

Big Data – Key Building Block for CSPs' Quest for Value





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Introduction

Beyond the hype around the Big Data concept, it is clear that next-generation analytics solutions will provide many industries with a new and very real opportunity to improve their operations and make a breakthrough in customer experience. This is particularly true for industries that have a large customer base and/or complex infrastructure such as retail, financial services, utilities and telecom.

For Communications Service Providers (CSPs), which have the distinctive advantage of possessing both network and customer data, Big Data analytics is a multi-fold opportunity, allowing to improve network utilization, efficacy of operations and customers experience, as well as to reduce OPEX and create new revenue streams.

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In this context, CSPs are already looking at better exploiting the internal data from their networks and systems to rationalize their operations and customize their services in near real-time. CSPs are not new to the volume of data, as their networks, OSS/BSS systems and devices create enormous amounts of data already. However, several additional sources of data – from increasing use of smartphones, clickstream data, signaling data from apps and M2M devices – all aided by better connectivity and faster networks, have led to a manifold increase in the amount of data they can use. In addition to internal and structured data, there is also unstructured data that comes from sources such as social networks, blogs, chats and customer surveys. These two forms of data are difficult to align and reconcile, and the dimension of time adds to the complexity, with some data in real-time and some following with a lag. If CSPs are able to manage these diverse data dimensions effectively, they can draw huge benefits from this investment.

Just as size and type of data have grown exponentially over the last few years and will continue to do so, technology has also evolved to process these higher volumes of data. This combination between new sources of data and new data processing technologies underpins the operational potential of Big Data. While most industry observers agree on this potential, specifically for CSPs, which have exclusive access to huge volumes of data that they can use and monetize, opinions vary on the pace of development of Big Data applications within the telecom industry. According to Gartner's Hype Cycle for the telecom industry¹, Big Data has crossed the "Peak of Inflated Expectations" and has entered into the "Trough of Disillusionment", with CSPs continuing to evaluate the exact benefits of Big Data. Gartner anticipates that the majority of CSPs are likely to engage in real investment in Big Data solutions in the middle term only.

However, a study from the University of Texas indicates that a 10% increase in Big Data utilization will result in a 17% boost in CSPs' productivity², amounting to US\$9.6 billion in revenue. In addition, the study highlights that Big Data analytics will help CSPs to better understand users behavior, leading to more effective marketing; if CSPs can identify unsatisfied customers, intervening steps (such as offering coupons and other inducements) can be taken to retain them. Given this perspective, it is more likely that CSPs will seriously look at Big Data in the very near future and accelerate the implementation of Big Data solutions.

In this paper we will develop a Capgemini point of view, discuss the key enablers of Big Data in the telecom industry and how CSPs can benefit from implementing Big Data analytics solutions, and highlight some of the challenges in doing so.

1 Gartner, "Hype Cycle for the Telecommunications Industry, 2014", 04 August 2014

2 Anitesh Barua, Deepa Mani, and Rajiv Mukherjee, "Measuring the Business Impacts of Effective Data"

Big Data enablers

The combination of new sources of data and new data processing technologies is set to enable CSPs to better monitor their operations and unlock the potential value hidden in customer data.

New sources of data

CSPs' sources of data are not limited to IT systems and applications, but extend to signals, devices and IP flows. This data encompasses customer profiles, billing data, call data records, usage patterns, and data related to location and browsing history. In addition to this, there is a continuous stream of unstructured data (eg: customer tweets and social media posts), multiple times larger than CSPs' structured internal data.

Source of Data	Examples	Type of data
IT	Charging Gateway, Billing, CRM, Order Management/Provisioning, Web logs	Structured
Networks	Data for 3 layers of services 2G/3G/4G and fixed line, network probes and DPIs, M2M Sensors	Structured and Semi structured and limited unstructured
Subscribers	CPEs, Devices, HLR, Subscriber Database	Structured and Semi structured
External Data	Partners and social media (eg: Twitter and Facebook)	Unstructured

It can be argued that CSPs have an advantage over other industries, given the volume and variety of data assets they have. However, CSPs have not yet been able to fully utilize this data for revenue assurance and monetization, or to provide value added services.

2.2 New Data Processing technologies

Advancements in data processing technologies, such as the evolution of Hadoop and in-memory processing, have increased the capacity to process large data sets in near real-time. Hadoop, which is an open source platform, is capable of handling multiple data sources. It can aggregate multiple sources of data for large-scale processing or read data from a database in order to run processor-intensive machine learning jobs. Its efficiency in handling large volumes of constantly changing data – like location-based data from weather or traffic sensors, web-based or social media data, or machine-to-machine transactional data – will help CSPs to gain real-time insights. Likewise, in-memory processing offers the advantage of storing data in a server's RAM to make it easily accessible (near-instantaneously) for analysis. It has gained momentum due to the fall in price of RAM chips and also the need for faster processing of large data sets.

Thus, the availability of technologies to store and process large amounts of data from networks, subscribers and devices (see above table) has meant that CSPs are shifting away from previous approaches (where the technology implementation like CRM and data warehousing was the main goal) towards a more business-focused approach.

Potential benefits of Big Data for CSPs

The benefits of Big Data for CSPs revolve around offering enhanced customer experience, network efficiency, and evaluation of the success of their services – resulting in cost reduction and increased revenue opportunities. We have segregated these potential benefits into four categories below and discuss them in detail.

Customer Experience

It is well understood that retaining a customer and enhancing the customer experience provides more revenue potential than acquiring a new customer. In this context, CSPs generate multiple streams of customer data from functions such as CRM and billing. Gartner³ predicts that by utilizing such customer data to enhance

 Customer Experience	 IT/Network Optimization	 Revenue Improvement	 New Revenue Streams
Customer Retention	Data value Assessment	Cross Sell/Up Sell	Data Monetization
Call center /Self care efficiency	IT/Network Asset Optimization	Real-time offers	Location based Ads
Proactive Customer Care	Network Service Assurance	Marketing campaigns	B2B partnerships
Perception Management	Intelligent wifi offload	Real time fraud detection	Internet of Things

the overall customer experience would potentially generate US\$300 million yearly in additional margins for an average CSP.

Some over-the-top (OTT) service providers are already adopting Big Data solutions to differentiate themselves from CSPs and offer an appealing customer experience. As a result, CSPs need to take advantage of existing data assets in their systems such as information on monthly spend, network use,

customer history, location, and content accessed in order to gain a better understanding of their customers and improve the customer experience. This could lead to benefits such as reduced churn through better segmentation of subscribers; targeted marketing spend based on actionable insights to predict churn; anticipation of a customer's complaint and timely intervention to transform it into a positive experience. Further, Big Data can also be used to reduce dependence on human intervention: for example, issuing automatic rebates for service quality issues; deflecting calls away from call-centers to other customer service channels; providing automated alarms for customer care agents to join Facebook or Twitter when a major customer experience issue surfaces; and providing automated key word finding.

³ Gartner, "Market Insight: Calculating the Value of CSP Customer Data"

IT/Network Optimization

The proliferation of smartphones and other mobile devices, with increasing demand for video and audio services, requires CSPs to enhance their network infrastructure to prevent network outages or declining service quality. It is then essential to analyze how, when and with what purpose mobile devices are used by millions of customers on a daily basis.

Big Data solutions can identify pain points and potentially vulnerable areas in a CSP's network infrastructure and help to streamline it and make it more efficient. At the corporate level, such solutions can help executives to make effective and targeted capex investments in their networks. For example, optimizing cell site investment based on a "customer value to connectivity index", or deployments of Wi-Fi offload across the customer base to balance network traffic while enhancing the customer experience. At an operational level, data insights can help to automatically trigger technical services, such as indicating that a switch will fall soon; informing and incentivizing customers to use devices and the network at certain times during the day; and avoiding particular types of bandwidth-consuming activity. It is estimated that some CSPs – using data-driven insights to optimize network infrastructure – have begun to realize substantial cost savings of 10-20%⁴.

Revenue Improvement

There is significant value attached to the "real-time" aspect of Big Data for CSPs, given the necessity for contextual real-time analysis required for location-based services, intelligent marketing campaigns, next best actions and fraud detection. Real-time information analysis offers rich and accurate understanding of a customer's needs and the ability to segment users on an individual basis. Such improved segmentation helps marketing teams to deliver more targeted and efficient campaigns and roll out new products and services. In addition, marketing managers can be provided with the most recent information about which services are more profitable, the impact of competitive offerings, and cannibalization caused by new service launches – thus increasing the revenue potential of CSPs.

The real-time aspect not only helps in improving revenues but also plays a vital role in mitigating potential revenue losses due to fraudulent activities, such as the use of cloned SIM cards. Fraud detection is estimated to deliver cost savings of US\$12 billion⁵ per year for CSPs. Real-time fraud detection can be carried out by analyzing large volumes of high velocity data and scoring and rating them according to the probability of actions being fraudulent, helping CSPs to act quickly to identify and prevent unauthorized use.

New Revenue Streams

The widespread use of Information, Communication and Technology (ICT) in today's business world offers a major opportunity for CSPs to monetize their entire ecosystem. In this regard, CSPs are already well placed to bring together industries and customers and act as a medium for information exchange between them. CSPs' data assets carry revenue potential for companies across different sectors, leading to a very real data monetization opportunity. It is estimated that Big Data has the potential to generate US\$10.5 billion of new revenue per year.⁶ One source of this could be through data insights based on anonymized or personal information that can be used by third parties – in industries such as retail, insurance and real estate – to target relevant subscribers with promotions, for example.

Similarly, there is an opportunity for CSPs to differentiate themselves from their competitors by focusing on the proliferation of connected devices and the Internet

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4 Economic Times, "Big Data generates trio of big opportunities", May 12, 2014

5 Heavy Reading, "Big Data and Advanced Analytics in Telecom: A Multi-Billion Dollar Revenue Opportunity", December 2013

6 Heavy Reading, "Big Data and Advanced Analytics in Telecom: A Multi-Billion Dollar Revenue Opportunity", December 2013

of Things, developments which are rapidly increasing the volume of data generated. The value of such connected devices – used for activities such as setting home appliances or thermostats – is enhanced through the added data insights derived from huge volumes of real-time or near real-time data from billions of end points. CSPs can further expand their role to smart cities, healthcare and other government sectors in both growing and mature markets. For instance, Orange⁷ participated in an experiment called “Traffic Zen” with highway operator Autoroutes du Sud de la France to create traffic forecasts based on data from its mobile network.

Challenges and obstacles in Big Data implementation

Big Data, with the hype around its potential benefits, is restrained by few implementation inhibitors due partly to its early stage nature, and the volume, variety and velocity at which data is acquired and modified. The challenges for CSPs at this stage revolve around the limited maturity of technology, the shortage of skill-sets and the absence of a compelling business case.

Technical Challenges:

- **Volume and Variety:** The advent of LTE/4G mobile networks, coupled with the expanded use of GPS, location-based services, social media and connected devices are all adding to the torrent of data. This volume of data demands operational capabilities with tools for mediating, managing and archiving data within available time frames. The volume of data, emerging from various sources, also comes in myriad formats. For instance, customer feedback is received in high volumes (millions of calls/messages) and a variety of formats (calls, messages and social media). Consolidating such data and analyzing it to derive faster and meaningful insights at an affordable cost is a very real challenge for CSPs.
- **Data Silos:** Each department of a CSP is structured in such a way that the seamless sharing of data, resources and processes are generally not clearly defined. Large CSPs, often organized in different business units and functional departments, create and store data in different “silos”. For example, the network engineering and operations team owns the data pertaining to planning, deployment, equipment inventory, QoS/performance and day-to-day management. These data silos are tactically shared or correlated with customer care departments. A similar situation might arise between the billing and finance team and the department responsible for networks. All of this adds to the challenge of consolidating data in order to obtain a holistic view of the situation.

Skills/Expertise Challenges:

- **Shortage of Skill-sets:** Big Data, because it is a relatively recent concept, requires a strong understanding of new tools and technologies, such as Hadoop, in order to harness the full potential. This includes the need for

⁷ IBM, “Analytics: Real-world use of Big Data in telecommunications”, April 2013

expertise to implement and evaluate technologies; quantitative and visualization expertise to carry out advanced analytics; and the skills to make those insights actionable. This has led to a high demand for suitably skilled workers. Once CSPs decide to run pilots for a specific business challenge, they are likely to find it difficult to scale up due to the paucity of suitably trained workers

- **Lack of Integrated Solutions:** The deployment of Big Data solutions requires a lot of pieces to be configured, and currently there is no single vendor offering all the necessary tools as one holistic solution. This has created the challenge of putting together a variety of solutions across Big Data structures, data models and event processing tools that lead to usable outcomes. Further, the frequent introduction of technologies for Big Data deployment, from both start-ups and established vendors, compounds the challenge of finding the right fit.

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Business Challenges:

- **Legal and Compliance:** Telecom systems, applications and databases contain a huge amount of critical customer data. This data should be governed as stipulated by local regulatory bodies in different countries and inter-connection agreements between different CSPs.
- **Excessive Monetization of Data:** CSPs are likely to be tested in their efforts to strike a balance between profit and customer privacy. Personal information streams – such as a user’s location data, device, content accessed or app used – running through CSPs’ networks are not always owned by them, and their legitimate use entails opt-in from subscribers. If customers’ data privacy rights are negatively impacted by CSPs’ data monetization ambitions it may negate the potential benefits of Big Data. Rising privacy concerns have forced Apple⁸, for example, to make sure that its apps obtain explicit permission from users before accessing contacts, calendars and other personal information from iOS 6 onwards.
- **Calculating ROI on Big Data:** Presently, a lot of discovery and experimentation is taking place to determine – patterns which matter and insights which can add value – the possible business benefits promised by Big Data for CSPs. Given this scenario, it is challenging to showcase the potential value of Big Data with a compelling business case to justify investments. Therefore, the top management at CSPs – already struggling with slowing revenue growth and increasing demand for capex for 4G/LTE networks – will have little appetite for such investments without measurable benefits. In this context, it is noticeable that only a few CSPs have reported economic and competitive advantages from Big Data, making other CSPs anxious about the returns promised from Big Data investments.

CSPs that have added value through the implementation of Big Data projects have often addressed the challenges discussed above at the pilot stage. Also, such projects are generally initiated by a particular Business Unit (BU) to depict small but strategic use cases, while other BUs are advised to observe and support a particular BU’s endeavors towards Big Data. This offers a learning curve, for different BUs and also for the CSP as a whole, to evade similar challenges in future.

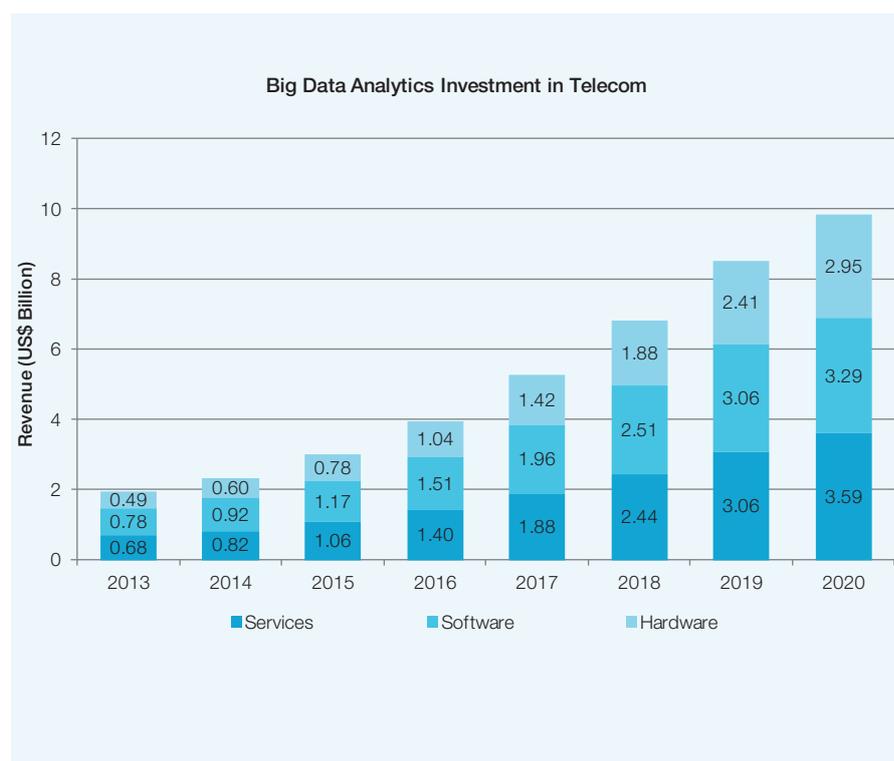
8 www.tekrevue.com, “iOS 8 Introduces New Location Permissions for Apps”, June 2014

How CSPs exploit Big Data

CSPs' aim in implementing Big Data solutions is to meet their business objectives of improved customer experience, network optimization and data monetization. Realizing the potential role that can be played by Big Data, CSPs are expected to increase their investments in analytics solutions at a CAGR of 26% between 2013 and 2020 to reach a total of US\$9.8 billion⁹ (see chart below).

CSPs have utilized various analytics-based tools for the past several years. However, these solutions have been restricted to simple forms of analysis based on excel spreadsheets and on relational databases with predetermined data structures. It is important to note that most companies, including CSPs, have adopted a data-warehousing approach to analytics where all data is captured and then mined for insights. With this approach, CSPs could take months to collate data from different sources and extract intelligence from that information. This usually would mean that the action taken by the executives would inevitably be delayed and may not be relevant at a later time.

To add to the complexity of data analysis, most of the new sources of data – such as from wireless devices, social media interactions, and embedded sensors – are fundamentally different from the type of data stored in standard data warehouses. Big Data solutions have developed over time with in-memory computing and tools like Hadoop to address the challenges posed by these data sources. Through the use of advanced solutions and tools, CSPs have drastically brought the analysis time down to a few weeks or even days.



⁹ Heavy Reading, "Big Data and Advanced Analytics in Telecom: A Multi-Billion Dollar Revenue Opportunity", December 2013

CSPs are implementing analytics to address issues ranging from customer churn, segmentation, fraud identification, pricing, network management, and sentiment analysis. For instance, Philippines operator Globe Telecom has used Big Data analytics to improve the effectiveness of promotions by 600%, thereby reducing customer churn. It has managed to drastically cut the time required to create new services from about 10 months to less than a week,¹⁰ enabling it to offer several promotions per week. Meanwhile Pakistan operator Ufone has deployed Big Data analytics to improve marketing offer acceptance rates from 25% to 50%.

Celcom, in Malaysia, upgraded its BSS systems and is collecting data from multiple channels and customer touch-points to create a 360-degree view of the customer. Using Big Data tools, Celcom customizes its promotional offers in real time to fit a customer's individual history and lifecycle.¹¹

Big Data analytics is also helping CSPs to develop their advertising campaigns. For instance, AT&T's in-house data scientists used Big Data analysis to identify what works and what doesn't in their ads and those of competitors.¹² By coding commercials for such things as the type of humor, storyline and so on, AT&T was able to identify the specific characteristics of an ad that propelled customers to buy a product. With 25% of AT&T's total sales driven by media advertising and 10% from TV alone, the US operator has benefited greatly from this approach.

Some leading CSPs have created alternate revenue models by monetizing the customer data they own. Telefónica Dynamic Insights¹³ collects and sells anonymous

- 10 IBM Case Study
- 11 Oracle Case Study
- 12 Advertising Age, "How Big Data Shapes AT&T's Advertising Creative", 25 March 2014
- 13 Company Website



and aggregated mobile customer data to companies across other industries that can leverage it to offer customized products. Telefonica's Smart Steps product uses fully anonymous and aggregated mobile network data to enable companies and public sector organizations to measure, compare, and understand what factors influence people visiting a location at any time. Likewise, Smart Steps offers similar anonymous and aggregated customer data that is relevant to organizations across the retail, transport, property, leisure and media sectors.

Similarly, Verizon Wireless' Precision Market Insights¹⁴ helps mobile advertisers to reach qualified consumers on their personal mobile devices using data they have collated about these consumers and their mobile use. For example, 1-800-FLOWERS.COM used the data to target male Android users between the ages of 25 and 44 with a Valentine's Day offer. Other Verizon Wireless programs offer marketers anonymous and aggregated reports; targeted advertising based on geography, demographics, and Verizon products and services; and subject to customers' opt-ins, targeted advertising based on location, demographics and call trends, as well as opt-in clickstream and application use.

- 14 Company Website
- 15 The Economist, "Data, data everywhere", February 25, 2010
- 16 SAS Customer Successes
- 17 Company website

How are other industries using Big Data?

Industries such as retail, financial services and airlines have implemented analytics solutions for a long time to address their industry-specific challenges. Over the years, they have refined those solutions to incorporate Big Data tools, which can predict outcomes with a greater accuracy. CSPs should plan to implement the best practices and solutions of other industries to tackle their own business challenges.

In the retail industry, companies operate on low margins while catering to a large subscriber base with different needs. Analytics helps large retailers to efficiently handle supply chains while meeting subscriber needs. For instance, Wal-Mart handles more than 1 million customer transactions every hour, storing nearly 2.5 petabytes of data¹⁵. Wal-Mart uses "Retail Link", a proprietary system to track and store all point of sales data for the company that is made available to all its suppliers. This ensures data integrity and a uniform data format for Wal-Mart, which the company can easily use to analyze large sets of data. Wal-Mart collects information about every customer transaction and applies analytics to understand customer behavior, and then predicts their responses to changes in offerings on a regional basis and stocks its branch locations accordingly.

In the airline industry, ensuring that flights are on time not only increases customer satisfaction and loyalty, but also reduces operational costs. To ensure on-time performance, the airline has to maintain optimum crew numbers while also taking into account the regulatory requirement of maximum continuous flying hours. A case in point is America West Airlines, which used analytics to predict reserve crew requirements, staffing requirements and to manage training to avoid overstaffing. All this has led to zero cancellations attributed to crew issues¹⁶. The company also managed to cut down its operating costs because of analytics.

In the financial services industry, banks are susceptible to various types of frauds and rogue transactions. Frauds also affect the profitability and other ratios of a bank. In this context, HSBC¹⁷ is an example of an organization that uses analytics to detect possible fraudulent transactions across its banking channels and prevent them before they occur. HSBC monitors customer transactions across all its channels, and with analytics integrates them into one single customer view to reduce frauds.

Recommendations for CSPs

No single approach to Big Data will suit CSPs across the entire industry. Rather, a successful Big Data strategy depends greatly on the objectives set and how they are executed. In addition, the implementation cannot be just about Big Data technology deployment, but must also be about setting priorities and necessary outcomes. It is worth highlighting that implementation of Big Data solutions must, in most cases, be a “brownfield project” and not a complete replacement of existing legacy systems. This implies that legacy systems and new tools have to coexist and evolve in an incremental fashion, as CSPs experiment and figure out how data is organized and used from multiple systems and silos. In line with this, and to ensure the feasibility of the Big Data strategy, it is best to engage in proof-of-concepts and pilots on some selected use cases/solutions.

The relatively fragmented Big Data solutions market means that the evolution of the value chain is still unclear, and it is in the interest of CSPs to opt for partnerships. In the near term, CSPs can partner with consulting firms which have business intelligence tool specialists, and system integrators with pockets of advanced analytic talent to get a head start on their Big Data implementation plan.

CSPs’ ultimate objective from the Big Data paradigm – to gather every bit of information available for a holistic view of all interactions of every individual – can be achieved by learning from the Big Data practices of companies such as Google and Facebook. These OTT service providers have best utilized Big Data solutions to date, with data being the principal factor for every decision, strategic or otherwise, that they make.

Below is a recommendations map, based on the potential benefits of Big Data for different categories of CSPs.



Focus Areas	Big Data Analytics Recommendations (type of projects)	Industry Mapping			
		Tier 1 CSP	Tier 2&3 CSP	MVNO	MSO/IPTV
Customer Experience Management	Integrate data silos across different business units (comprising customer demography, behaviors, NPS scores, customer segmentations, aggregation of network performance/utilization data). The shared goals and vision, across business units, are achieved if the integration strategy encompasses data available from all the elements in a common sustainable platform				
	Partnering with OTT for content and revenue sharing (eg: Netflix or Hulu), based on customer viewership patterns and social media sentiments. The partnership would help in customer retention, as offers will be personalized based on customer engagements with different OTT services				
	Leverage Social CRM analytics to increase brand value and customer NPS				
	Content analytics - from internal websites, set-top box and social media data – to increase customer satisfaction				
Network/IT Optimization	Evaluate data assets across systems /applications / platforms to build offload strategy to Big Data platform (eg: Hadoop)				
	Leverage "As a service" platforms like "Analytics as a service" on cloud infra to gain business agility as well as to reduce the cost of building and retaining in-house BI capabilities				
	Predictive analysis of end-to-end network data for network upgrades, new roll outs and network sharing partnership (eg: Base station sharing). The average revenue per cell vs average cost per cell is one of the key factors used as key parameters for network optimization				
Revenue Improvement	In post-paid markets, revenue (ARPU) improvement potential lies in leveraging the customer engagement history, social media analytics and influence analysis to roll-out timely personalized offers				
	In pre-paid centric markets, opportunity lies in gaining insights about floating population such as frequent flyers. In addition, understanding usage patterns of "customers re-charging frequently" will help in floating real-time offers				
	Integrate video usage data with the customer demography and network performance, which would ensure improvement of customer experience by up-sell and cross-sell in near real time				
New Revenue Streams	Lawful data sharing with cross industries - Airlines, Retail and Utility – for revenue-based incentives				

Conclusion

The increasing amount of data stored in the IT systems and networks of CSPs offers extremely rich material that could transform competitive challenges into opportunities and create a real differentiator. Looking at the Gartner Hype Cycle, which is consistent with what we see and the feedback we get from most of the clients we have workshops with, we believe that CSPs still have to work out their Big Data strategy in areas such as building business cases, prioritizing use cases, and assessing benefits and challenges. When it comes to Big Data strategies, CSPs are still a long way from reaching maturity.

CSPs need to be cognizant of the fact that business value is not in data (flowing-in), but in the results emerging from such data. Also, it is important to note that deployment of Big Data analytics do not offer straightforward answers to business questions. CSPs need to devise a strategy and implementation plan that is agile and iterative. We expect, for most of the CSPs, that this will be the plan for the next couple of years. Therefore, while the industry still needs to reach maturity, when implementation does take off Big Data analytics solutions will provide strong differentiators for players in the telecom industry. CSPs must act now to be battle-ready for such a race.

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