SAP HANA is truly a Game Changer

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Abstract— The SAP HANA Database is the core part of the SAP HANA Appliance which is developed to support the analytical processes and transactional workload. This paper discusses basic characteristics of the SAP HANA, how it will overcome the problem of Data Explosion & emphasizing the distinctive features from other traditional relational database management systems. From the technology perspective, the SAP HANA database consists of many data engines that supporting both row and column oriented tables, to OLTP & OLAP data load we can use the same system. This paper outline the specific support provided by the SAP HANA database of multiple technologies & domain specific languages with a built-in set of natively implemented business libraries and functions.

Key words: HANA, SAP

I. DEFINITION

SAP Hana is an in-memory data platform that is deployable as an on-premise appliance, or in the cloud. It is a revolutionary platform that's perfectly suited for performing real-time data analytics, and developing and deploying real-time applications [1].

SAP Hana is a combination of hardware and software which is uses in-memory technology for analytics and transaction and for processing large amount of real-time data in short time [2].

II. WHY HANA

As per Moore's Law, "The processors speed and overall processing power for computer will be double every two years" [3]. By 2003 it was clear that this was running into a hard limitation and that the processors were not going to be Single Core. Hence by 2003 also, it was clear that a completely new kind of database pattern we required. So SAP Hana was invented from that thought.

SAP HANA is working on in-memory technology which helps users to explore and analyses all transactional & analytical data in real time from any data source [4]. We can easily simplified existing modeling & new modeling. In SAP HANA all models are purely virtual and calculated result based on detailed operational data. Real-Time Analysis can be done when business processes are continuous going on whereas in other databases customers are waiting to stop that respective database and then do the analysis on it. SAP HANA database can retrieve huge amount of data or large tables in few seconds. It also lesser in cost because of simplifications in hardware, maintenance and testing. SAP HANA database simplified the process of operations and monitoring with the integration of basic HANA Administration capabilities [5].

III. INTRODUCTION

Data Management requirements are changed in past few years. Nowadays companies using the advance method to access transactional & analytical data instead of using traditional way. Today in the world 80% fo data is unstructured & 20% of data is structured. This data is keeps on increasing. Hence companies are faced with the problem of big data that go beyond the abilities of traditional databases. Nowadays data size typically reaches Terabytes, Petabytes, or even Zettabytes [6]. So traditional SQL-based databases are too narrow to provide full support. SAP knows these challenges hence they created HANA to provide full support & overcome the big data problems in low cost. When Hana was launched, it came with 1THB of RAM, also able to support up to 5TH of Uncompressed Data. And in 2011, HANA had 8TB of RAM with support up to 40TB of Uncompressed Data.

SAP HANA is in-memory technology was known as column-based RDBMS which can do analysis on Real Time. It is also synthesis of three technologies:[7]

A. TREX

It is SAP's Search Engine. It is included in-memory and columnar store attributes, which were designed to improve search capability in main memory

B. MAXDB

It is a combination of MySQL AB & SAP. It is SAP's own RDBMS. MAXDB is very flexible, capable & relatively simple than ORACLE. MAXDB brought in persistence and backup layer to SAP HANA

C. P*TIME

It is a lightweight, OLTP in-memory RDBMS system P*TIME came from acquisition of Transact in Memory by SAP in 2005.It is provide the in-memory backbone to SAP HANA Software. It has traditional row-based data store.
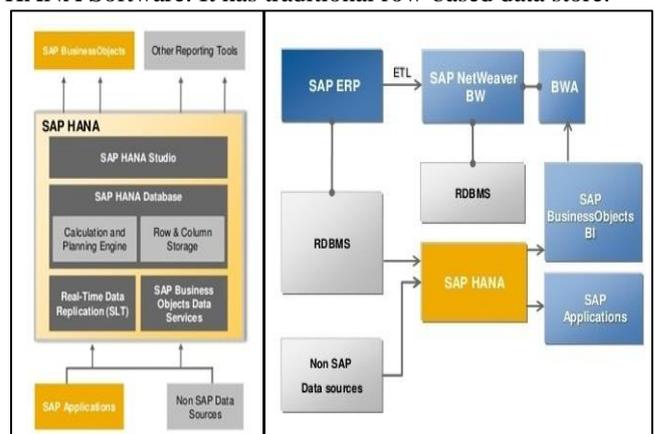

Fig. 1: Component of SAP HANA Appliance[8]

SAP HANA Appliance has four components [9].

D. SAP HANA Appliance

It is a combination of SAP HANA DB Software and partner certified hardware. It also includes the modeling, replication tools from HANA Studio as well Data Transformation tools to move data into HANA DB.

E. SAP HANA as a Database

It refers to the database technology itself. As a Database, it has some storage areas & engines.

F. SAP HANA Studio

It is a suite of tool provided by SAP for design, develop & administration of database. It has various perspectives like Administration console, Modeler, SAP HANA Development, Debug.

G. SAP HANA Application (Cloud)

It is the cloud based infrastructure for delivery of applications. It follows Platform-as-a-Service (PaaS).

IV. ARCHITECTURE OVERVIEW

Business application requirements have become more demanding. They want complex reports on huge volume of transactional data should be generated in few seconds & also from other business data like structured & semi-structured. Today's need is to integrate of transactional & analytical data into single system.

The SAP HANA Database is memory centric DBMS that utilizes the power of modern hardware, specially multi core CPU's, Cache, large amount of main memory. Following component helping SAP HANA Appliance to deliver the fast result[10].
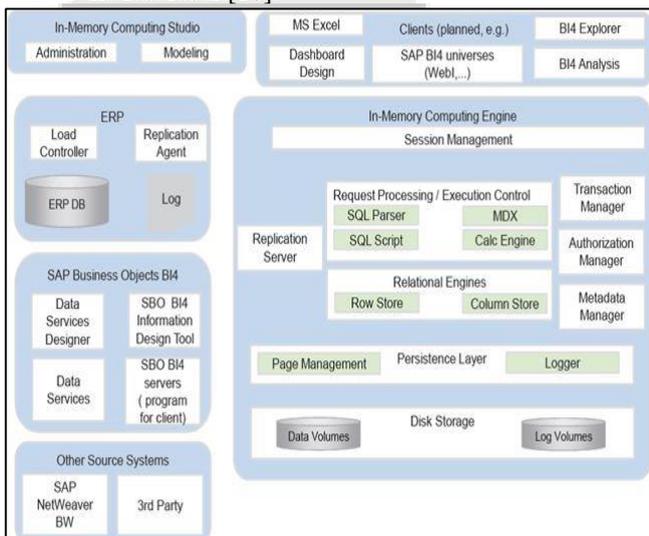

Fig. 2: The SAP HANA Architecture [11]

A. Index Server

Index Server is the place where most of the magic happens. This server contains actual data and engines to process the data. When SQL or MDX is execute a query against SAP HANA System in the case authentication and transactions, index server controls these commands & process it.

B. Name Server

Name Server contains all the information about the system landscape. It is fully responsible for topology of SAP HANA. In a multi-server SAP HANA distributed landscape, it will store which data is on which server to save the time.

C. Pre-Processor Server

This is used for Text Data Analysis. Index Server uses Pre-Processor Server to analyze the text data & for searching

D. Statistics Server

Statistical Server help to analyze the present status, resource consumption, allocation and performance of the SAP HANA System. This server also provide the history and logs of measured data for further analysis

E. XS Engine

It is also known as 'Extended Application Services'. It is a light weight application server. XS Engine allows external application to access the system via XS Engine Client. It is the architecture and lower the Total Cost of Operation.

F. SAP IMCE (In Memory Computing Engine)

It uses technologies such as in-memory computing, massively parallel processing, columnar databases, data compression and analyze large amount of analytical and transaction data from the enterprise in real time. This engine provides functionality with native support for row and columnar storage with providing full ACID transactional properties.

G. Other Engines

– OLAP Engine called backend when we run queries on analytic views. If there is any calculation involved then CALC engine used along with OLAP Engine,
– Join Engine used to execute any attribute view. If there is any calculation involved then Join Engine use CALC Engine for calculation & fetching the result,
– CALC Engine is used when we execute calculation view. This engine called by other engines to perform calculations,
– Planning Engine includes aggregation, disaggregation, complex planning oriented operations, holding forecast etc.
– GIS Engine is a Geo-graphic engine used for tracking the transportation & vehicles by sensors
– Graph Engine is used to represent and processing of data graph.

This is extensible so SAP will add some more engine later on.

H. Session Management

This creates & manages the session and connections for database clients. When session is created some set of parameters are maintained in the backend. After the connection established, database client communicate with HANA Database.

I. Transaction Manager

It is the component that controlling the transaction isolation and coordinates database transactions and keeps track of running and closed transactions. Transaction manager informs to relative storage engines about running & closed transactions, so that they can execute necessary actions when a transaction is committed or roll back.

J. Authorization Manager

It is used to check the user having required privileges or not to execute the requested operations. By authorization manager you can grant or revoke the rights to perform a specified operation on specific object.

K. Metadata Manager

It helps to access the metadata. Metadata stored in row-based table. SAP HANA's metadata contains tables, views, SQL script function, object sore metadata. Central metadata stored across the server in distributed architecture of the systems. The transaction support and multi-versioning concurrency control are used in metadata management.

L. Persistence Layer

This layer is uses to write ahead log, shadow paging & save points. It also manages transactional logs & it also contains SAP HANA logger.

V. PLAYERS IN THE GAME

There are many players in the game called data analytics but some of them called experts in this game like SAP HANA, IBM Netezza, Oracle Exadata, Teradata DW Appliance. We see some of them in detail. Appliance is known as combination Hardware & Software. Why & How this questions will be reveal power of SAP HANA. As SAP HANA was designed to be a replacement to Oracle or Teradata or IBM databases, either for net new installations or for existing customers.

	SAP HANA	IBM Netezza	Oracle Exadata
Publicly Available [12]	Mid of 2011	December 30, 1999 & IBM acquire Netezza on 20 September, 2010	2008
ROI [13]	Depends, but minimum 100% - 519 % for sure	Depends, but average 212%	For Non-Risk-Adjusted - 139% For Risk-Adjusted - 105%
Initial Cost [14]	For 512 GB - $49770.52 For 256 GB - $38802.26	$125,000	$500,000
Core [15]	8CPU * 12 Core	2 Quad Core 2+ GHZ CPU	2 x86, Up-to 18-core processors
Memory [16]	256GB - 2TB per CPU	2x per Snippet Processor	256GB (expandable up to 768GB)
Architecture [17]	NA	Shared Nothing Architecture	Shared Disk Architecture
Response Time [18]	4 - 500 MSec	500 MSec (10x)	4 - 5 Seconds
Special Feature [19]	TREX, P*TIME, MAXDB	S-Blade, MPP Engine	Racks (Full, Half, Quarter)
Supporting OS [20]	SUSE LINUX 11.X, Red Hat Enterprise Linux 6.5	Red Hat Enterprise Linux (RHEL) 5.3,	Oracle Linux, Oracle Solaris
Supporting Databases [21]	SAP DB 7.5 or Higher, MSSQL Server, Oracle, IBM DB2, SAP HANA DB	NetezzaDB, MSSQL	Oracle
Customers [22]	More than 6400	596	NA

Table 1: SAP HANA

Hence as per the above table we can decide ourselves who is the Game Changer!!! SAP HANA.

VI. BENEFITS OF SAP HANA

There are five important business factors which motivates organization to purchase SAP HANA[24]:

A. Make Decision in Real-time

It can do easy & fast creation of ad-hoc queries & views, also access to real time analysis

B. Accelerate Business Performance

By increasing the speed of transactional information flow, planning, pricing.

C. Unlock New Insights

Removed the barrier of analyzing the large amount of data - trends, sensor data, predictive analytics, etc. It can also analyze the structured & unstructured data.

D. Increase Business Productivity

Because of analyzing the large data set in seconds and give the results on the fly. Use data from anywhere & anytime.

E. Improve IT Efficiency

In the less IT cost we can manage growing data volume & its complexity.

VII. SUMMARY

Providing efficient solutions for scale applications require a robust and efficient data management and processing platform with special support for transactional, analytical, graph traversal and text retrieval processing. The SAP HANA Database therefore should not be compared to traditional SQL or typical key-value, document-centric; or Graph based NOSQL database. So HANA is more than a database, it's a platform. HANA is flexible data storage, manipulation, and analysis platform; comprehensively exploit current trends in hardware to get outstanding query performance and throughput at the same time. By using all functionalities we can overcome the problem of Data Explosion.

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