



White Paper

Using Next-Generation Advanced Analytics to Harness Big Data

Prepared by

Ari Banerjee, Principal Analyst, Service Provider IT
Sarah Wallace, Analyst
Heavy Reading
www.heavyreading.com

on behalf of



www.sas.com

November 2014

Executive Summary

Big data has been a hot industry buzzword as communications service providers grapple with how to manage the copious amounts of data that grows exponentially every day due to increased mobile broadband usage from the now ubiquitous use of smart devices. Obviously there is no shortage of data, but service providers need help in harnessing the right data to optimally improve operations, better serve their customers and ultimately increase revenue. Traditional, static business intelligence solutions no longer work in today's digital ecosystem, where social networks have created an amalgamation of structured and unstructured data.

Service providers must correlate this new mix of data, then use it to take action in real time and enable more targeted, personalized service. However, this is easier said than done, as service providers openly report to Heavy Reading that they are struggle with zeroing in on the right quality of data while also trying to handle the growing amount of data flowing through their networks.

Service providers need a big data analytics solution that provides real-time intelligence that can create value in terms of customer retention, increased revenue and operational efficiency. The solution should also present results in real time on a central, unified dynamic dashboard. Having a dynamic dashboard is crucial, so that it can be used and understood by multiple stakeholders within the organization.

A strategic big data and advanced analytics implementation can enable service providers to have a correlated and more granular view of customer data. By having a more segmented, personal understanding of the individual subscriber or certain segments, this ultimately leads to an enhanced overall customer experience, which service providers now report is a top priority. An integrated big data and advanced analytics-driven solution should also meet a service provider's real-time transaction needs by providing real-time intelligence that enables service providers to make offers or fix service quality issues in a timely manner. This preemptive and more personalized approach will increase customer loyalty and decrease churn.

Service providers are well aware that they must be better at managing their big data and are planning on significant investments to do so. Heavy Reading recently conducted a survey of 69 global operators that explores their perceptions and involvement, as well as future plans, regarding big data and advanced analytics, and a large majority of global respondents report that big data and advanced analytics will be either be "critical" or "very important" to their company in the next 12 to 24 months. When asked what critical pain points and priorities can be resolved by big data and advanced analytics, the top responses were targeted offer and campaign management, followed by churn prediction and proactive customer care, which indicates that customer experience is service providers' top priority.

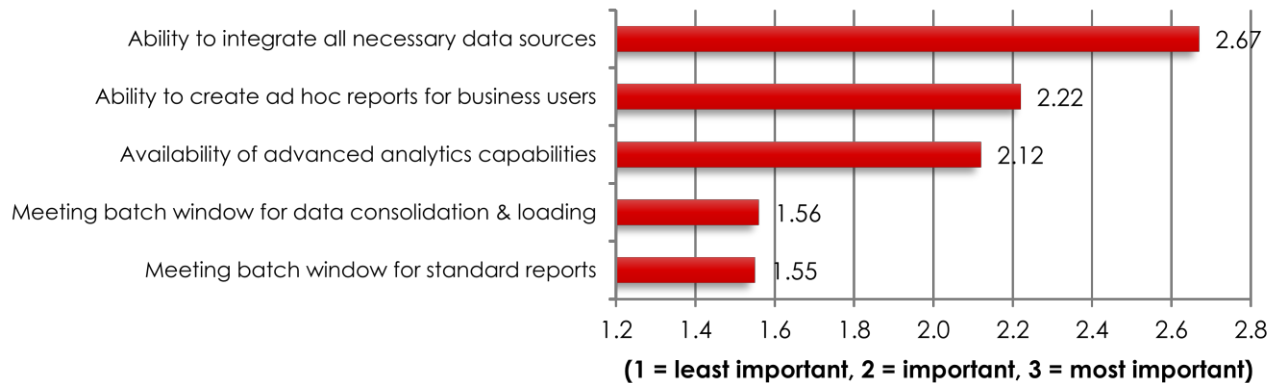
Hence, Heavy Reading predicts a fast growing multi-billion market potential that will provide opportunities for both hardware and software vendors. Service providers will need to harness big data effectively to provide actionable insight and the driver will be the use of a big data advance analytics solution. Service providers should look to an advanced analytics vendors that will offer a streamlined approach that correlates both structured and unstructured data, while allowing them to preemptively and proactively provide service in real time.

Crafting an Advanced Analytics Strategy

Big data is definitely an industry-wide buzzword, and there are several competing definitions circulating in the market. Heavy Reading defines big data and advanced analytics as the utilization of hardware and software solutions designed to process large volumes of data (in the range of hundreds of terabytes) to unearth actionable insight. Big data is a combination of both structured and unstructured data coming from text, social media, video, etc. As such, real-time streaming and complex event processing technologies are part and parcel of big data solutions.

With the proliferation of smart devices and exponential increase of mobile data traffic, operators must use advanced analytics to effectively manage and monetize their big data. They can use advanced analytics to enable more innovative business models that offer more targeted, personalized offerings to increase revenue and ultimately reduce churn. They can also use advanced analytics for preemptive assurance and customer care by correlating information about the customer from various systems, which can trigger certain actions to prevent problems before they occur. However, this is easier said than done: Just because service providers have no dearth of data at their disposal does not mean that they are managing the data efficiently. As shown in **Figure 1**, a recent Heavy Reading survey of 60 global operators reveals that integration of data sources is a primary operational challenge.

Figure 1: Top Operational Challenges That Are a Priority for Service Providers



Source: Heavy Reading

Service providers need to be able to build a single, easily viewed and secure customer profile by analyzing all the collected subscriber-related data using trend and predictive analytics. To achieve this, the single, smart customer profile must be transformed into real-time, intelligent, actionable insight. Correlating and optimally using the right customer data gives service providers the opportunity to strengthen customer relationships and gain competitive advantage. Advanced analytics can help serve multiple functions across an organization, in that it creates an architecture that enables the collection, storage and integration of data sets from a variety of systems. An effective analytics solution must be able to access data, analyze it and provide the results of that analysis on demand, so that end users (either people or technology systems) have the insight needed to make better decisions without delay. A big data advanced analytics solution that can seamlessly and effectively utilize structured and unstructured data to improve real-time decision-making will be the "silver bullet" that service providers need to alleviate their business problems.

Evolving From Legacy to Advanced Analytics

In today's digital ecosystem, dealing with customer data means dealing with unstructured data, which is complex as it does not always fit into neat tables of columns and rows. The advent of these new data types that can be both structured and unstructured means they must be pre-processed to yield insight into a business or condition. Data from Twitter feeds, blogs, call detail reports, network data, video cameras and equipment sensors is not stored directly in a data warehouse until it is pre-processed to correlate and normalize the data to detect basic trends and associations. It is a cost-effective mechanism to structure the unstructured data part, load that data into data warehouses for comparison and then use that data with other collected data to run advanced analytics processes on it.

There is a need for solutions that can combine customer usage and subscription data with insight into the network, cost, customer mood and customer preference data to trigger specific actions, which helps enhance customer experience. Therefore, traditional, static analytics solutions are no longer applicable in a world where structured and unstructured data are melding.

Figure 2 illustrates the key differences between the realities of yesterday's analytics infrastructure and our expectations for tomorrow's big data analytics infrastructure.

Figure 2: Legacy Analytics vs. Big Data Analytics Infrastructure

	LEGACY ANALYTICS	BIG DATA ANALYTICS
Storage Cost	High	Low
Analytics	Offline	Real-time
Utilizing Hadoop	No	Yes
Data Loading Speed	Low	High
Data Loading Time	Long	Average 50%-60% faster
Data Discovery	Minimal	Critical
Data Variety	Structured	Unstructured
Volume	Gigabyte, terabyte	Petabyte, exabyte, zettabyte
Velocity	Batch	Real-time
Administration Time	Long	Average 60% faster
Complex Query Response Time	Hours/days	Minutes
Data Compression Technique	Not matured	Average 40%-60% more data compression
Support Cost	High	Low

Source: Heavy Reading

Key benefits that service providers will obtain from a savings and operational efficiency standpoint from using modern-day big data analytics solutions are:

- Reduction in data compression, maintenance cost and support cost
- Increase in data loading speed
- Reduction in administration cost
- Reduced time to run queries and real-time response for *ad hoc* queries by hundreds of concurrent users
- Easy implementation of any data model from any data source with no changes needed and no additional response time with data growth
- Saving in storage space because of advanced compression techniques
- Utilization of complementary technologies such as Hadoop and Map-Reduce with existing RDBMS and data warehouse technologies
- Leverage commodity hardware

Holistic Visibility of the Customer Through a Real-Time Unified Dynamic Dashboard

One of the must-have traits of a big data advanced analytics solution is in-memory – in other words, having the ability of high-speed performance. This means the solution will be able to delve into large amounts of data and present the results in real time on a central, unified dynamic dashboard. Dashboards of the past were often snapshots taken from information aggregated in data warehouses. A dynamic dashboard by contrast is one that can be fed from in memory data visualization tools so is the latest and greatest info. It must be able to have visibility and insight into all the subscriber-related data and have unified views across domains. It must also have common hardware and software for stakeholders and it must provide comprehensive data about both the control and data planes while providing real-time analysis. Such a dashboard must also bring together and provide visualization of data sets so that stakeholders do not have to shift from tool to tool.

How Advanced Analytics Creates Value

A big data analytics solution can provide real-time intelligence that creates value for service providers in terms of customer retention, increased revenue and operational efficiency. Following are some big data advanced analytics use cases for service providers.

Customer Experience Management

Churn Identification, Prediction, Prevention

Segmenting customers for more accurate marketing campaigns is part of the overall objective of increased customer satisfaction to prevent customers from churning. The key to a big data-driven advanced analytics solution providing optimal churn prevention will be its ability to provide preventive churn actions in real time. So, for example, a customer complaint or service quality problem would trigger a very targeted and customized offer that is more attractive to a subscriber, greatly decreasing the propensity of this subscriber churning. Strategic utilization of big data and advanced analytics enables service providers to shift their business intelligence focus from looking back at old records to looking forward with current data in a predictive and preventative fashion to determine things such as "What behaviors will trigger churn events?" and "What actions are most likely to prevent a churn event?"

Social Media

In a world where more and more customers interact and talk about their experiences and issues online, online brand management has become big business. Service providers that ignore what customers say about them in unstructured environments risk swift and widespread brand damage. Making sense of structured and unstructured data to understand the mood and transaction pattern of customers is a leading indicator and is, therefore, critical, as is social network and sentiment analysis. This will help service providers to take preventative actions to avoid churn or customer dissatisfaction. A big data advanced analytics solution can help manage unstructured data coming various social platforms by analyzing the feedback and sentiment to better understand their customers' preferences and enhance their personalized offerings.

Net Promoter Score (NPS)

NPS has been gaining traction for measuring brand loyalty and advocacy among service providers. The concept of NPS is used to ascertain how customers feel about the services they are receiving from a brand in a bid to turn potential detractors into promoters and brand advocates. From an industry benchmark standpoint, the NPS ranking of the communications industry is much lower than other industry verticals – clearly indicating that service providers have a lot of work to do to convert customers into brand advocates. A big data advanced analytics solution can help analyze customer's feedback in order to have a better understanding of their NPS.

Offer Optimization

Using advanced analytics for sophisticated offer management enables service providers to confirm which service bundles and promotions are successful and to offer management capability based on data such as subscriber network usage, traffic-based promotion, loyalty points, event-based promotion and rules-based promotion. And identifying and offering innovative promotions, such as offers for early adopters, cross-product promotions and loyalty points, will be critical in driving value-added services adoption, which will be provided either by the service provider itself or by partnering with over-the-top players.

Audience Measurement

By using advance analytics, content providers and distributors can leverage audience full viewership data to get an understanding of the customer viewer behavior. For example, a cable, satellite or content provider can extract in-the-moment customer behavior and predict what show an individual customer will be most likely to watch or what ad would most resonate with them. This allows the distributor to optimize marketing efforts by making relevant actions, such as cross-selling or up-selling bundles/packages. Having a more granular understanding of individual customers is much more effective than population sampling, which may be less accurate. This also could help content distributors with programming negotiations by having a better pulse on content viewership.

Revenue & Pricing

Price Modeling

There is continued pressure on service providers to provide superior services while simultaneously providing innovative yet affordable price plans. Service providers can use a big data advanced analytics solution to analyze and identify patterns to predict when and if customers will be likely to migrate to a price plan or switch providers altogether. This price modeling will allow for performance analysis of price plans and allow the development of future price plans by identifying which segments or customer profiles will be most profitable. This will also allow for more accurate development of product bundles based on key drivers for the affinity toward certain price plans.

Credit Risk

A big data analytics solution can help service providers make real-time credit decisions when dealing with customers. An advanced analytics solution can look at various sources of subscriber related data, such as customer lifecycle history, from various sources, such as billing, etc. The solution can then make a risk assessment decision in real time and ultimately save the service providers the hassle of extending a payment deadline to a customer who may not have the ability or the intention to pay his/her bill on time. This may also help service providers identify repeat offenders who terminate service then sign up again in hopes of getting new customer discounts. This type of advanced credit-risk analytics enable service providers to improve their credit-risk decisions and increase revenues while reducing risk costs.

Demand Forecasting

Traditionally defined as the activity of estimating the quantity of a product or service that consumers will purchase, demand forecasting usually involves both informal techniques, such as educated guesses, and quantitative techniques, such as the use of historical sales data or current data from test markets. For service providers, demand forecasting may be used in making pricing decisions, in assessing future capacity requirements, or in making decisions on whether to enter a new market. A big data advanced analytics solution enables service providers to examine usage trends by product or service or by certain markets. All this helps them more accurately plan their next investment wisely versus unproductive rollouts of new services or geographic areas that may prove to be unsuccessful.

Fraud

Strengthening network security and reducing profitless resource consumption is at the top of most service providers' requirements. Operators can utilize a big data-driven advanced analytics infrastructure to identify in real-time malicious calls, applications, etc., and prevent them from wreaking havoc on their operations. Big data-driven analytics solutions must help detect abnormal subscriber consumption,

fraud cases and help save operators from bad debt concerns. Detecting abnormal subscriber consumption, cybersecurity threats and changes in subscriber behavior or traffic flows are critical areas in which pattern matching can be used. Pattern matching can be effectively utilized by service providers to match customer events and note major variances in patterns to raise fraud alerts and drive processes to block transactions or implement some revenue assurance fix processes.

Intelligent Store

An advanced analytics solution can help service providers intelligently manage data storage. A comprehensive solution will enable service providers to properly handle the growing volume of stored information while at the same time helping to balance the workload across processors and storage devices within a single server. The management of data storage will also enable the distinction between the more crucial data that will be used to better serve the customer across various channels. Though not noticed outwardly by the customer, it plays a vital role in enhancing the overall customer experience and, thus, extending the customer lifecycle.

Clustering

Advanced analytics can use dynamic profiling to analyze incoming data sources as varied as customer care, product/service/device portfolios, cost and billing, and network service quality to cluster or segment customers by (for example) their:

- Usage (e.g., voice, data, SMS usage, times of day)
- Interests (e.g., gaming, music or video downloads, time spent on social media portals)
- Location (e.g., area code)
- Socioeconomic class (e.g., prefers the newest, high-end devices)
- Influence in their network (e.g., what type of influence they are within their own contextual cluster, such as their family, business community or peers)
- Propensity to churn (e.g., predictive modeling)
- Relationship with off-net users (e.g., makes frequent calls to those using a different service provider)

For service providers, being able to segment the customer is crucial for retention and customer satisfaction. For example, a provider must be able to identify the heads of household and keep them as satisfied customers, because, if this type of influencer churns, they may take with them five devices and the services that support them. By properly identifying and predicting the proper needs of these influencers, a service provider can offer them more attractive services, helping to retain them as a customer and enhance their customer satisfaction and loyalty.

Data Monetization

Intelligent Messaging

A big data advanced analytics solution can enable service providers to provide optimal or intelligent messaging. This includes text messages, app push notification, voice and email to customers to either push out campaigns, offer support or enable self-service. In some scenarios customers may choose from a range of options depending on their needs, and advanced analytics can be used to accurately determine which type of messaging is most appropriate for each customer. Intelligent messaging can also manage functions such as opt-in lists, and create profiles based on information received from subscriber data that comes across various channels.

Mobile Commerce

Big data and analytics can be used to provide a robust platform for a trusted mobile payments ecosystem. As traditional physical wallets are gradually being replaced by virtual ones, a mobile wallet platform can enable end users to manage and operate all their cards, including credit, debit, transport, loyalty and gift cards. Advanced analytics can be used to help manage all these transactions and payments, which can be made through near field communications technology or QR codes, with the relevant enabled cards presented at compatible points of sale. In addition, advanced analytics can analyze mobile wallet user data to determine possible future transactions and enable a third-party partnership with an app or merchant.

Enable Location-Based & Personalized Advertising

One significant advantage of big data and analytics is that it provides location-based data that enables providers and site owners to better target users in the form of geo-fencing or location-based advertising. In this scenario, a subscriber enters a certain geographic zone and may receive a non-chargeable, timely SMS or relevant banner to his/her social media with an advertisement or promotion (based on their customer behavior and preference) from a local merchant. When integrated into a mobile shopping cart, consumers will have the ability to consent to have their checkout forms automatically populated with personal information and payment options. This is critical as manual data entry on a mobile device is one of the leading causes of shopping cart abandonment and errors. For added security, the joint solution will use network location data to verify mobile transactions by confirming that the owner and their phone are in the vicinity of the merchant or ATM at the time of transaction.

Enrich Loyalty Card

Using advanced analytics for advanced offer management will enable service providers to confirm which service bundles and promotions are successful and to offer management capability based on data such as subscriber network usage- and traffic-based promotion such as loyalty points. Loyalty points can be rewarded for early adopters or for steadfast patronage. Cross-product promotions and loyalty points will be critical in driving value-added services adoption, which will be provided either by the service provider itself or by partnering with over-the-top players. Loyalty programs can also be used to create customized offerings to individual customers. For example, a loyal customer can receive an on-demand service pass in the form of a free top-up or speed boost on their birthday.

Real-Time Analysis & Decision-Making

In order to remain relevant as a service provider in today's digital world, operators need to capitalize on real-time intelligence and customer insight. They must be able to make better informed decisions by tapping into subscribers' context and usage information, and their underlying software infrastructure must be able to support initiatives to deliver and monetize new, personalized service offerings. However, the stark reality is that service providers are struggling to address the real-time needs of their subscribers effectively, which is negatively impacting their revenue potential. A big data and advanced analytics-driven solution should meet a service providers real-time transaction needs and provide real-time intelligence, enabling the service providers to maximize revenue potential from a short window of opportunity.

Network & Operations

Opex remains stubbornly high for most service providers, as the expansion of network footprints due to organic and inorganic growth has resulted in poor capacity utilization. Strategic utilization of big data and advanced analytics can increase

operational efficiency and significantly reduce opex to the order of 10-15 percent, as discovered by Heavy Reading research.

Intelligent Network Planning

Service providers need network planning solutions that are embedded with advanced analytics to federate and correlate information from multiple network data repositories, as well as sales forecasting systems, such as customer rights management (CRM). This will provide operators with:

- The ability to plan, predict and optimize their investment in network build and rollout, identify potential stress points
- Prioritized and optimal network investment plan based on service forecast demands
- The ability to anticipate and implement necessary network change just ahead of the demand curve

Service provider network planning systems must be advanced analytics-driven and work closely with their operations support systems (OSSs), such as network inventory solutions, service activation solutions, network discovery information, etc., and via service modeling and correlation of utilized resources, which need to help in accurate operational planning by predicting network resource exhaustion in a timely manner. These systems must drive capacity optimization and provide network planners with the ability to create "what if" scenarios based on past utilization trends, subscriber information, sales forecasts and service consumption trends.

Congestion Control

RAN congestion has emerged as a major problem for mobile operators. Solutions that incorporate subscriber information with their services and location data can provide visibility at individual sub-cell level and provide priority to certain subscribers based on their tiers, etc., when they are moving across certain cells that are suffering from congestion issues. Since congestion events are often fleeting, making use of historical information about congestion from OSSs to preempt similar problems and deploying RAN congestion only in those areas where congestion is anticipated is a key area where operators are planning to utilize big data and analytics solution.

Cell-Site Optimization

4G networks are intended to be increasingly self-optimizing, with cells automatically managing how they interact with one another (adjusting their power to minimize interference, while maximizing bandwidth and coverage), managing their power consumption and how they load balance traffic and handover traffic between cells. They will be able to do this much more effectively if they can augment the network performance with contextual information, which includes subscriber information, such as user experience in specific areas, how that user experience varies according to the different types of services they might use and the typical patterns of user behavior throughout the day.

Subscriber-Centric Wireless Offload

Analytics capable of combining data from remote cell site monitoring solutions (across various generations of network), deep packet inspection systems, customer usage systems, backhaul network management systems and subscriber data repositories can be used in real time to push different types of traffic belonging to different types of customers to different cells, depending on their subscription levels, the applications they are using and the traffic load on different cells of different types. In

the context of 4G, where WiFi offload is a common phenomenon, contextual intelligence can, in the case of congestion, correlate customer information with their lifetime value, spending pattern, type of services they are running, particular service-level agreements (SLAs), etc., and intelligently decide which subscribers should be offloaded on WiFi.

Field Operations

A recent Heavy Reading survey of 60 global operators found one of the top mobility application services that enterprise and small to midsize enterprises/businesses (SME/SMBs) are asking for is field workforce automation. Field workforce automation increases effectiveness of the mobile work force by delivering integrated forecasting, scheduling, dispatch, mobile and reporting. Advanced analytics can enable an efficient mobile workforce by helping to automate processes and integrate applications, help manage labor resources and help manage software applications throughout the organization.

Service Assurance

Rapid detection of performance issues, unified end-to-end session views, cross-domain capability and transaction level granularity will be must have characteristics of next-gen service assurance. A big data advanced analytics solution will play a vital role in enabling such characteristics. An effective advanced analytics system will be quickly able to enhance service quality by effectively finding root cause and automatically provide resolution prior to end users experiencing degradation of service. In addition to this preemptive approach, advanced analytics will also enable actionable insight by taking the collected and correlated data that will automatically trigger proactive operations, such as churn prevention or more targeted marketing campaigns.

Call Center

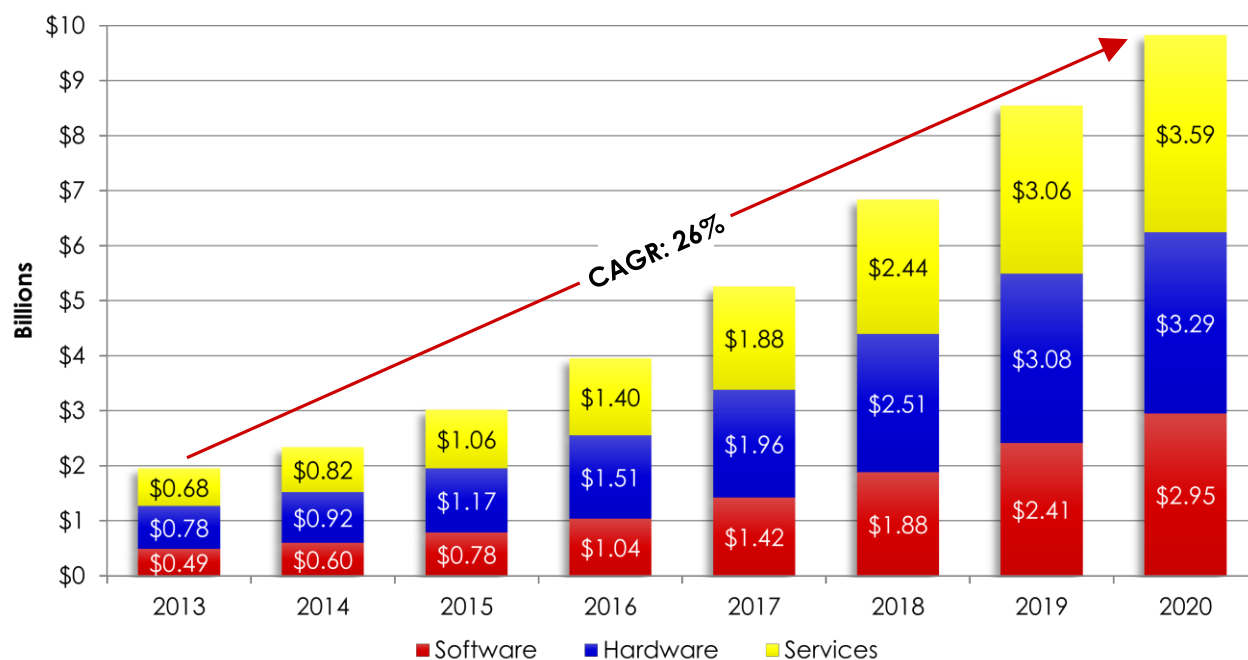
Call centers are known to generate more data than most departments within an organization. Most companies already collect call center performance data, call-related data, agent-performance data and training data. The problem is that it is siloed in various platforms so it is not used to its maximum potential. Advanced analytics can be used to identify a more granular view of the end customer behaviors that can lead to more personalized offerings that can help to retain a customer or increases their ARPU. Performance analytics, such as call routing and call volume forecasting, can also be used. In most cases, the data required already exists but is stored away in a data center and not used to its potential.

Investment Priorities for Advanced Analytics

Heavy Reading's conclusion is that operators are well aware that they must effectively manage and extract the value out of their big data and are planning on significant investments to do so. Our study of big data technology usage in telecom indicates widespread adoption of big data and analytics in the telecom industry. Our primary research conducted with major global operators suggests a fast growing, multi-billion market potential that will provide opportunities for both hardware and software vendors. Some of the key findings from our forecast include the following:

Heavy Reading expects the big data technology and services market to grow from \$1.95 billion in 2013 to \$9.83 billion in 2020, as shown in Figure 3. This represents a total compound annual growth rate (CAGR) of 26 percent. Breakout CAGR growth between software, hardware and services are the following: software will grow at 29.3 percent CAGR, hardware will grow at 22.8 percent CAGR and services will grow at 26.8 percent CAGR.

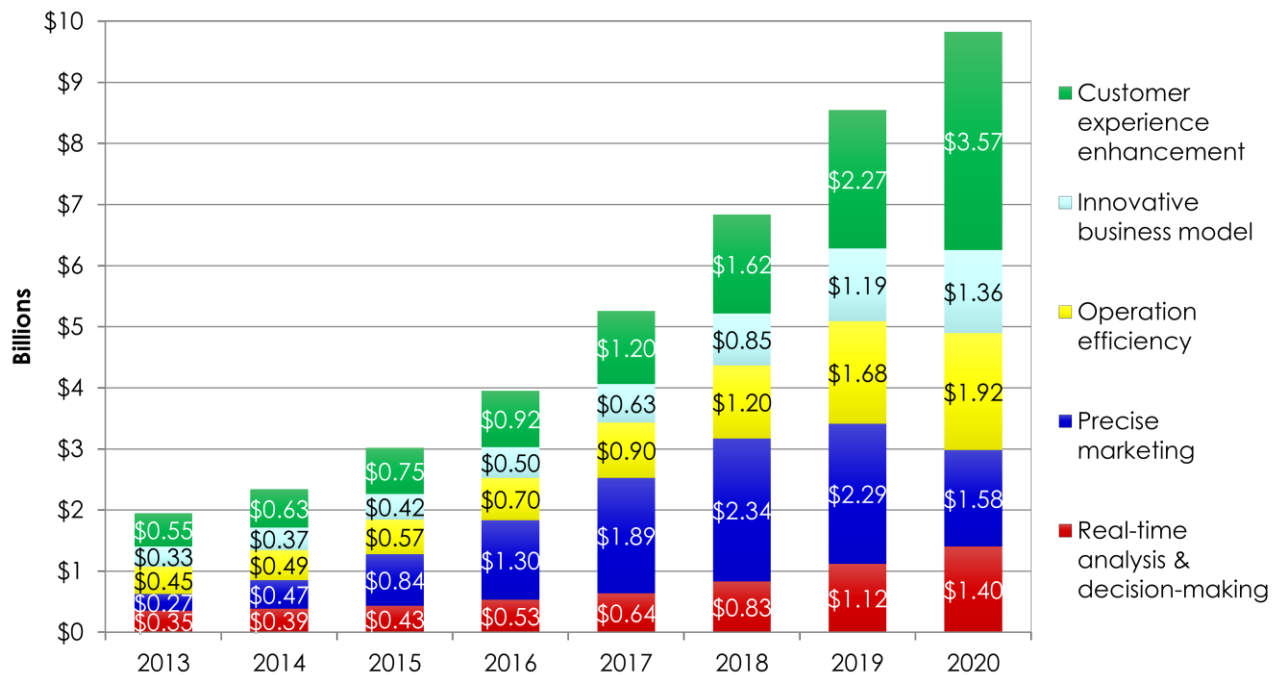
Figure 3: Big Data & Analytics Market in Telecom



Source: Heavy Reading

Of the five identified business application categories, we believe customer experience enhancement will grow the most, from \$546 million in 2013 to \$3.57 billion in 2020 at 30.8 percent CAGR, shown in Figure 4. Precise marketing category will increase from \$273 million in 2013 to \$1.6 billion in 2020 at 28.5 percent CAGR. Operational efficiency improvement will increase from \$449 million in 2013 to \$1.7 billion in 2020 at 23 percent CAGR, followed by the innovative business model category, which we predict will grow from \$332 million in 2013 to \$1.3 billion at 22.4 percent CAGR between 2013 and 2020, and real-time analysis and decision-making from \$351 million in 2013 to \$1.4 billion in 2020 at 21.9 percent CAGR.

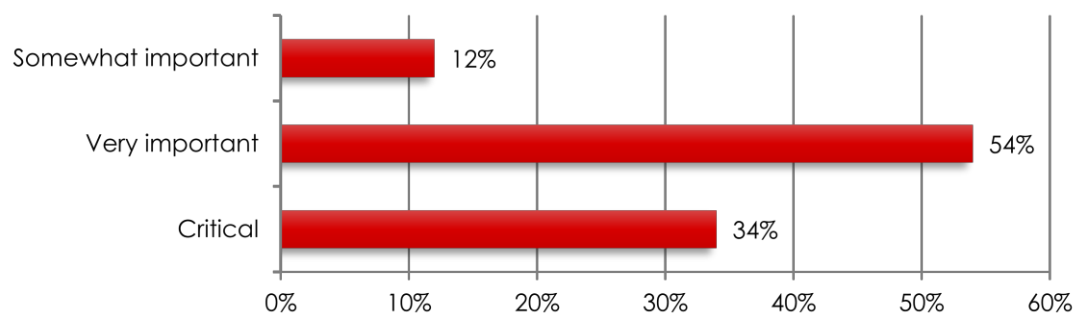
Figure 4: Big Data Analytics Market Size by Business Category



Source: Heavy Reading

Heavy Reading recently conducted a survey of 69 global operators that explores their perceptions and involvement, as well as future plans regarding big data and advanced analytics. More than half of global respondents (54 percent) report that big data and advanced analytics is perceived as very important to their organization over the next two years (**Figure 5**).

Figure 5: Significance of Big Data & Advanced Analytics Over the Next Two Years

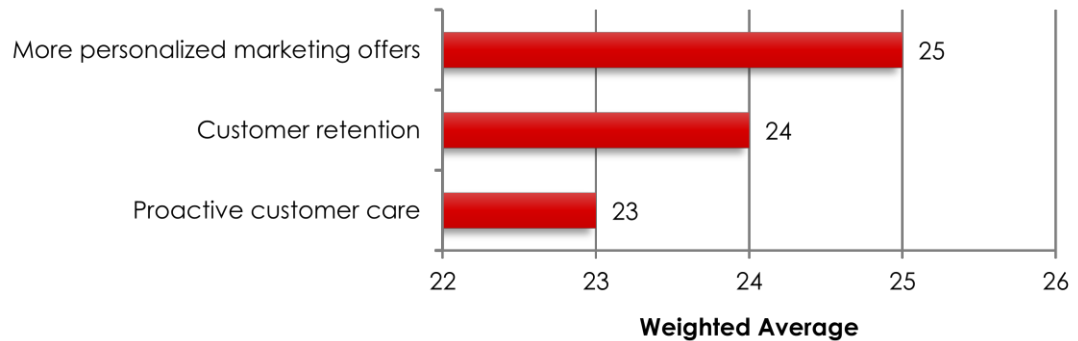


Source: Heavy Reading

When asked to rank the leading pain points they would like to have resolved by big data and advanced analytics, the top responses were more personalized marketing offers, followed by customer retention and proactive customer care (**Figure 6**).

These top priorities align with **Figure 4**, which indicates that customer experience enhancement is service providers' top priority and where there will be more spending with big data and advanced analytics with the customer in mind.

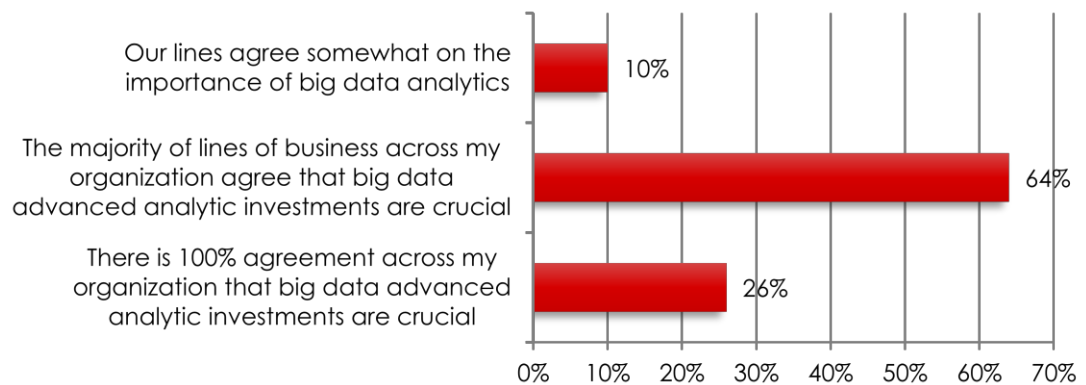
Figure 6: Leading Pain Points Service Providers Want Big Data & Advanced Analytics to Resolve



Source: Heavy Reading

Almost two thirds (64 percent) of respondents report that the majority of their lines of business agree that big data advanced analytics is crucial to the company's future success (**Figure 7**). This is a strong indicator that all lines of business across service providers are making big data a priority, not just the marketing departments.

Figure 7: Agreement on Importance of Big Data & Advanced Analytics Across Lines of Business



Source: Heavy Reading

Service providers must choose a big data advanced analytics solution that will enable them to make better informed decisions by tapping into subscribers' context and usage information with the ability to react in real time, harnessing all subscriber-related insight. The solution must be able to integrate with service providers' legacy systems and support initiatives to deliver and monetize new, personalized service offerings. This will help service providers maximize their revenue potential from more real-time, intelligent service delivery, enabling them to drive efficiency, creativity, customization and ultimately profitability more effectively than they can currently.

Vendor Profile: SAS's Approach to Big Data

A holistic approach to big data and advanced analytics strategy relies on technology alignment of grid computing, in-database and in-memory strategies. Any big data and analytics provider must be able to harness these three technology components and be able to support both active data warehouse and enterprise data warehouse requirements. An active data warehouse supports near-time or near-real-time decision-making and depends on event-driven actions triggered by a continuous stream of queries that can be generated by people, machines or applications against a broad, deep granular set of telco data. In this context role of in-memory engine specifically engineered for the demands of interactive and iterative analytics becomes critical as the big data infrastructure needs to support real time, hundreds of users' stateless transactions running on distributed environment such as Hadoop or on specialized appliances, such as Teradata, EMC or Oracle.

Visual analytics should also be a critical component of a big data solution, as it should be able to present results in real time on a central, unified dynamic dashboard. Current data visualization tools require human interpretation followed by manual intervention to manage the customer experience. Next-generation big data and advanced solutions should have dashboards that provide users with a picture of current performance, and visually highlight anomalies and exceptions. Users should be able to easily drill in to specific activities or transactions to get the context and take the appropriate action. They should be able to easily compose and personalize them without programming.

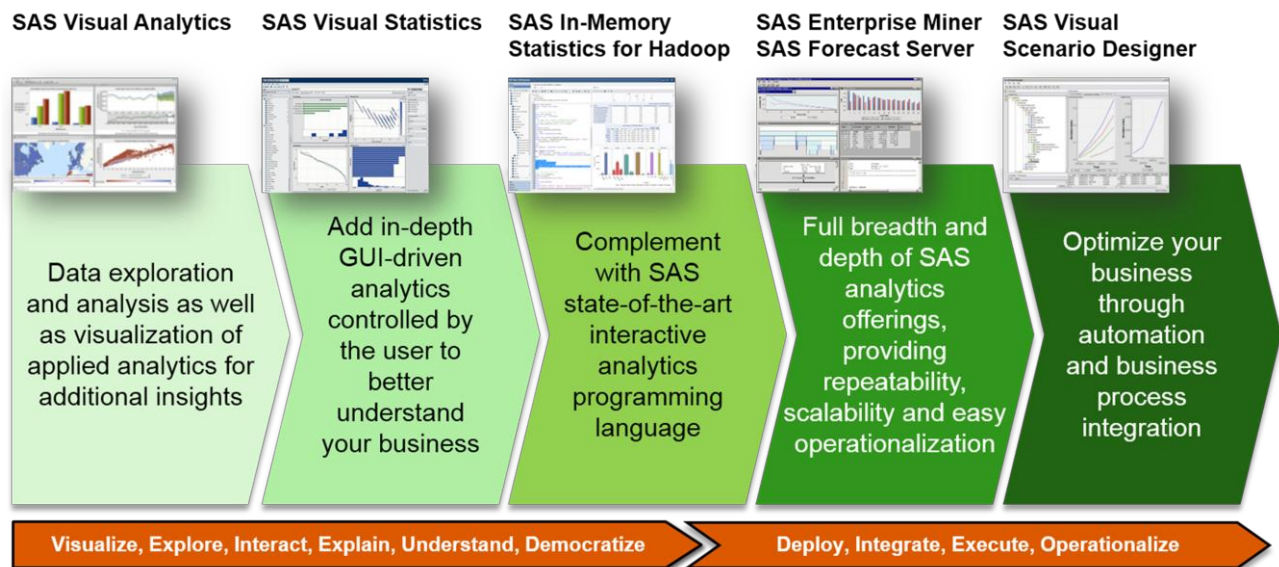
SAS, a market leader in the analytics space, brings together its years of expertise to provide a holistic solution to the big data and advanced analytics conundrum. Not only does its approach provide support to all of the requirements listed above, it also provides a transition path to operators that are in different stages of maturity. SAS's big data approach can support operators that are in different maturity stages and can support: their analytics workload of choice in Hadoop; their data integration toolset of choice for Hadoop; and their data exploration and reporting product of choice for Hadoop. With SAS, operators are not at all restricted in their approach, and they can pursue creative ways to use their existing data, as well as incorporate more data sources easily to enhance their decision-making process.

With SAS, service providers can tap into the potential hidden in their big data assets, including customer care, network and marketing data. They can get quicker insights and unite all types of diverse data in a unified data hub. High-performance analytics can help service providers embark on new business opportunities. And SAS data visualization capabilities enable service providers to perform quick and agile analytics while providing a dynamic dashboard of information. With big data analytics from SAS, service providers can:

- Get fast answers to their toughest business questions. SAS In-Memory Analytics enables concurrent, multiuser access to all their data, big and small, for extremely fast analytics operations. The software is optimized for distributed in-memory processing and can easily handle the huge data volumes associated with things such as location-based services.
- Ensure the consistency of all their data. SAS In-Database Analytics eliminates unnecessary data movement steps and uses a massively parallel processing (MPP) database architecture to execute data management and analytics tasks inside the database.

- Meet peak demands and accommodate growing, increasingly diverse user workloads. SAS Grid Computing capabilities help eliminate IT constraints, so service providers can create a managed, shared environment for processing huge volumes of data and analytics programs. And flexible architecture options mean that their toughest business requirements will be met – both today and tomorrow.
- Combine the benefits of Hadoop with the business analytics power of SAS, and transform big data into big knowledge with seamless, transparent access to your Hadoop environment so they can gain insights and discover new trends.

Figure 8: SAS Big Data Analytics



Source: SAS

For more information on SAS's big data analytics capabilities, visit:
www.sas.com/en_us/insights/big-data.html

Conclusion

Converting the deluge of information into actionable real-time information is an arduous task that service providers must tackle if they want to have a user-defined telco IT architecture to dynamically meet their business objectives that centers on accurate network planning, providing preemptive service assurance and delivering superior customer experience.

The challenges of taming big data in order to achieve actionable insight lies in the service provider's ability to collect all the data generated and analyze the data collected cost-effectively. Unstructured, non-standard, incomplete and inaccurate data makes the task all the more complex. Overall, the complexity surrounding big data is that it is expensive to manage and difficult to extract value out of it. However, big data used effectively has the potential to revolutionize the way telecom operators build, run and market their services.

A big data advanced analytics solution that enables actionable insight in real time will play a key role in the success of service providers, not only providing operators with real-time intelligence, but also helping them to maximize their revenue potential from a short window of opportunity, which will enhance the overall customer experience and allow for more personalized and targeted marketing.

The solution should also present results in real time on a central, unified dashboard. Having such a dashboard is crucial so that it can be used and understood by multiple stakeholders within an organization. Strategic big data and advanced analytics implementation can enable operators to do all of the above. In the future, big data and advanced analytics implementation will become a fundamental pillar of service and network service.

In today's highly competitive service provider market, we believe that service providers must remain agile and focused on ways that they can improve their network and the experience of their top customers in order to differentiate their services from those of their competitors. In Heavy Reading's opinion, SAS's approach to taming big data and providing actionable insight through its market-leading advanced analytics performed on service providers' big data assets will be a critical means to achieve that goal.