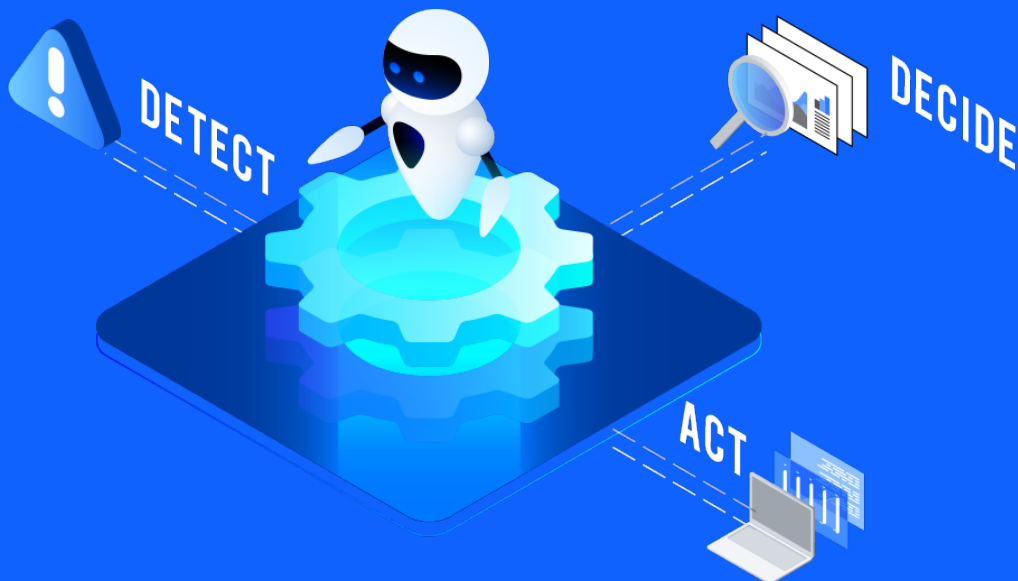


Best practices for taking a hybrid approach to AIOps on IBM Z



Purpose of **this handbook**



Best Practices

Taking a hybrid cloud approach to AIOps will enable IT Ops teams to innovate and optimize time to value. This handbook builds on the [Best practices for taking a hybrid approach to AIOps on IBM Z®](#) blog series focusing on the Detect/Decide/Act capabilities within IBM's Journey to AIOps framework.

Challenges for **CIOs**



Innovation versus stability

- 2,000+ IT incidents per month
- 9 will be critical, costing \$139k per hour on average
- 70% of the team is tied up just keeping what they already have alive

Complex environments and siloed teams

- Days to detect and diagnose a complex issue
- Major outages can cost up to \$420k per hour
- Challenges with siloed teams

Challenges for **IT Ops Teams**



Overwhelmed by disparate tools

- Struggling with inconsistent alerts across sources
- Workflow interrupted to swap between disparate tools
- Challenges with sharing data

Burnout & skills

- Only 10% of FTEs have 90% of critical expertise
- Teams & CIOs struggle with talent risk

Enterprise cognitive computing applications can enhance **operational excellence, client satisfaction, and employee experience.**

MIT Sloan Management Review

AIOps on IBM Z Summary

Detect

Monitoring & observability

Full-stack monitoring with best practices for early detection of Z incidents

IBM Z Monitoring Suite

Application performance management

End-to-end tracking visibility across hybrid cloud application

IBM Z APM Connect

IBM Observability by Instana APM on z/OS®

Anomaly detection

Intelligent anomaly detection to avoid costly incidents

IBM Z Anomaly Analytics with IBM Watson®

IBM Z Monitoring Suite

Decide

Cross-domain metrics & trace analysis

Detect bottlenecks in code, server resources or with external dependencies

IBM Z Monitoring Suite

Log analytics

Accelerate hybrid incident identification with real-time operational analytics

IBM Z Operational Log and Data Analytics

Anomaly correlation

Correlate anomalous activities across z/OS subsystems

IBM z/OS Workload Interaction Navigator

Performance & capacity planning

Performance analysis, capacity forecasting and modelling

IBM Z Performance and Capacity Analytics

Act

Collaborative incident remediation

Improved collaboration and faster incident resolution through chat-based operations and user-friendly dashboards

IBM Z ChatOps & Service

Intelligent automation

End-to-end, goal-driven and policy-based system automation for a consistent and reliable automation across the enterprise

IBM Z Service Automation Suite

Predictive workload automation

End-to-end workload automation with embedded predictive scheduling for SLA management cross enterprise

IBM Z Service Automation Suite

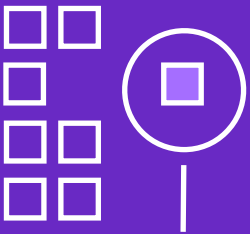
Storage automation

Machine aided storage resource management and automated storage tasks across the enterprise for improved SLAs

IBM OMEGAMON® for Storage



Click on the color-coded hand icon to go directly to that section

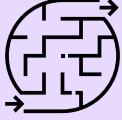





Detect

Monitor hybrid infrastructure and applications and detect issues and anomalies

Monitoring & observability

Identify poorly performing tasks quickly for faster resolution with full-stack monitoring for early detection of Z incidents

Challenge		<ul style="list-style-type: none">• Growing complexity• More metrics & collection points• Open tooling for analysis in context of modern hybrid cloud applications• Attracting and retaining the skills and expertise
What's new today vs. what I have		<ul style="list-style-type: none">• Demand to augment higher-level operational dashboards with performance statistics across the entire IT stack• Collaboration using preferred chat tools• IT operations should be able to perform key tasks like first level system triage• Leverage AI / ML for anomaly detection on collected data and correlate events
IBM solution		<ul style="list-style-type: none">• IBM Z Monitoring Suite• IBM Z Service Management Suite
Value		<ul style="list-style-type: none">• Improve collaboration between teams – Alert details sent to your collaboration tool for faster problem triage which can be seen by the entire channel.• Modern, open, hybrid cloud tools for visualization and analytics• Reduce noise and incidents – Event correlation across the enterprise with Watson AIOps reduces noise by grouping relevant events for targeted problem isolation.• Get relevant context – When an incident occurs, the wider teams are provided with additional context, such as domain dependencies and resource consumption.• Automate remedial actions – Teams can automate problem remediation directly through an event action or interlocking with system automation.

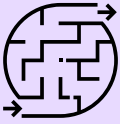



“We’re under current revised service level agreements and we are achieving 99.91 percent of availability.”

- Dražen Zadro, Systems Engineer, APIS IT d.o.o.

IBM Z monitoring and observability provides faster problem identification, isolation and resolution with intelligent monitoring and alerting. [Link](#) to the full blog.

Application performance management

End-to-end tracking visibility across hybrid cloud application

Challenge		<ul style="list-style-type: none">• API-enabled mainframe resources and workloads form the critical foundation of hybrid cloud applications• Over 70% of enterprises have multiple APM solutions deployed however most lack visibility into the mainframe• Problem isolation involving both Z and non-Z teams is time-consuming and impacted by siloed visibility
What's new today vs. what I have		<ul style="list-style-type: none">• End-to-end transaction tracing capability to view application from mobile to mainframe• Automated full-stack visibility includes Z resources to provide transparency and consistency when troubleshooting• Real-time detection and mapping of all interdependencies reduces risk by ensuring that you're always looking at accurate information
IBM solution		<ul style="list-style-type: none">• IBM Observability by Instana APM on z/OS• IBM Z Application Performance Management Connect
Value		<ul style="list-style-type: none">• Ensure the mainframe is a first-class participant in hybrid cloud observability through integration with industry leading APM solutions• Reduce time to isolate application problems by identifying likely cause and the appropriate context to Z subject matter experts to address the issue faster• Minimize impact to business and protect the client's digital experience when issues occur

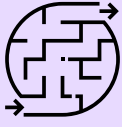



One of the world's largest banks application team used IBM Z APM Connect with AppDynamics to isolate the location of performance issue impacting a core application.

The appropriate Z SMEs inside their organization were alerted to address the issue with their dedicated Z monitoring tools before clients were even impacted, saving the bank valuable time and money.

Enterprise observability across the hybrid cloud requires visibility into business-critical IBM Z services and resources.
[Link](#) to full blog.

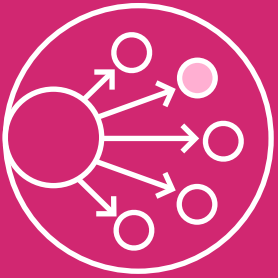
Anomaly detection

Intelligent anomaly detection to avoid costly incidents

Challenge		<ul style="list-style-type: none">• As the digital transformation continues, hybrid applications are rapidly changing along with the adoption of DevOps• Vast amounts of operational data are impossible to manually analyze in real time
What's new today vs. what I have		<ul style="list-style-type: none">• Leverage machine learning to analyze historical data to understand how your environment behaves day-to-day without the need for static thresholds• Compare live data to your environment's normal behavior to detect operational anomalies which may be indicators of current or future issues• Machine learning analyzes both metric and log data, unattended, and without manual intervention• Alerts can be generated for anomalous behavior to notify IT Operations of potential problems or integrated into IBM Cloud Pak® for Watson AIOps to help determine the health of an entire hybrid cloud application
IBM solution		<ul style="list-style-type: none">• IBM Z Anomaly Analytics with Watson• IBM Z Monitoring Suite• IBM Z Service Management Suite
Value		<ul style="list-style-type: none">• Keep critical business applications up and running by reducing the mean time to detect operational issues from hours to real time• Alerts of anomalous behavior can be integrated directly into your event management systems, service desk solutions, or with IBM Cloud Pak for Watson AI Ops for complete hybrid cloud application visibility

“A major United States airline has adopted the anomaly detection capability from IBM. They were able to detect operational anomalies in their log data. Had those anomalies gone undetected it would have impacted pilot and crew scheduling systems and left frustrated passengers on the ground”

IBM Z Anomaly Analytics with Watson leverages machine learning to detect operational anomalies.
[Link](#) to the full blog.



Decide

Analyze issues and anomalies to isolate problems and identify root causes

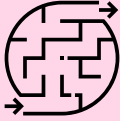

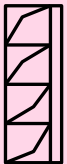

Detect

Decide

Act

Cross-domain metrics & trace analysis

Diagnose application bottlenecks within code, server resources or external dependencies

Challenge		<ul style="list-style-type: none">• Growth of complex application architectures and open mainframe services• Locating the root cause from among many domain areas• Collecting and analyzing bottlenecks within application code or subsystem programs
What's new today vs. what I have		<ul style="list-style-type: none">• Expedite root cause analysis and assist domain experts• Identify bottlenecks within application code or subsystem program• Collect traces dynamically and analyze application code• Share detailed trace reports with program developers to develop fixes rapidly
IBM solution		<ul style="list-style-type: none">• IBM Z Monitoring Suite• IBM Z Service Management Suite
Value		<ul style="list-style-type: none">• Dynamically enable subsystem / application tracing within subsystems to collect deeper metrics• Enable intelligent alerts to capture diagnostic details inflight• Activate CICS® or IMS™ tracing to view bottlenecks, server resources and external dependencies• Utilize proprietary INSPECT feature to observe load module statistics in real-time• Avoids blind spots with detailed API monitoring support on Z• Combine IBM Z and hybrid cloud metrics to analyze complex cross-platform issues.

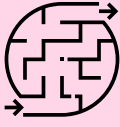



“We have reduced system complexity and achieved higher availability by identifying problems earlier and avoided outages by removing bottlenecks.”

- Klaus Wahler, Head of Mainframe Operations, W&W Informatik GmbH(WWI)

IBM Z provides experts and development teams the input they need to expedite root cause analysis to fast-track problem remediation.
[Link](#) to the full blog.

Log analytics

Accelerate hybrid incident identification with real-time operational analytics

Challenge		<ul style="list-style-type: none">• Increasingly complex environments• Acceleration workload volume• Z skills are becoming harder to acquire• Difficulty gaining visibility into mainframe
What's new today vs. what I have		<ul style="list-style-type: none">• Many other areas of the enterprise rely of a robust log analytics platform to visualize and understand their data• There is a need to visualize and bring Z operational data to the same pane of glass
IBM solution		<ul style="list-style-type: none">• IBM Z Operational Log and Data Analytics
Value		<ul style="list-style-type: none">• Reduced cost – Save on streaming & maximize your log analytics investment<ul style="list-style-type: none">– Filter & transform before streaming to lower ingestion costs– Offload workloads with zIIP processing– Leverage your current log analytics platforms• Reduced effort – Leverage the analytics platform of your choice to quickly make sense of your Z data<ul style="list-style-type: none">– Modern & intuitive dashboards make Z data consumable– Training & acquiring skills is easier with platform familiarity• Greater visibility – Contextualize your Z data to uncover & investigate incidents with increased speed and confidence<ul style="list-style-type: none">– View Z & distributed data on the same pane of glass– Minimize time spent in war room scenarios

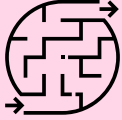

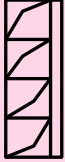

“IZOA is the tool that simplifies the mainframe so I can put more sense into the data.” - Dražen Zadro, Systems Engineer, APIS IT d.o.o.*

**IZOA is the previous version of IBM Z Operational Log and Data Analytics*

IBM provides the platform & integrations to uncover contextualized insights with enhanced visibility into your Z operational data.
[Link](#) to full blog.

Anomaly correlation

Correlate anomalous activities across z/OS subsystems

Challenge		<ul style="list-style-type: none">• IBM Z workloads are often a black box where the interdependencies of workload activities are unknown• When issues arise in an environment, time is lost identifying the true root cause by investigating symptoms of the problem• Data can be costly, siloed and too voluminous to quickly diagnose performance issues that are often transient in nature
What's new today vs. what I have		<ul style="list-style-type: none">• IBM z/OS Workload Interaction Correlator generates standardized, synchronized, smarter data that is specifically built for diagnosing workload performance issues – all with low system overhead• IBM z/OS Workload Interaction Navigator analyzes short intervals of data to temporally correlate and prioritize anomalous workload activities to help identify cause and victim relationships
IBM solution		<ul style="list-style-type: none">• IBM z/OS Workload Interaction Correlator• IBM z/OS Workload Interaction Navigator
Value		<ul style="list-style-type: none">• Gain visibility into how activities across your entire workload interact and share system resources• Reduce the mean time to identify the root cause of operational issues by understanding cause and victim relationships across multiple workload activities• Proactive change verification by Analyzing multiple time periods to ensure desired changes to software, workload, or hardware have the desired effect

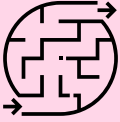



“IBM support teams rely on z/OS Workload Interaction Navigator to help diagnose client performance issues. In all cases where it was used, the solution helped determine the root cause of the client critical situations.”

IBM z/OS Workload Interaction Navigator helps you understand your IBM Z environment with exceptional detail.

[Link](#) to full blog.

Performance & capacity planning

Performance analysis, capacity forecasting and modelling

Challenge		<ul style="list-style-type: none">• Increasingly complex hybrid cloud environments require tools to understand the relationship between applications and resources to ensure that SLAs are met• Timely access to detailed performance information can be difficult to report on have high resource overhead• Capacity forecasting to ensure adequate resources are available to support the business is essential but can require time and skilled personnel• Growing need to manage workloads under the consumption-based pricing models (Tailored Fit Pricing) to help to keep cost and performance optimized
What's new today vs. what I have		<ul style="list-style-type: none">• Near real-time access to insights through key performance metrics out-of-the-box summaries and self-service reporting to empower end users• Leverage data to provide immediate forecasts and simulations on potential future performance to support capacity planning activities and understand the “what if” impact of environmental changes• Lower overall processing overhead with exploitation of zIIP processors
IBM solution		<ul style="list-style-type: none">• IBM Z Performance and Capacity Analytics
Value		<ul style="list-style-type: none">• Access, curate and make performance and operational decisions quickly• Empower capacity planners to enable smart investments decisions and ensure resources support the business• Identify optimization opportunities within existing workloads to keep costs in check and improve performance

A major US-based bank deployed IBM Z Performance and Capacity Analytics to modernize their entire performance management, capacity planning and chargeback processes. They decommissioned their legacy toolsets and reduced the number of tools and licenses to be maintained.

IBM Z delivers a single solution to address performance analysis, capacity forecasting and cost management.





[Link](#) to full blog.



Rapidly respond to reduce impact on the clients with improved resiliency

Collaborative incident remediation

Improved collaboration and faster incident resolution through chat-based operations and user-friendly dashboards





Challenge		<ul style="list-style-type: none">• Increasingly hybrid and complex application landscapes• Information, team, and data silos increase the time to problem resolution• Collaboration across teams and remote workforce• Lack of skills• Many different tools needed
What's new today vs. what I have		<ul style="list-style-type: none">• ChatOps solutions that foster collaboration and surface relevant data and actions in enterprise chat platforms• Consolidated web-based dashboards that bring mainframe management information and tasks from disparate sources into a single environment• Alert the team through chat platforms and use an intelligent chatbot to analyze and operate an IBM Z environment
IBM solution		<ul style="list-style-type: none">• IBM Z ChatOps• IBM Service Management Unite<ul style="list-style-type: none">– Included within<ul style="list-style-type: none">IBM Z Service Management SuiteIBM Z Service Automation SuiteIBM Z Monitoring SuiteIBM Z System Automation
Value		<ul style="list-style-type: none">• Improved collaboration within and across teams• Faster incident identification and resolution• Faster onboarding of next generation of Z Operators• Easy sharing of Z data• Integration with other tooling

*“ChatOps is very helpful and will minimize downtimes”
– Large Communications Company in North America*

With IBM Z ChatOps, combined with IBM Service Management Unite, IBM provides unique collaborative incident remediation capabilities!
[Link](#) to full blog.

Intelligent automation

End-to-end, goal-driven and policy-based system automation for a consistent and reliable automation across the enterprise

Challenge		<ul style="list-style-type: none">• Innovation vs stability: 70% of the team is tied up just keeping what they already have alive• Maintenance cost of automation code• Skill optimization
What's new today vs. what I have		<ul style="list-style-type: none">• Growth of hybrid cloud applications that rely on components spanning across different platforms that has dependencies each other• Documentation on automation code is generally poor and maintenance of that is not cost effective.• New automation administrators are not familiar with traditional mainframe interfaces
IBM solution		<ul style="list-style-type: none">• IBM Z Service Automation Suite<ul style="list-style-type: none">• IBM Z System Automation• IBM Service Management Unite• IBM Z ChatOps• IBM Z NetView®
Value		<ul style="list-style-type: none">• Service Management Unite provides a modern and user-friendly set of dashboard to manage automated resources in your environment• IBM Z System Automation is a policy-based automation tool that implies less automation code required to manage automated resources cross-sysplex and cross-platform• IBM Z ChatOps provides a chatbot to interact with Z resources from the chat tool already in use





“A health insurance company in Germany boosts its system automation efficiency and reduces operating costs when it implements IBM System Automation for z/OS software to replace its existing automation solutions.”

IBM Z is the end-to-end solution delivering intelligent automation across the enterprise.

[Link](#) to full blog.

Predictive workload automation

End-to-end workload automation with embedded predictive scheduling for SLA management cross enterprise





Challenge		<ul style="list-style-type: none">• Growing complexity of workload to be managed, with dependencies between processes (job) running on different platforms• Shrink of the “batch window” requires continuous optimization of the batch execution, avoiding violation of SLA constraints• Skill optimization
What’s new today vs. what I have		<ul style="list-style-type: none">• Need to open scheduling to integration in devOps toolchain and hybrid cloud application integration• Next generation schedulers are not familiar with mainframe traditional interfaces
IBM solution		<ul style="list-style-type: none">• IBM Z Service Automation Suite<ul style="list-style-type: none">– IBM Z Workload Scheduler
Value		<ul style="list-style-type: none">• Modern, web-based User Interface (Dynamic Workload Console) to model, monitor and control the scheduling execution cross platform from a single point of control• Workload Service Assurance and What-if analysis simulator help in get early notification of SLA violation risk and simulate corrective actions to avoid the violations• Zowe® extensions for API Mediation Layer and CLI enable an easy integration of scheduling in scripts (devOps) and hybrid Cloud applications.

“The information technology services company for a leading bank in Italy significantly reduces costs, mitigates the need to maintain homegrown solutions and gains a single point of control across its server platform when it implements IBM Z Workload Scheduler software to manage workload automation.”

Delivering a predictive workload automation that integrates DevOps with hybrid cloud provides the competitive advantage on IBM Z.
[Link](#) to full blog.

Storage automation

Machine aided storage resource management and automated storage tasks across the enterprise for improved SLAs

Challenge		<ul style="list-style-type: none">• Constant risk of costly outages and unexpected events that disrupt storage environments• Managing and maintaining a complex storage environment• Anomaly detection and productivity issues• Lack of skills• Less expensive options for storing cold data
What's new today vs. what I have		<ul style="list-style-type: none">• Realtime Data Set Metrics viewer with 'take action' capabilities to recall, rename, reorganize, and delete datasets.• Cloud tier for cold data with updated security options with Life Cycle Encryption• Enhanced ICF Catalog management through smart alerting and notifications
IBM solution		<ul style="list-style-type: none">• IBM Z Advanced Storage Management Suite
Value		<ul style="list-style-type: none">• Reduction in human manual intervention using smart alerts and notifications leading to faster incident identification and resolution• Improved productivity and data availability• Automated storage space allocation and catalog management• Keep your DFSMSHsm™ environment free of errors and inefficiencies• Integration with IBM's Tivoli® Enterprise Portal (TEP)

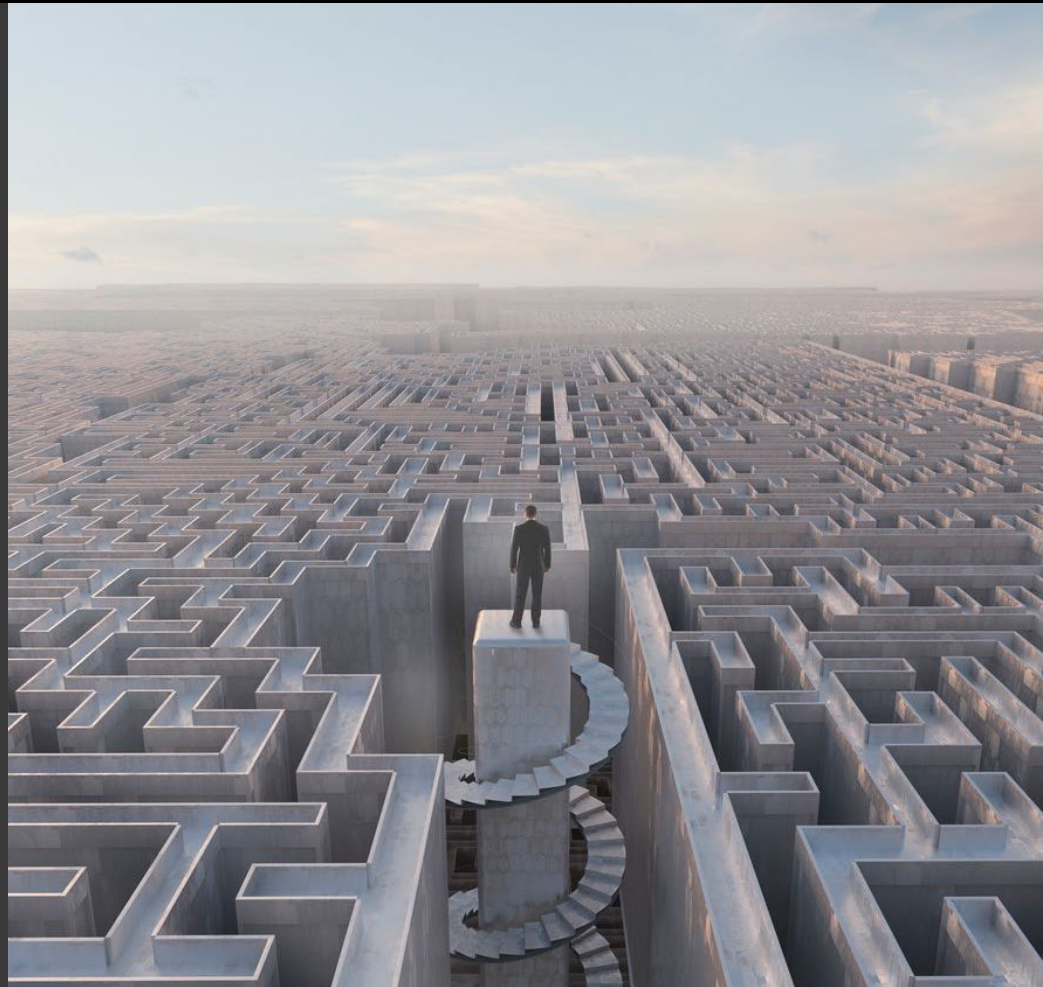
“Predictive analytics improve storage efficiencies and the ability to identify anomalies and address those issues without human intervention saves on OPEX and makes a great case to continue investing in storage software as workloads continue to converge” - IDC

The IBM Z Advanced Storage Management Suite provides the automation to improve SLAs across your enterprise.
[Link](#) to full blog.

The Journey to AIOps

Every client's journey will be different.

Different starting points and different destinations.



The IBM AIOps framework and solutions will help determine the next best step

Call to Actions:

- Stay informed by joining the [AIOps on IBM Z community](#)
- Continue to reference the [Best practices for taking a hybrid approach to AIOps blog](#)
- Reach out to your IBM Z Sales Representative for an AIOps Assessment/Workshop session
- Experience the products using [zTrials](#)

Notices and Disclaimers

© 2021 International Business Machines Corporation. No part of this document may be reproduced or transmitted in any form without written permission from IBM.

U.S. Government Users Restricted Rights — use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM.

This document is current as of the initial date of publication and may be changed by IBM at any time. Not all offerings are available in every country in which IBM operates.

Information in this presentation (including information relating to products that have not yet been announced by IBM) has been reviewed for accuracy as of the date of initial publication and could include unintentional technical or typographical errors. IBM shall have no responsibility to update this information. **This document is distributed “as is” without any warranty, either express or implied. In no event, shall IBM be liable for any damage arising from the use of this information, including but not limited to, loss of data, business interruption, loss of profit or loss of opportunity.** IBM products and services are warranted per the terms and conditions of the agreements under which they are provided.

The performance data and client examples cited are presented for illustrative purposes only. Actual performance results may vary depending on specific configurations and operating conditions.

Any statements regarding IBM's future direction, intent or product plans are subject to change or withdrawal without notice.

Performance data contained herein was generally obtained in a controlled, isolated environments. Client examples are presented as illustrations of how those clients have used IBM products and the results they may have achieved. Actual performance, cost, savings or other results in other operating environments may vary.

References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business.

It is the client's responsibility to ensure its own compliance with legal requirements and to obtain advice of competent legal counsel as to the identification and interpretation of any relevant laws and regulatory requirements that may affect the client's business and any actions the client may need to take to comply with such laws. IBM does not provide legal advice or represent or warrant that its services or products will ensure that the client follows any law.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products about this publication and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. IBM does not warrant the quality of any third-party products, or the ability of any such third-party products to interoperate with IBM's products. IBM expressly disclaims all warranties, expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a purpose.

The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents, copyrights, trademarks or other intellectual property right.



©Copyright IBM Corporation 2021
IBM Corporation
New Orchard Road
Armonk, NY 10504
U.S.A.
12/21

IBM, the IBM logo, ibm.com, IBM Cloud Paks, IBM Watson, IBM Z, CICS, DFSMSshsm, IMS, NetView, OMEGAMON, Tivoli and z/OS

are trademarks or registered trademarks of the International Business Machines Corporation.

A current list of IBM trademarks is available on the Web at <https://www.ibm.com/legal/us/en/copytrade.shtml> and select third party trademarks that might be referenced in this document is available at https://www.ibm.com/legal/us/en/copytrade.shtml#section_4

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.

Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.

InfiniBand and InfiniBand Trade Association are registered trademarks of the InfiniBand Trade Association.

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

The registered trademark Linux® is used pursuant to a sublicense from the Linux Foundation, the exclusive licensee of Linus Torvalds, owner of the mark on a worldwide basis.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

OpenStack is a trademark of OpenStack LLC. The OpenStack trademark policy is available on the [OpenStack website](#)

Red Hat®, JBoss®, OpenShift®, Fedora®, Hibernate®, Ansible®, CloudForms®, RHCA®, RHCE®, RHCSA®, Ceph®, and Gluster® are trademarks or registered trademarks of Red Hat, Inc. or its subsidiaries in the United States and other countries.

RStudio®, the RStudio logo and Shiny® are registered trademarks of RStudio, Inc.

TEALEAF is a registered trademark of Tealeaf, an IBM Company.

UNIX is a registered trademark of The Open Group in the United States and other countries.

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

Zowe™, the Zowe™ logo and the Open Mainframe Project™ are trademarks of The Linux Foundation.

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

All client examples cited or described in this presentation are presented as illustrations of the manner in which some clients have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual client configurations and conditions.

This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.

This information provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g., zIIPs, ZAAPs, and IFLs) ("SEs"). IBM authorizes clients to use IBM SE only to execute the processing of Eligible Workloads of specific Programs expressly authorized by IBM as specified in the "Authorized Use Table for IBM Machines" provided at www.ibm.com/systems/support/machine_warranties/machine_code/aut.html ("AUT").

No other workload processing is authorized for execution on an SE. IBM offers SE at a lower price than General Processors/Central Processors because clients are authorized to use SEs only to process certain types and/or amounts of workloads as specified by IBM in the AUT.