Field guide to application modernization

on IBM Power Systems™

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IBM **Power Systems**

IBM

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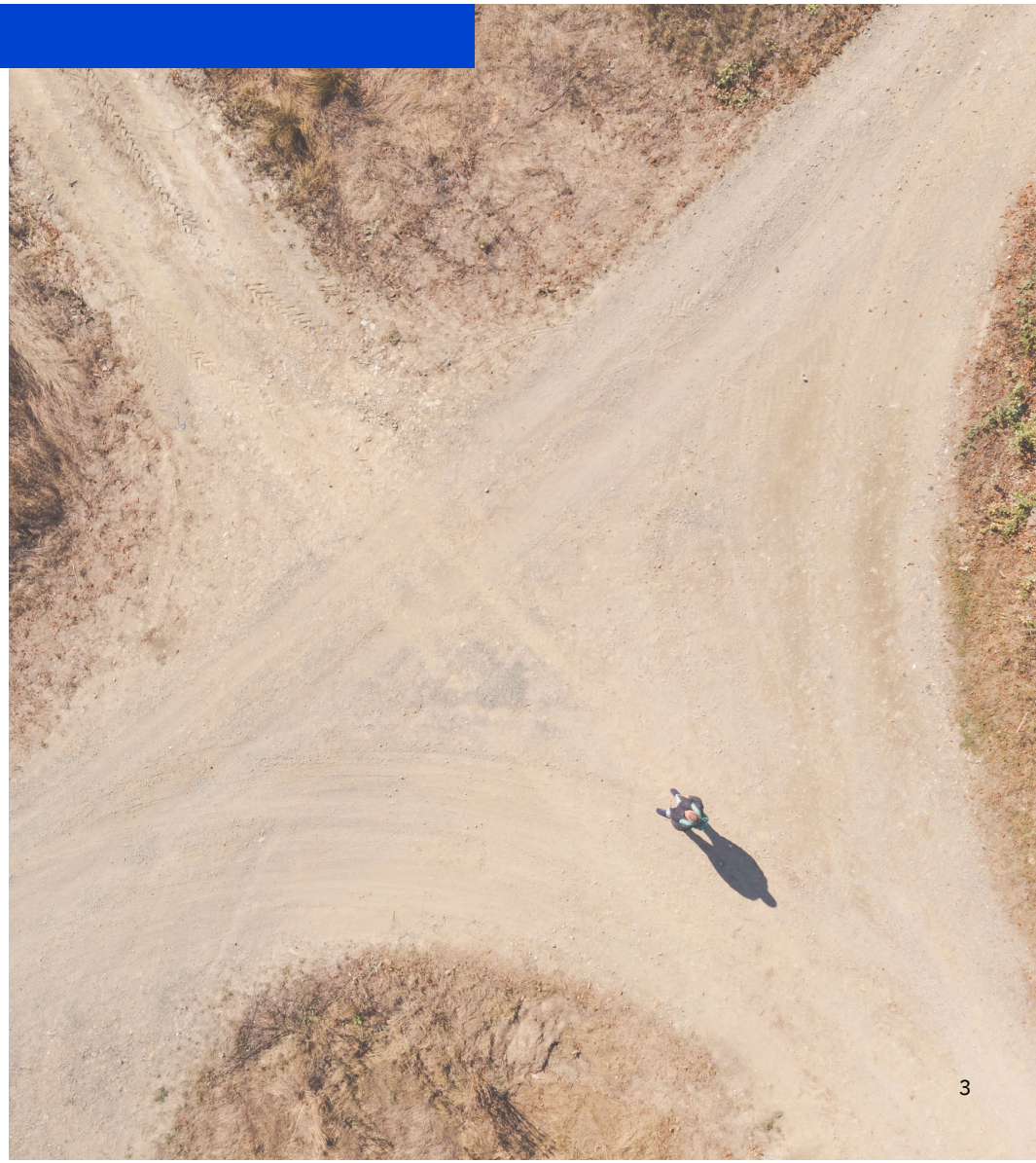
It’s time to modernize your enterprise application portfolio

Rapid changes in the world over the last two years (including COVID-19) are impacting IT in a very profound way. IT strategies are shifting to serve an increasingly always-on world, and for many organizations this has meant accelerating digital transformation efforts. Managing and modernizing critical processes and operations remain top priorities for IT leaders like you who want to find new ways to gain advantage and opportunity in a fluctuating environment. The question for your business, then, is how do you know when it’s time to modernize an application? Where do you start, and what are the best ways to make a business case for the investment in modernization? In this ebook, we will describe the best practices for building modern applications in an incremental, safe and economically sound manner. We will also describe how to avoid some of the common pitfalls that enterprises fall victim to (examples include no clear business value, projects taking too long, vendor lock-in) so that you know what to keep an eye out for as you embark on this journey.



Drivers and immediate benefits

What exactly is "app modernization"? In its simplest form, it's the process of updating an app so that it can be maintained, extended, deployed and managed in a way that allows the app to meet your current and future needs. Application modernization opens the door to several business and technical benefits for your organization. Let's take a closer look at some of them.

Accelerate digital transformation

More than ever, organizations need to find new ways to provide innovative, engaging experiences that satisfy existing customers, attract new ones and gain a competitive edge. A Forrester Consulting study — commissioned by IBM® — on the business value of modernizing applications with IBM and Red Hat® solutions found that modernization efforts can help accelerate release frequency by up to 10x, improving customer engagement, time to market and operations.[1]

Gain a superior developer experience

Your organization's most valuable assets are its people. When it comes to uncovering hidden competitive advantages through IT, you want to ensure your app developers always have the right set of technologies — and the most up-to-date applications — at their fingertips to unleash their creativity and build truly amazing customer experiences.

Deploy enterprise applications anywhere in the hybrid multicloud

As enterprises further embrace a hybrid cloud strategy, it's critically important that applications have the flexibility to be deployed anywhere across this landscape to reap the full benefits. This will allow you to leverage the continuous innovation that's happening across public cloud providers along with the security, data privacy and reliability of your own data center. This level of choice and flexibility is paramount for successful competitive differentiation in today's market.

Building a business case for modernization

One of the biggest challenges your enterprise will likely encounter before its modernization journey even begins is securing a budget. Build a business case by demonstrating how app modernization will not only pay for itself but generate additional savings over time.

Consider these quantified benefits Forrester has illustrated in its Total Economic Impact™ study of both IBM and Red Hat solutions together.[1]

Infrastructure savings

4%

Reduced top-line TCO by up to 4%.

44%

Decreased hardware costs by up to 44%.

30%

Optimized resource utilization by up to 30%.

50%

Reduced licensing costs by up to 50%.

Workforce productivity and acceleration

33-90%

of infrastructure administration labor reallocated.

66%

Accelerated development cycles by up to 66%.

Enhanced business outcomes

10x

Increased release frequency by up to 10x (signifying more features and patches reaching customers more quickly).

2x-10x

Accelerated workload processing speed by between 2x and 10x.

Virtually eliminated
user-impacting downtime.

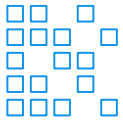
Four actions to modernize your applications

When you modernize your existing enterprise applications, you can ease your transition to a hybrid cloud environment by gaining the flexibility to run your apps wherever you want, whenever you want. Embracing a cloud-native microservices approach will allow you to capitalize on the scalability and flexibility inherent to cloud.

Modernizing on IBM Power Systems enables new cloud-native microservices to coexist and connect with your existing enterprise applications and investments, while still leveraging the inherent performance, reliability and security benefits of the Power platform. You can thus remove barriers to productivity and integration in order to create new user experiences, develop new applications and ultimately unlock new business opportunities.

Assess current applications

Identify traditional, composite and cloud-native applications.



Modernize incrementally

Innovate while minimizing complexity and identify common modernization patterns and use cases.

Embrace a DevOps culture acrosss the board

Deploy and operate traditional apps and cloud-native apps seamlessly

[1] Assess current applications

Begin your app modernization journey by assessing your current applications. Identify applications that can be readily deployed in a cloud and those that will require refactoring. This is an ongoing process. As you're progressing on your modernization journey, you should complete a series of application assessments. After each assessment, evaluate where things stand relative to your organizational goals and budget and repeat as needed.

Identify traditional applications

Traditional applications, sometimes referred to as monolithic applications, have served enterprises well over the last 15+ years. Applications of this nature typically consist of multiple services packaged and deployed as a single unit, usually running inside a virtual machine (also known as an LPAR). For example, consider a fictitious banking application running a 3-tier architecture whose application tier provides services for deposits, withdrawals and balance inquiries. The presentation and app tiers are typically deployed and updated as a single unit into a J2EE runtime (for example, IBM WebSphere Application Server) on Power Systems. Often, applications of this kind grow over time and consist of several WAR files bundled up into one gigantic EAR file. The underlying data tier is served by a highly available relational database (for example, Db2 or Oracle) running inside a virtual machine (for example, IBM AIX™ or IBM i), leveraging years of proven and trusted reliability and performance. This is a perfect example of a traditional application that is well-poised for modernization.

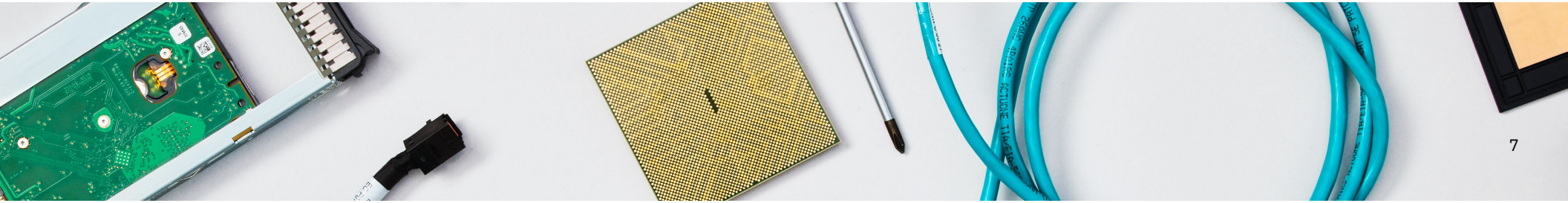
Identify composite applications

Composite applications are those represented by a combination of traditional apps and cloud-native apps — that is, apps leveraging both virtual machines and containers. Some form of this tends to be the "sweet spot" for many organizations, as it lets them take advantage of new modern software development techniques where they provide value without forcing them to rewrite every application. Composite apps have previously gone through some form of modernization. Aim to continue iterating on this journey as time, budget and return on investment (ROI) allow.

For example, if an enterprise application provides ten high-level capabilities, the first few rounds of modernization may have only converted three of them to a cloud-native model because they were the services that were most important to update and provided the most business value. During the next software cycle, the next two most valuable services were selected, and so forth. This cycle continues until either the entire app has been converted to a fully cloud-native model or until there is no longer sufficient ROI (or budget) to continue.

Identify cloud-native applications

Cloud-native applications are applications that were "born in the cloud," meaning they take full advantage of a microservice-based architecture and leverage containers and a corresponding container orchestration platform (likely Kubernetes or Red Hat® OpenShift®, or both). These applications can, generally speaking, run anywhere — either on premises in one or more public clouds. Thus, you can run these apps where you want, when you want, based on the needs of your business. While cloud-native applications likely don't require any significant architectural updates, there are still opportunities to ensure you're fully leveraging multicloud management capabilities and DevOps automation pipelines for app deployment, configuration and updates. This will ensure that everything on the app is done in a reliable, repeatable and secure manner.



[2] Modernize incrementally

The next stop on your app modernization journey is to create a roadmap. This way you are modernizing a piece at a time rather than attempting to tackle your entire enterprise infrastructure all at once.

Innovate while minimizing complexity

App modernization has many benefits but also common pitfalls. In particular, projects can take too long, become too expensive, or run on without clear definitions of when they are "done." They all revolve around one common thread — managing complexity relative to the innovation and business value being extracted. When it comes to mission-critical apps, there are important benefits to modernizing on a compute platform that you trust with your enterprise applications — a platform that lets you develop, run and manage apps and workloads in a consistent way across a hybrid cloud environment. One key benefit is the ability to minimize risk and expense while maximizing value. For example, on IBM Power Systems, you can continue running your existing apps — eliminating risk and drastically lowering expenses — while you start surrounding them with new cloud-native apps at your own rate and pace. Not only are you then able to leverage your existing investments, but you also reap all the innovation, technology and economic benefits of the Power platform as you modernize your technology stack, as shown in Figure 1.

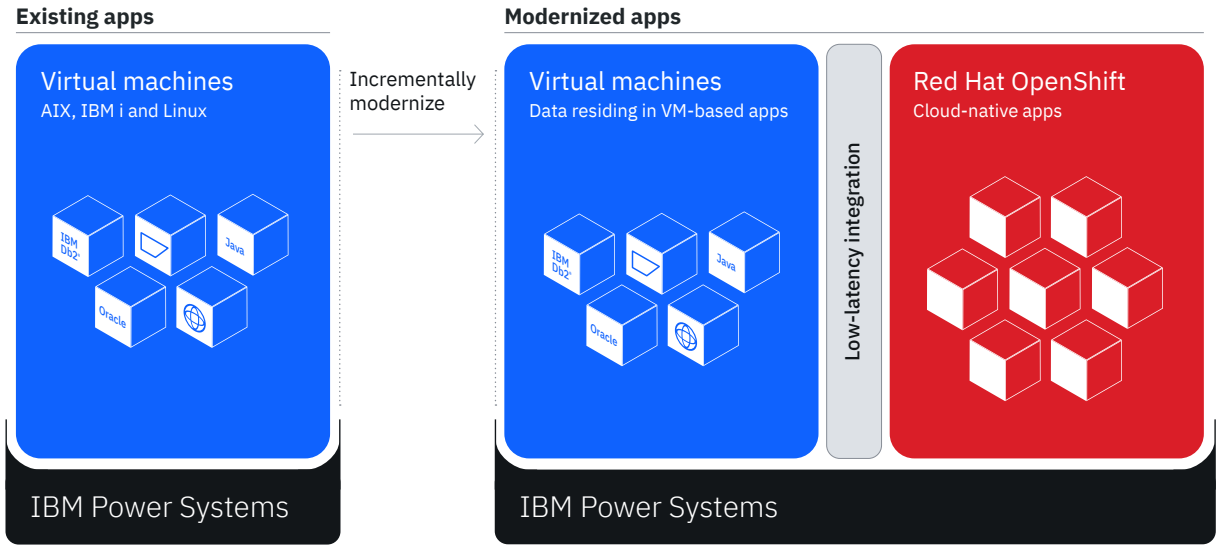


Figure 1: Incremental app modernization on IBM Power Systems

Common modernization patterns and use cases

Step 1: Embrace containers and surround existing enterprise applications

While the concept of "containers" has been around for several years in various forms, it's only within the last 3 to 5 years that containers have become widely popular. This explosive growth was fueled by the ecosystem — that is, the concept of popular container registries (such as Docker Hub and Quay.io) as places for developers to download and share reusable container assets. With containers, you can isolate individual components, refactor and test them, redeploy, and scale as needed — all without disrupting or updating the entire application itself. These loosely coupled microservices carry common sets of standards and security as they travel across your hybrid cloud.

In addition to all the inherent technology benefits of containers — they are lightweight, quick to start, and have consistent and portable app runtime — now developers can easily share these assets with each other, greatly reducing the time to build applications as less time is spent on the underlying boilerplate work.

To that end, an easy place to start your modernization journey is to surround your traditional applications with new and innovative cloud-native services. For example, going back to our fictitious banking application, imagine that you want to create a new mobile front-end interface or leverage cloud-based location services to find the nearest ATM. This provides an approachable low-risk path that won't disrupt your existing apps, yet also paves the way for innovation and skill development with new programming languages and development methodologies including Node.js, Python, Golang, CI/CD. You can also leverage new deployment and operational practices of modernized applications with Red Hat OpenShift Container Platform and Red Hat Ansible® Automation Platform — all while leveraging your existing Power Systems hardware investments.

Step 2: Transition to containers

As your app modernization journey advances further and you grow comfortable with the technology, tools and practices involved, you can evaluate packaging apps inside containers, paving a path to more portable applications across the cloud and more frequent software updates by leveraging DevOps practices. Assuming your apps are based on portable technology (Java, for example), this is a fairly straightforward process. You usually do not have to make many changes to the application itself to reap the operational, management and monitoring benefits of containers paired with Red Hat OpenShift.

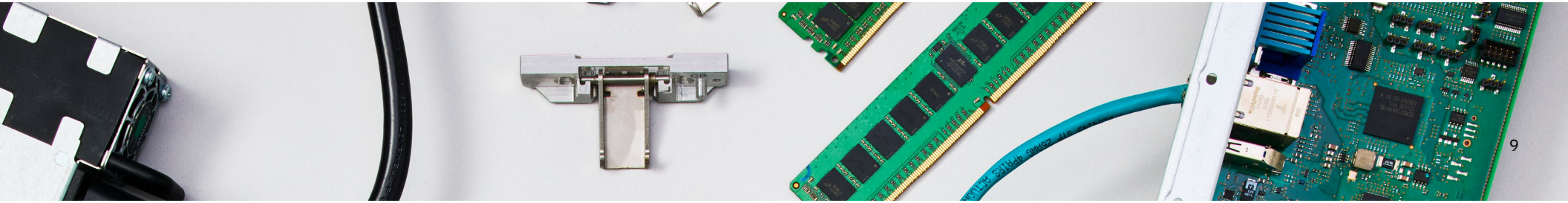
> An easy place to start your modernization journey is to surround your traditional applications with new and innovative cloud-native services

For applications running native IBM AIX or IBM i technology (RPG or COBOL, for example), consider leaving them as-is and focusing on the "surround with containers" approach described previously. This provides a path to maximize innovation with new technologies while eliminating the large risk and expense of re-platforming.

Step 3: Rearchitect to cloud-native, microservices and API-first architecture

As described previously, the second step to application modernization is to transition your apps into containers. That does not necessarily mean those apps are truly cloud native. Each cloud-native application has a set of microservices representing each logical capability. Each microservice also has a well-defined API that sits on top of it to expose its capability. Because this approach typically requires changes to the application, it can take longer to complete than just moving your app into containers. With that in mind, taking an iterative approach to the process will keep things manageable.

Leveraging these approaches as part of your modernization journey will open doors to tremendous benefits. These include a quicker time to market, increased developer efficiency, app deployment flexibility, seamless integration with DevOps automation and access to the latest technology innovations.



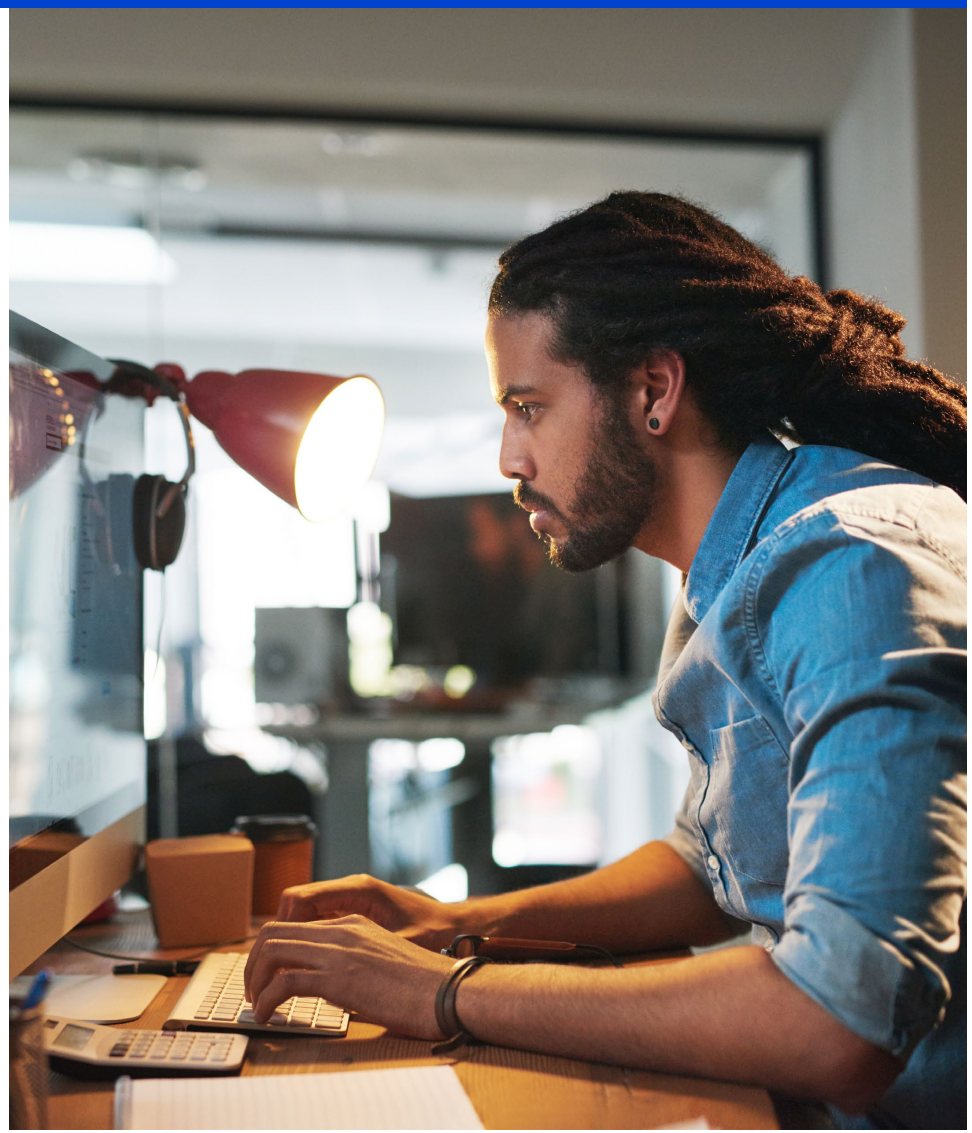
[3] Embrace a DevOps culture across the board

As you embark on your modernization journey, a culture of DevOps and automation is crucial for success. Recall that one of the primary benefits of app modernization is more frequent software deliveries with higher quality. This can be achieved through an effective DevOps and automation strategy. For example, as organizations increasingly embrace microservices and containers, an industry best practice is to completely automate your build and deployment pipeline. No direct human involvement should be required when building or deploying applications to your app platform (for example, Red Hat OpenShift, Kubernetes).

Technologies such as Jenkins, Travis CI, Red Hat OpenShift Pipelines and Tekton can be used to create these types of DevOps-style build and deployment processes. A DevOps culture will not only save your team precious time by automating boilerplate tasks, it will also increase quality by doing everything in a repeatable, reliable fashion.

Explore DevOps technologies →

> One of the primary benefits of app modernization is more frequent software deliveries with higher quality



[4] Deploy and operate traditional apps and cloud-native apps seamlessly

From a cloud management standpoint, effective mechanisms for both operating and observing your infrastructure are key tenets for success. In modern hybrid cloud infrastructure, applications consist of virtual machines, containers or some combination of these. Not only will this environment leverage IBM Power Systems, but it should also have the ability to integrate with other platforms (for example, x86 and IBM Z®) for maximum flexibility. Further, these apps can be deployed on premises (that is, in private cloud), in one or more public clouds, or both. The ability to quickly understand resource consumption and app health, and to troubleshoot problems, is a must. As such, it is important that you establish a hybrid multicloud management framework that can accommodate these new realities, such as the IBM Cloud Pak® for Multicloud Management.

Get started

Tips for planning, prioritizing and staying on track

As you prepare to begin a modernization project, make sure that you keep your efforts aligned with business priorities. This will allow you to clearly articulate the business value of all your efforts. It will also help you prioritize and set the scope of your technical deliverables. Let's recap some tips for keeping the project on track.

1. **Assess your applications.** Follow the guidelines in the earlier section and categorize your apps as either traditional, composite or cloud native. This will give you a breakdown of your application landscape so you can start making some decisions about where to focus your efforts.

> Contain your initial effort to a specific application, or even a specific component of a more complex application

2. **Be realistic with your scope.** As you prepare to build your business case, keep your scope containable. For example, it's not advisable to create one massive business case to modernize hundreds of apps in one fell swoop and to create a project timeline that spans several years. Rather, contain your initial effort to a specific application, or even a specific component of a more complex application.

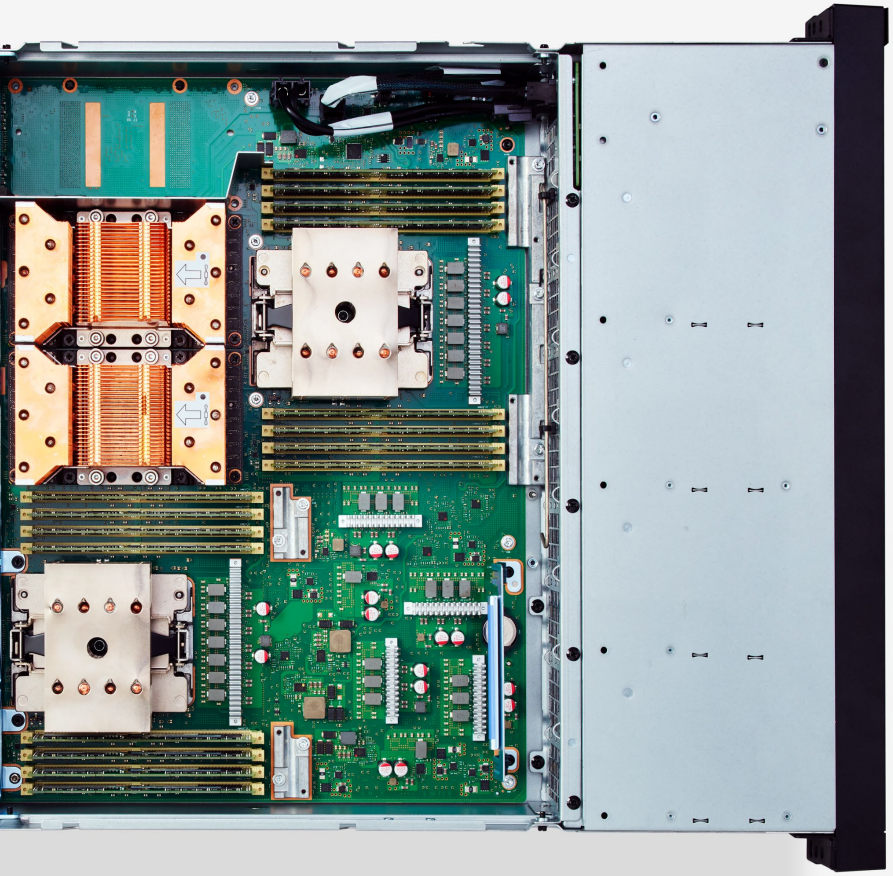
3. **Build your business case.** Similarly, by following the guidelines in the earlier section "Building a business case for modernization," create a business case. Not only will this help keep you focused, it will, if needed, help you secure executive approval for the modernization project. Using your application assessment as a starting point, focus on the app that will provide the biggest ROI. This will vary from enterprise to enterprise as every business has its own unique opportunities and challenges. For example, an online retailer may need to get a mobile user interface in the hands of users as soon as possible, while a financial institution might need to release new versions of a web interface weekly instead of monthly, without sacrificing software quality. Ensure that your own business case includes the desired outcomes and benefits from both a business perspective (that is, long-term financial savings) and a technical perspective, the estimated cost to perform the project and the timeframe in which the project should be completed.

4. **Execute.** Begin executing the project. If along the way you realize that your initial assumptions about either the business value or amount of work the project would take were incorrect, revisit the business case and adjust the scope accordingly so that you don't find yourself in a never-ending project.

5. **Evaluate and repeat.** As you complete each project, you will learn a lot about the technologies, what worked well, and what didn't. You'll have more DevOps experience and can use that knowledge to inform your next modernization project.

Ensure that your business case includes:

- The desired outcomes and benefits from both a long-term financial perspective and a technical perspective
- Estimated project cost
- Timeline to completion



Leverage the strengths and benefits of IBM Power Systems

Power Systems provides industry-leading reliability, performance and security. Not only does the IT infrastructure provide superior compute performance for data-intense and mission-critical applications, *it also provides an excellent foundation for modern container-based apps of all flavors* (for example: web and middleware, cloud and DevOps, modern programming languages and runtimes, databases, analytics and monitoring). Consider the following benefits.

Flexible, efficient utilization. Manage spikes and support more cloud workloads per server with the IBM PowerVM® hypervisor's on-demand CPU capacity, and by sharing pools of CPU cores across Red Hat OpenShift CoreOS nodes. Differentiating hypervisor constructs such as uncapped processors and shared processor pools provide the ability to guarantee performance SLAs while donating unused processor cycles to worker nodes in need of additional capacity. These advanced capabilities contribute to the foundation of IBM's 80% utilization guarantee on an IBM Power Systems E980 server.[2]

More performance from software with fewer servers. Enable 3.2X more containers per core with more CPU threads, achieve 2.6X better price performance[3] (based on number of containers), and colocate cloud-native apps with AIX, IBM i and Linux® virtual-machine-based apps and enterprise data to exploit low latency API connections to business-critical data. Leverage sub-capacity licensing to greatly reduce containerized software license costs (IBM Cloud Pak Solutions, for example) using PowerVM shared processor pools, allowing CPU cores to be autonomously shared across Red Hat OpenShift worker nodes without sacrificing app performance. This translates into having to buy fewer Power servers to run an equivalent set of applications at comparable throughput levels than on competing platforms.

Gravity to your enterprise data. IBM Power Systems houses your enterprise's mission-critical data. Running Red Hat OpenShift in a virtual machine adjacent to your AIX, IBM i or Linux virtual machines provides low-latency secure communication to your enterprise data via PowerVM Virtual I/O Server. This provides superior performance due to fewer network hops. It also allows for highly secure communication between your new cloud-native apps and your enterprise data stores as network traffic never has to leave the physical server.

Proven security and resiliency. Utilize the most reliable mainstream server platform — with the only hypervisor among its major competitors — that has zero security vulnerabilities.

Explore IBM Power Systems for your hybrid multicloud strategy →

Build on a trusted and proven foundation

Kubernetes provides the core foundation for modernizing your enterprise applications. As the premier open-source container orchestration platform, it benefits both developers and IT admins. Your developers have access to the latest software innovations to build software faster while your IT administrators can easily observe, operate and manage the platform and infrastructure. This helps you deliver high-value, high-quality software faster to end users. All of this is enabled through Red Hat OpenShift Container Platform.

Red Hat OpenShift Container Platform on IBM Power Systems

Red Hat OpenShift is an enterprise-ready Kubernetes container platform with full-stack automated operations to manage hybrid multicloud deployments. Red Hat OpenShift is optimized to improve developer productivity and promote innovation; it is fully supported on all IBM Power Systems servers (IBM POWER8® processors or later). Power Systems is poised well for your core enterprise applications and also for the next wave of digital transformation fueled by application modernization. As described previously, Power Systems provides superior performance and economics for containerized workloads. By colocating new cloud-native applications right alongside existing system of record applications, you can enjoy the benefits of gravity to existing data — such as lower communication latency, better throughput and superior security.

IBM Cloud Pak Solutions on IBM Power Systems

IBM Cloud Pak Solutions provide enterprise-ready containerized software solutions for modernizing existing applications and developing new cloud-native apps that run on Red Hat OpenShift. IBM Cloud Pak Solutions have three key tenets: they are comprehensive and easy to use, they are supported by Red Hat and IBM, and they run anywhere Red Hat OpenShift runs. IBM Cloud Pak Solutions provide a bundled approach that allows you to accelerate your modernization journey by packaging everything you need to get started — including Red Hat OpenShift and the apps that run on top of it. The following IBM Cloud Pak Solutions are currently available on IBM Power Systems.

- **IBM Cloud Pak for Applications.** Quickly build cloud-native apps by leveraging built-in developer tools and processes, including support for microservices functions and serverless computing. This is especially important for Power Systems customers looking to modernize existing web app footprints, including WebSphere Application Server, and Red Hat JBoss®.
- **IBM Cloud Pak for Data.** Simplify the collection, organization and analysis of data. Turn data into insights through an integrated catalog of IBM, open source, and third-party microservices and add-ons.
- **IBM Cloud Pak for Multicloud Management.** Gain consistent visibility, automation and governance across a wide range of hybrid multicloud infrastructure, inclusive of several compute platforms such as IBM Power Systems, IBM Z® and x86. Provide the ability to manage both virtual machines (also known as LPARs) running AIX, IBM i and Linux and containers (or some combination thereof). Streamline the management of these complexities from one place.

Explore IBM Cloud Pak solutions →

IBM Transformation Advisor

IBM Cloud® Transformation Advisor helps you analyze your on-premises workloads for modernization. It determines the complexity of your applications and provides recommendations to help you along the way. More specifically, it can analyze IBM WebSphere®, Red Hat JBoss, Oracle WebLogic, Apache Tomcat, IBM MQ®, WebSphere Message Broker and IBM Integration Bus.

IBM Transformation Advisor is licensed along with the IBM Cloud Pak for Applications or the IBM Cloud Pak for Integration. Additionally, you can evaluate its capabilities with a fully functional 90-day trial license for free. Check out the IBM Knowledge Center for further details.

Take a guided tour of IBM Transformation Advisor →

Innovate with an extensive container software ecosystem

At the heart of any application modernization effort is a strong software ecosystem that allows teams to innovate using the latest technologies. Now more than ever, open source communities are playing a significant role in organizations' modernization journeys. IBM Power Systems can not only run your core business applications, but also run a wide range of popular open source and commercial container software, as shown in Figure 2.

Linux images

- Red Hat
- CentOS
- AlpineLinux
- SUSE
- ubuntu
- BusyBox
- Debian

Web and middleware

- WebSphere Liberty
- JBoss by Red Hat
- Open Liberty
- Wildfly
- Apache Tomcat
- RabbitMQ
- ActiveMQ
- WordPress

Cloud and DevOps

- Jenkins
- Ansible
- Red Hat OpenShift
- Kubernetes
- Gradle
- Maven
- Terraform
- Travis CI

Networking and monitoring

- Prometheus
- NGINX
- Apache HTTP Server
- Etcd
- ZooKeeper
- HaProxy

Languages and runtimes

- Java
- Python
- PHP
- GO
- OpenJDK
- Node
- R
- Ruby
- GCC
- TensorFlow
- Erlang
- IBM Cloud Transformation Advisor
- Appsody

Databases

- Cassandra
- MongoDB
- Redis
- MariaDB
- MySQL
- PostgreSQL
- IBM Db2
- CouchDB

Analytics and AI

- Grafana
- Kibana
- ElasticSearch
- Logstash
- Fluentd
- IBM Watson® Studio
- IBM Watson® Machine Learning
- Kafka

Storage

- Container Storage Interface
  - IBM Spectrum Virtualize™
  - Power VC CSI Driver
  - NFS
  - And more

References:

- Red Hat OpenShift Catalog
- Docker Hub (ppc64le and ibm.com)
- Power Systems Ecosystem
- Entitled registries as appropriate for licensed software (e.g. IBM, Red Hat, etc.)

Figure 2: Extensive container software ecosystem on IBM Power Systems (not intended to be exhaustive)

Resources and expertise

App modernization comes in many shapes and sizes, and it's not always easy to know where to start. Your goal is to accelerate value, deliver frequently and reduce risk. IBM IT Infrastructure experts can help.

IBM Garage

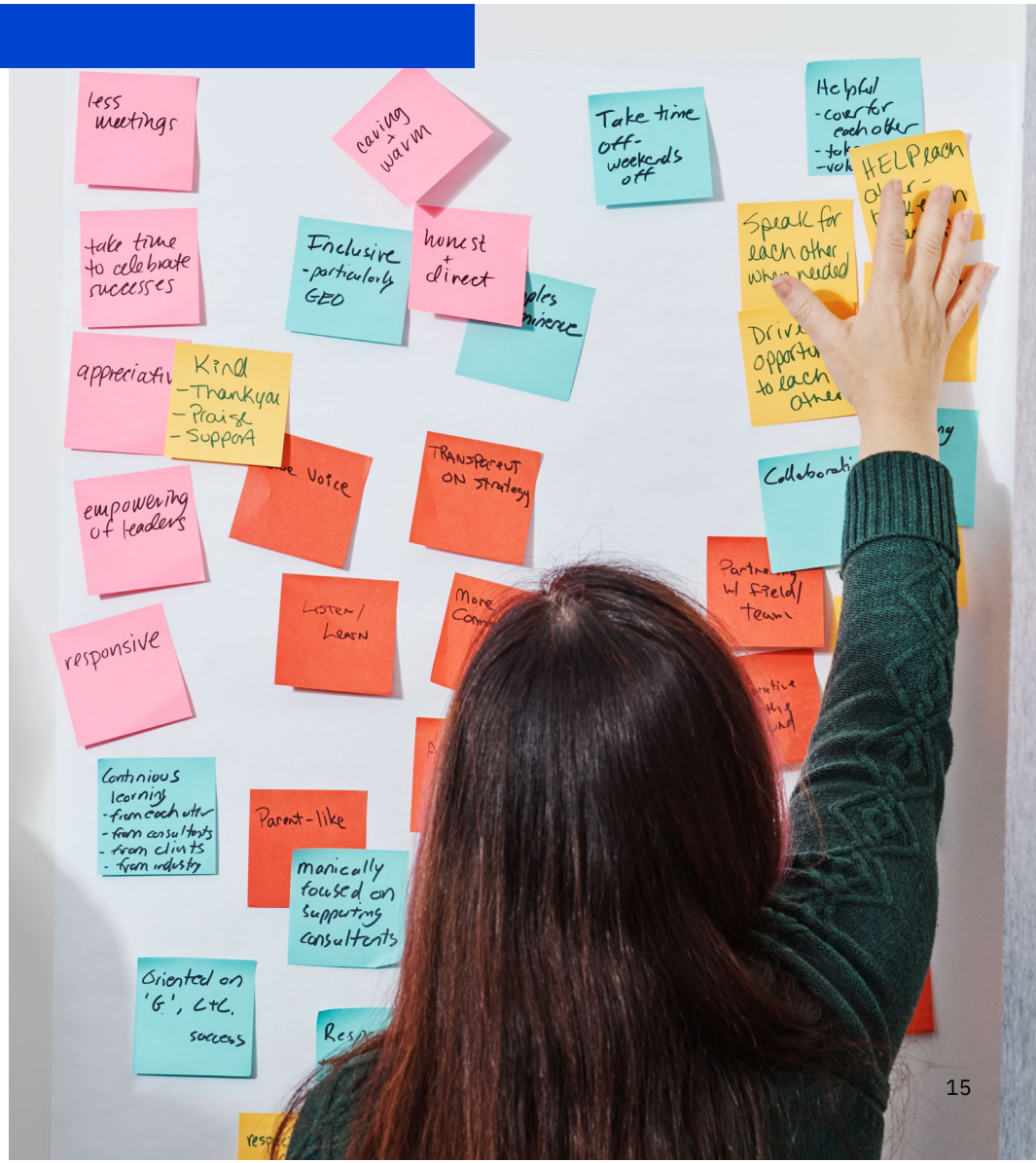
The IBM Garage can help you identify business modernization opportunities. You can then define and build the architecture and minimal viable product with your team, iterate on feedback, and co-create a solution.

Visit the IBM Garage →

IBM Lab Services

The IBM Lab Services team can expedite your modernization plans. They can help you install Red Hat OpenShift on Power Systems fast and train your team. Plus, their expertise across the entire Power Systems cloud portfolio can help accelerate the implementation of any cloud project.

Explore Lab Services →



Conclusion

Application modernization is a vital investment that you need to make in order to meet the needs of your customers and clients. IBM Power Systems makes it easy to accomplish this modernization process so that all aspects of your business stay up-to-date and ready to tackle the challenges of a rapidly transforming world.

Learn about IBM Power Systems on hybrid cloud →

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1 A commissioned study conducted by Forrester Consulting, "Emerging Technology Assessment: The Total Economic Impact™ Of Using Both IBM And Red Hat Solutions Together." June 2019.

2 80% utilization guaranteed on POWER E980 Systems: 5x throughput based on VM to VM transfer rate for Linux of 50 Gbit/sec vs. local area network attached server transfer to VM on same local area network of 5 Gbit/sec. When a Client acquires a POWER9 E980 Enterprise Server and the Client runs eligible workloads, IBM guarantees that the system will perform as warranted with a System Utilization Rate of up to 80%. Should the Client not be able to achieve 80% system utilization rate, assuming there is sufficient work to drive the machine to 80% utilization, IBM will assist with the attainment of 80% system utilization rate, at no additional cost.

3 Based on IBM internal testing running MongoDB on Red Hat OpenShift Container Platform. Each container uses MongoDB 4.0.2 & Node.js v8.14.1 (REST APIs) with socket bound containers. Testing added containers to each server until servers reached response time limit of 99% of transactions completing in under 1 second. Results valid as of 7/16/19. Conducted under laboratory condition with speculative execution controls to mitigate user-to-kernel and user-to-user side-channel attacks on both systems, Individual result can vary based on workload size, use of storage subsystems & other conditions. Details about MongoDB workload: https://docs.mongodb.com/manual/tutorial/geospatial-tutorial/ 3.2X greater containers/core is based on 174 containers/20 cores for Power L922 and 98 containers/36 cores for Intel Xeon. – (2,531/20)/(2,290/36) = 3.2