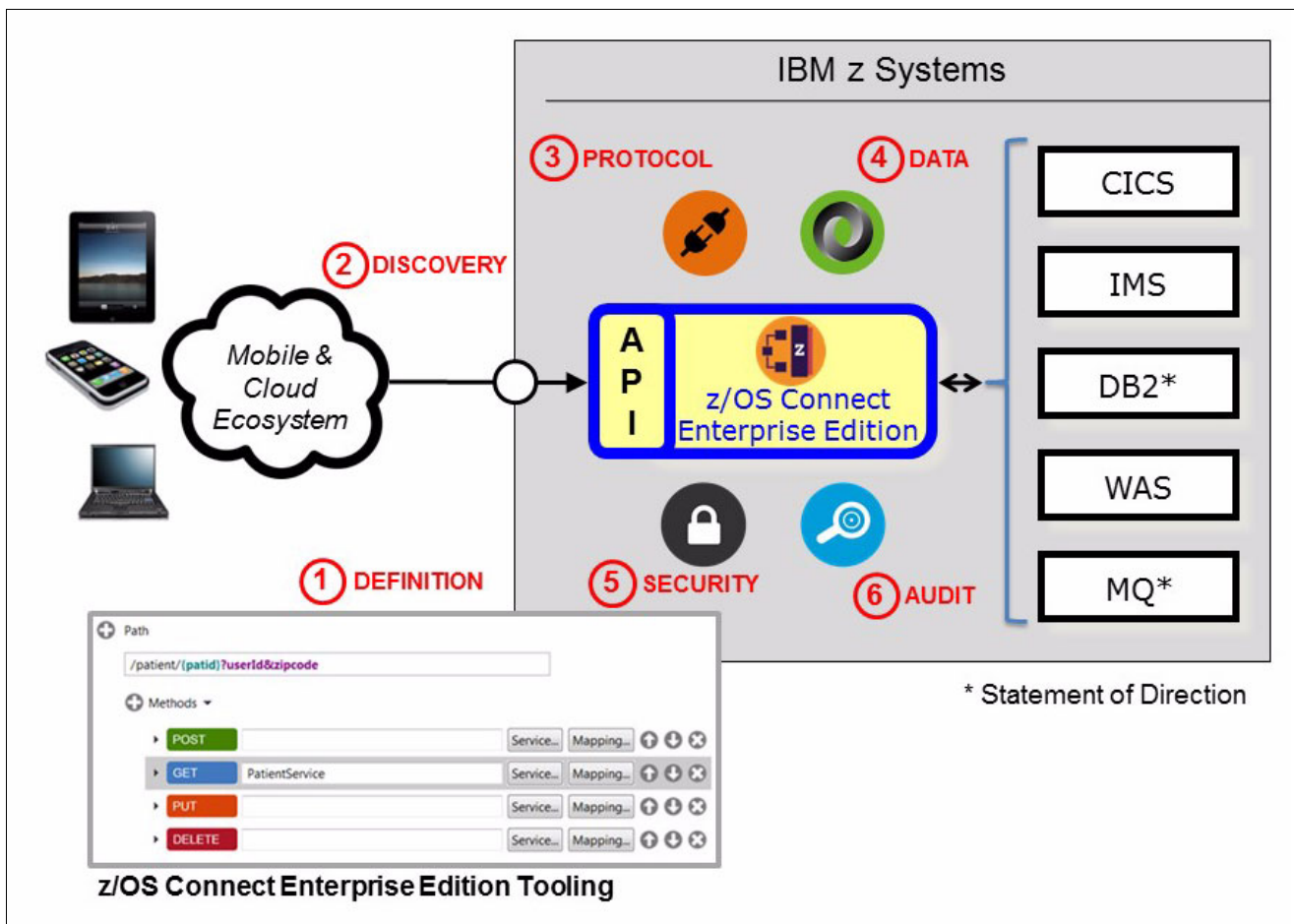

Figure 1   IBM z/OS Connect Enterprise Edition acting as the API gateway to IBM z Systems environments

The following z/OS Connect Enterprise Edition capabilities are shown in Figure 1 on page 3:

▶ Definition (Capability 1)

Owners of the business services that underpin a particular API typically have the greatest understanding of the true nature of the transaction, so they are in the best position to define it. z/OS Connect Enterprise Edition provides intuitive tools to enable the service owner to rapidly define the façade of the API as it maps to the underlying transaction.

▶ Discovery (Capability 2)

z/OS Connect Enterprise Edition provides a secure discovery service, where developers with the appropriate security credentials can explore and browse the catalog of services that is published in z/OS Connect Enterprise Edition. The open standards definitions of these APIs ensure that developers and technologies, such as IBM API Connect, can query and import service definitions directly into their own API catalogs.

▶ Protocol (Capability 3)

APIs are most frequently used as RESTful services, which follows the Internet-style architecture for calling remote services. At run time, z/OS Connect Enterprise Edition provides the bridge to receive the RESTful services request and convert this request into a native call into the relevant z/OS subsystem, which can be CICS, IMS, DB2, or WebSphere Application Server for z/OS. Critically, this protocol conversion means that no change is needed to the underlying application.

▶ Data (Capability 4)

Another characteristic of REST APIs is that they most commonly support a JavaScript Object Notation (JSON) data payload. At run time, z/OS Connect Enterprise Edition provides a bridge to map the inbound data structure from JSON to the native structure that is expected by the underlying service provider. This capability is the second critical piece of z/OS Connect Enterprise Edition. This data mapping means that no change is needed to the underlying application.

▶ Security (Capability 5)

z/OS Connect Enterprise Edition takes full advantage of z Systems security architecture, which ensures that API discovery and runtime requests are fully authorized and authenticated before being executed.

▶ Audit (Capability 6)

IBM z Systems platforms are optimized to provide a fully auditable record of activity on the system with little or no overhead drain on operational capacity. z/OS Connect Enterprise Edition software taps into this capability, and provides a full audit trail of which services are called, when, how frequently, and by whom. Armed with this information, business service providers can refine, iterate, and optimize their offerings in response to consumer demand.

Therefore, there are compelling incentives to adopt z/OS Connect Enterprise Edition as the strategic API gateway into z Systems environments because it offers the following benefits:

▶ Provides a common and consistent entry point for access to one or many back-end systems
▶ Shields developers from the implementation detail of underlying z Systems applications
▶ Shields core business applications on z Systems from inquiries from REST APIs
▶ Provides a control point for authorization, by using z Systems security, for users to invoke core services
▶ Provides an audit point for capturing use information about underlying core applications
▶ Simplifies the use of core services, which enables REST verbs to map directly to core business functions

Power the API economy with IBM API Connect

After the mainframe-based core business services are API-enabled, the key next step is for those services to participate in the organization's wider API framework. It is vital to curate the APIs to ensure that they are well-defined, usable, appropriately secured, and that their consumption models are well-understood. Meeting these requirements introduces the need for an API management solution.

IBM API Connect fulfills this precise function by simplifying and enabling all aspects of the API lifecycle, as shown in Figure 2.
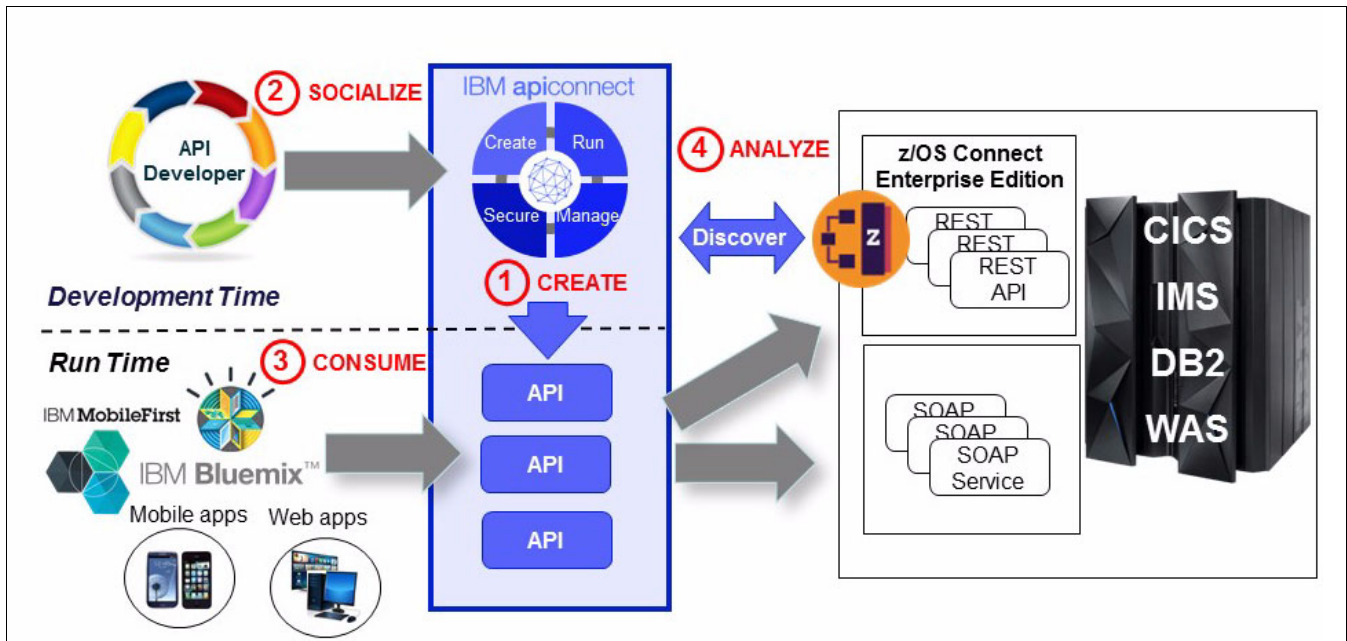

Figure 2   Navigating and governing the API lifecycle with IBM API Connect

The following capabilities of API Connect are shown in Figure 2:

► Create (Capability 1): API definition and creation

APIs can be imported, discovered, or adapted from services and then industrialized. z/OS Connect Enterprise Edition standards-based API definitions enable API Connect to import z Systems services automatically. After they are defined in API Connect, the APIs are hardened with entitlement and security definitions. This approach simplifies version-to-version management of services.

API Connect also provides a comprehensive API creation tool set and a multi-technology adapter framework. It enables APIs to be created from various services, which range from APIs, web services, databases, messaging systems, or even Internet of Things devices. It is uniquely positioned to support the rapid assembly and prototyping of APIs, which helps teams experiment, expand, and deploy new APIs.

► Socialize (Capability 2): Socializing the APIs

A major benefit of the API economy is to unlock the innovative potential of a multitude of developers. API Connect provides a Developer Portal in which communities can register, explore, and discover APIs in an intuitive, self-service way. This requirement is within and increasingly beyond the boundaries of the enterprise.

► Consume (Capability 3): Consuming APIs

After the developers sign up to access a set of APIs, their credentials and agreed entitlement are enforced through a security gateway that shapes and routes the traffic of their requests to the appropriate end-point service.

► Analyze (Capability 4): Analyzing APIs for insight

One of the most critical factors in establishing a business model that is based on APIs is understanding who is calling which services, how frequently, and from where they are calling. API Connect offers a comprehensive analytics service to enable API providers to refine and enhance their underlying business services.

Scenario: From the drawing board to mainframe-powered mobile app

Consider a scenario in which a mobile app developer wants to rapidly prove a business concept by combining a set of services in an innovative new way. Assume that IBM z/OS Connect Enterprise Edition was configured to show a set of CICS application functions as a series of REST APIs that are governed by IBM API Connect.

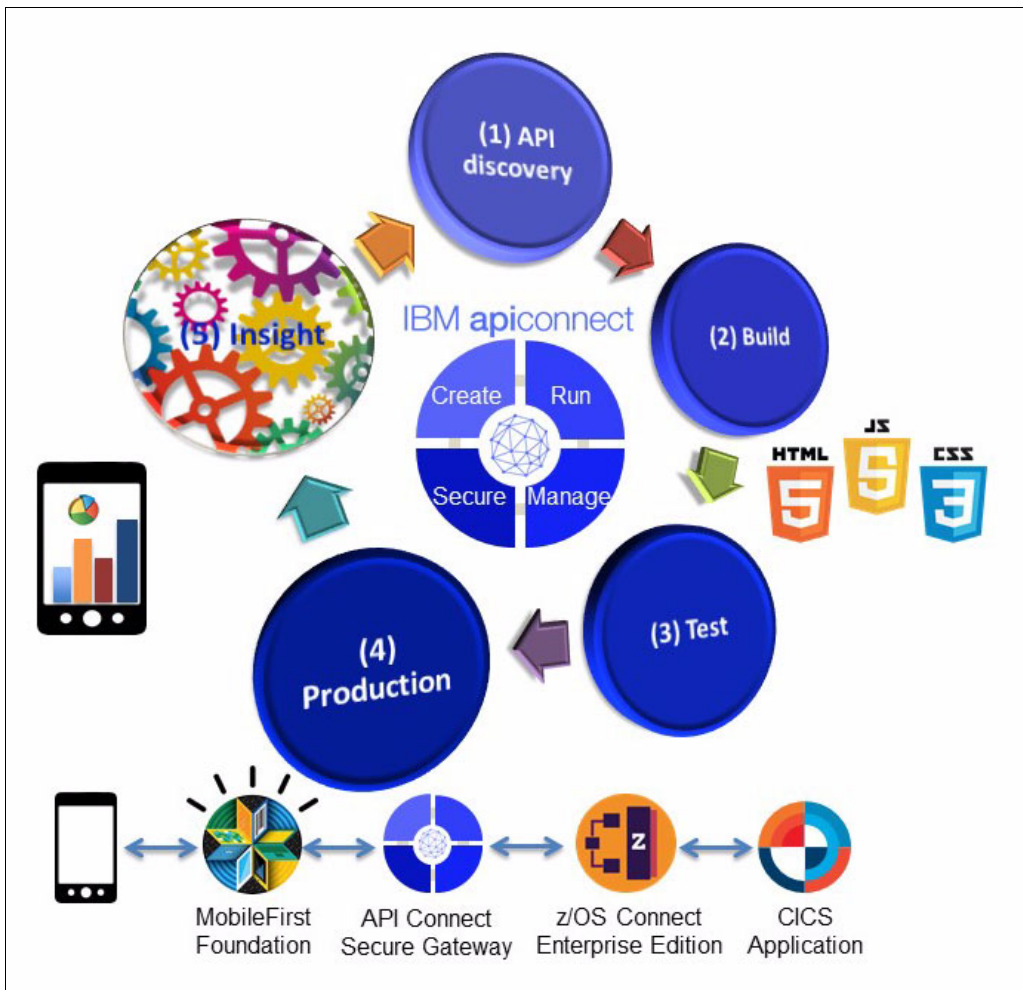The accelerated lifecycle of the mobile app in the API economy is shown in Figure 3.

Figure 3   Lifecycle of a mobile app in an API-enabled world

As shown in Figure 3, the lifecycle of a mobile app includes the following steps:

► Step 1: API discovery

Developers can explore the APIs that are available in the IBM API Connect Developer Portal. They do not need to consult a mainframe expert to use the CICS application and do not need any understanding of the data payloads. They are entirely self-sufficient to understand and call the service in the same way they would with a Twitter or Google Maps API.

- ► Step 2: Build

    After developers identify the most appropriate APIs and how to use them, they can start building their mobile apps. One of the fastest proven paths to creating and operating successful apps is to use a Mobile Enterprise Application Platform (MEAP), such as IBM MobileFirst™ Foundation.

- ► Step 3: Test

    After creating the app, the developer can test the mobile service through the MEAP, which proves that each API is successfully returning information from the CICS application. Success! However, all of the data that is returned is text, which is not ideal for a mobile user experience. So, our intrepid developer who is keen for the prototype to impress, discovers a NoSQL image library that corresponds to the reply from CICS. Realizing this feature will be useful in the future, the developer can use the tools in IBM Connect to create an API that aggregates the original API request from CICS with the images from NoSQL.

    At this stage, a developer can demonstrate the viability of a new mobile service, which proves new business concepts in a matter of hours instead of weeks or months. Also, the enhanced API can now be industrialized and governed by IBM API Connect.

- ► Step 4: Production

    After the mobile app is tested and refined, it can be published for use by customers or employees.

- ► Step 5: IBM Insight™

    After the app is released, individuals settle into common use patterns and from there, it is important to understand which APIs are most frequently used and whether they must be refined. Increasingly, organizations are introducing multiple apps, each with a focused set of functions for a more streamlined user experience. Therefore, many apps use hundreds of APIs and in all likelihood, there will be many more cloud and web apps that will use an even broader range of APIs.

    It is at this stage where API Connect excels by providing analytical insight into which APIs are called, how frequently, and by whom. For mainframe teams that want to hone in on their most valuable assets, the built-in audit capabilities in z/OS Connect Enterprise Edition offer a more detailed perspective.

The tools and techniques that are described in this scenario dramatically reduce the needed time to complete the full lifecycle of any mobile or cloud-based application. This scenario illustrates how new business concepts can be tested and proven in a matter of hours, rather than weeks, and supports the model of *fail-fast, fail-often, iterate and learn for success*.

Based on this new API economy, new business offerings can be delivered in a matter of days and weeks, built on a foundation of core business services underpinned by z Systems platforms.

What's next: How IBM can help

IBM recently enhanced and introduced new technologies in the marketplace to support the emerging mobile and digital economy, which is driven by APIs. Technologies, such as IBM z/OS Connect Enterprise Edition, place core business services that are hosted on IBM z Systems platforms at the center of this new world and securely extend these services beyond the enterprise with IBM API Connect for full API lifecycle creation and governance.

If you are running a mainframe and are in the process of a digital transformation, place z Systems platforms at the heart of your API economy. IBM has extensive mobile, cloud, and z Systems expertise and can organize and perform the following tasks for you:

- ► Assess the effectiveness of your mobile solutions, now and in the future.
- ► Conduct a z Systems mobile or API workshop, including presentations and demonstrations of deploying mobile solutions on z Systems platforms.
- ► Organize an IBM Smarter Banking® demonstration for those organizations in the banking sector. The demo focuses on some of the mobile and API banking scenarios that are highlighted in this paper.

► Arrange tailored proofs of concepts to demonstrate the key benefits that are described in this paper with your own systems, applications, and data.

For more information about using z Systems platforms for mobile solutions, contact your local IBM representative.

Resources for more information

For more information about the concepts that are highlighted in the paper, see the following resources:

► IBM Middleware, API economy:

http://www.ibm.com/middleware/integration/en-us/api-economy.html

► IBM z/OS Connect Enterprise Edition product page:

http://www.ibm.com/software/products/en/zos-connect-enterprise-edition

► IBM API Connect product page:

http://www.ibm.com/software/products/en/api-connect

► Mainframe software for IBM System z®:

http://www.ibm.com/software/os/systemz/mobility/

► *IBM z Systems Integration Guide for the Mobile and API Economy*, REDP-5319:

http://www.redbooks.ibm.com/abstracts/redp5319.html

► *IBM System z in a Mobile World: Providing Secure and Timely Mobile Access to the Mainframe*, SG24-8215:

http://www.redbooks.ibm.com/abstracts/sg248215.html

► IBM developerWorks®, APIM for z: APIs for the Enterprise:

https://developer.ibm.com/apimanagement/2015/05/13/apim-for-z-apis-for-the-enterprise/

► *The Power of the API Economy: Stimulate Innovation, Increase Productivity, Develop New Channels, and Reach New Markets*, REDP-5096*:*

http://www.redbooks.ibm.com/abstracts/redp5096.html

► *Stepping Forward into the API Economy*, REDP-5164*:*

http://www.redbooks.ibm.com/redpapers/pdfs/redp5164.pdf

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