Article

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Adoption of In-Memory Analytics

Abstract: In-Memory analytics has brought a paradigm shift in storage and data management in facilitating instant reporting for decision making. Revolution in advanced memory technology, drastic decline in price of memory, and evolution of multi-core processors have changed the orientation of business intelligence query and fetching of data along with the way data is stored and transferred. This article discusses the adoption of in-memory technology, its architecture, and few enabling software of in-memory computing. It also discusses the scope and benefits of In-Memory approach.

Introduction

In-Memory Analytics facilitates querying of data from Random Access Memory instead of physical disk. Detailed data can be loaded from multiple sources into the system memory directly. This technique helps in taking faster business decisions. Performance is improved as storage and operations are performed in the memory. The approach of In-Memory Analytics has brought a paradigm shift in storage philosophy. Here, summarized data are stored in RAM. However, In case of databases, data is stored in tables through relationships and interconnection among tables, and other database objects. Similarly, multidimensional cubes are created and data are stored in traditional business intelligence platforms. In case of In-Memory Analytics, the creation of Multidimensional cubes are avoided[1]. As per Gartner, capabilities of in-memory analytics includes faster query and calculation which almost avoids to build aggregate and precalculated cubes. Some myths and facts of in-memory approach are described below (Fig. 1).

Architecture of In-Memory Analytics

There are different approaches of the architecture of In-Memory computing. They are associative model, in-memory OLAP, Excel in-memory add-in, in-memory accelerator, and in-memory visual analytics. In associative model, associations are based on the relationships between various data elements .When a user clicks on an item within a data set, the selected items turn green and all associated values turn white. This facilitates users to quickly query all relevant data without the dependency of a predefined hierarchy or query path, and are not limited to navigate the analytical data in a predetermined way. Similarly, Excel in-memory add-in allows users to load large volumes of data into Microsoft excel using in-memory. Once the data is within excel, relationships are automatically inferred between the data sets, permitting users to perform on-the fly sorting, filtering, slicing, and dicing of huge data sets, which overcomes some of the technical data volume limits of excel. This approach improves self-service capabilities as it reduces dependency on IT, and lessens the needs for business users to become expert in multi-dimensional structures and techniques. This add-in is dependent on a particular back end data management and portal platform which helps sharing of data and collaboration. In-memory OLAP Approach functions by loading data in-memory, which allows complicated calculations and queries to be computed on-demand resulting in fast response times. If write-back is supported then users can change assumptions on the fly to support what-if scenarios, which is a specific requirement in forecasting and financial planning. In-memory visual analytics combines an in-memory database with a visual data exploration tool allowing users to quickly query data, and reports within a visual and interactive analytics ambience. In-Memory accelerator approach improves query performance within an existing business environment. This accelerator functions by loading data into memory and leveraging pre built indexes to support super fast query response times[2]. There are many In-Memory computing enabling softwares like In-Memory analytics and event processing, In-Memory messaging, In-Memory application platforms, and In-Memory data management. These softwares provide new business ideas and IT challenges. A comparison of traditional data analytics technology and in-memory data analytics technology is given below (Fig. 2).

In-Memory Application Platforms

SAP HANA (High Performance Analytics Appliance)

As per Garter's study on information explosion, data of enterprises will grow 650% over past five years, with 80% of that data unstructured, which means that the data explosion spans both traditional sources like point of sale and shipment tracking records along with non traditional sources like emails, web content, and documents[8]. In-Memory technology allows processing of huge quantities of data in real time to provide instant result for decision making. SAP HANA provides a foundation for building new generation applications, which facilitates processing of huge quantities of data in the main memory of the server from any source virtually to provide results from analysis. SAP HANA is a technology, which permits the processing of massive quantities of real time data in the main memory of the server by providing instant result from analysis and transactions. As per SAP, SAP HANA Technology will drastically improve query performance and speed up data loads. The reduced data layers will also simplify system administration and reduce operating costs. This software platform is specifically prepared to support operational and analytics operations. This platform also helps SAP Partners and customers to develop their own applications.

Oracle Exalytics

Organizations needs analytics for gaining insight, so as to take correct decision. However, due to budgetary pressure, time

Myths	Facts
"In-Memory is just a Hype spread by SAP"	All major software vendors deliver in memory technology
"It's new and unproven technology"	It has been around since 1990s
"It is solely about running analytics faster"	It's widely used for transaction and event processing as well
"It's incremental and nondisruptive"	Prediction :In-memory will have an industry comparable to web and cloud

Source: Gartner[6]
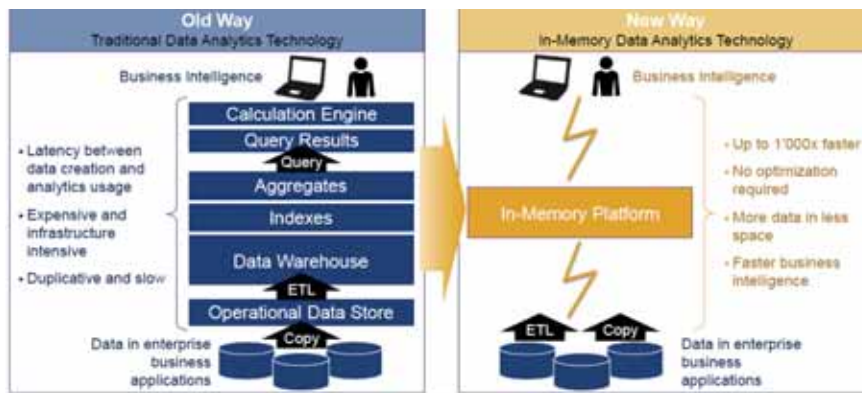
Source: SAP HANA Overview and Roadmaps (SAP Community Network)[7]

sensitivity, and extensive requirement, IT firms usually face challenges to produce actionable analytics. The task even becomes more complex due to involvement of multiple hardware, networking, software, storage vendors, and expensive resources are wasted integrating software and hardware components to generate complete analytics solution.

Oracle Exalytics is an optimized system, which provides solution to all business related issues without compromising speed, simplicity, manageability, and intelligence. Oracle Exalitics is built with market leading BI software, in-memory database technology, and industry-standard hardware. Oracle claims that exalytics uses a new interface designed to produce quick result regardless of the query, location, and device types[3].

Scopes and Benefits of In-Memory Analytics

In-Memory Analytics should be used to improve query performance and processing of reports. Hence, reorientation of existing report infrastructure is needed so as to implement in-memory analytics. However, clear understanding of the demand of users and applications on computing resources should be understood through data proofing. It is also important to identify users and applications who need processing of ad hoc and non routine reports. This effort is accomplished through data usage models, which reduce the cost and effort of in-memory analytics introduction in a firm .Mostly, operational and standard reporting need is approximately 70-80% and non routine and ad hoc reporting need is about 20-30% of an organization, which should be recommended after

exact analysis. In few firms ,the need for consolidated reporting and forecasting is required frequently within 10 to 12 weeks .In-Memory analytics is quite fit to be used in these circumstances[1] .In the current context, there is a drastic drop in prices of memory and processors. At the same time, multi-core processors are evolving. In-Memory computing has made it possible to perform storage and operations in main memory, where the requirement of hard disk can be avoided. Due to two valid reasons, In-Memory computing is useful. Firstly, the volume of information is growing at an alarming rate. Secondly, immediate responses are needed as quick decisions are needed now in all forward looking organizations. Traditionally, annual and quarterly review reports were taken as the basis for decision making. Past data analysis using data warehousing technology is slowly vanishing. In-Memory computing is supporting event driven systems, which enable decision making in real time. Here data is brought closer to central processing unit. Compared to disk based access, the querying of the data based on in-memory is million times faster. Adoption of 64-bit architecture is a facilitator to in-memory approach as the addressable memory space is increased. Usually midsized companies lack in technical expertise and resources to construct data warehouses, and performance tuning tasks. However, in-memory approach for midsized companies is less cumbersome, easy to administer and set up. IT Infrastructure is not a barrier here, in optimizing business performance. In-memory approach reduces the skill gaps in constructing and consuming analytical applications. The reason for reducing the difficulties is due to avoidance of use of OLAP cubes, which are stored in back end

databases. Total cost of ownership of the firms is reduced and business performance is enhanced.

In-Memory Analytics Vendors

The vendors who provide solution include hardware vendors, servers, and software Applications (Table 1)

Research Challenges

There are few research issues and challenges of in-memory analytics. In-memory analytics must face the challenge of technology incumbency, particularly in companies where there is heavy dependency on traditional OLAP technology. Many organizations have entire departments built around certain business intelligence platforms, and the threat of any disruptive technology that may significantly reduce, even eliminate these empires will be met with resistance and skepticism. Enterprise reporting has emerged as a mission-critical function, and once the user community is dependent upon large numbers of reports, one should hesitate before introducing too much change, too fast[1]. As per the IDC Report (2011), traditional method of building and developing computing infrastructure in case of analytics applications are not suitable, when migration to in-memory analytics applications is needed.

Conclusion and Future Ahead

As per a study, around 30% of firms will have one or more critical applications running on an in-memory database in next five years, and by 2014, 30% of analytics applications will use in-memory functions to add scale and computational speed[9]. The companies are seeking to be responsive, insight driven, and more real time. There is a guarantee that in-memory computing will dominate the marketplace in future and grip forward[4]. IDC (2011) report states that in-memory technology in public and private sectors will facilitate these firms to the highest level of competitiveness through "freedom of excess". The in-memory technology platforms that promote innovations reduce IT compromises, and enable access to information by the right people at the right time[5]. Market Research Media research report stated that the high performance computing market is expected to reach $200 Billion by 2020.In-Memory computing is one of the fastest growing components of that market. As per Gartner, In-memory Analytics approach is now

Table 1

Vendor	Website	Hardware Solution	Analytics Solution
Dell	http://www.dell.com	VIS Next Generation Datacenter Platform;PowerEdge R910	
Fujitsu	http://www.fujitsu.com	PRIMEQUEST 1800 Series; FCRAM; FRAM	
Fusion IO	http://www.fusionio.com	Fusion IO Flash Memory	
HP	http://www.hp.com	HP Converged Infrastructure Platform; ProLiant DL 900 Series	
IBM	http://www.ibm.com	IBM soildCB	
NEC	http://www.nec.com	Express 5800/A1080a	
Oracle	http://www.oracle.com	Exalytics In-memory Machine	
SAP	http://www.sap.com	SAP High Speed Analytical Appliance (HANA), SAP In-Memory Computing	
Kognitio	http://www.kognitio.com	Kognitio WX2 Analytics Database, WX2 Datawarehouse Appliance, DaaS Cloud	
Advizor Solutions	http://www.advizorsolutions.com		Advisor 5.8; Advisor Analyst
Microsoft	http://www.microsoft.com		PowerPivot
QlikTech	http://www.qlikview.com		QlikView
Quantrix	http://www.quantrix.com		DataNaV
Quartet FS	http://www.quartetfs.com		Active Pivot
SAS	http://www.sas.com		In-Memory Analytics
Sybase	http://www.sybase.com		Adaptive Server Enterprise (ASE)
TIBCO	http://www.tibco.com		Spotfire

Source: Aberdeen Group, December 2011

being used in variety of applications like risk management, inventory forecasting, profitability analysis, fraud detection, algorithmic trading, and areas like sales incentive promotion management. Refactoring existing applications in-memory to utilize the approaches of in-memory can result in better scalability and transactional application performance, lower latency application messaging, drastically faster batch execution, and faster response time in analytical applications. In year 2012 and 2013, cost and availability of memory intensive hardware platforms reach tipping points. So the in-memory approach will enter the mainstream.

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