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An Analysis for Big Data and its Technologies

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Abstract **- "Big Data" is a term encompassing the use of techniques to capture, process, analyse and visualize potentially large datasets in a reasonable timeframe not accessible to standard IT technologies. By extension, the platform, tools and software used for this purpose are collectively called "Big Data technologies". In this paper, we provide the meaning, characteristics, models, technologies, life cycle and many other aspects of big data.**

***Keywords*— Big Data, Hadoop, Map Reduce, HDFS (Hadoop Distributed File System), Cloud Computing.**

I. Introduction

We have entered an era of Big Data. Through better analysis of the large volumes of data that are becoming available, there is the potential for making faster advances in many scientific disciplines and improving the profitability and success of many enterprises.

Big data is creating unprecedented opportunities for businesses to achieve deeper, faster insights that can strengthen decision-making, improve the customer experience, and accelerate the pace of innovation. But today, most big data yields neither meaning nor value. Businesses are so overwhelmed by the amount and variety of data cascading into and through their operations that they struggle just to store the data—much less analyze, interpret, and present it in meaningful ways.

The term "big data" encompasses more than structured and transaction-based data. It also includes videos, RFID logs, social networking conversations, sensor networks, search indexes, environmental conditions, medical scans, "data exhaust"—the trail of clicks through the Internet produced by web surfers—and more.

Big data techniques complement business intelligence (BI) tools to unlock value from enterprise information. Whereas BI traditionally performs structured analysis and provides a rear-view mirror into business performance, big data analytics provides a forward-looking view, enabling organizations to anticipate and execute on opportunities of the future. [17]

Big data is a relative term describing a situation where the volume, velocity and variety of data exceed an organization's storage or compute capacity for accurate and timely decision making.

Big data, synonymous today with business intelligence, business analytics, and data mining, has shifted business intelligence from reporting and decision support to prediction and next-move decision making.

Governments expect big data to enhance their ability to serve their citizens and address major national challenges involving the economy, health care, job creation, natural disasters, and terrorism.

Businesses use big data to pursue profits, governments use it to promote the public good. [06]

Big Data presents concepts, methods, technologies, IT architectures and tools available to the exponentially increasing volumes of diverse information in better implementation of sound and timely management decisions and thus improve the inventiveness and competitiveness of enterprises. [04]

The use of big data could provide sufficient benefit to a small to medium sized company to the extent that the business would be willing to commit resources to implement big data technology in-house. [13]

To make the most of big data, enterprises must evolve their IT infrastructures to handle these new high-volume, high-velocity, high-variety sources of data and integrate them with the pre-existing enterprise data to be analyzed. [02].

Complex problems can be solved quickly using big data and sophisticated analytics in a distributed, in-memory and parallel environment. [16]

The trend toward visualization-based data discovery tools is worth exploring by any business that seeks to derive more value from big data. [07]

This paper is organized as follows. Section 2 presents the background details. Section 3 and section 4 describes respectively the big data technology and technologies for big data. In Section 5, we describe briefly big data and the cloud. Section 6 details the adoption of big data and analytics. Section 7 describes the security in big data and Section 8 discusses the challenges and responses in big data. Finally, this paper is concluded.

II. Background Details

Meaning

According to O'Reilly, "Big data is data that exceeds the processing capacity of conventional database systems. The data is too big, moves too fast, or does not fit the structures of existing database architectures. To gain value from these data, there must be an alternative way to process it".

Characteristics of Big Data

Big Data is not just about the size of data but also includes data variety and data velocity. Together, these three attributes form the three Vs of Big Data as shown by Fig. 1. [01]

Volume: It is synonymous with the "big" in the term, "Big Data". Volume is a relative term – some smaller-sized organizations are likely to have mere gigabytes or terabytes of data storage as opposed to the petabytes or exabytes of data that big global enterprises have. Data volume will continue to grow, regardless of the organization's size. There is a natural tendency for companies to store data of all sorts: financial data, medical data, environmental data and so on. Many of these companies' datasets are within the terabytes range today but, soon they could reach petabytes or even exabytes.

Variety: Data can come from a variety of sources (typically both internal and external to an organization) and in a variety of types. With the explosion of sensors, smart devices as well as social networking, data in an enterprise has become complex because it includes not only structured traditional relational data, but also semi-structured and unstructured data as depicted in Fig. 2.

Structured data: This type describes data which is grouped into a relational scheme (e.g., rows and columns within a standard database). The data configuration and consistency allows it to respond to simple queries to arrive at usable information, based on an organization's parameters and operational needs.

Semi-structured data: This is a form of structured data that does not conform to an explicit and fixed schema. The data is inherently self-describing and contains tags or other markers to enforce hierarchies of records and fields within the data. Examples include weblogs and social media feeds.

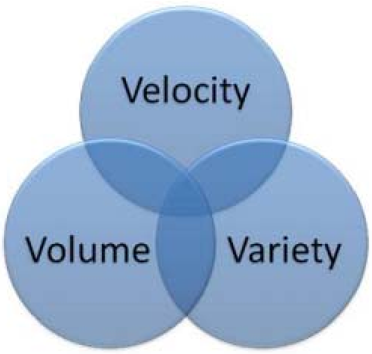

Fig. 1 The 3 Vs of Big Data

Unstructured data: This type of data consists of formats which cannot easily be indexed into relational tables for analysis or querying. Examples include images, audio and video files.

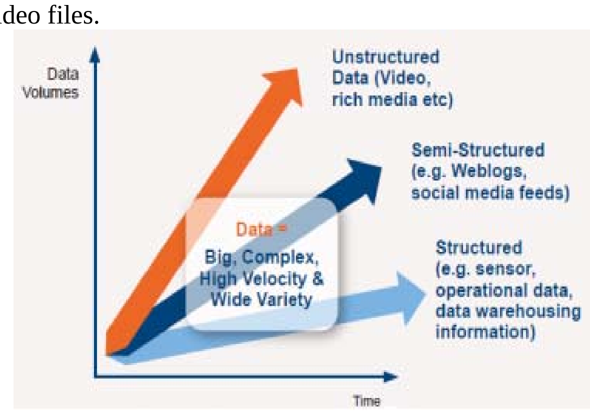

Fig. 2 The three data types

Velocity: The velocity of data in terms of the frequency of its generation and delivery is also a characteristic of big data. Conventional understanding of velocity typically considers how quickly the data arrives and is stored, and how quickly it can be retrieved. In the context of Big Data, velocity should also be applied to data in motion: the speed at which the data is flowing. The various information streams and the increase in sensor network deployment have led to a constant flow of data at a pace that has made it impossible for traditional systems to handle.

Handling the three Vs helps organizations extract the value of Big Data.

The value comes in turning the three Vs into the three Is:

1. Informed intuition: Predicting likely future occurrences and what course of actions is more likely to be successful.
2. Intelligence: Looking at what is happening now in real time (or close to real time) and determining the action to take.
3. Insight: Reviewing what has happened and determining the action to take.

The fourth dimension of Big Data is the **Value** it delivers is shown by Fig. 3 and Fig. 4. A few huge data sets that are generated inside and outside enterprises have very little or no value. Despite meeting the three characteristics criteria – Volume, Variety, and Velocity - these datasets do not qualify as Big Data. Identifying data sets that deliver the maximum value for any use case, therefore, assumes prime importance in the qualification of Big Data.

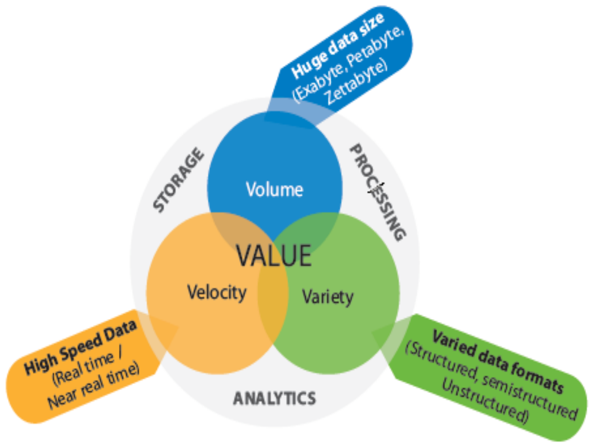

Fig. 3 Dimensions of Big Data

III. Big Data Technology

Big Data technology can be broken down into two major components – the hardware component and the software component, as shown in the Fig. 5. The hardware component refers to the component and infrastructure layer. The software component can be further divided into data organization and management software, analytics and discovery software, and decision support and automation software.

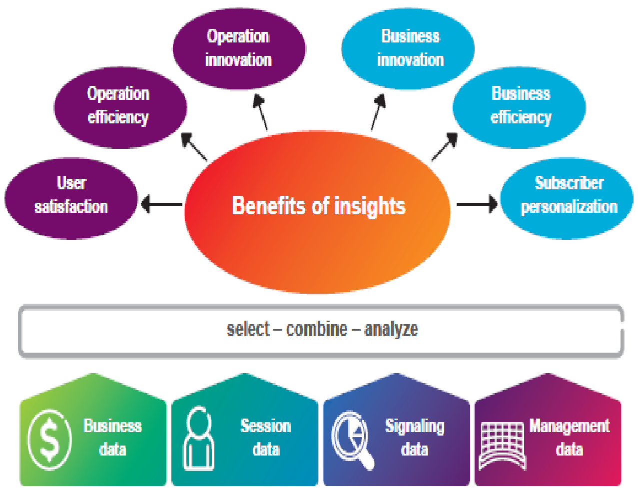

Fig. 4 Creating value from network data

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A. Infrastructure

Infrastructure is the foundation of the Big Data technology stack. The main components of any data storage infrastructure - industry standard x86 servers and networking bandwidth of 10 Gbps - may be extended to a Big Data storage facility.

B. Data organization and management

This layer refers to the software that processes and prepares all types of structured and unstructured data for analysis. This layer extracts, cleanses, normalizes and integrates data. Two architectures – extended Relational Database Management System (RDBMS) and the NoSQL database management system – have been developed to manage the different types of data. Extended RDBMS is optimized for scale and speed in processing huge relational data (i.e., structured data) sets, adopting approaches such as using columnar data stores to reduce the number of table scans (columnar database) and exploiting massively parallel processing (MPP) frameworks. On the other hand, the NoSQL database management system (NoSQL DBMS) grew out of the realization that SQL's transactional qualities and detailed indexing are not suitable for the processing of unstructured files.

Fig. 5 Big Data Technology Stack

C. Decision support and automation interface

The process of data analysis usually involves a closed-loop decision making model which, at the minimum, includes steps such as track, analyze, decide and act. To support decision making and to ensure that an action is taken, based on data analysis, is not a trivial matter. From a technology perspective, additional functionalities such as decision capture and retention are required to support collaboration and risk management.

Data Analytics and Discovery

This layer comprises two data analytics software segments – software that supports offline, ad hoc, discovery and deep analytics, and software that supports dynamic real-time analysis and automated, rule-based transactional decision making. The tools can also be categorized by the type of data being analyzed, such as text, audio and video. The tools within this layer can also be at different levels of sophistication. There are tools that allow for highly complex and predictive analysis as well as tools that simply help with basic data aggregation and trend reporting. In any case, the usage of the tools is not mutually exclusive – there can be a set of tools with different features residing in a system to enable Big Data analytics.

There are two decision support and automation software categories: transactional decision management and project-based decision management software.

Hadoop MapReduce and Hadoop Distributed File System (HDFS)

Hadoop is a framework that provides open source libraries for distributed computing using MapReduce software and its own distributed file system, simply known as the Hadoop Distributed File System (HDFS). It is designed to scale out from a few computing nodes to thousands of machines, each offering local computation and storage. One of Hadoop's main value propositions is that it is designed to run on commodity hardware such as commodity servers or personal computers, and has high tolerance for hardware failure. In Hadoop, hardware failure is treated as a rule rather than an exception.

HDFS

The HDFS [15] is a fault-tolerant storage system that can store huge amounts of information, scale up incrementally and survive storage failure without losing data. Hadoop clusters are built with inexpensive computers. If one computer (or node) fails, the cluster can continue to operate without losing data or interrupting work by simply re-distributing the work to the remaining machines in the cluster. HDFS manages storage on the cluster by breaking files into small blocks and storing duplicated copies of them across the pool of nodes. The figure below illustrates how a data set is typically stored across a cluster of five nodes. In this example, the entire data set will still be available even if two of the servers have failed. It is shown by Fig. 6.

Compared to other redundancy techniques, including the strategies employed by Redundant Array of Independent Disks (RAID) machines, HDFS offers two key advantages. Firstly, HDFS requires no special hardware as it can be built from common hardware. Secondly, it enables an efficient technique of data processing in the form of MapReduce.

MapReduce

Most enterprise data management tools (database management systems) are designed to make simple queries run quickly. Typically, the data is indexed so that only small portions of the data need to be examined in order to answer a query. This solution, however, does not work for data that cannot be indexed, namely in semi-structured form (text files) or unstructured from (media files). To answer a query in this case, all the data has to be examined. Hadoop uses the MapReduce technique as shown by Fig. 7 to carry out this exhaustive analysis quickly.

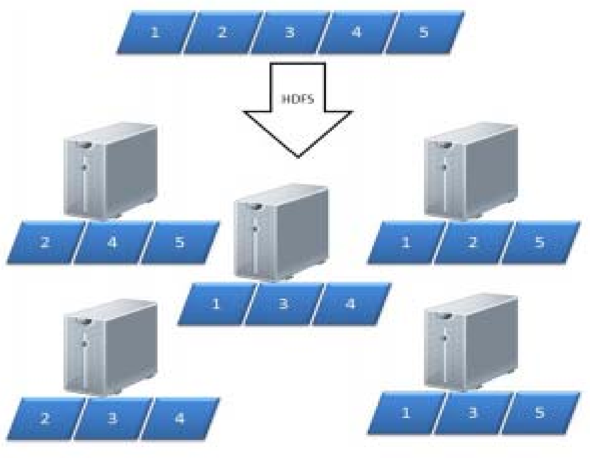

Fig. 6 Illustration of distributed file storage using HDFS

MapReduce is a data processing algorithm that uses a parallel programming implementation. In simple terms, MapReduce is a programming paradigm that involves distributing a task across multiple nodes running a "map" function. The results from the parallel map functions are collected and distributed to a set of servers running "reduce" functions, which then takes the results from the sub-parts and re-combines them to get the single answer.

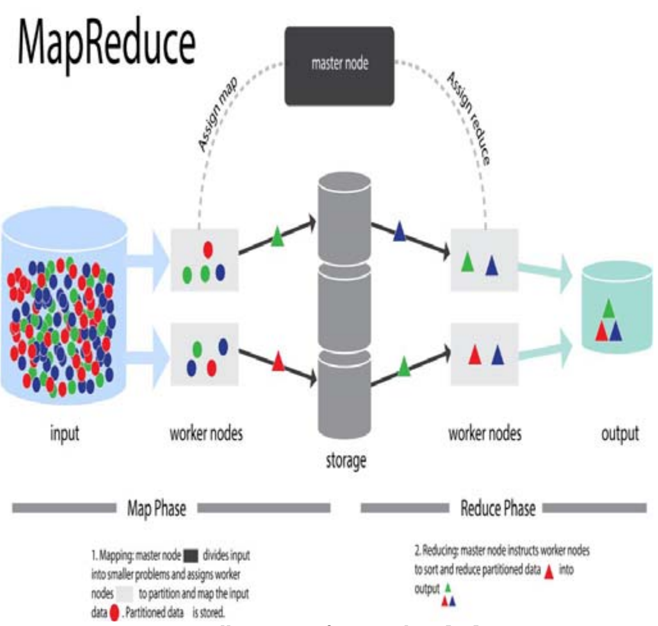

Fig. 7 Illustration of MapReduce [05].

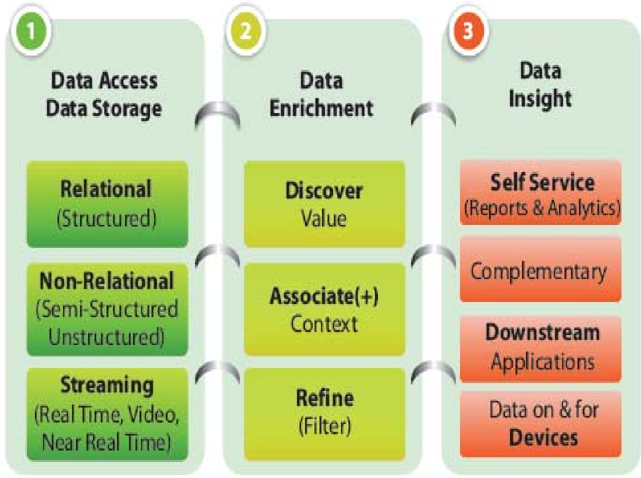

Figure 8: Big Data lifecycle

The life cycle of Big Data comprises of

- Data access and storage
- Data enrichment and
- Data insight

It is shown by Fig. 8.

IV. TECHNOLOGIES FOR BIG DATA

Big data technologies describe a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data by enabling high-velocity capture, discovery and/or analysis.

A. Column-oriented databases

Traditional, row-oriented databases are excellent for online transaction processing with high update speeds, but they fall short on query performance as the data volumes grow and as data becomes more unstructured. Column-oriented databases store data with a focus on columns, instead of rows, allowing for huge data compression and very fast query times. The downside to these databases is that they will generally only allow batch updates, having a much slower update time than traditional models.

B. Schema-less databases, or NoSQL databases

There are several database types that fit into this category, such as key-value stores and document stores, which focus on the storage and retrieval of large volumes of unstructured, semi-structured, or even structured data. They achieve performance gains by doing away with some (or all) of the restrictions traditionally associated with conventional databases, such as read-write consistency, in exchange for scalability and distributed processing.

C. MapReduce [18]

This is a programming paradigm that allows for massive job execution scalability against thousands of servers or clusters of servers. Any MapReduce implementation consists of two tasks:

- The "Map" task, where an input dataset is converted into a different set of key/value pairs, or tuples;
- The "Reduce" task, where several of the outputs of the "Map" task are combined to form a reduced set of tuples (hence the name).

D. Hadoop

Hadoop [18] is by far the most popular implementation of MapReduce, being an entirely open source platform for handling Big Data. It is flexible enough to be able to work with multiple data sources, either aggregating multiple sources of data in order to do large scale processing, or even reading data from a database in order to run processor-intensive machine learning jobs. It has several different applications, but one of the top use cases is for large volumes of constantly changing data, such as location-based data from weather or traffic sensors, web-based or social media data, or machine-to-machine transactional data.

E. Hive

Hive is a "SQL-like" bridge that allows conventional BI applications to run queries against a Hadoop cluster. It was developed originally by Facebook, but has been made open source for some time now, and it's a higher-level abstraction of the Hadoop framework that allows anyone to make queries against data stored in a Hadoop cluster just as if they were manipulating a conventional data store. It amplifies the reach of Hadoop, making it more familiar for BI users.

F. PIG

PIG is another bridge that tries to bring Hadoop closer to the realities of developers and business users, similar to Hive. Unlike Hive, however, PIG consists of a "Perl-like" language that allows for query execution over data stored on a Hadoop cluster, instead of a "SQL-like" language. PIG was developed by Yahoo!, and, just like Hive, has also been made fully open source.

G. WibiData

WibiData is a combination of web analytics with Hadoop, being built on top of HBase, which is itself a database layer on top of Hadoop. It allows web sites to better explore and work with their user data, enabling real-time responses to user behavior, such as serving personalized content, recommendations and decisions.

H. PLATFORA

Perhaps the greatest limitation of Hadoop is that it is a very low-level implementation of MapReduce, requiring extensive developer knowledge to operate. Between preparing, testing and running jobs, a full cycle can take hours, eliminating the interactivity that users enjoyed with conventional databases. PLATFORA is a platform that turns user's queries into Hadoop jobs automatically, thus creating an abstraction layer that anyone can exploit to simplify and organize datasets stored in Hadoop.

I. Storage Technologies

As the data volumes grow, so does the need for efficient and effective storage techniques. The main evolutions in this space are related to data compression and storage virtualization.

J. SkyTree

SkyTree is a high-performance machine learning and data analytics platform focused specifically on handling Big Data. Machine learning, in turn, is an essential part of Big Data, since the massive data volumes make manual exploration, or even conventional automated exploration methods unfeasible or too expensive.

V. BIG DATA AND THE CLOUD

Cloud computing implementation of big data has the potential to become a frontrunner in promoting a secure, virtual and economically viable IT solution in the future.

The term big data is derived from the fact that the datasets involved are so large that typical database systems are not able to store and analyze the datasets. The datasets are large because the data are unstructured data and are from many new sources, including e-mail, social media etc. The characteristics of big data present data storage and data analysis challenges to businesses. Suitable algorithms and tools to satisfactorily analyze Big Data are largely missing. [03]

Cloud Computing is a term used to describe a new class of network based computing that takes place over the Internet or a model that relies on a large, centralized data center to store and process a great wealth of information[03]. In Cloud Computing, a client business pays on a per-use basis whenever the equipment is used to support computing operations such as: storage, hardware, servers, and networking equipment [15].

Analyzing big data is done using a programming paradigm called MapReduce. The MapReduce paradigm requires that huge amounts of data be analyzed. The mapping is done concurrently by each separate NAS device; the mapping requires parallel processing. The parallel processing needs of MapReduce are costly, and require the configuration noted previously for storage. The processing needs can be met by cloud-service providers.

Big Data is a data analysis methodology enabled by recent advances in technologies and architecture which support high-velocity data capture, storage, and analysis. However, big data entails a huge commitment of hardware and processing resources, making adoption costs of big data technology prohibitive to small and medium sized businesses. Cloud computing offers the promise of big data implementation to small and medium sized businesses.

Data sources extend beyond the traditional corporate database to include email, mobile device output, sensor-generated data, and social media output Big Data requires huge amounts of storage space. While the price of storage continues to decline, the resource needed to leverage big data still poses financial difficulties for small to medium sized businesses.

A typical big data storage and analysis infrastructure will be based on clustered network-attached storage (NAS) [19]. Clustered NAS infrastructure requires configuration of several NAS “pods” with each NAS “pod” comprising of several storage devices connected to an NAS device [19]. The series of NAS devices are then interconnected to allow massive sharing and searching of data [19]. Data storage using cloud computing is a viable option for small to medium sized businesses considering the use of Big Data analytic techniques.

Cloud computing is on-demand network access to computing resources which are often provided by an outside entity and require little management effort by the business. A number of architectures and deployment models exist for cloud computing, and these architectures and models can be used with other technologies and design approaches [19]. Owners of small to medium sized businesses who are unable to afford adoption of clustered NAS technology can consider a number of cloud computing models to meet their big data needs. Small to medium sized business owners need to consider the correct cloud computing in order to remain both competitive and profitable.

The growth of data constitutes the "Big Data" phenomenon – a technological phenomenon brought about by the rapid rate of data growth and parallel advancements in technology that have given rise to an ecosystem of software and hardware products that are enabling users to analyse this data to produce new and more granular levels of insight. Cloud computing technology is being used to minimize the usage cost of computing resources. [20]

VI. ADOPTION OF BIG DATA AND ANALYTICS

A. Healthcare

Big Data has a huge application in healthcare, particularly in areas where analysis of large data sets is a necessary pre-condition for creating value.

B. Retail

The retail sector is built on an understanding of the consumers' retail habits. Top retailers are mining customer data and using Big Data technologies to help make decisions about their marketing campaigns, merchandising and supply chain management.

C. Education

Creating a profile for each of the students would require disparate sets of information and this is where the opportunity lies for Big Data analytics.

D. Transport

Big Data analytics offers the opportunity for public transport service operators to obtain critical insights on passenger demand trends so as to implement more effective measures in their service provisions.

E. Finance

Big Data plays a significant role in the finance sector, especially with regard to fraud detection with the application of Complex Event Processing (CEP).

VII. SECURITY IN BIG DATA

For marketing and research, many of the businesses use big data, but may not have the fundamental assets particularly from a security perspective. If a security breach occurs to big data, it would result in even more serious legal repercussions and reputational damage than at present. In this new era, many companies are using the technology to store and analyse peta bytes of data about their company, business and their customers. As a result, information classification becomes even more critical. For making big data secure, techniques such as encryption, logging, and honeypot detection must be necessary. In many organizations, the deployment of big data for fraud detection is very attractive and useful.

The challenge of detecting and preventing advanced threats and malicious intruders, must be solved using big data style analysis. These techniques help in detecting the threats in the early stages using more sophisticated pattern analysis and analysing multiple data sources.

Not only security but also data privacy challenges existing in industries and federal organizations. With the increase in the use of big data in business, many companies are wrestling with privacy issues. Data privacy is a liability, thus companies must be on privacy defensive. But unlike security, privacy should be considered as an asset; therefore it becomes a selling point for both customers and other stakeholders. There should be a balance between data privacy and national security. Traditional security mechanisms such as identity, authentication, and authorization are no longer enough for clouds in their current form [17].

VIII. CHALLENGES AND RESPONSES IN BIG DATA

Table-1 describes the main features and a problem connected to handing different types of large data sets, and explains how Big Data technologies can help to solve them. [12]

Table-1: Challenges and responses in big data

Aspect	Characteristics	Challenges and Technology responses
Volume	The most visible aspect of Big Data, referring to the fact that the amount of generated data has increased tremendously the past years. However, this is the less challenging aspect in practice.	The natural expansion of internet has created an increase in the global data production. A response to this situation has been the virtualization of storage in data centres, amplified by a significant decrease of the cost of ownership through the generalization of the cloud based solutions. The noSQL database approach is a response to store and query huge volumes of data heavily distributed
Velocity	This aspect captures the growing data production rates. More and more data are produced and must be collected in shorter time frames.	The daily addition of millions of connected devices (smart phones) will increase not only volume but also velocity. Real-time data processing platforms are now considered by global companies as a requirement to get a competitive edge
Variety	With the multiplication of data sources comes the explosion of data formats, ranging from structured information to free text.	The necessity to collect and analyse non-structured or semi-structured data goes against the traditional relational data model and query languages. This reality has been a strong incentive to create new kinds of data stores able to support flexible data models
Value	This highly subjective aspect refers to the fact that until recently, large volumes of data where recorded (often for archiving or regulatory purposes) but not exploited.	Big Data technologies are now seen as enablers to create or capture value from otherwise not fully exploited data. In essence, the challenge is to find a way to transform raw data into information that has value, either internally, or for making a business out of it.

CONCLUSION

Big Data technologies are designed to help handle extremely large and complex datasets that cannot be processed using traditional systems. Initially, Big Data was leveraged to process the huge amounts of digital data made available due to the unprecedented growth of social media. Since then, it has been used to process large complex datasets that arise as a result of various scientific experiments, manufacturing processes, network logs, and so on. In a very short time, Big Data has entered the technology arena and has established its presence across industry verticals. Recognizing the real power of Big Data, organizations are now actively trying to leverage this technology to derive business benefits and also, to not face a competitive disadvantage in the long run. Big data and Cloud computing is going to dominate the enterprise computing in the next decade because of the benefits it provide.

REFERENCES

[01]. A, Katal, Wazid M, and Goudar R.H. "Big data: Issues, challenges, tools and Good practices.". Noida: 2013, pp. 404 – 409, 8-10 Aug. 2013.

[02]. An Oracle White Paper June 2013,"Oracle: Big Data for the Enterprise".

[03]. Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., Lee, G…Zaharia, M. (2010, April). A view of cloud computing. Communications of the ACM, 53(4), 50-58. DOI: 10.1145/1721654.1721672.

[04]. Atif Mohammad, Hamid Mcheick and Emanuel Grant," Big Data Architecture Evolution: 2014 and Beyond", DIVANet'14, September 21 - 26 2014, Montreal, QC, Canada.

[05]. Big Data Working group-whitepaper, 2013,"Big Data Analytics for Security intelligence".

[06]. Gang-Hoon Kim, Silv ana Trimi, and Ji-Hyong Chung, white paper March, 2014,"Big-Data Applications in the Government Sector".

[07]. Intel IT Centre whitepaper March 2013," Big Data Visualization: Turning Big Data into Big Insights".

[08]. IOS Press. (2011). Guidelines on security and privacy in public cloud computing. Journal of EGovernance, 34 149-151. DOI: 10.3233/GOV-2011-0271 .

[09]. K, Chitharanjan, and Kala Karun A. "A review on hadoop — HDFS infrastructure extensions.". JeJuIsland: 2013, pp. 132-137, 11-12 Apr. 2013.

[10]. Li W, Ping L (2009) Trust model to enhance Security and interoperability of Cloud environment. In: Proceedings of the 1st International conference on Cloud Computing. Springer Berlin Heidelberg, Beijing, China, pp 69–79.

[11]. Lu, Huang, Ting-tin Hu, and Hai-shan Chen. "Research on Hadoop Cloud Computing Model and its Applications.". Hangzhou, China: 2012, pp. 59 – 63, 21-24 Oct. 2012.

[12]. NESSI White Paper, December 2012, Big Data, "New World of oppurtunities".

[13]. OlukunleA Iyanda,"Big Data and Current Cloud Computing Issues and Challenges", International Journal of Advanced Research in Computer Science and Software Engineering", Volume 4, Issue 6, June 2014, pp-1192-1197.

[14] Onur Savas, Yalin Sagduyu, Julia Deng, and Jason Li, "Tactical Big Data Analytics: Challenges, Use Cases, and Solutions", Performance Evaluation Review, Vol. 41, No. 4, March 2014.

[15]. Rouse, M. (2010b, August). Infrastructure as a Service. Retrieved from http://searchcloudcomputing.techtarget.com/definition /Infrastructure-as-a -Service-IaaS

[16]. SAS whitepaper 2013," Big Data Meets Big Data Analytics".

[17]. TCS-whitepaper 2012,"Big Data-An emerging technology paradigm".

[18]. Wie, Jiang, Ravi V.T, and Agrawal G. "A Map-Reduce System with an Alternate API for Multi-core Environments.". Melbourne, VIC: 2010, pp. 84-93, 17-20 May. 2010.

[19]. White, C. (2011). Data Communications and Computer Networks: A business user's approach, (6th ed.). Boston: Cengage Learning.

[20]. Y, Amanatullah, Ipung H.P., Juliandri A, and Lim C. "Toward cloud computing reference architecture: Cloud service management perspective.". Jakarta: 2013, pp. 1-4, 13-14 Jun. 2013.