IBM Power

Power10 Roadmap and Strategy

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Today’s environment of constant, rapid change is driving greater alignment between business and IT priorities.

- Increase flexibility
- Improve security and resiliency
- Derive more value from data
- Ensure continuous operations
Enhanced operational agility and flexibility is the clear top priority for the next 2-3 years

Across all respondents, operational agility and flexibility is identified as a priority at least more than any other factor

37%
Challenge:
Modernizing critical workloads and existing IT infrastructure

Being ready for

- Unpredictable demand
- Cyber risk
- AI-driven applications
- Anywhere workplace

Requires

- Dynamic and efficient scaling
- Pervasive, layered security
- Data access and privacy
- IT flexibility
IBM Power

Modernize with a frictionless\(^1\) hybrid cloud experience

**Engineered for agility**

- **Respond faster to business demands** with efficient scaling and consistent\(^2\) pay-for-use consumption across public and private clouds
- **Protect data from core to cloud** using memory encryption at the processor level designed to support end-to-end security across public and private clouds without impacting performance
- **Streamline insights and automation** by running AI inferencing directly in core and leveraging Watson services in IBM Cloud

**Maximize availability and reliability** with built-in advanced recovery and self-healing for infrastructure redundancy and disaster recovery in IBM Cloud

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1. IBM Power help deliver a frictionless experience in extending mission-critical workloads across hybrid cloud, without requiring additional middleware or application refactoring
2. Power offers a consistent approach to buy pay-per-use capacity with Hybrid Cloud Credits. Credits can be bought once and can be used to consume capacity in on-premises private cloud and Power Systems Virtual Server
Introducing: IBM Power E1080
First of the Power10 family

>1.5X More throughput than the most powerful server in the industry (Power E980)

Up to 240 Power10 cores
- 25% more than Power
- 20-30% more performance per core
- Improved sustainability (Same energy and space footprint)
- Enhanced security
- Integrated AI Inferencing acceleration

Up to 64 TB OMI Memory

PCIe Gen5 ready
Introducing: IBM Power E1080
First of the Power10 family

Respond faster to business demands

- World record 8-socket two-tier SAP SD standard application benchmark \(^1\)
- 4.1X more containerized throughput per core than x86\(^2\) running Red Hat OpenShift
- 2.5X per core vs x86 SPECInt rate\(^3\)
- 50% more capacity, same energy consumption\(^7\)
- Instant scaling, pay per use consumption

Protect data from core to cloud

- Transparent memory encryption
- 2.5X faster AES crypto performance per core vs. Power E980\(^4\)
- Advanced protection for ROP attacks
- Support for quantum-safe cryptography and fully homomorphic encryption

Streamline insights and automation

- 5X faster in-core AI inferencing and ML\(^6\)
- Provides alternative to using separate GPU systems
- Train AI models anywhere, deploy on Power without changes for AI with high RAS
- Support for libraries, AI frameworks, ONNX runtime

Maximize availability and reliability

- 2X better memory RAS than IS-DIMMs\(^5\)
- Advanced recovery, self healing and diagnostic capabilities reducing application downtime

- 1.5x more throughput
- 240 cores
- 20-30% more per core
- > 25% more cores
- 64 TB OMI memory

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1. IBM Power E1080; two-tier SAP SD standard application benchmark running SAP S/4Hana 1809 DP2, Power10 12-core 2.0 GHz processor, 4.0TB GDDR memory, 16TB SSD, 174,000 SD benchmark users (500,000 SAPS); 30 sec average response time, 19,101 max transaction/hr, 57,339,000 dialog credits/hr, 80% utilization, AIX 7.2, DB2 11.5 with average request time 0.192 sec dialog/0.168 sec update. Contributions from available at time of use of all users can be found at sap.com/benchmark. Valid as of 02/2021.

2. Based on IBM internal testing of Red Hat OpenShift Container Platform 4.8.2 worker nodes running 80 pods each with 10 users using the Daytrader7 workload (https://github.com/WASdev/sample.daytrader7/releases/tag/v1.4) accessing AIX Db2 databases. Average cpu utilization for the OCP worker nodes is > 95%. Comparison: Power E1080 running OCP accessing AIX Db2 on an S922 versus OCP on Cascade Lake accessing AIX Db2 on the same S922. Valid as of 08/26/2021 and conducted under laboratory conditions. Individual result may vary based on workload size & environment. IBM Power E1080 (40 cores/3.8 GHz/2 TB memory) in maximum performance mode, 25 Gb two-port SRIOV adapter, 1 x 16Gbps FCA, with PowerVM. Competitive system: Intel(R) Xeon(R) Gold 6248 CPU (Cascade Lake) in performance mode, 40 cores/3.9GHz/512GB memory, 2x25G 2x port SRIOV adapter, 1 x 10Gbps FCA, RHEL 8.4 KVM.


4. AES-256 in both GCM and CTS modes runs about 2.5 times faster per core when comparing Power10 E1080 (15-core modules) vs. Power9 E980 (12-core modules) according to preliminary measurements obtained by IBM, LLC, through OpenStack, 4.1.16

5. Based on IBM's internal analysis of the IBM product failure rate of DDIMMs vs Industry Standard-DIMMs.

6. 5x improvement in per socket inference throughput for large scale DL neural point inference models from Power9 E980 (12-core modules) to Power10 E1080 (15-core modules). Based on IBM inferring at PyTorch, OpenBLAS on the same BERT Large with SQuAD v1.1 data set

IBM Power E1080 sets world record 8-socket two-tier SAP SD standard application benchmark result¹

- **World record 8-socket performance**
  - 955,050 vs. 670,830 SAPS
  - 174,000 vs. 122,300 users
- **More performance per core**
  - 4x vs. 16-socket Intel²
  - 2.7x vs. 8-socket Intel³
- **The most flexible and reliable SAP HANA platform⁴**
- **Power E1080 servers scale to 16 sockets**

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¹ IBM Power E1080, two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5, Power10 3.55-4.0 GHz processor, 4,096  GB memory, 8p/120c/960t, 174,000 SAPS benchmark users, Certification # 2021059. All results can be found at sap.com/benchmark. Values as of 8/27/21.
² Google Cloud Platform, two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5 (cloud); Intel Xeon Platinum 8280L 2.7 GHz, 157,000 SAPS benchmark users, Windows Server 2019, Microsoft SQL Server 2017, Certification # 2021008.
³ HPE Superdome Flex; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8380H 2.9 GHz, 122,300 SAPS benchmark users, Windows Server 2016 and Microsoft SQL Server 2012, Certification # 2021006.
⁴ Ranked most reliable server in its category for 12th year by ITIC. Flexible: Only platform that runs AIX, IBM i, Linux OS'es while supporting the ability to run 16 SAP HANA production environments in a single server.

100 SAPS = 2,000 fully business processed order line items per hour.
IBM Power10
Scalable, sustainable compute

Same work ➔ Less infrastructure ➔ Smaller carbon footprint

52% lower energy consumption for the same workload in Power E1080 vs Power E880C*

33% lower energy consumption for the same workload in Power E1080 vs Power E980*

Reduce carbon footprint with Power10

IBM Power8:
- 10,376 watts

IBM Power9:
- 7,478 watts

IBM Power10:
- ~5,000 watts

* Power8 (12c) is 3679 rPerf @ 16,600 Watts (0.22 rPerf/Watt), Power10 (15c) is 7998 rPerf @ 17,320 Watts (0.46 rPerf/Watt); 0.46 / 0.22 = 2.06 more rPerf/Watt, delivering 2X energy efficiency.

Power9 (12c) is 5081 rPerf @ 16,520 Watts (0.31 rPerf/Watt), Power10 (15c) is 7998 rPerf @ 17,320 Watts (0.46 rPerf/Watt); 0.46 / 0.31 = 1.48 more rPerf/Watt.
Same work, fewer resources, smaller carbon footprint

Customer example

<table>
<thead>
<tr>
<th>Previous customer environment:</th>
<th>Consolidated environment:</th>
<th>Projected consolidation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>126 Intel Oracle Database servers</td>
<td>3 Power E980’s</td>
<td>2 Power E1080’s</td>
</tr>
</tbody>
</table>

Benefits achieved with consolidation

<table>
<thead>
<tr>
<th>Number of DB servers</th>
<th>Energy Usage (KW)</th>
<th>Number of Oracle licenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>126</td>
<td>102</td>
<td>891</td>
</tr>
<tr>
<td>Intel</td>
<td>Power9</td>
<td>Intel</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>328</td>
</tr>
<tr>
<td>Power9</td>
<td>20</td>
<td>Power9</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Power10</td>
</tr>
<tr>
<td>Power10</td>
<td></td>
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### Red Hat OpenShift & IBM Cloud Paks on Power

<table>
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<tr>
<th>Efficient Scaling</th>
<th>More containerized throughput per core than x86 running Red Hat OpenShift*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent Security and Reliability</td>
<td>Most secure workload isolation</td>
</tr>
<tr>
<td>Optimize Utilization</td>
<td>Automated core allocation across worker nodes</td>
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*Based on IBM internal testing of Red Hat OpenShift Container Platform 4.8.2 worker nodes running 80 pods each with 10 users using the Daytrader7 workload (https://github.com/WASdev/sample.daytrader7/releases/tag/v1.4) accessing AIX Db2 databases. Average cpu utilization for the OCP worker nodes is > 95%. Comparison: Power E1080 running OCP accessing AIX Db2 on an S922 versus OCP on Cascade Lake accessing AIX Db2 on the same S922. Valid as of 8/26/2021 and conducted under laboratory conditions. Individual result can vary based on workload size, use of storage subsystems & other conditions. IBM Power E1080 (40 cores/3.8GHz/2TB memory) in maximum performance mode, 25 Gb two-port SRIOV adapter, 1 x 16Gb FCA, with PowerVM. Competitive system: Intel(R) Xeon(R) Gold 6248 CPU (Cascade Lake) in performance mode, 40 cores/3.9GHz/512GB memory, 25Gb two-port SRIOV adapter, 1 x 16Gb FCA, with PowerVM.
Red Hat on Power momentum enables accelerated delivery of app and infrastructure modernization capabilities

**What’s new?**

- **Modernize existing & develop new applications**
  - Red Hat OpenShift + add-ons (Service Mesh, Pipelines, etc.)
  - Consistent DevOps: Red Hat Runtimes + CodeReady Workspaces
  - Red Hat Advanced Cluster Management
  - Power Private Cloud Rack for faster, efficient Red Hat OpenShift deployment
  - Certified Ansible modules fully supported by Red Hat

- **Expand flexibility with a frictionless Hybrid Cloud**
  - Red Hat OpenShift on Power Virtual Server
  - RHEL for SAP HANA (on-premises and in Power Virtual Server)
  - On-premises, by the minute metering and consumption for RHEL and Red Hat OpenShift*

*Currently a statement of direction

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- 200+ Customers
- 32,000+ Ansible module downloads
- 50,000+ Subscriptions
Protect Data: End to end security with full stack encryption

Transparent memory encryption with:
- No additional management setup
- No performance impact

Blazing fast hardware-accelerated encryption compared to Power9
- 2.5x faster AES crypto performance per core\(^1\)
- 4x crypto engines in every core

Stay ahead of current and future threats with support for:
- Quantum-safe cryptography
- Fully homomorphic encryption

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1. AES-256 in both GCM and XTS modes runs about 2.5 times faster per core when comparing Power10 E1080 (15-core modules) vs. Power9 E980 (12-core modules) according to preliminary measurements obtained on RHEL Linux 8.4 and the OpenSSL 1.1.1g library.
Confidential Computing: Isolation and Integrity

Most secure multi-tenant cloud environment with orders of magnitude lower CVEs vs x86 hypervisors

IBM Power

AIX
IBM i
Linux
Red Hat OpenShift

Built-in hypervisor: PowerVM

IBM Power

New in-core defense against Return-Oriented-Programming attacks

Enhanced CPU isolation from service processors

Secure and trusted boot for host and guest LPARs

Respond faster to business demands
Protect data from core to cloud
Streamline insights and automation
Maximize availability
Simplify and integrate security management

Ensure correct configuration across the stack, monitor them and react quickly if unexpected changes are detected.

PowerSC
- Centralized dashboard
- Compliance Automation and Reporting (PCI, HIPAA, GDPR, …)
- Real-time intrusion detection (FIM)
- Patch management
- MFA

Key management
- Standards based enterprise key management
- Bring Your Own Key (BYOK) with IBM Cloud Hyper Protect Crypto Services

Respond faster to business demands

Protect data from core to cloud

Streamline insights and automation

Maximize availability
In-core AI inferencing and machine learning

Bring your own models and run inference where your operational data resides

- ONNX
- Inference
- Intelligent workflows

**AIX**  IBM  **Linux**  **Red Hat OpenShift**

**Faster AI inferencing per socket over Power E980***

- Perform in-core AI inferencing and ML where data resides
- Provides alternative to using separate GPU systems
- Train AI models anywhere, deploy on Power without changes for AI; with high RAS
- Support for popular libraries, AI frameworks and ONNX runtime

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* 5x improvement in per socket inferencing throughput for large size 32b floating point inferencing models from Power9 E980 (12-core modules) to Power10 E1080 (15-core modules). Based on IBM testing using PyTorch, OpenBLAS on the same BERT Large with SQuAD v1.1 data set
IBM Power10
Making the most reliable server, even better

Maximize memory availability

The new memory architecture, Open Memory Interface (OMI) in Power10 delivers:

- 2x better memory RAS than industry standard DIMMs\(^1\)
- 2.6x higher memory bandwidth than scalable (4+ socket) x86 processors
- Ability to support future advanced memory solution

Minimize outages

Leading the industry in infrastructure reliability in its class for over a decade, Power servers historically offer at least 25% less downtime vs. comparable high-end servers.\(^2\)

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1. Based on IBM's internal analysis of the IBM product failure rate of DDIMMS vs Industry Standard-DIMMs
2. Based on “ITIC 2020 Global Server Hardware, Server OS Reliability Report”, April 2020
Delivering a frictionless hybrid cloud experience
IBM Power approach to frictionless hybrid cloud

Consistent experience for elastic computing across the IT environment

- Consistent and compatible IT architecture – no additional middleware or application refactoring required
- Extend workloads across on-premises and Power Virtual Server
- Consistent management and automation services across hybrid & heterogeneous architectures
- Common hybrid cloud currency for pay-per-use consumption

On-premises, Power Private Cloud with Dynamic Capacity

IBM Cloud

Available capacity
Pay per use consumption
Permanent Activations

Common hybrid cloud currency

Enterprise workloads: e.g. SAP, Red Hat OpenShift, IBM Cloud Paks etc.

Power Virtual Server
IBM Power & Storage
IBM Cloud Services

Connect with cloud services
IBM Power
Infrastructure built for business with hybrid cloud agility

Consume Infrastructure-as-a-Service
Flexibility in deployment, management, and payment options

IBM Power
Business continuity and agility
Designed for the most challenging business requirements

- Leadership performance and scale
- Industry-leading availability
- Flexibility & agility
- End-to-end security from the processor to virtualization and OS

Power Private Cloud with Dynamic Capacity
Pay only for what you use
Cloud capabilities on-prem. with advanced monitoring

- Flexible consumption options with built-in cost optimization
  - 20-30% lower TCO
  - ~ 50% lower TCA
- Simple agility to respond to business demands
- Cloud-based monitoring, metering by the minute
  - Including RHEL and OCP
- Power10 and POWER9 can co-exist in the same pool

Power Virtual Server with IBM Cloud
Extend to public cloud
Same mission-critical infrastructure as on-prem, for Dev/Test, HA/DR, modernization

- VM-as-a-Service
- Consistent architecture to on-prem infrastructure
- AIX, IBM i and Linux
- Access to other cloud services
- Global footprint
- Quick access to OpenShift to accelerate app modernization
IBM intends to deploy Power10 in select Power Virtual Server datacenters. Power10 in Power Virtual Server is intended to deliver improved performance, scale, security and embedded AI capabilities, allowing clients to further enhance their Power hybrid cloud infrastructure.
Frictionless hybrid cloud experience with IBM Power

**Cloud Innovation**
Agility, flexibility and automation across private and public Cloud

**Application Modernization**
Enterprise AI, advanced analytics, containerization, extension via microservices

**Resilient, Scalable & Secure**
Business continuity through reliability and agility

### Modernize existing & develop new cloud-native applications with speed and agility

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<td>Open ecosystem for access and use by IT admins and developers with no special skills required</td>
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### Enabling a Frictionless Hybrid Cloud Experience for Enterprise-class Workloads

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Frictionless hybrid cloud experience with IBM Power

Cloud Innovation
Agility, flexibility and automation across private and public Cloud

Application Modernization
Enterprise AI, advanced analytics, containerization, extension via microservices

Resilient, Scalable & Secure
Business continuity through reliability and agility

Modernize applications with speed and agility

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Accelerate transformation
with IBM Power

ibm.biz/power10

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