International Journal of Computer Science and Software Engineering (IJCSSE), Volume 3, Issue 1, December 2014
ISSN (Online): 2409-4285 www.IJCSSE.org Page: 78-85

A Survey of Big Data Cloud Computing Security

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ABSTRACT

Big Data and cloud computing are two important issues in the recent years, enables computing resources to be provided as Information Technology services with high efficiency and effectiveness. Now a day's big data is one of the most problems that researchers try to solve it and focusing their researches over it to get ride the problem of how big data could be handling in the recent systems and managed with the cloud of computing, and the one of the most important issue is how to gain a perfect security for big data in cloud computing, our paper reviews a Survey of big data with clouds computing security and the mechanisms that used to protect and secure also have a privacy for big data with an available clouds.

Keywords: *Cloud Computing, Big Data, Cloud Providers, NAS, Big Data Security, big data privacy.*

1. INTRODUCTION

Big data is known as a datasets with size beyond the ability of the software tools that used today to manage and process the data within a dedicated time. With Variety, Volume, Velocity Big Data such military data or other unauthorized data need to be protected in a scalable and efficient way [1]. Information privacy and security is one of most concerned issues for Cloud Computing due to its open environment with very limited user side control. It is also an important challenge for Big Data. After few years later more data globally would be touched with Cloud Computing which provides strong storage, computation and distributed capability in support of Big Data processing. Other considerations are that information privacy and security challenges in both Cloud Computing and Big Data must be investigated. the privacy and security providing such forum for researchers, and developers to exchange the latest experience, research ideas and development on fundamental issues and applications about security and privacy issues in cloud and big data environments [2].

The cloud helps organizations and enables rapid on demand provisioning of server resources such as CPUs, manage, storage, bandwidth, and share and analyze their Big Data in a reasonable and simple to use. The cloud infrastructure as a service platform, supported by on demand analytics solution seller that makes the large size of data analytics very affordable. As location independent cloud computing Involving shared services providing resources , software and data to systems and The hardware on demand, actually the storage networking in cloud is a very strong because use driver for high performance.

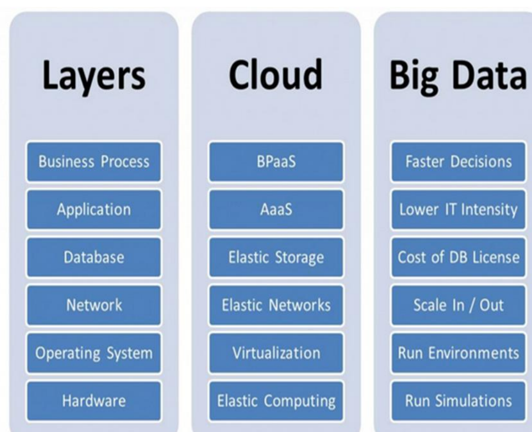

Fig. 1. Big Data and clouds

For example Arista provides Networks with Specifications and product line of switching solutions as shown in figures 2 and 3 below. However, the requirements of cloud storage needs hypothesized to a group of sub nodes operations performed with some of the units and CPUs advanced.

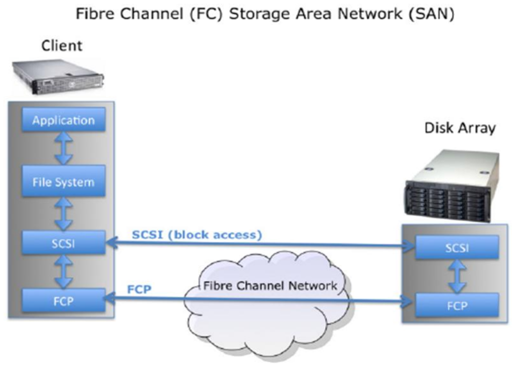

Fig. 2. Fiber Channel Storage area Network

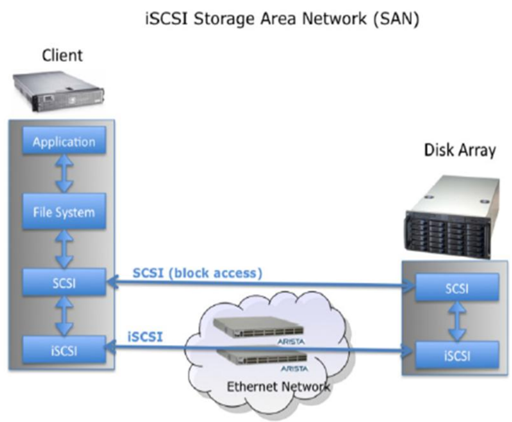

Fig. 3. iSCSI storage area network

In this figures Storage Area Networks the access storage based on block. In network attached storage as in figure 4 below the user access data remotely based on system via network. 10 Gigabit Ethernet prevails as the mainstream technology for Cloud Storage with ISCSI based block storage and network attached storage (NAS). With non-blocking throughput, record density, low latency, and leading total cost of ownership, Arista Networks switches are ideal for cloud storage applications [3].

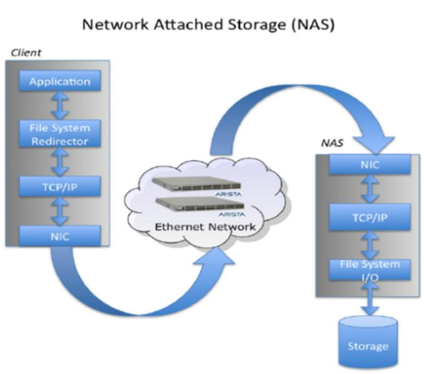

Fig. 4. Network attached storage

2. PRESENT OF BIG DATA AND FUTURE

This days the data produce from many sources such as social networks, website and sensor network. Also the total of data volume is expanding Continuity .however; big data refers essentially to the following data types; Traditional enterprise data such as Customer ınformation in Data Base, the transactions websites companies. Machine generated and Sensors data such as smart meter, manufacturing sensors etc. and Social data such as social network and application platforms like Facebook, LinkedIn, what's app, Twitter and YouTube. According to a recent report the most of data unstructured or semi structured and the size of data exists now is doubling in every two years. So between 2013 and 2020 it will go to 44 trillion GB from 4.4 trillion GB. Moreover the huge amount of data recorded mostly in nonstandard forms which cannot be analyzed using traditional data models and methods. Big Data today have a wide range of challenges but the opportunities are also exists the right decision making, marketing strategies and improved customer relations, better public services and so on.

By 2015 According to a Gartner report 4.4 million new big data related jobs will be created globally and only one third of these will be filled. So, employment opportunities are enormous in the big data job markets but there are very few training and education offerings focusing on this market. Big data has opened the growing interest to new tools production Beginning with the introduction of Apache Hadoop and Map Reduce and also many open source have been implemented and developed by companies IBM, Oracle, Cloudera, SAP, Teradata, SAS Amazon and many others. Most big data products are mainly based on open-source technologies. Therefore, standards are especially important and needed for interoperability of the hardware and software components of commercial solutions. Lack of official standards also aggravates privacy and security problems [4].

3. CLOUD COMPUTING IN BIG DATA

The rise of cloud computing and cloud data stores has been a precursor and facilitator to the emergence of big data. Cloud computing is the commodification of computing time and data storage by means of standardized technologies. It has significant advantages over traditional physical deployments. However, cloud platforms come in several forms and sometimes have to be integrated with traditional architectures. This leads to confuse for decision makers in charge of big data projects, leads to a question of how and which cloud computing is the optimal choice for their computing needs, especially if it is a big data project? These projects regularly exhibit unpredictable, bursting, or immense computing power and storage needs.

At the same time business stakeholders expect swift, inexpensive, and dependable products and project outcomes. This article introduces cloud computing and cloud storage, the core cloud architectures, and discusses what to look for and how to get started with cloud computing.

4. BIG DATA CLOUD PROVIDERS

Cloud providers come in all shapes and sizes and offer many different products for big data. Some are household names while others are recently emerging. Some of the cloud providers that offer IaaS services that can be used for big data include Amazon.com, AT&T, GoGrid, Joyent, Rackspace, IBM, and Verizon/Terremark. Currently, one of the most high-profile IaaS service providers is Amazon web Services with its Elastic Compute Cloud (Amazon EC2). Amazon didn't start out with a vision to build a big infrastructure services business.

The cloud computing space has been dominated by Amazon Web Services until recently. Increasingly serious alternatives are emerging like Google Cloud Platform and other clouds that mentioned above. Amazon Web Services compatible solutions, i.e. Amazon's own offering or companies with application programming interface compatible offerings, and Open Stack, an open source project with a wide industry backing. Consequently, the choice of a cloud platform standard has implications on which tools are available and which alternative providers with the same technology are available.

Amazon EC2 offers scalability under the user's control, with the user paying for resources by the hour. The use of the term elastic in the naming of Amazon's EC2 is significant. Here, elasticity refers to the capability that the EC2 users have to increase or decrease the infrastructure resources assigned to meet their needs. Amazon also offers other big data services to customers of its Amazon web Services portfolio. These include the following [5]:

Amazon Elastic MapReduce: Targeted for processing huge volumes of data. Elastic MapReduce utilizes a hosted Hadoop framework running on EC2 and Amazon Simple Storage Service (Amazon S3). Users can now run HBase.

Amazon DynamoDB: A fully managed not only SQL (NoSQL) database service. DynamoDB is a fault tolerant, highly available data storage service offering self-provisioning, transparent scalability, and simple administration. It is implemented on SSDs (solid state disks) for greater reliability and high performance.

Amazon Simple Storage Service (S3): A web-scale service designed to store any amount of data. The strength of its design center is performance and scalability, so it is not as feature laden as other data stores. Data is stored in "buckets" and you can select one or more global regions for physical storage to address latency or regulatory needs.

Amazon High Performance Computing: Tuned for specialized tasks, this service provides low-latency tuned high performance computing clusters. Most often used by scientists and academics, HPC is entering the mainstream because of the offering of Amazon and other HPC providers. Amazon HPC clusters are purpose built for specific workloads and can be reconfigured easily for new tasks.

Amazon RedShift: Available in limited preview, RedShift is a petabyte-scale data warehousing service built on a scalable MPP architecture. Managed by Amazon, it offers a secure, reliable alternative to in-house data warehouses and is compatible with several popular business intelligence tools.

5. BIG DATA CLOUD STORAGE

The cloud storage challenges in big data analytics fall into two categories: capacity and performance. Scaling capacity, from a platform perspective, is something all cloud providers need to watch closely. Data retention continues to double and triple year-over-year because customers are keeping more of it. Certainly, that impacts us because we need to provide capacity [6].

In Professional cloud storage needs to be highly available, highly durable, and has to scale from a few bytes to petabytes. Amazon's S3 cloud storage is the most prominent solution in the space. S3 promises a 99.9% monthly availability and 99.999999999% durability per year. This is less than an hour outage per month. The durability can be illustrated with an example. If a customer stores 10,000 objects he can expect to lose one object every 10,000,000 years on average. S3 achieves this by storing data in multiple facilities with error checking and self-healing processes to detect and repair errors and device failures. This is completely transparent to the user and requires no actions or knowledge. A company could build and achieve a similarly reliable storage solution but it would require tremendous capital expenditures and operational challenges. Global data centered companies like Google or Facebook have the expertise and scale to do this economically. Big data projects and start-ups, however, benefit from using a cloud storage service. They can trade capital expenditure for an operational one, which is excellent since it requires no capital outlay or risk. It provides from the first byte reliable and scalable storage solutions of a quality otherwise unachievable. This enables new products and projects with a viable option to start on a small scale with low costs. When a product proves successful these storage solutions scale virtually indefinitely. Cloud storage is effectively a boundless data sink. Importantly for computing performances is that many solutions also scale horizontally, i.e. when data is copied in parallel by cluster or parallel computing processes the throughput scales linear with the number of nodes reading or writing [7].

6. BIG DATA CLOUD COMPUTING

Cloud computing has managed to make the world's already open for data storage even more voracious. Last year IT market research firm, cited public cloud-based service providers, from Amazon Web Services to YouTube, as the most significant drivers of storage consumption in the past three years. The government sector contributes as well: IDC noted that the private clouds of government and research sites compare in scope and complexity to their public cloud counterparts. The so-called big data problem has surfaced in the past two years to rank among the primary IT challenges. Technologies such as the Apache Hadoop distributed computing framework and NoSQL databases have emerged to take on the challenge of very large and unwieldy datasets. And now another technology, already at work behind the scenes, could grow in importance in the coming years. Erasure coding has been around since the 1980s, but until recently its use in storage circles has mainly been confined to single storage boxes as a way to boost reliability more efficiently [8].

As known that when it comes to storage, everything is getting bigger, whether it's an individual disk, a storage system or a cloud-based repository. Erasure coding, an error correcting algorithm, plays a role across this range of ever-growing storage platforms. Vendors most commonly use erasure coding to boost the resiliency and performance of their Redundant Array of Independent Disks (RAID) storage systems, said Bob Monahan, director of management information systems at DRC, a consulting and IT services firm. But it's the use of erasure coding as an alternative to data replication that is attracting new interest in this storage mechanism. In many traditional cases, redundancy is achieved by replicating data from primary storage devices to target arrays at the data center or an off-site location. Mirroring data in that way provides protection but also consumes lots of storage, particularly when organizations make multiple copies of data for greater redundancy. The approach becomes particularly unwieldy for organizations that deal with petabytes or more of data. Erasure coding offers an alternative way to achieve redundancy while using less storage space, said Russ Kennedy, vice president of product strategy, marketing and customer solutions at storage vendor Clever safe, which uses erasure codes in its object-based storage solutions [9].

Cloud computing provides vast computing resources on-demand. It has become important due to the growth of "big data": the large, complex, datasets now being created in almost all fields of activity, from healthcare to e-commerce. The full potential of cloud computing for extracting knowledge from big data has however rarely been achieved outside a few large companies due to a severe shortage of skilled people. The Newcastle University CDT will address this by producing the multi-disciplinary experts in the statistics and computing science required to extract knowledge from big data [10]. The implications for an IT project or company using cloud computing are significant and change the traditional approach to planning and utilization of resources. Firstly, resource planning becomes less important. It is required for costing scenarios to establish the viability of a project or product. However, deploying and removing resources automatically based on demand needs to be focused on to be successful. Vertical and horizontal scaling becomes viable once a resource becomes easily deployable.

Horizontal scaling refers to the ability to replace a single small computing resource with a bigger one to account for increased demand. Cloud computing supports this by making various resource types available to switch between them. This also works in the opposite direction, i.e. to switch to a smaller and cheaper instance type when demand decreases. Since cloud resources are commonly paid on a usage basis no sunk cost or capital expenditures are blocking fast decision making and adaptation. Demand is difficult to anticipate despite planning efforts and naturally results in most traditional projects in over- or under-provision resources. Therefore, traditional projects tend to waste money or provide poor outcomes.

Vertical scaling achieves elasticity by adding additional instances with each of them serving a part of the demand. Software like Hadoop are specifically designed as distributed systems to take advantage of vertical scaling. They process small independent tasks in massive parallel scale. Distributed systems can also serve as data stores like NoSQL databases, e.g. Cassandra or HBase, or filesystems like Hadoop's HDFS. Alternatives like Storm provide coordinated stream data processes in near real-time through a cluster of machines with complex workflows.

Cloud Architectures Three main cloud architecture models have developed over time; private, public and hybrid cloud. They all share the idea of resource commodification and to that end usually virtualize computing and abstract storage layers.

6.1 Private Cloud

As big data volume, variety and velocity grow exponentially, the enterprise infrastructure must adapt in order to utilize it, becoming increasingly scalable, agile, and efficient if organizations are to remain competitive. To meet these requirements, Synnex Corporation, a leading distributor of IT products and solutions, announced it is the first distributor to offer a fully integrated, big data turnkey private cloud appliance powered by Nebula to the channel. The rack level appliance is a fully integrated private cloud system engineered to deliver workloads for both Apache Cassandra and MongoDB, enabling an open and elastic infrastructure to store and manage big data. The new rack system includes industry-standard servers, the Nebula One Cloud Controller, Apache Cassandra, MongoDB, backed by SYNNEX' powerful distribution model. This big data appliance enables an open and elastic infrastructure to store and manage big data. As an open source NoSQL database technology, Apache Cassandra provides multi-site distributed computing of big data across multiple data centers, while MongoDB is a cross-platform document-oriented open source database system [11].

Private clouds are dedicated to one organization and do not share physical resources. The resource can be provided in-house or externally. A typical underlying requirement of private cloud deployments are security requirements and regulations that need a strict separation of an organization's data storage and processing from accidental or malicious access through shared resources. Private cloud setups are challenging since the economic advantages of scale are usually not achievable within most projects and organizations despite the utilization of industry standards. The return of investment compared to public cloud offerings is rarely obtained and the operational overhead and risk of failure is significant. Additionally, cloud providers have captured the trend for increased security and provide special environments, i.e. dedicated hardware to rent and encrypt virtual private networks as well as encrypted storage to address most security concerns. Cloud providers may also offer data storage, transfer, and processing restricted to specific geographic regions to ensure compliance with local privacy laws and regulations. Another reason for private cloud deployments are legacy systems with special hardware needs or exceptional resource demand, e.g. extreme memory or computing instances which are not available in public clouds. These are valid concerns however if these demands are extraordinary the question if a cloud architecture is the correct solution has to be raised. One reason can be to establish a private cloud for a period to run legacy and demanding systems in parallel while their services are ported to a cloud environment culminating in a switch to a cheaper public or hybrid cloud [12].

6.2 Public Cloud

Public clouds share physical resources for data transfers, storage, and processing. However, customers have private visualized computing environments and isolated storage. Security concerns, which entice a few to adopt private clouds or custom deployments, are for the vast majority of customers and projects irrelevant. Visualization makes access to other customers' data extremely difficult. Real world problems around public cloud computing are more mundane like data lock-in and fluctuating performance of individual instances. The data lock-in is a soft measure and works by making data inflow to the cloud provider free or very cheap. The copying of data out to local systems or other providers is often more expensive. This is not an insurmountable problem and in practice encourages utilizing more services from a cloud provider instead of moving data in and out for different services or processes. Usually this is not sensible anyway due to network speed and complexities around dealing with multiple platforms [13].

6.3 Hybrid Cloud

There is no matter your organization's size or industry, chances are your business finds value in big data. But, how are you managing this data? Is there an optimal environment for storing and processing large amounts of data in the cloud? Hybrid clouds may hold the answer. Their dedicated private and public cloud combination offers enhanced security, optimal performance and better financial savings for businesses working with big data.

Perhaps your business's big data includes customer contact information, financial data or social network history. Regardless of the type of data, security is paramount. Many hybrid clouds offer protection by providing many of the security services you'd find in a traditional dedicated environment such as Web Application Firewalls (WAF), Intrusion Prevention (IPS), File Integrity Monitoring (FIM) and Security Information and Event Management (SIEM). This creates an environment that allows you to add layers of security that can be more difficult to find at providers who only offer public cloud solutions.

Big data's varying nature also requires infrastructure flexibility and elasticity. Cloud bursting, made possible via hybrid environments, allows you to spin up new workloads either larger machines or simply more machines when information from your systems or applications signal the need for additional resources, all while avoiding any downtime your workload performance. Hybrid environments allow for cloud bursting on any scale, and as a result, offer a more cohesive, adaptable cloud solution for big data management and storage. Lastly, hybrid cloud environments allow for adding resources only if/when they're needed rather than all upfront. The public cloud component of hybrid environments allows for the financial flexibility of quickly spinning up additional resources as needed, even on a short term basis, while the private cloud component provides the dedicated resources for the base workloads that data processing requires. The hardware and resources needed to productively manage and store large amounts of data varies greatly, so leveraging public cloud components for parts of your workload will likely result in financial savings [14].

Big data with actionable analytics, and hybrid cloud computing, however, may stick out as opportunities for many cloud services provider (CSPs).With regards to big data and actionable analytics, governments are having difficulty with managing and processing issues that exceed the capabilities of traditional IT, the IT research firm said. Gartner added that the difficulties remain in governments finding a product that can leverage big data to gain business efficiencies, while also reducing costs [15].

The hybrid cloud architecture merges private and public cloud deployments. This is often an attempt to achieve security and elasticity, or provide cheaper base load and burst capabilities. Some organizations experience short periods of extremely high loads, e.g. as a result of seasonality like black Friday for retail, or marketing events like sponsoring a popular TV event. These events can have huge economic impact to organizations if they are serviced poorly. The hybrid cloud provides the opportunity to serve the base load with in-house services and rent for a short period a multiple of the resources to service the extreme demand. This requires a great deal of operational ability in the organization to seamlessly scale between the private and public cloud. Tools for hybrid or private cloud deployments exist like Eucalyptus for Amazon Web Services. On the long-term the additional expense of the hybrid approach often is not justifiable since cloud providers offer major discounts for multi-year commitments. This makes moving base load services to the public cloud attractive since it is accompanied by a simpler deployment strategy [16].

7. BIG DATA PRIVACY AND SECURITY

Big Data remains one of the most talked about technology trends in 2013. But lost among all the excitement about the potential of Big Data are the very real security and privacy challenges that threaten to slow this momentum. Security and privacy issues are magnified by the three V's of big data: Velocity, Volume, and Variety. These factors include variables such as large-scale cloud infrastructures, diversity of data sources and formats, streaming nature of data acquisition and the increasingly high volume of inter-cloud migrations. Consequently, traditional security mechanisms, which are tailored to securing small-scale static (as opposed to streaming) data, often fall short [17].

The CSA's Big Data Working Group followed a three step process to arrive at top security and privacy challenges presented by Big Data; Interviewed CSA members and surveyed security practitioner oriented trade journals to draft an initial list of high priority security and privacy problems studied published solutions. Characterized a problem as a challenge if the proposed solution does not cover the problem scenarios. Following this exercise, the Working Group researchers compiled their list of the Top 10 challenges as shown in figure 6 below. The Expanded Top 10 Big Data challenges have evolved from the initial list of challenges presented at CSA Congress to an expanded version that addresses three new distinct issues [18]:

- Modeling: formalizing a threat model that covers most of the cyber-attack or data-leakage scenarios.
- Analysis: finding tractable solutions based on the threat model.
- Implementation: implanting the solution in existing infrastructures.

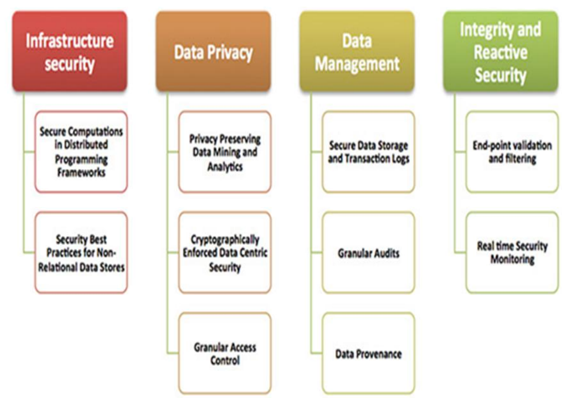

Fig. 6. 10 Challenges of CSA's Big Data Working Group

The information security practitioners at the Cloud Security Alliance know that big data and analytics systems are here to stay. They also agree on the big questions that come next: How can we make the systems that store and compute the data secure? And, how can we ensure private data stays private as it moves through different stages of analysis, input and output? The answers to those questions that prompted the group's latest 39-page report detailing 10 major security and privacy challenges facing infrastructure providers and customers. By outlining the issues involved, along with analysis of internal and external threats and summaries of current approaches to mitigating those risks, the alliance's members hope to prod technology vendors, academic researchers and practitioners to collaborate on computing techniques and business practices that reduce the risks associated with analyzing massive datasets using innovative data analytics. Existing encryption technologies that don't scale well to large datasets. Real-time system monitoring techniques that works well on smaller volumes of data but not very large datasets. The growing number of devices, from smartphones to sensors, producing data for analysis. General confusion "surrounding the diverse legal and

policy restrictions that lead to ad hoc approaches for ensuring security and privacy [19].
Given the very large data sets that contribute to a Big Data implementations, there is a virtual certainty that either protected information or critical Intellectual Property (IP) will be present. This information is distributed throughout the Big Data implementation as needed with the result that the entire data storage layer needs security protection. There are many types of protection and security used such as [20].
Vormetric Encryption: seamlessly protects Big Data environments at the file system and volume level. This Big Data analytics security solution allows organizations to gain the benefits of the intelligence gleaned from Big Data analytics while maintaining the security of their data – with no changes to operation of the application or to system operation or administration.
Data Security Platform: The Vormetric Data Security Platform secures critical data – placing the safeguards and access controls for your data with your data. The data security platform includes strong encryption, key management, fine-grained access controls and the security intelligence information needed to identify the latest in advanced persistent threats (APTs) and other security attacks on your data.
Encryption and Key Management: Data breach mitigation and compliance regimes require encryption to safeguard data. Vormetric provides the strong, centrally managed, encryption and key management that enables compliance and is transparent to processes, applications and users.
Fine-grained Access Controls: Vormetric provides the fine-grained, policy based access controls that restrict access to data that has been encrypted allowing only approved access to data by processes and users as required to meet strict compliance requirements. Privileged users of all types (including system, network and even cloud administrators) can see plaintext information only if specifically enabled to do so. System update and administrative processes continue to work freely – but see only encrypted data, not the plaintext source.
Security Intelligence: Vormetric logs capture all access attempts to protected data providing high value, security intelligence information that can be used with a Security Information and Event Management solution to identify compromised accounts and malicious insiders as well as finding access patterns by processes and users that may represent and APT attack in process.

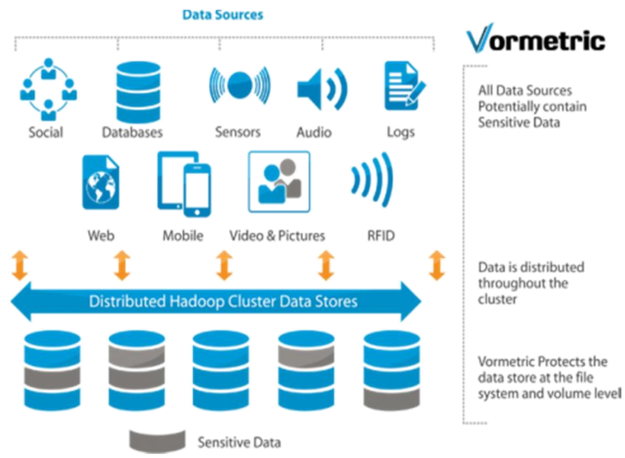

Fig. 7. Vormetric Concept

Automation: Use the Vormetric Toolkit to easily deploy, integrate and manage your Vormetric Data Security implementation with the rest of your big data implementation.

8. CONCLUSION

Recently , researchers focusing their efforts in how to manage , handling and also processing the huge amount of data as known a Big data deals with three concepts volume , Variety and velocity which requires a new mechanisms to manage , processing , storing , analyzing and securing the big data . as managing and processing of big data have many problems and required more efforts to handle these requirements when deal with big data , security is one of the challenges that arise when systems try to handle the concept of big data. More researches required to overcome the security of big data instead of current security algorithms and methods.

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