

Why Oracle on IBM Power



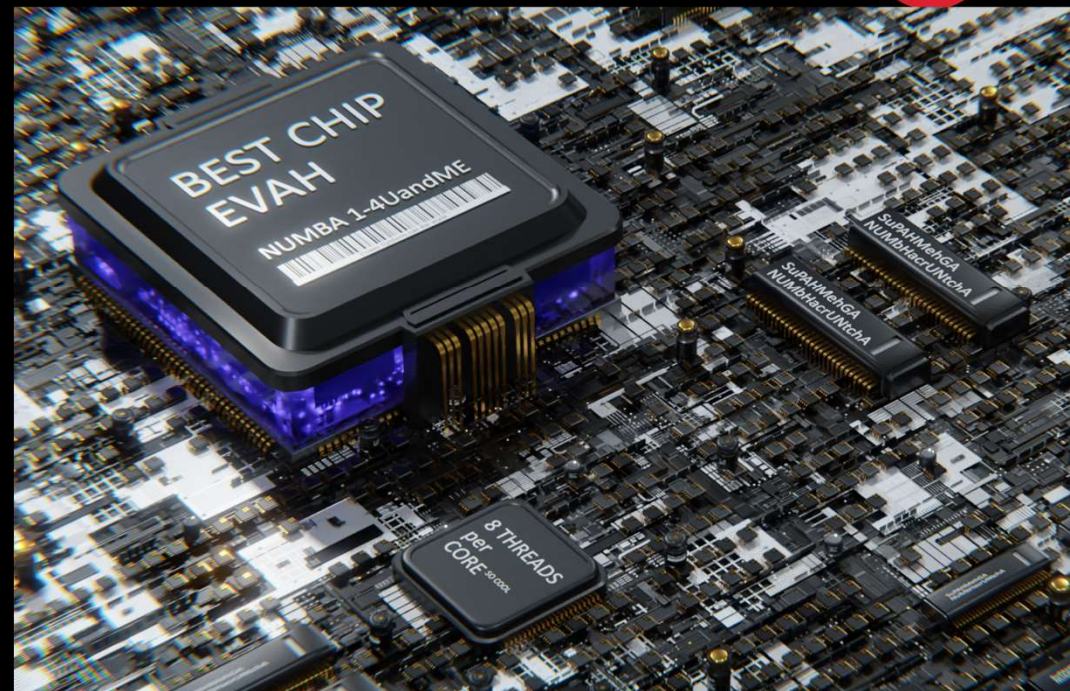
AIX

IBM i

Linux

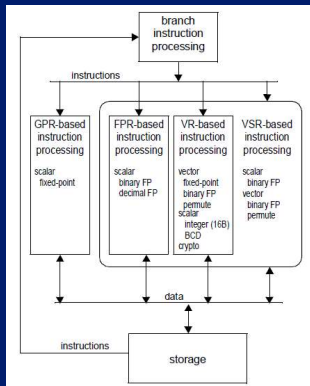


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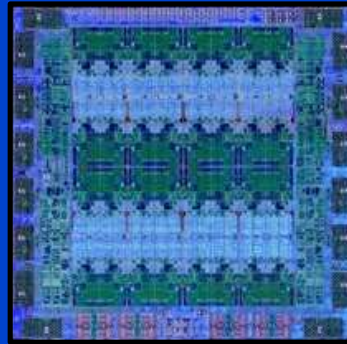
What is “Power”?

An architecture



- Power instruction set architecture (ISA) defines functionality and how software interacts with it
- RISC-based

A processor



- Microprocessors that implement the Power architecture instructions
- Latest generation: **Power10**

A family of servers



- IBM Power servers include E1080, E1050, S1024, and many others
- Built with Power processors

The Power10 portfolio supports workloads of all sizes

On - Prem

Off - Prem

Power Scale-out

S1022
S1022s
S1014



Up to 40 cores,
4TB

S1024



Up to 48 cores,
8TB

E1050



Up to 96
cores, 16TB

Power Enterprise

E1080



Up to 240 cores,
64TB

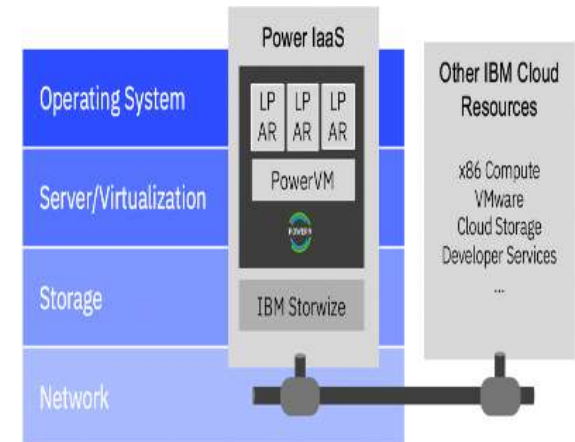


Enhanced RAS

Capacity On Demand

Power Private Cloud with Shared Utility Capacity (Enterprise Pools 2.0)

IBM Power Virtual Server



Multi-tenant, self managed,
Power compute as-a-service
with consumption-based OPEX
pricing; with access to IBM
Cloud services

Mission Critical Workloads with Oracle Database

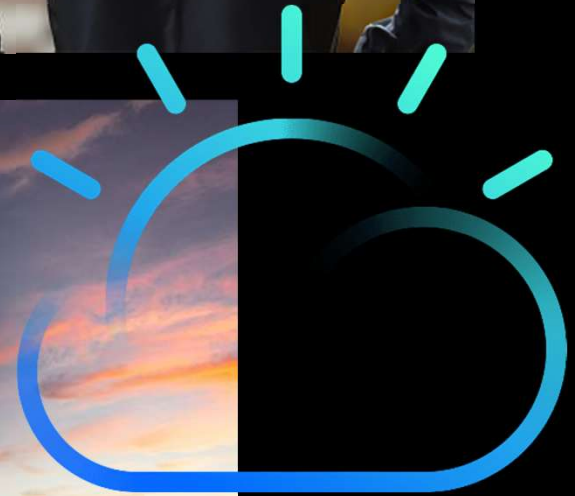
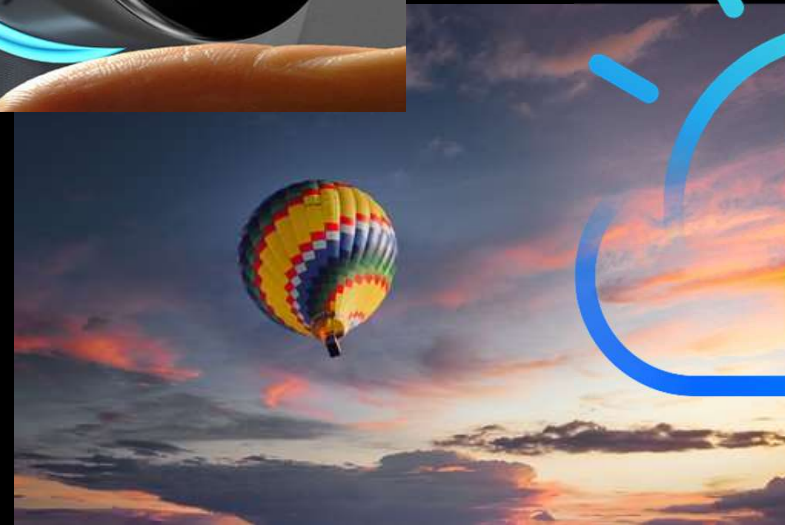
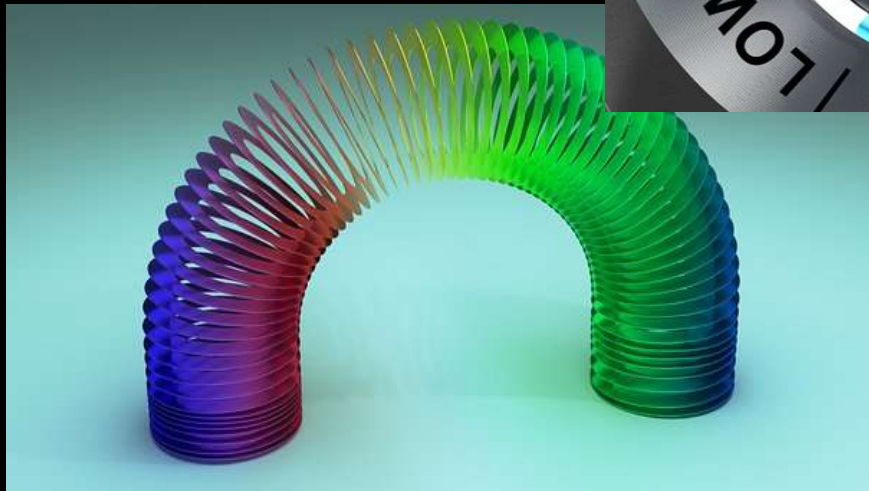
Why Oracle

on

IBM Power ?







How IBM Power drives Oracle TCO savings



Oracle software cost is 80% of the TCO, licensing, and SWMA - cost reduction is the key to success

based on client testimonies and TCO studies

Reduce #cores, better utilize CPU, and server

- reduce licensing and SWMA cost
- grow with no additional licenses purchase

Σ  = **License_factor * core_performance * %cpu_utilization * platform_efficiency**



**2.2x better performance
per core Power10 vs x86**

SMT8 real simultaneous Multi-threading



**Architecture design
for data processing**



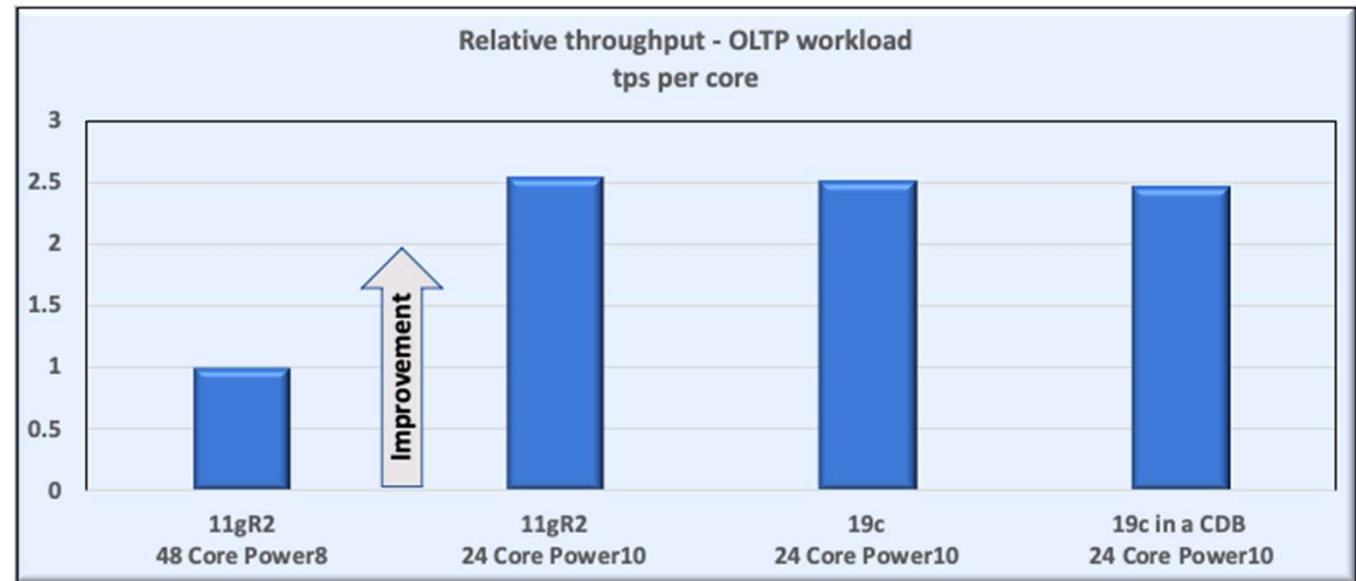
Unique capabilities for

Flexibility, Agility, Robustness, Scalability

From proven official standard benchmarks representative of ERP/database workloads

Oracle Database on Power10 capacity improvement

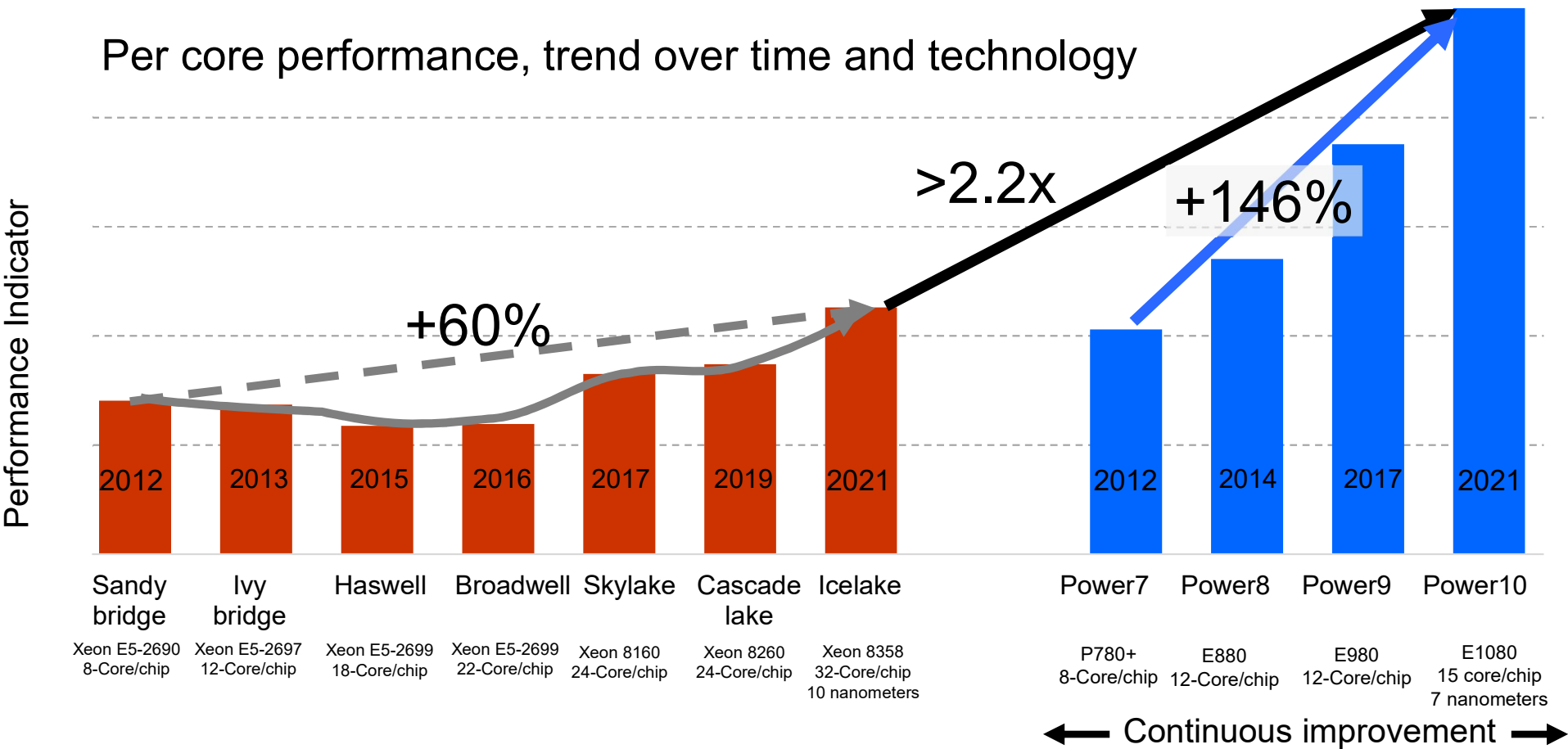
- 2.5x per core relative throughput
- Fewer cores
- Fewer licenses
- Half rack enclosures



Source: Modernizing Oracle Database on IBM Power

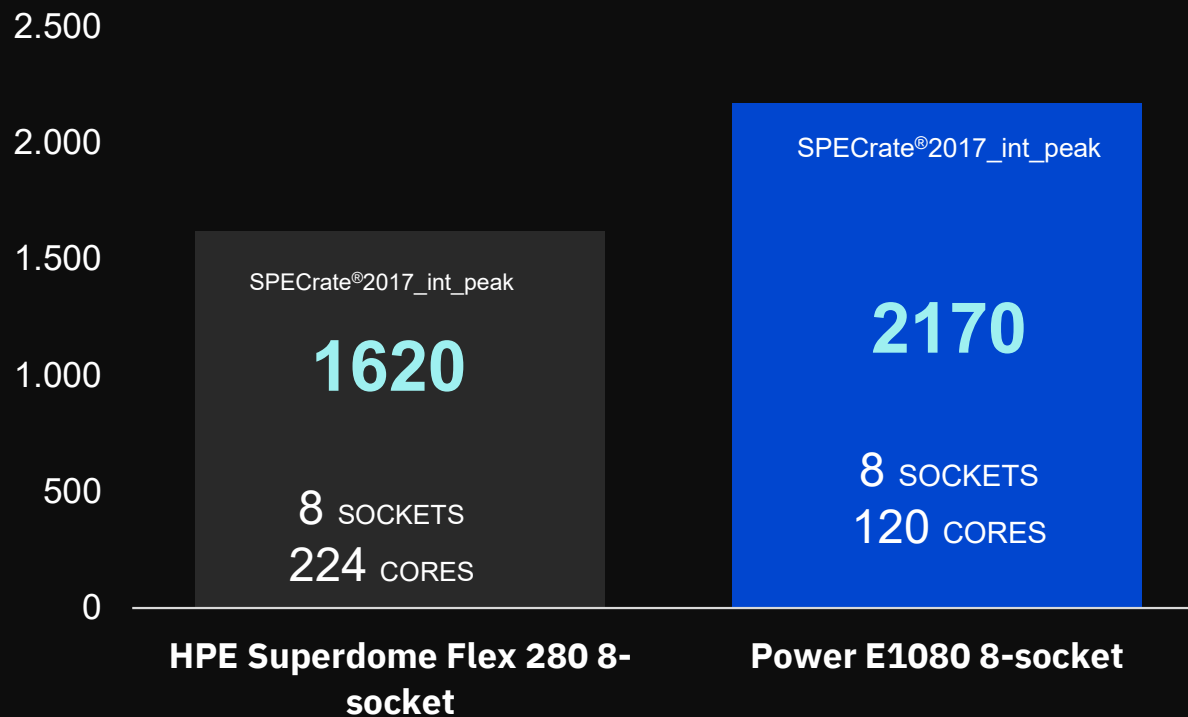
➔ Free up licenses for growth needs, avoid additional licenses purchase, database options, 22% annual SWMA, prepare Oracle ULA contract exit

Core performance and improvement



Performance is based on IDC's Quantitative Performance Index (QPI) data as of July 18, 2022.

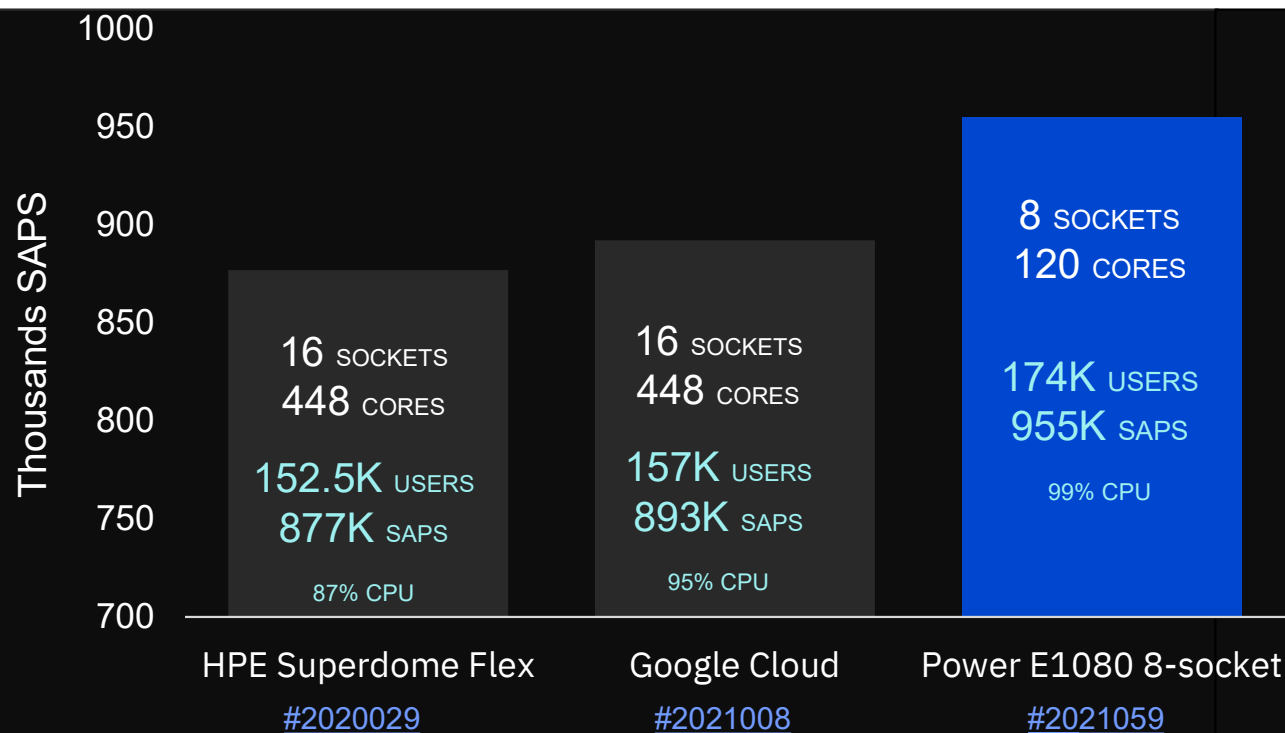
IBM Power E1080 sets world record 8-socket server SPEC CPU 2017 benchmark result¹



- World record 8-socket performance
- SPECrate®2017_int_peak
2170 versus 1620
- SPECrate®2017_int_base
1700 versus 1570
- 2.5x more performance per core
- 1.3x more performance per socket
- Power E1080 scale to 16 sockets

1. Comparison based on best performing single 8-socket systems (IBM Power E1080 3.55 - 4 GHz, 120 core, AIX and Superdome Flex 280 2.90 GHz, Intel Xeon Platinum 8380H) using published results at www.spec.org/cpu2017/results/ as of 02 September 2021. SPEC® and the benchmark names SPECrate®2017_int_base and SPECrate®2017_int_peak are registered trademarks of the Standard Performance Evaluation Corporation. For more information about SPEC CPU 2017: <http://spec.org/cpu2017/>.

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



- World record 8-socket performance
 - 955,050 versus 670,830 SAPS
 - 174,000 versus 122,300 users
 - Performance per core
 - 4x versus 16-socket Intel²
 - 2.7x versus 8-socket Intel⁴
- Higher CPU Utilization
- Most flexible and reliable SAP HANA platform⁵
- E1080 servers scale to 16 sockets

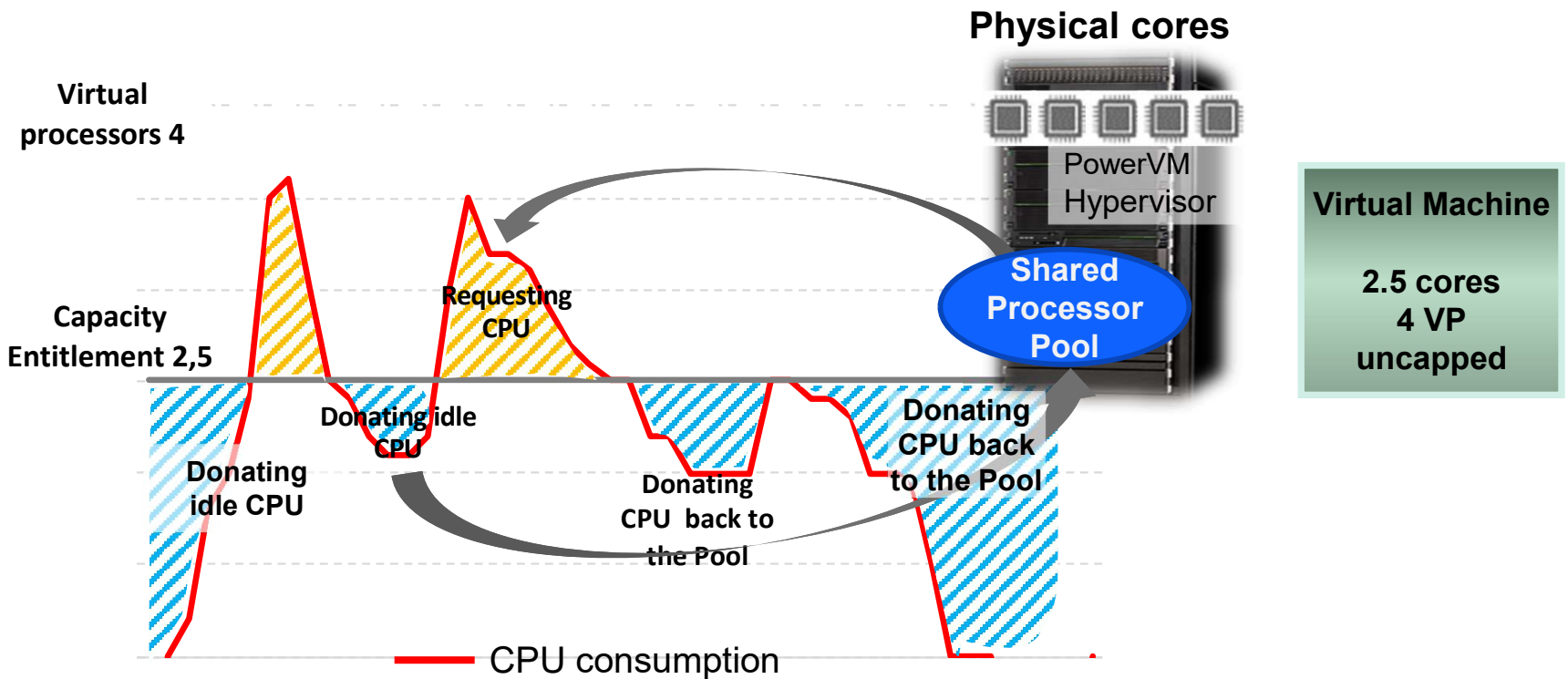
1. IBM Power E1080; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Power10 3.55-4.0 GHz processor, 4,096 GB memory, 8p/120c/960t, 174,000 SD benchmark users (955,050 SAPS), AIX 7.2, DB2 11.5. Certification # 2021059. All results can be found at sap.com/benchmark Valid as of 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, 16p/448c/896t, 157,000 SD benchmark users (892,270 SAPS), running Windows Server 2019 and 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 8280L 2.7 GHz, 16p/448c/896t, 152,508 SD benchmark users (877,050 SAPS), running Windows Server 2019 and Microsoft SQL Server 2019, Certification # 2020029.
4. HPE Superdome Flex; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8380H 2.9 GHz, 8p/224c/448t, 122,300 SD benchmark users (670,830 SAPS), Windows Server 2016 and Microsoft SQL Server 2012, Certification # 2021006.
5. Ranked most reliable server in its category for 12th year by [ITIC](https://www.itic.com). Flexible: Only platform that runs AIX, IBM i, Linux OS'es while supporting the ability to run 16 SAP HANA production environment in a single server.

Resource utilization and efficiency

10 cores running at 80% / 20 cores at 40% / 40 cores at 20%?

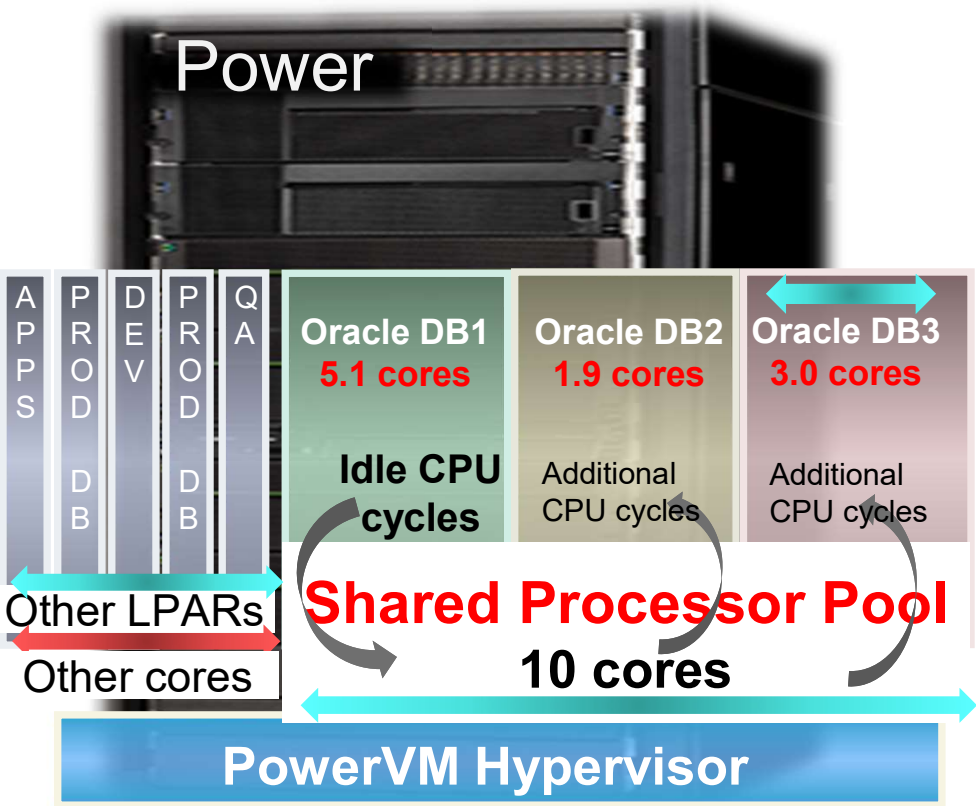
- Simultaneous Multi Threading SMT8 to improve core utilization
- SMP vertical scalability to improve CPU efficiency
- Data processing server, integrated, and complete design including memory
- PowerVM embedded virtualization to improve CPU utilization

Sharing CPU: PowerVM shared processor pool mechanism



Sharing idle CPU is a unique capability thanks to PowerVM bare metal hypervisor

Shared Processor Pool: optimize CPU, cores, and Oracle licensing



Each VM (LPAR) running Oracle DB has its own guaranteed CPU (Capacity Entitlement), no CPU overcommitment

VMs could be defined uncapped with number of VPs up to the maximum peak consumption

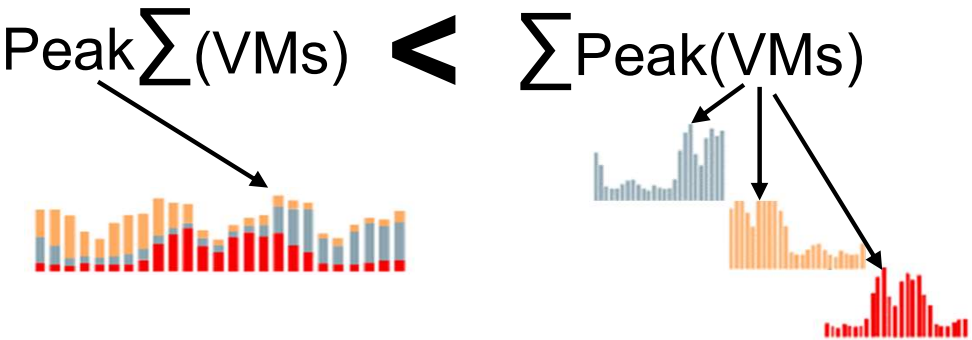
VMs cede idle CPU back to the Pool, or request from the pool additional CPU than the Entitled Capacity

Each LPAR can consume up to the size of the Pool (VP=cores in the pool), depending on other LPARs consumption

Size of the Pool can be defined with more cores than total Capacity Entitlements (spare idle CPU)

Pool size is less than sum of all VM's peaks

→ Better Utilization → less cores → less Oracle licenses



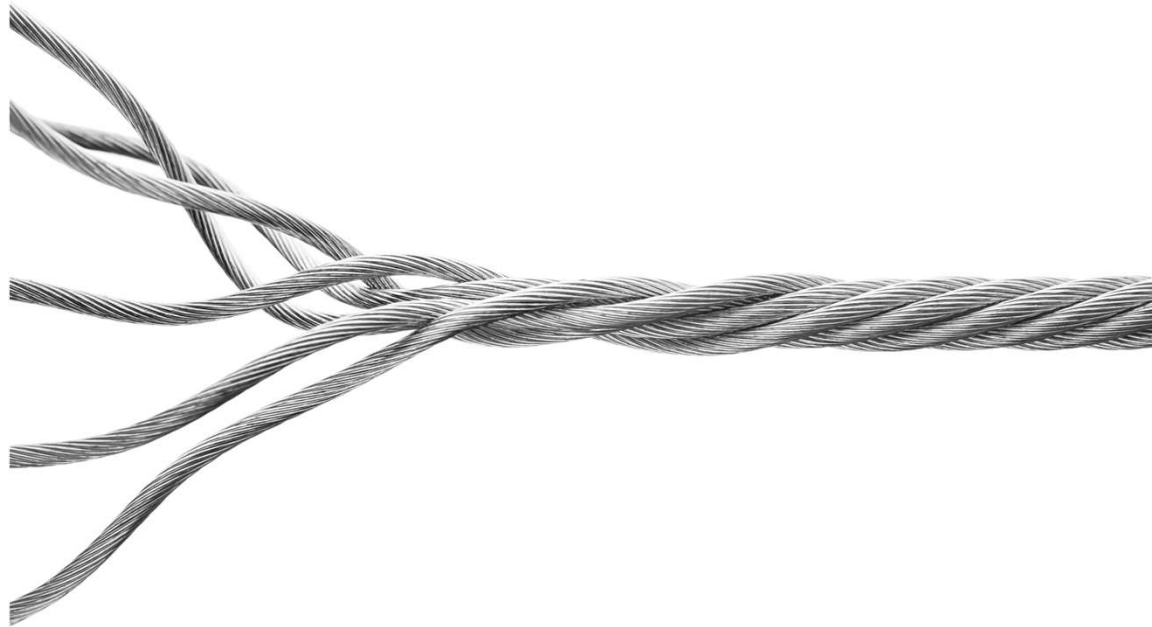
Platform efficiency

RAS

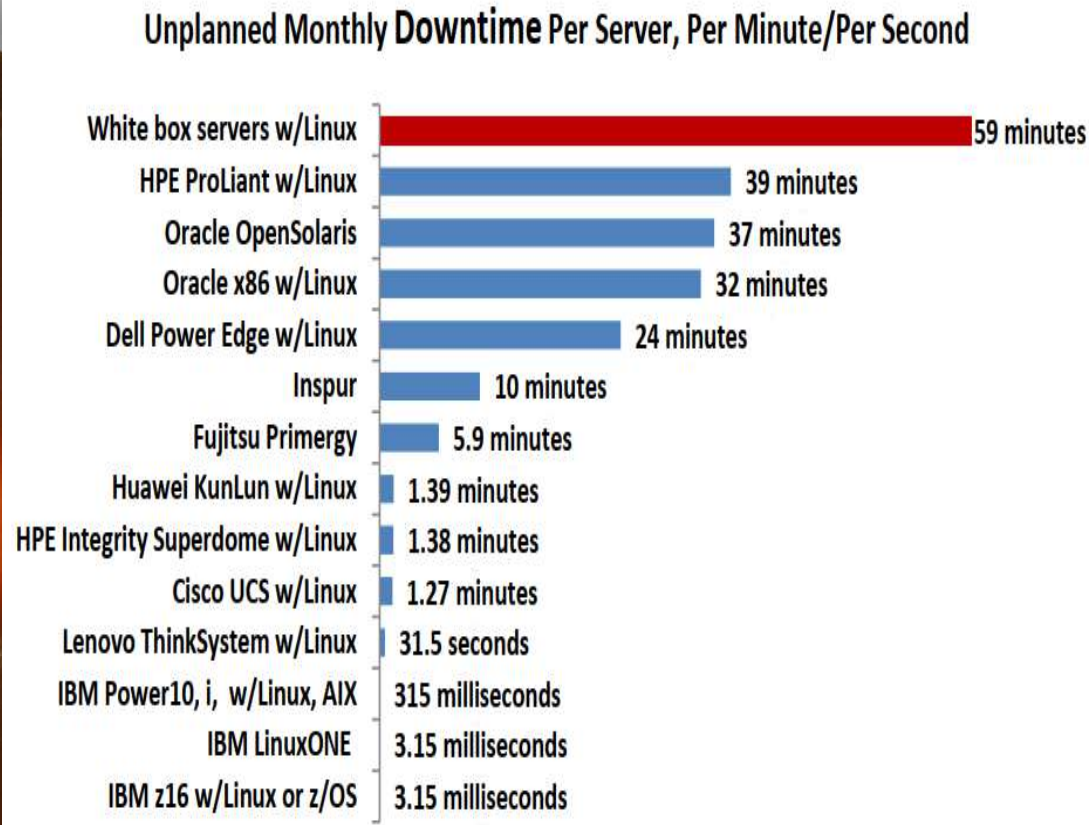
Security

Encryption

Sustainability...



IBM Power ranked number 1 in every major reliability category by ITIC for the **14th straight year**

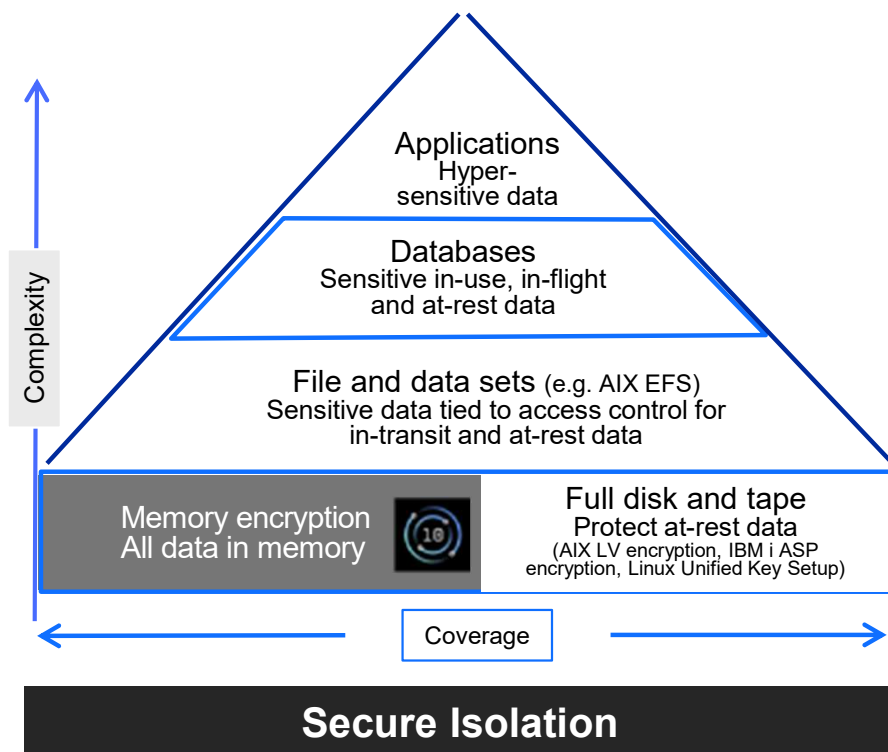


IC 2023 Global Server Hardware, Server OS Reliability Survey

Power10, security by design without cost and complexity

Protect data in memory with
transparent memory encryption

Host based HW Encryption at all levels of the stack



- Encrypt Oracle single instance DB from top to bottom, Transparent Memory Encryption and AIX Logical Volume encryption at no additional cost
- All data encrypted in Oracle DB, no need to define specific records, tables, columns
- OracleDB encryption option could be used, Transparent Data Encryption, but is \$15k list price per license
- Cryptographic HW acceleration for Storage volumes and network protocols, including Quantum safe)
- Overall security combination with storage immutable copies on Spectrum Virtualize, called Safeguarded Copy

In addition, PowerSC (Power Security and Compliance) provides end to end security control, for VMs, containers, workload files, operating system, boot integrity, and fully integrated with hardware/firmware:

Compliance automation, Trusted AIX, AIX Auditing, Multi-Factor Authentication, Trusted boot

IBM Power in the Oracle ecosystem

Oracle Support Statement:

https://support.oracle.com/knowledge/Oracle%20Database%20Products/2766930_1.html

- Confirms the **large install base and relevance of IBM Power to Oracle with almost 80,000 joint clients**
- Confirms long-term commitment to develop and release Oracle Database on IBM Power
- Confirms upcoming long-term releases of Oracle Database will be on IBM Power and provides a target date for next release of 2023
- Demonstrates supported offerings well past the end of the decade

25+ Years Collaboration

Ensure IBM and Oracle products working together at their most current releases

Oracle Technologies (DB, RAC, Fusion Middleware ...)

Oracle Applications (Siebel, EBS, PSFT, FlexCube ...)

IBM Systems & Software

Joint Enablement and Optimization

On-site people dedicated to joint Oracle and IBM product development

Technical Assistance and platform-specific training to Oracle

Documented best practices, performance tuning and other lessons learnt

[Oracle on IBM Power Redbook](#)

Technology Features Recognition via Certification

Oracle leverages:

Power and AIX Exclusives execution in a micro-partition exploitation of SMT8, VIOS, AME

Live Kernel Update, Shared Processor Pool

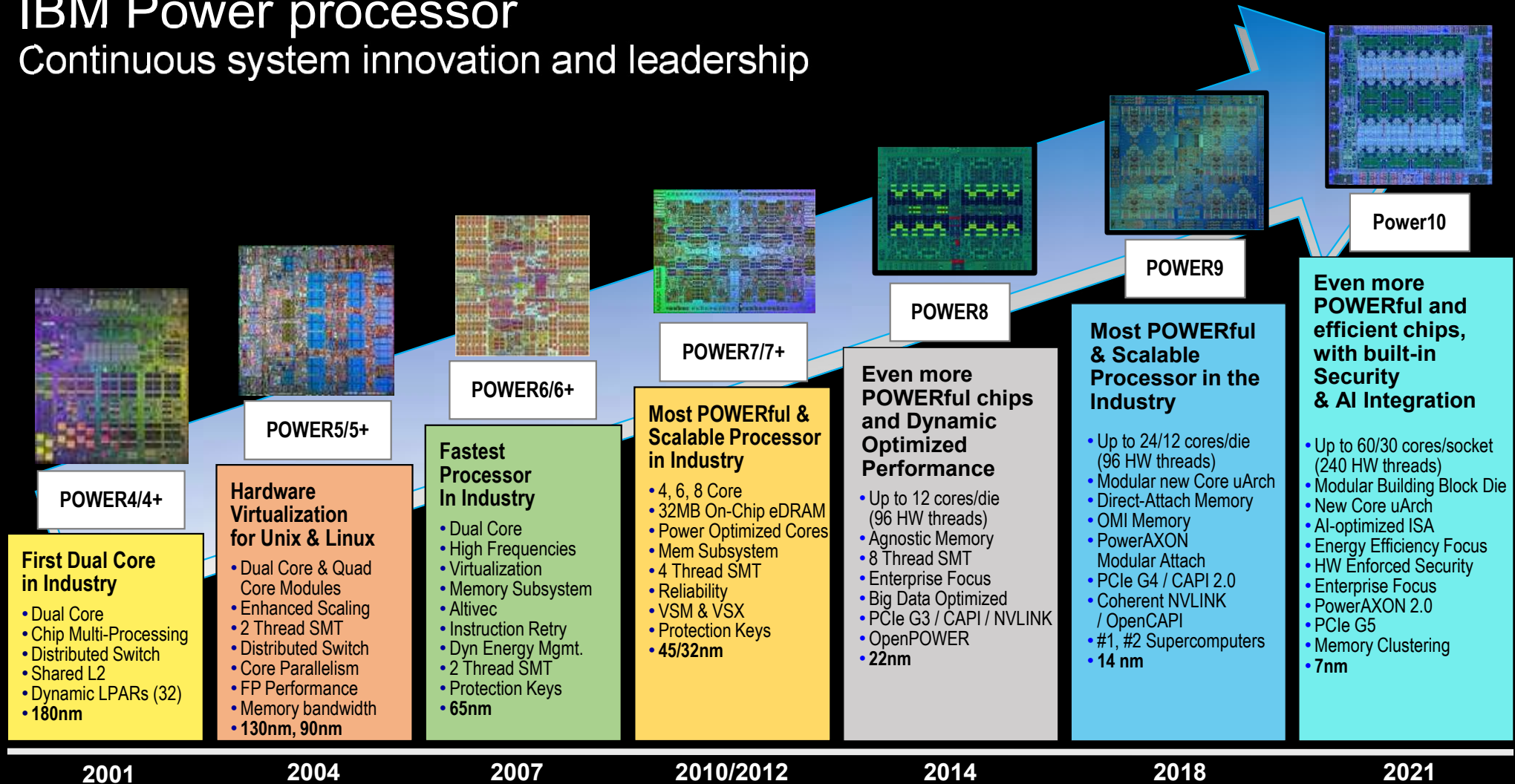
Cooperative Customer Support Process

Post Sales and Support

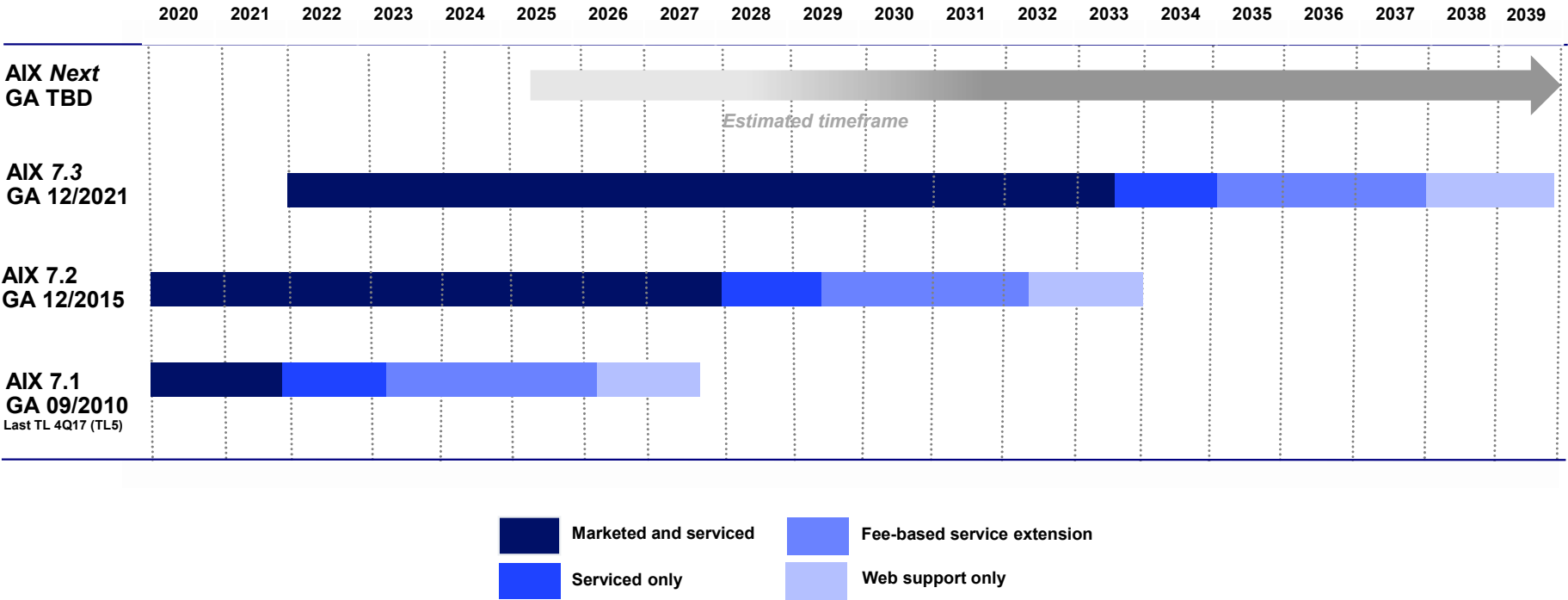
IBM and Oracle have a formal joint process for formal communications between support organization on an “as required” basis

IBM Power processor

Continuous system innovation and leadership



AIX Roadmap



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

Long-term Secure Roadmap

Oracle Support Statement: https://support.oracle.com/knowledge/Oracle%20Database%20Products/2766930_1.html

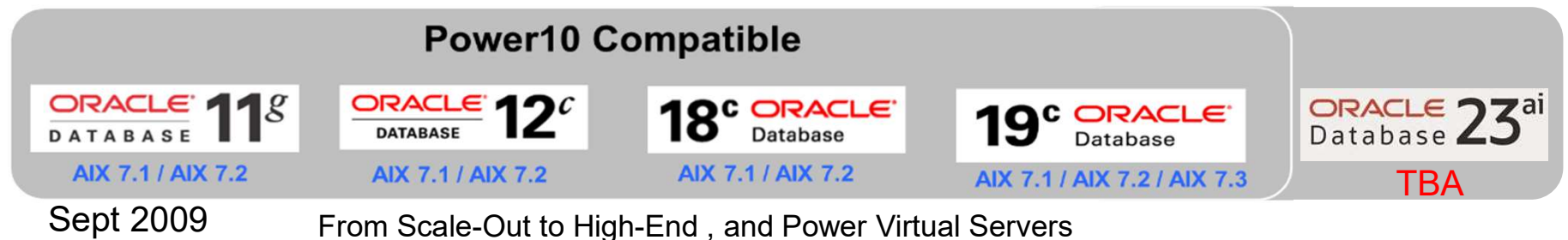
Confirms **large install base and relevance of IBM Power to Oracle with almost 80,000 joint clients**
long-term commitment to develop and release Oracle Database on IBM Power
upcoming Oracle DB long-term releases will be on IBM Power, target date for next release 2023

IBM Power has ~21% Oracle DB Market Share (IDC SW tracker), largest WW Oracle SW implementations run on Power
https://www.idc.com/getdoc.jsp?containerId=IDC_P25240

Long-term investment

Oracle Database
23^c

Oracle Certifies for the AIX O/S version, and Power10 runs multiple AIX versions



Flexibility and Coverage to run the products and versions you need while getting benefit of latest infrastructure technology and Power10 performance

https://support.oracle.com/knowledge/Oracle%20Database%20Products/742060_1.html

<https://www.oracle.com/fr/database/technologies/virtualization-matrix.html>

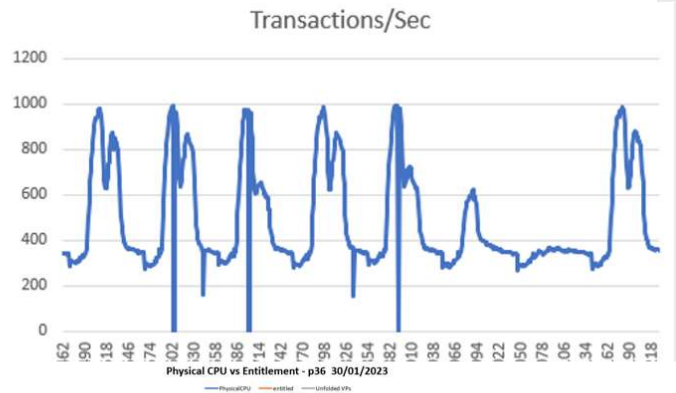
Oracle Database Service Offerings from Technology Expert Labs

- Oracle Database **Performance Optimization Assessment**
 - Thorough analysis of the full stack (Hypervisor, OS, database and application behaviour (as can be seen on the database))
 - Provides setup specific tuning recommendation and tips
- Oracle Database **License Optimization Assessment**
 - Analyzes workload characteristics, used options, optimization options concerning pool usage and HA options
- Oracle Database **Migration Services**
 - Ansible based IBM TEL Migration Framework for highly automated Oracle Database migrations to Power and LinuxONE (as Service Offering)
 - Useful to efficiently migrate large number of databases in parallel
- **Other Oracle Database Services**
 - Architecture Reviews, installation/upgrade support, health checks, DB and SQL statement tuning
 - DBA support (not 24x7)

Contact: TEL.Infrastructure.DACH@de.ibm.com

Observations	Recommendations
Observed Oracle Database is at Release 19 Update 3 Revision 0 with Patch 29517242 issued on May 19, 2019.	Unless there is a reason to stay with a 3year old patch release update patches should be applied to avoid security and bugs. The most recent "N-1" patch update issued on Oct 18, with patch numbers 34416665 (GI RU) and 34419443
There is a mismatch between the database redo block size and the JFS2 filesystem block size for /oradata03 (oradata01 is ok) which should be corrected.	It is recommended that redo log filesystems should be agblsize=512 (not 4096) for better performance. Option: If the physical disk sector size is 4K, you have the redo block size to 4K with database parameter: "_disk_sector_size_override"=TRUE Then recreate the redo logs with: SQL> alter database add log file <xyz> size 500M b This, however, could lead to a high "redo wastage" so i option check AWR / Statspack report for that measurer using 4k block size. Usually, the default of 512 byte is r
Database parameter filesystemio_options is not set, and filesystems are not mounted with cio option.	This results in the AIX filesystem cache being used for (which are already cached in the database buffer cache). You should set database Parameter filesystemio_ to make sure no AIX filesystem cache is used.

Load Profile	Per Second	Per Transaction
DB Time(s):	1.5	0.0
DB CPU(s):	0.5	0.0
Background CPU(s):	0.0	0.0
Redo size (bytes):	357,737.1	2,210.1
Logical read (blocks):	32,939.3	203.5
Block changes:	1,494.2	9.2
Physical read (blocks):	2,771.2	17.1
Physical write (blocks):	342.1	2.1
Read IO requests:	630.7	3.9
Write IO requests:	37.5	0.2
Read IO (MB):	21.7	0.1
Write IO (MB):	2.7	0.0
IM scan rows:	0.0	0.0
Session Logical Read IM:	0.0	0.0
User calls:	1,113.8	
Parses (SQL):	532.4	
Hard parses (SQL):	9.1	
SQL Work Area (MB):	9.9	

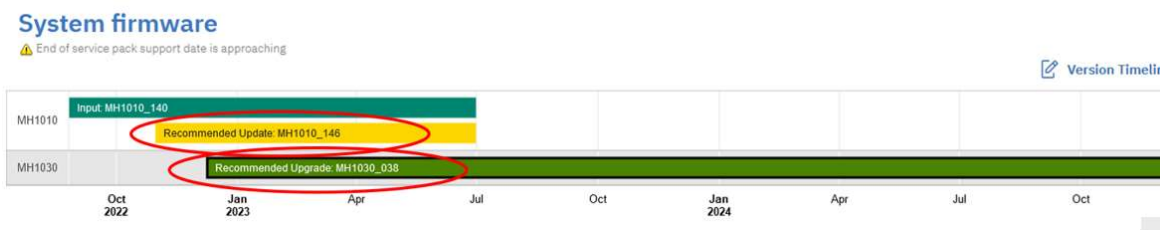


Id	Operation	Name
0	SELECT STATEMENT	
1	PARTITION RANGE ITERATOR	
2	PARTITION LIST SINGLE	
3	TABLE ACCESS BY LOCAL INDEX ROWID BATCHED	
* 4	INDEX SKIP SCAN	

Buffer Pool Advisory				
• Only rows with estimated physical reads >0 are displayed • ordered by Block Size, Buffers For Estimate				
P	Size for Est (M)	Size Factor	Buffers (thousands)	Est Phys Read Factor
D	2,432	0.10	298	13.88
D	4,964	0.20	596	3.86
D	7,296	0.30	893	2.32
D	9,728	0.40	1,191	1.44
D	12,160	0.50	1,489	1.24
D	14,592	0.60	1,787	1.16
D	17,024	0.70	2,085	1.10
D	19,456	0.80	2,382	1.06
D	21,888	0.90	2,680	1.03
D	24,320	1.00	2,978	1.00
D	26,752	1.09	3,276	0.97
D	29,184	1.19	3,574	0.94
D	31,616	1.29	3,871	0.90
D	34,048	1.39	4,169	0.87
D	36,480	1.49	4,467	0.83
D	38,912	1.59	4,765	0.80
D	41,344	1.69	5,063	0.77
D	43,776	1.79	5,361	0.75
D	46,208	1.89	5,658	0.73
D	48,640	1.99	5,956	0.71

Top 10 Foreground Events by Total Wait Time					
Event	Waits	Total Wait Time (sec)	Avg Wait	% DB time	Wait Class
DB CPU		464.8K		30.6	
log file sync	1.8E+08	454K	2.57ms	29.9	Commit
PGA memory operation	1.7E+08	83K	480.07us	5.5	Other
SQL*Net more data from client	11,931,948	18.1K	1.51ms	1.2	Network
db file sequential read	14,654,720	9511.3	649.02us	.6	User I/O
flashback log file sync	10,763,354	8004.6	743.69us	.5	User I/O
cursor: pin S	6,816,350	7582.6	1.11ms	.5	Concurrency
direct path read	11,196,328				
library cache: mutex X	36,301,423				
control file sequential read	11,022,772				

Power Systems E1080 (9080-HEX) Announcement Letter



```

skipping: [1]
TASK [debug] *****
ok: [1] => {
  "msg": "All checks on source and primary target passed."
}
ok: [1] => {
  "msg": "All checks on source and primary target passed."
}
PLAY [perform prechecks on target standby] *****
skipping: no hosts matched
PLAY RECAP *****
0 rescued=0 ignored=0 ok=24 changed=0 unreachable=0 failed=0 skipped=2
1 rescued=0 ignored=0 ok=16 changed=0 unreachable=0 failed=0 skipped
-34 rescued=0 ignored=0

2023-02-27 10:09:22 - Finished section install step 1

--- Precheck and setup source reference and target

[OK] 2.1 A a Precheck source and target
--> 2.2 A a Setup scripts for xtt
.... 2.3 A a -- Close this section

*** LIVE *** Project: $ - max: 3 - last: 1 - result: 0 - next: 2
1) next 2) last 3) info 4) quit #?

```

```

changed: [1]
TASK [debug] *****
ok: [1] => {
  "create_ts_without_lines": [
    "",
    "Tablespace created.",
    "",
    "Tablespace created.",
    "",
    "Tablespace created.",
    "",
    "Tablespace created.",
    "",
    "Tablespace created.",
    ""
  ]
}
PLAY RECAP *****
1 ignored=0 ok=7 changed=3 unreachable=0 failed=0 skipped=1 rescued=0
1 ignored=0 ok=6 changed=3 unreachable=0 failed=0 skipped=0 rescued=0

```

```

"my_queues": [
  1,
  2,
  3,
  4
]
TASK [Remove FAILED file] *****
ok: [1] => (item=1)
ok: [1] => (item=3)
ok: [1] => (item=3)
ok: [1] => (item=4)
TASK [Create background script for xtt driver.pl -G] *****
[WARNING]: Using world-readable permissions for temporary files Ansible needs to create when becoming an
unprivileged user. This may be insecure. For information on securing this, see
https://docs.ansible.com/ansible/become.html#becoming-an-unprivileged-user
changed: [1] => (item=1)
changed: [1] => (item=2)
changed: [1] => (item=3)
changed: [1] => (item=4)
TASK [Execute xtt driver.pl -G] *****
changed: [1] => (item=1)
changed: [1] => (item=2)
changed: [1] => (item=3)
changed: [1] => (item=4)
PLAY [Wait for transfer step to finish] *****
TASK [Gathering Facts] *****
ok: [1]
TASK [Wait for transfer jobs to finish] *****

```

```

ated/".
"create bigfile tablespace TS_ datafile size 100M autoextend on next 100M maxsize
unlimited/".
"create bigfile tablespace TS_ datafile size 100M autoextend on next 100M maxsize
unlimited/".
"create bigfile tablespace USERS datafile size 100M autoextend on next 100M maxsize unlimited/".
"create bigfile tablespace TOOLS datafile size 100M autoextend on next 100M maxsize unlimited/".
"create bigfile tablespace TS_ datafile size 10G autoextend on next 10G maxsize unlim
ited/".
"create bigfile tablespace TS_ datafile size 100M autoextend on next 100M maxsize
unlimited/".
"create temporary tablespace TS_ tempfile size 10 autoextend on next 10 maxsize unlim
ited/".
"create temporary tablespace TS_ TMP tempfile size 10 autoextend on next 10 maxsize un
limited/".
"create temporary tablespace TS_ tempfile size 10 autoextend on next 10 maxsize unlim
ited/".
"create temporary tablespace TS_ ATATMP tempfile size 10 autoextend on next 10 maxsize
unlimited/".
}
TASK [Fetch tablespace create script] *****
changed: [1]
PLAY [Fix MAXSIZE issue in tablespace create script] *****
TASK [Fix MAXSIZE issue in tablespace create script] *****
ok: [1] => localhost
ok: [1] => localhost
TASK [Pause to allow fix of tablespace sizes] *****
[Pause to allow fix of tablespace sizes]
You can fix tablespace sizes (on CMS) now:

```

IBM