

WHITE PAPER

Next-Gen Data Analytics for Telcos of the Future



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Next-Gen Data Analytics for Telcos of the Future

Digital revolution and transformation may be novelties for many industries, but telecom has always been about anticipating what's next in the digital evolution ever since Alexander Graham Bell invented the telephone.

In the 1960s and 1970s, telecommunications service providers used celluloid photographic equipment to capture the images of analogue subscriber meters at the telephone exchanges as part of their quarterly billing function. Today, the same telephone exchanges are becoming multi-access edge computing (MEC) sites that provide opportunities for partnering with leading cloud providers like AWS, Azure, and Google Cloud to offer many next-generation services for vertical industries and consumers.

Similarly, today's telco customers use the embedded camera in their smartphone to capture events and share them instantly across their social network in any part of the world. The smartphone is also used as a multi-function payment device to buy almost anything – all at consumers' fingertips with everything made possible by a complex web of WiFi, fiber broadband, and 3G, 4G, and 5G communication networks built and managed by communication service providers (CSP).

These CSPs have a "next generation" mindset that makes it possible for everyone to enjoy the convenience and ease of use of telecommunications to make life smoother and frictionless without even having to think about it!

Improving Quality of Work and Life with 5G

Quality of life benefits are only going to get better as 5G accelerates the way we live, work, and play. Be it autonomous driving, smart city road transport optimization, or remote surgery, 5G will connect everyone with everything around us by transforming how transportation, healthcare, manufacturing, and other industries operate to make everything smarter and safer.

The next level of digitalization will require the next generation of machine learning, artificial intelligence (AI), and hyperscale data management capabilities. This will place greater demands on the chief technology officers (CTOs) of CSPs to efficiently and cost effectively manage the transition from 3G and 4G to 5G.

For instance, it is sensational to know that 5G can deliver high speeds of 1 Gbps, but that alone is not enough for a surgeon operating on a patient remotely who cannot afford to have the “dropped call” and “video buffering” syndromes of yester-year generations of mobile networks.

Surgeons and other professionals need the assurance of an ultra-reliable network and very low latency to ensure there is no delay in the transmission or loss of video images. Industries will place additional demands on 5G. For example, autonomous cars on the road will put pressure on 5G with demands for intelligent transport systems with millions of sensors continually transmitting data at short intervals. A consistent quality of service and enabling reliable customer network experiences are essential.

Next for Telcos of the Future: Data Analytics at Hyperscale

Telco CTOs have the challenge of identifying where to put the next 5G cell site that makes economic sense. This requires effective capital expenditure (CapEx) spend that needs to be aligned with revenue growth and the assurance that revenue will not be impacted by customer attrition due to a poor experience.

CTOs are looking beyond traditional radio network engineering planning to integrate customers’ perceptual experience. These CTOs know that the mass mobility of today’s customers can put pressure on cell site signals in unpredictable ways, which can impact quality of service and customer experiences. Cell site capacity planning based on population demography alone is no longer enough. As a result, CTOs are resorting to machine learning algorithms for help.

In addition, CFOs want to ensure that shareholders’ funds are well invested. They are looking at value-based mobile network capacity planning that considers decommissioning previous-generation networks and commissioning next-generation networks with an assurance of retained revenue growth. As part of their planning, CFOs are asking their chief marketing officer (CMO) counterparts how the new investment in networks is resulting in an improved Net Promoter Score (NPS). They’re also asking if customers are getting superior experiences and if customers are satisfied with those experiences.



Figure 1: A data analytics-driven approach empowers every part of the CSP organization

Evolving 3G and 4G networks toward 5G by connecting everyone with everything requires “outside in” thinking and planning. It involves connected data, connected analytics, and connected processes that seamlessly empower every part of the CSP organization (Figure 1). Network planners can then optimize the placement of 5G cell sites by factoring in customer needs. Optimal placement helps the VP of Customer Experience drive better experiences and higher NPS scores.

This approach also allows financial controllers to approve CapEx spending that is aligned with revenue growth. The VP of Services Strategy benefits by developing new offerings with guaranteed quality of service. Offerings can be tailored for a single customer, which is where Teradata Vantage™ can help.

As the connected multi-cloud data platform for enterprise analytics, Vantage empowers companies to perform trillions of interactions per month, more than 100 million queries per day, and target a customer segment of one using prescriptive analytics. Managing customers as a segment of one across the enterprise helps ensure the growth and lifetime value of customers. Welcome to the telco of the future with Teradata Vantage hyperscale data analytics!

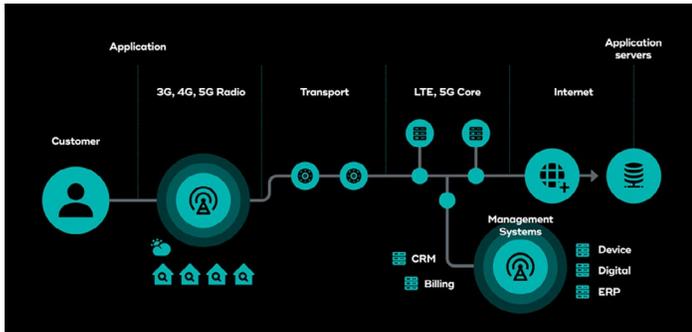


Figure 2: Vantage helps orchestrate end-to-end data analytics and business processes at hyperscale

Vantage enables CSPs to orchestrate end-to-end data analytics and business processes at hyperscale (Figure 2). Data analytics orchestration helps CSPs overcome the many challenges of planning increasingly complex mobile networks. With Vantage, CSPs can analyze existing data, including network coverage maps, triangulated signals, “control plane,” and “user plane” event logs.

CSPs can also analyze customer data, billing transactions, contact center and digital event logs, and more. Vantage runs advanced algorithms on the data, such as geospatial and 4D analytics, time series, K-means, SAX, and statistical prediction models to uncover new insights.

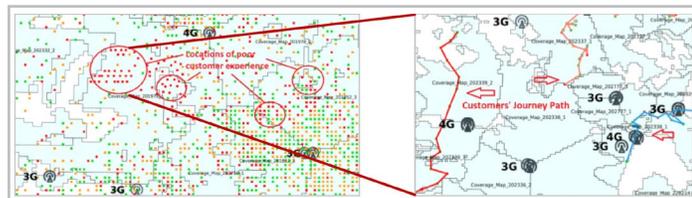


Figure 3: Vantage geospatial analytics helps to identify locations of mobile network problems along customers' everyday commute

Leveraging the Power of Vantage for Network Planners

Mobile network planning engineers in the CTO’s office use network coverage map and expansion plans by relying on static population, demography, topography, and drive tests. However, planning engineers also realize that customer density in a location in any given hour is unpredictable due to the varying dynamics of the mobile population. Vantage uses advanced geospatial analytics to leverage customer mobility and behavioral experience data to predict where to put the next cell site.

The day in the life of a network planner starts with using geospatial analytics to visualize network coverage maps and cell site location maps from Pitney Bowes/ESRI ArcGIS loaded in Vantage. Then network planners overlay a complex series of triangulated signal strengths, such as reference signal received power (RSRP), at GPS-like locations available in Vantage. The triangulated signaling data shown as a heatmap represents with four, three, two, one, or zero bars on customers’ smartphones, which indicate likely problems with network connection (Figure 3).

For CSPs that do not collect triangulated signals due to the high CapEx and operating expense (OpEx) investments needed for implementation and data collections using the technologies provided by Actix, NetMax et al., Teradata provides accurate predictions of such triangulated signal locations that could be used as an alternative.

Vantage helps network planners understand areas of the network coverage map where customers are receiving a poor signal, leading to loss of network connection. The insights also provide an opportunity to plan for locations where new cell sites could be deployed.

To develop a business case for additional investments, network planners must determine the root cause of any problems at precise locations along customer journey paths through a CSP’s network of cell sites. This requires working with network operations teams.

Providing Answers into Network Operations

Network planners work with their network operations counterparts to analyze network passive probe data from the control plane and the user plane. The signaling data generated by systems such as Tektronics and NetScout can be made accessible in Vantage.

For a CSP with 30 million customers, this can be many terabytes of data volume per day that can reside in Native Object Store (NOS) in the cloud or a data lake. Teradata QueryGrid makes the analyses efficient without the need to move the data in and out of NOS or the data lake. Eliminating the need to move data reduces the cost of data management while increasing the value of analyses by providing new insights from integrated data.

Integrating the passive network probe data and performing analytics provides the network operations team with insights on customers' perceptual experience. The experience can be shaped by the demands of specific smartphone apps and continual transition between 5G, 4G, and 3G cell sites and the varying bandwidth capabilities of each generation's mobile network.

Vantage can help identify what affects customer experiences. For example, further analyses of root cause failure data in Vantage can allow the network operations team to discover that the customer's poor experience was caused by mobility related congestion and network failure.

The network operations team can also identify if "handover impossible," "signal transport resource failure," and "network optimization" were further causes of failure (Figure 4).

Additionally, Teradata path analyses provides a sequence view of network events that lead to failures. This is extremely useful to predict failure events before they occur so remedial actions can be taken (Figure 5).

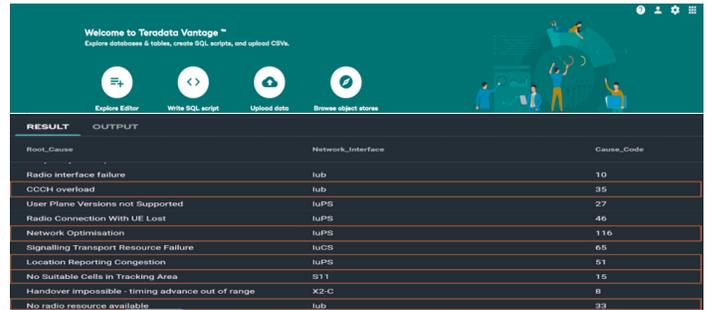


Figure 4: Analyzing root causes of network failures in Vantage

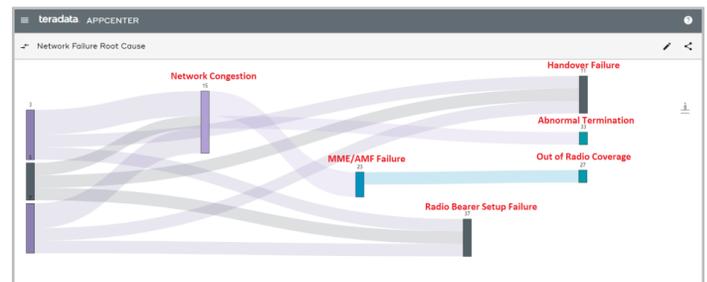


Figure 5: Path analytics helps to take preventive action before network failures

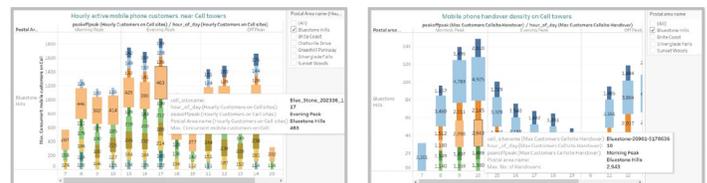


Figure 6: Vantage predictive analytics tracks dynamic changes and saturation levels in the mobile network

Vantage Analytics for Network Management

While root cause analyses of network failures are very useful, network operations teams may still be unsure which cell sites are prone to failures. To get the answers they need, these teams can utilize Vantage time series analytics and statistical models. This enables the teams to analyze control plane signalling data for cell handovers, connection requests to determine morning peak, and evening peak and off-peak hourly density of customers for each cell site in postal areas and economic zones to determine if cell sites are reaching saturation levels (Figure 6).

The information enables intelligent planning for upgrades, decommissioning, and replacement with next-generation cell towers.

Network teams don't stop there in their analyses. They use Vantage for machine learning algorithms such as K-means to predict all other cell sites that exhibit similar signalling traffic and mobility characteristics to prevent failures before they occur.

New Levels of Insight for Financial Controllers

Armed with root cause analyses of network failures along with a list of cell sites from the network operations team, network planners determine a plan for upgrades, decommissioning, and replacements with next-generation cell towers. But they need to work with financial controllers from the CFO office to build a business case comparing various options for blanket upgrades, capacity-based upgrades, and value-based upgrades (Figure 7).

For financial controllers, workflows and the rules engine in Vantage Analyst provide new levels of visibility and insights (Figure 8). For example, the controller can see that more than 63% of "data starved" customers with 4G smartphones were frequently assigned to 2G or 3G cell sites with lower data speeds, which led to lost revenue.

This insight underpins a strategy for decommissioning or re-farming 2G and 3G in favor of spectrum-efficient 4G and 5G NR technologies. The strategy allowed one CSP to grow retained revenue to \$13.9 million from newly satisfied customers.

Meanwhile, the VP for Customer Experience routinely tracks customer satisfaction and NPS to determine if the network investments approved by the CFO's office and the network upgrade provided by the CTO's office are resulting in customer loyalty and lifetime value growth indicated by improvements in NPS (Figure 9).

Option - 1: Blanket upgrade versus Value based network upgrade

Mobile Network Type	% of NextGen Devices*	Blanket Upgrade Cost	Value-based Upgrade cost	Cashflow Improvement	3-year Savings
2G-2.5G	71%	\$937,739	\$909,959	\$27,780	\$83,340
3G HSDPA	63%	\$6,739,339	\$56,431,493	\$307,846	\$923,538
4G	3%	\$6,068,528	\$5,543,165	\$525,363	\$1,576,089
4G LTE-A - 5G NSA	2%	\$6,571,445	\$5,823,679	\$747,766	\$2,243,298
Grand Total	Null	\$20,317,051	\$18,708,296	\$1,608,755	\$4,826,265

Figure 7: Vantage Analyst enables financial modeling of network upgrade options

Option - 2: Capacity based versus Value based network upgrade

Mobile Network Type	% of NextGen Devices*	Capacity-based Upgrade cost	Value-based Upgrade cost	Opportunity Cost*	3-year Savings	Action
2G-2.5G	71%	\$587,342	\$909,959	\$322,617	\$96,7851	Decommission 2G & upgrade to 4G
3G HSDPA	63%	\$4,687,031	\$6,431,493	\$1,744,462	\$5,233,386	Progressively upgrade to 4G
4G	3%	\$3,998,256	\$5,543,165	\$1,544,909	\$4,634,727	Progressively upgrade to 5G NSA
4G LTE-A - 5G NSA	2%	\$4,776,771	\$5,823,679	\$1,046,908	\$3,140,724	Opportunistically upgrade to 5G NR SA
Grand Total		\$14,049,400	\$18,708,296	\$4,658,896	\$13,976,688	

Figure 8: Vantage Analyst provides new insights in network upgrade/ decommissioning decisions



Figure 9: Tracking Net Promoter Score (NPS)

Predictive Network Maintenance Made Simple

Predictive maintenance of capital-intensive communication networks allows the maintenance team to fix problems early and save money by preventing failures, leading to better customer experiences. Vantage enables network maintenance teams to regularly review the performance metrics of 4G (LTE) and 5G networks to ensure network evolution is progressing as planned.

Network maintenance teams monitor the 4G to 5G handovers and various quality of services (QoS) parameters, 5G new radio (NR) beamforming, and network slicing to plan for preventive and predictive maintenance requirements of the network (Figure 10). The monitoring helps ensure faults are fixed before they occur to ensure a consistent customer experience.

Vantage advanced time series analytics such as SAX help the network team and data scientists compress massive volumes of the performance data residing in the cloud as NOS. Vantage seamlessly connects and performs these analyses in-database without the friction of data movement.

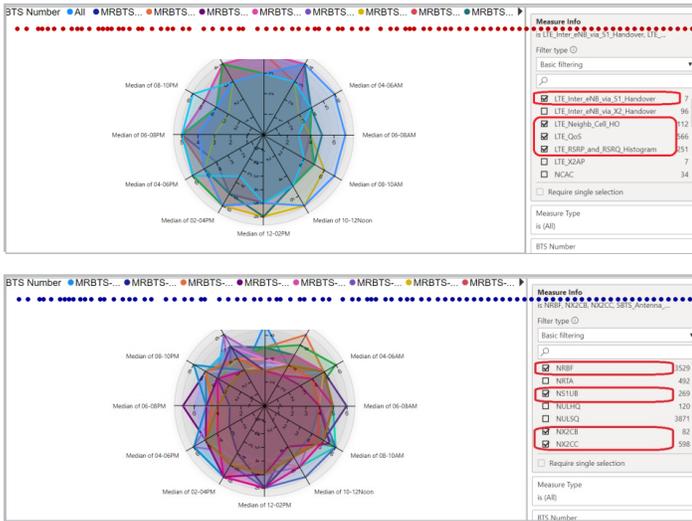


Figure 10: Predictive network maintenance

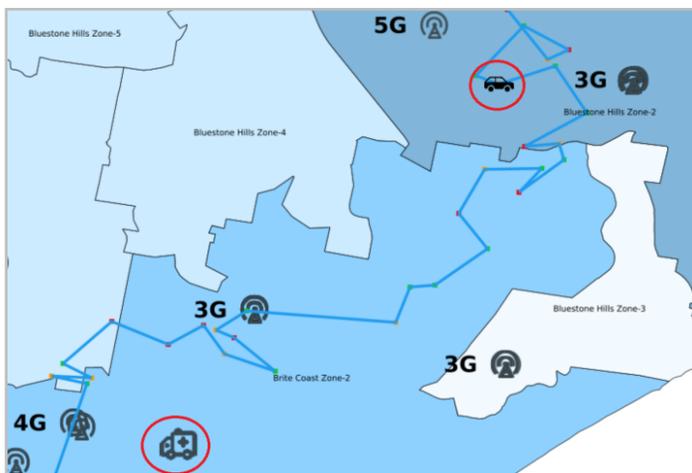


Figure 11: Vantage 4D Analytics

Streamlining Service Strategy and Product Management

Network slicing in 5G is a new virtualized network capability on the same physical network infrastructure that is designed to efficiently embrace a plethora of services such as autonomous driving. It has very different service level requirements on independent logical networks.

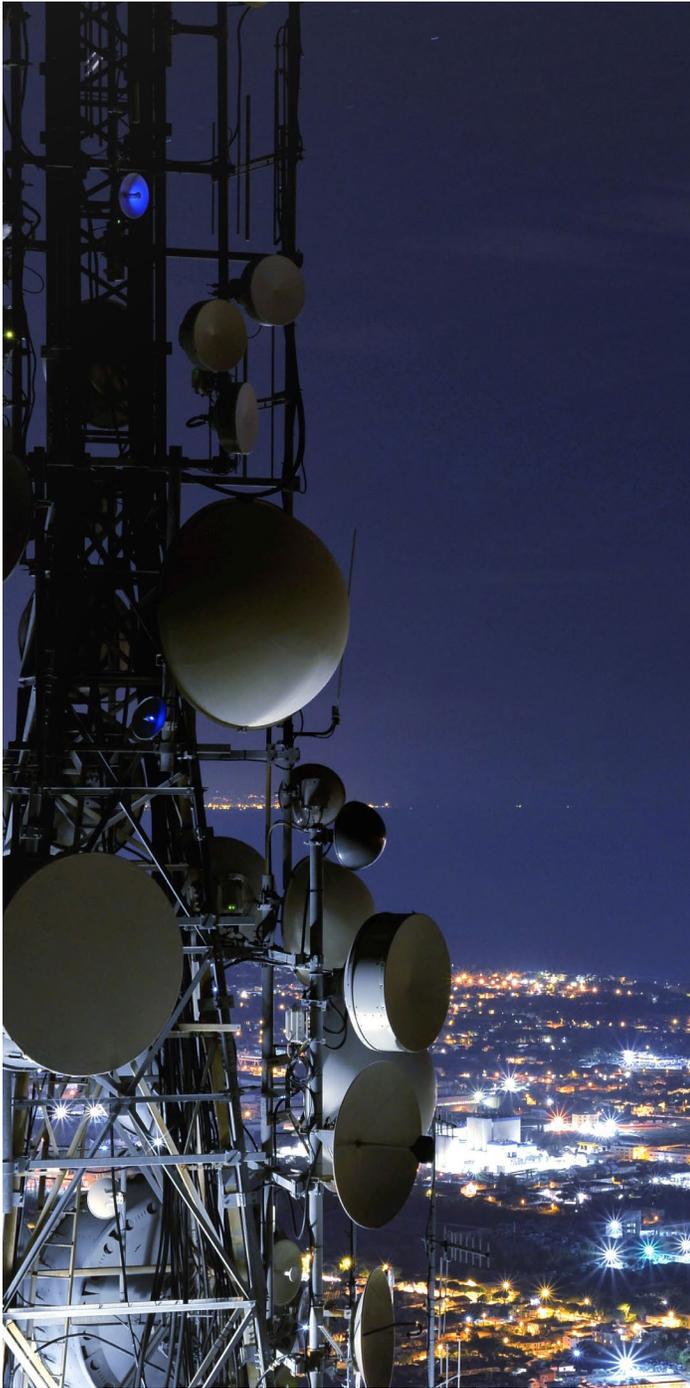
The VP for Service Strategy and Product Management looks to leverage such network performance capability for 5G network slicing when it is fully implemented. Vantage 4D analytics is exactly the kind of advanced analytical solution that meets such this need (Figure 11).

The 4D analytics combine geospatial and time series data to estimate the speed of travel for customers to infer mode of transport and direction of travel. This helps anticipate and predict any likely cell site congestion ahead of the customer arriving near the next cell site location. Telcos can use the insights to reserve the required network resources to meet QoS commitments.

Teradata Vantage Empowers Telcos of the Future

Telcos of the future will require sophisticated data and analytics beyond today's single purpose vendors. Only Vantage can orchestrate all of a telco's data at scale, run thousands of analytics concurrently, serve all parts of the business from one integrated solution, and create a single source of truth to help roll out 5G networks and services.

Successful and forward-thinking CSPs have already begun this transformative journey and are in the midst of reorganizing their businesses. They are actively planning to incorporate the next generation of data analytics and have begun their courtship with leading vertical industry business partners and consumers. Many of these companies have partnered with Teradata to optimize the connected multi-cloud data platform for enterprise analytics and to integrate enterprise-wide operations for next-generation data analytics. These CSPs are seeing significant decreases in costs and increases in savings.



About the Author

Sundara Raman has been a telecom industry professional for more than 35 years with a wide range of experience in product management, solution marketing, presales for new generation networks and services, information management strategy, data analytics, and enterprise architecture development.

At Teradata, Sundara focuses on business and technology consulting to enable telecom customers and prospects to achieve business outcomes and value through data analytics. Sundara has a Master's Degree in Business and Administration with research on the economic value of information from Massey University, New Zealand. Sundara has been living in Sydney, Australia for many years. Sundara is an inventor and Australian patent holder for an expert system in cognitive mental health that applies machine learning algorithms.

About Teradata

Teradata is the connected multi-cloud data platform company. Our enterprise analytics solve business challenges from start to scale. Only Teradata gives you the flexibility to handle the massive and mixed data workloads of the future, today. The Teradata Vantage architecture is cloud native, delivered as-a-service, and built on an open ecosystem. These design features make Vantage the ideal platform to optimize price performance in a multi-cloud environment. Learn more at [Teradata.com](https://www.teradata.com).