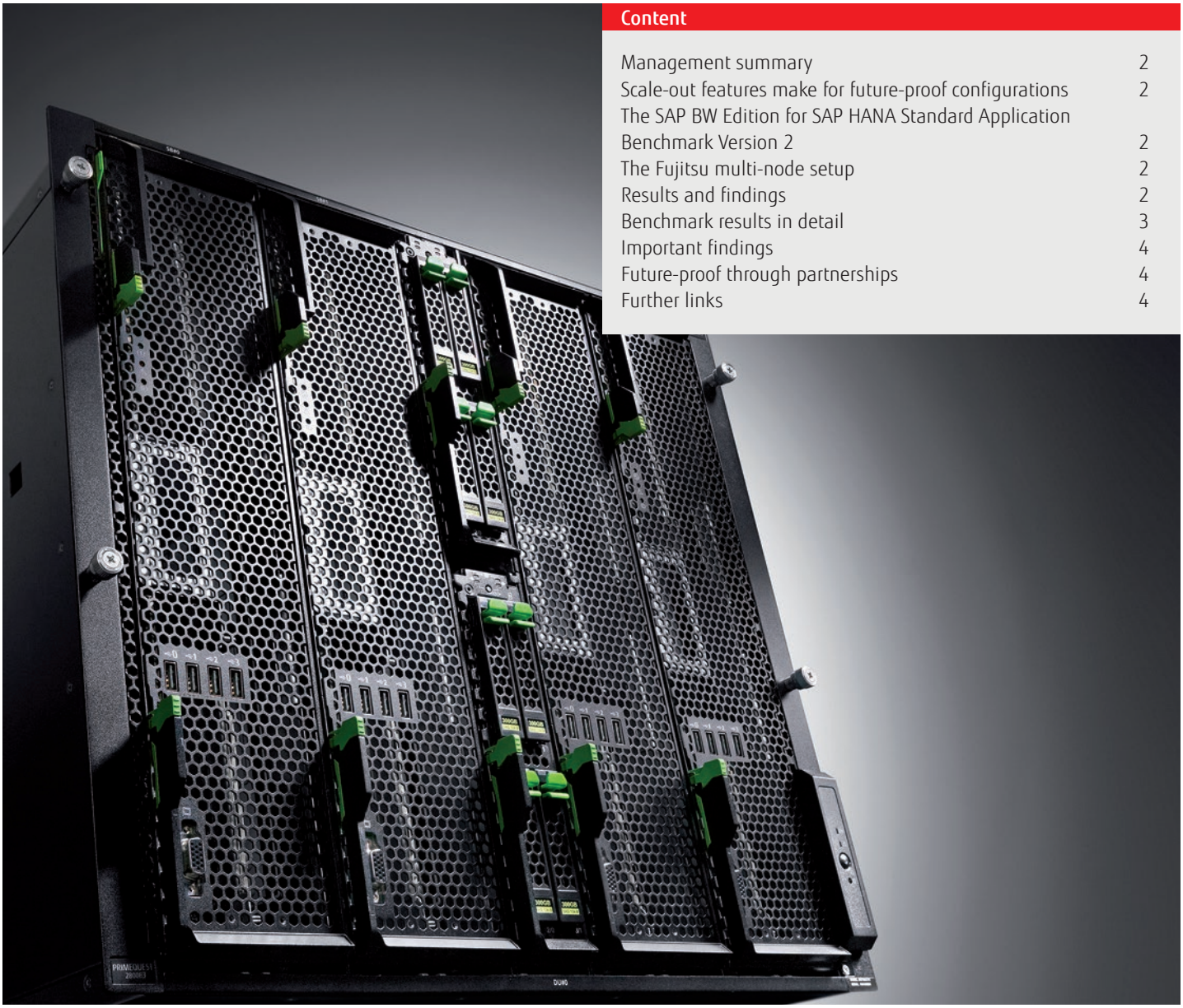
FUJITSU

White Paper
SAP HANA Scale-out and Virtualization

Fujitsu is the first manufacturer worldwide to receive SAP® HANA Scale-out Certification for VMware® vSphere 6.5. The certification was achieved by conducting the current SAP BW Edition for the SAP HANA Standard Application Benchmark Version 2 on the FUJITSU Integrated System PRIMEFLEX for SAP HANA equipped with PRIMEQUEST 2800B3 servers. This white paper provides an overview of the benchmark testing and findings.



Content

Management summary

Based on a complex testing procedure, Fujitsu was granted SAP HANA Scale-out Certification for PRIMEFLEX for SAP HANA with VMware vSphere 6.5 on PRIMEQUEST 2800B3/E3/S3 series and PRIMERGY RX4770 M3 servers. Fujitsu demonstrated that even extremely large SAP HANA scale-out systems can be virtualized with VMware vSphere 6.5. With massively scaled PRIMEFLEX for SAP, it was also shown that Fujitsu is the first vendor worldwide to fulfill the strict requirements for data throughput, speed and scalability in various multi-node configurations. For customers this means that SAP now supports SAP HANA scale-out systems with Intel Broadwell-EX CPUs (Intel Xeon™ E7-4800 v4 and Intel Xeon E7-8800 v4) and VMware vSphere 6.5 up to 16 (15+1) nodes. Depending on the customer's specific situation, SAP HANA BW scale-out configurations having RAM of up to 64 TB are possible. This enormous scalability pays off in terms of dynamic digital transformation because customers do not have to change their hardware or their virtualization platform in order to cope with exploding data growth. PRIMEFLEX for SAP HANA lets customers start with an affordable configuration tailored to their needs which can be scaled later should their requirements change.

Scale-out features make for future-proof configurations

To successfully complete their digital transformation, business enterprises need platforms that enable them to consistently and comprehensively manage their entire SAP landscapes. This is also true when it comes to SAP S/4HANA and SAP HANA. IT managers expect that in-memory computing architectures will generate added value for their business based on the real-time processing of various types of data. However, due to the dynamics of digital transformation, it is difficult to accurately forecast how many resources will actually be needed in many cases. This poses a number of major risks – both in terms of the continuity of the transformation phase, as well as the IT work and IT costs involved. Thus the scale-out capability of platforms is a decisive factor that determines how future-proof solutions will be.

The SAP BW Edition for SAP HANA Standard Application Benchmark Version 2

The performance requirements of the new SAP BW Edition for SAP HANA benchmarks raise the bar in order to ensure that platforms fully utilize the inherent performance of SAP HANA. When it comes to multi-node setups, candidates must prove that their platforms are able to scale massively – both natively and virtualized. The ability of the manufacturer to scale the platform with the appropriate components, including network and storage, is the decisive factor in native scenarios. For scale-out virtualized infrastructures, attention is also focused on the overhead that is involved. Three key performance indicators (KPIs) are significant in the benchmark: the Data Load Phase, the Query Throughput Phase and the Query Runtime Phase. One of the central rules of the benchmark stipulates that the memory utilization must be at least 65 percent. The permissible data volumes are a multiple of 1.3 billion initial data records.

The Fujitsu multi-node setup

Fujitsu used the benchmark test* to develop best practices for SAP HANA scale-out with a bare metal setup and then virtualized it with VMware vSphere 6.5. The integrated PRIMEFLEX for SAP HANA system with PRIMEQUEST servers based on Intel Broadwell CPUs was used. Both the platform with VMware vSphere 6.5 and the benchmarks were certified. Three different setups were tested:

- The first was a bare metal configuration with 4 nodes (1 Master Node, 3 Worker Nodes) and 3.9 billion initial data records. The configuration was comprised of 4 PRIMEQUEST 2800B3, each equipped with 4 processors/88 cores/176 threads Intel Xeon E7-8880 v4 2.20 GHz and 1024 GB of main memory.
- This configuration was later virtualized with VMware vSphere 6.5 (1 virtualized Master-Node, 3 virtualized Worker Nodes) and then the test was conducted again.
- The third test cycle involved 10.4 billion initial data records in an 8-node configuration virtualized with VMware vSphere 6.5 (1 virtualized Master Node, 7 virtualized Worker Nodes). This scenario was comprised of 4 PRIMEQUEST 2800B3, each equipped with 8 processors/176 cores/352 threads Intel Xeon E7-8880 v4 2.20 GHz and 2048 GB of main memory.

RESULTS AND FINDINGS

- The comparison of both two 4-node test cases on bare metal and on VMware vSphere 6.5 shows that the performance impact of virtualization is small.
- Fujitsu also compellingly demonstrated the excellent scale-out capabilities of its platform with 4-node and 8-node configurations. The high in-system scalability of elements like PRIMEQUEST servers and ETERNUS storage systems, along with appropriate network components, means that even larger environments can be set up.
- Officially SAP now supports SAP HANA scale-out systems with servers based on Intel Broadwell-EX CPUs and VMware vSphere 6.5 with up to 16 nodes.

* All benchmarks were run on three-tier configurations with SUSE® Linux Enterprise Server 12, SAP NetWeaver® 7.50 and SAP HANA 1.0.

Benchmark results in detail

The benchmark with 4 nodes (see Table 1) – 1x bare metal and 1x virtualized – resulted in a number of important findings. In the Data Load Phase, for example, both CPU and I/O, as well as the network, were under heavy loads, and in the Query Throughput Phase the CPU was under an extremely heavy load – contrary to that, in the Query Runtime Phase only few CPU cores were used, hence the single thread performance is important here. These findings show that having a well-harmonized system is very important. The following findings were derived from the bare metal and virtualized configuration tests: VMware vSphere 6.5 can utilize up to 128 vCPUs per VM, meaning that 48 threads in the system remain unused. Overall, however, running VMware vSphere 6.5 results in very little overhead and thus achieves very good performance figures.

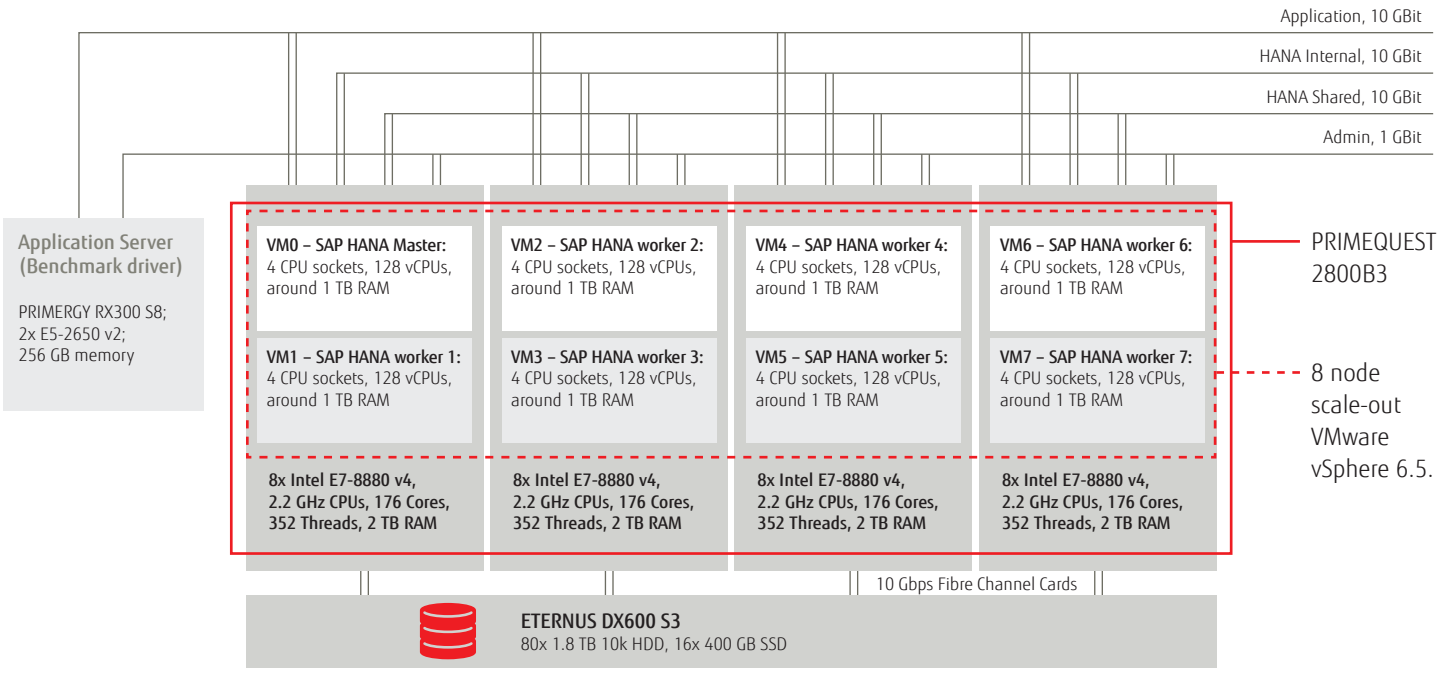
	Test Case 1: 4 Nodes	Test Case 2: Virtualized 4 Nodes	4 Virtualized Nodes vs. 4 Nodes
Nodes	4 (1 Master, 3 Workers)	Virtualized 4 (1 Master, 3 Workers)	
Initial data records	3,900,000,000	3,900,000,000	
Benchmark Phase 1: Total Runtime of Data Load/Transformation (seconds)	56,174	61,418	+9,3%
Benchmark Phase 2: Query Executions per Hour	6,405	5,772	-9,9%
Benchmark Phase 3: Total Runtime of complex query phase (seconds)	256	254	-0,8%

The benchmark with 8 nodes (virtualized) confirmed the excellent performance already achieved by VMware vSphere 6.5 in the 4-node configuration. Although 167 percent more data needed to be processed, the runtime for loading the data was extended by only 89 percent, and the processing of queries was even improved by 25 percent.

	Test Case 2: Virtualized 4 Nodes	Test Case 3: Virtualized 8 Nodes	8 vs. 4 Virtualized Nodes
Nodes	Virtualized 4 (1 Master, 3 Workers)	Virtualized 8 (1 Master, 7 Workers)	**133% more Worker Nodes**
Initial data records	3,900,000,000	10,400,000,000	**167% more data**
Benchmark Phase 1: Total Runtime of Data Load/Transformation (seconds)	61,418	116,169	**Only 89% longer Data Load Runtime**
Benchmark Phase 2: Query Executions per Hour	5,772	7,239	**25% more executions with 167% more data**
Benchmark Phase 3: Total Runtime of complex query phase (seconds)	254	240	**5% shorter Complex Query Runtime**

The SAP HANA Hardware Configuration Check Tool (HWCCT) was used to ensure that the KPIs stipulated for storage and network were fulfilled. These tests were also run successfully, whereby the Latency KPI for the Data Log of 1 ms and the Network KPI, which must equal or exceed 9 Gbit/s per SAP HANA scale-out node, were both achieved.

Configuration diagram of the virtualized 8-node system with 4 PRIMEQUEST 2800B3 servers:



Important findings

The BW Edition for the SAP HANA Version 2 Benchmark confirms that Fujitsu can deliver SAP HANA scale-out solutions with outstanding scalability. In virtualized environments, as opposed to bare metal configurations, there is very little impact on performance. PRIMEFLEX for SAP HANA customers can thus upgrade to VMware vSphere 6.5 without worry. The findings of the extensive tests open up new perspectives for all SAP users who want to embrace digital transformation and make their IT future-proof. Fujitsu offers complete, seamless integrated infrastructures based on PRIMEFLEX for SAP HANA that support the digital strategies of business enterprises with high levels of efficiency and flexibility. Solutions with the great reliability and extreme scalability of the PRIMEQUEST 2800B3/E3/S3 series (as tested in the benchmark environment) and the PRIMERGY RX4770 M3 provide wide-ranging in-system upgrade options for maximum flexibility. When combined with virtualization, the complexity of SAP landscapes is reduced considerably, along with administrative tasks in general. Fujitsu offers PRIMEFLEX for SAP HANA and VMware solutions precisely designed to help you easily standardize management, processes and operations so that your critical applications will be very efficient and highly available.

Further links:

- PRIMEFLEX for SAP (Internet)
- FUJITSU Server PRIMEQUEST (Internet)
- FUJITSU storage systems (Internet)
- Certification 2017051
  4-nodes bare metal (PDF)
- Certification 2017052
  4-nodes virtualized (PDF)
- Certification 2018007
  8-nodes virtualized (PDF)
- Website SAP Benchmarks (Internet)

FUTURE-PROOF THROUGH PARTNERSHIPS

For years Fujitsu has been working very closely with strategic partners such as SAP and VMware in developing solutions that deliver tangible value to our mutual customers.

The strategic partnership with VMware was initiated more than 15 years ago and has resulted in more than 5,000 successful customer projects throughout EMEA.

The partnership with SAP has grown over a period of more than 40 years, and Fujitsu is one of the very few SAP partners having Global Partnership Status for Technology, Services and Hosting. From the very beginning Fujitsu was involved in the development of SAP HANA and can offer customers in-depth know-how and comprehensive support, ranging from consulting to the actual operation of SAP HANA platforms.

Published by
FUJITSU LIMITED

www.fujitsu.com