

# MongoDB for Telecommunications

Telecommunications resiliency in the new data  
age: digital transformation and cost optimization

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# Executive Summary and Industry Overview

After the pandemic changed the world into a virtual-first community with total digital connection, the telecommunications industry is continuing down a familiar path of uncertainty.

How does the industry that holds the key to global human connection walk the delicate tightrope between taking innovative risks to modernize,

while also delivering flawless connection to customers that are constantly consuming more data and services?

## Shifting Consumer Trends in Telecommunications

The global telecommunications industry made monumental strides after facing redefining challenges in 2020. Cellular and mobile communications were crucial to connect communities as in-person interaction was limited by global health restrictions. Telecommunications firms around the world succeeded in meeting the surge in connectivity demand without significant added costs to customers.

The increases in U.S. consumer broadband demand brought on increased capital expenditures from providers; both AT&T and Verizon boosted year-over-year spending by

21% in 2021, according to research prepared by Forrester Research, Inc. In Europe, after a tough year of decline in demand for telecommunications services in 2021, the trend is expected to reverse this year to grow 0.7%, according to Forrester.

Fresh demand is on the way, too. One in three U.S. businesses will boost telecommunications spending in the next two years, according to Forrester's research. A robust platform-based approach to digital transformation will open doors to smoother modernization processes and digital services go-to-market strategy.

# Redefining Communications Service Providers

Telecommunications providers are also busy investing in new services for consumers that are hoped to provide a bigger return on investment than traditional connectivity services.

The shift from identifying as a communications service provider (CSP) to a comprehensive digital services provider (DSP) requires global telecommunications companies to rethink monetization strategy.

Even before the pandemic, an evolution was well underway for telecommunications providers that shifted from a traditional service delivery model to a digital services-focused model offering networks, apps, streaming services, and retail. Now, telecommunications providers are delving into complex technologies. The continued stress on

networks and BSS infrastructure demands attention to aging IT infrastructure, particularly as firms aim to tap into new revenue streams like 5G edge services, IoT as a service, and VR/AR technologies.

From 2010 to 2020, overall revenue coming from connectivity services grew by only 2%, according to [research](#) compiled by Kearney. Throughout the same period, digital services experienced a five-fold increase.

Although telecommunications providers successfully sparked a revolution that grew into a \$6.3 trillion digital economy, only those capitalizing on digital services reaped the benefits. In 2020, digital services like e-commerce and online advertising surged, capturing nearly 80% of growth.

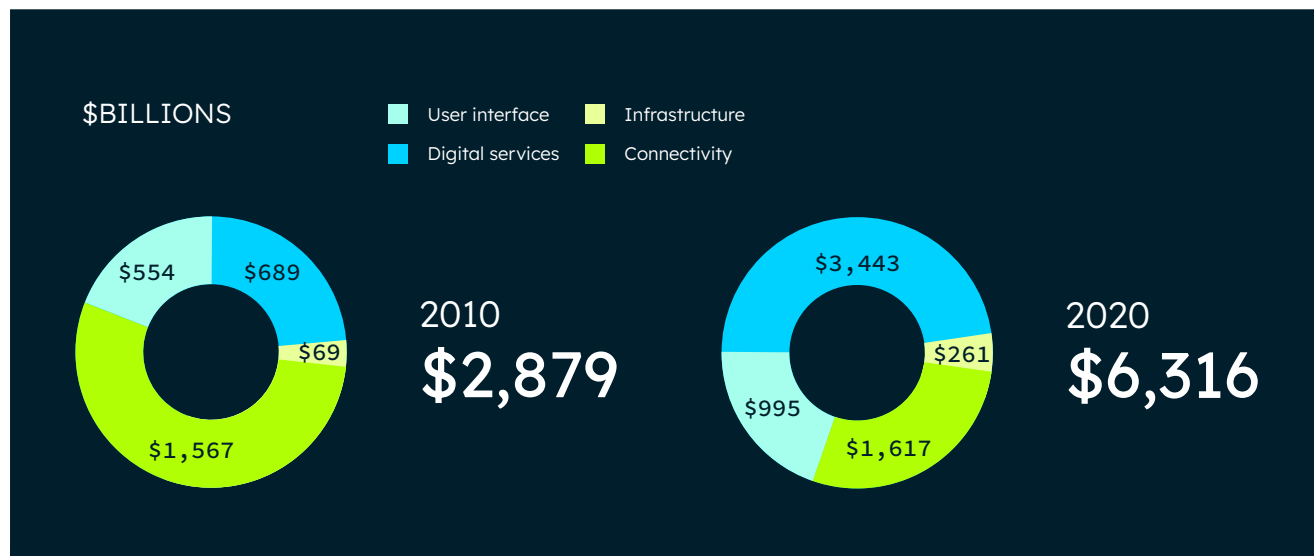


Figure 1: The shifting value chain in telecommunications. Source: Kearney



# Global Telecommunications Spending Trends

Across the world, telecommunications providers will continue to pour spending into the modernization and development of communications equipment. The incentives for increased investment varies by region, and will universally benefit customer connectivity.

In North America, forecasted U.S. business and government spending on communications equipment and network gear surged by 11% to \$143 billion in 2021. Disparities between U.S. rural and urban wireless broadband coverage came to center stage in 2020, sparking new government-supported investments aimed to support wider

4G and 5G infrastructure development from the 2021 [federal stimulus package](#). Spending growth will continue in 2022 at a slower 5% pace to reach \$150 billion in 2022, according to Forrester Research, Inc.

Europe's forecasted communications equipment spending growth is just above the U.S. at 6% in 2022, compared to 1.5% growth in 2021, according to Forrester. Also driven by 5G service rollout acceleration, European firms are spending to avoid falling further behind the U.S. and China. Globally, 5G investment has potential to reach \$250B as [IoT connections tripled](#) in the last five years.

## Opportunities for Telecommunications Modernization

Today, MongoDB sees four key opportunities for the telecommunications industry to enhance technology operations while delivering bigger profits from longer-term modernization projects. Follow our perspective for strategies, use cases and success stories from our partners in four key modernization pillars:

1. 5G including mobile edge computing
2. Network optimization

3. Digital services

4. BSS modernization

The modernization strategies underway at global telecommunications companies are bound to lay the foundation for growth, digital transformation, and thorough revitalization of data exploitation for sales motions, business growth, and customer satisfaction. **We want to help take you there.**



# MongoDB and the Telecommunications Journey

Across the growing telecommunications industry, digital services are disrupting the status quo. Artificial intelligence and IoT applications are reducing costs for businesses, increasing overall customer satisfaction and optimizing IT operations and processes. And as 5G continues to emerge, telecommunications providers are faced with new connectivity challenges and a key opportunity to leverage big data technologies such as AI/ML and advanced analytical capabilities to improve customer experience while at the same time reducing cost.

## 5G and Mobile Edge Computing: Putting Disruptive Technology in the Hands of Innovative Builders

5G expansion plans call for a thorough technology audit and modernization overhaul at many leading communications service providers. Market-disrupting 5G networks are cloud-native, software-defined, and they offer unparalleled flexibility in digital services they can deliver. Within the telecommunication industry, enterprises are discovering that legacy systems and the business support systems, or BSS, are ill-equipped to handle the network demands of 5G. Furthermore, the demands of quickly multiplying data volumes are slowed down significantly by aging systems.

Between 2020 and 2025, global telecommunications operators are expected to invest \$1.1 trillion in their networks, according to research from the GSM Association. Of the \$1.1 trillion, about 80% will be spent on 5G.

If you're planning for 5G expansion, you need a plan to modernize. Here's the perspective of Randeep Singh Sekhon, the CTO of Airtel, one India's largest communication service providers:

"There is serious investment in acquiring platforms ... instead of extracting data through

For telecommunications firms, 5G networks change the value proposition and give traditional service providers an opportunity to compete in the \$6.3 trillion global digital services marketplace.

files, manually crunching data, then doing script files ... you need to APIfy your network, put in a data lake and run your intelligence layers on top," said Randeep Singh Sekhon, Airtel's CTO, in an [interview](#) with FutureNet World. "You cannot run networks with traditional OSS tools and key performance indicators."

As the boundary between the services offered by cloud providers and CSPs [continue to blur](#), into the connectivity services market, the ongoing commoditization of traditional connectivity services will continue to compress margins for CSPs. The digital services that are enabled through 5G network connectivity will thrive in the new telecommunications era, and hold promise to open new revenue streams.

"There is serious investment in acquiring platforms ... instead of extracting data through files, manually crunching data, then doing script files ... you need to APIfy your network, put in a data lake and run your intelligence layers on top."

—RANDEEP SINGH SEKHON, AIRTEL'S CTO



## Mobile edge computing and the cloud computing paradigm

As Industry 4.0 applications become standard, connectivity providers will have to look beyond standalone 5G networks. Next generation telecommunications networks can deliver up to 100x improvements in speed and data throughput, but without optimization, underlying cloud computing environments remain a bottleneck to deliver ultra-low latency.

Herein lies the cloud computing paradigm. Mobile edge computing (MEC) solves the 5G bottleneck by combining the best experiences of hyperscaler compute and storage alongside topological proximity of 5G networks. Through MEC's mode of cloud deployments, firms can run applications within public and private 5G networks through virtual machines, containers, or Kubernetes clusters.

In public MEC deployments, operators leverage the radio access network across a variety of geographies to deliver cloud computing services at the edge of commercial networks. In private MEC deployments, operators leverage the dedicated packet core of the enterprise's private network to co-locate hyperscaler compute and storage to enable a seamless extension of the parent region to the customer premises.

With a robust mobile edge computing portfolio, it's possible to build a unified compute mesh across both the private and public environments, creating a seamless data exchange. The combination of public and private MEC deployments, or hybrid

## Customer Spotlight: Verizon 5G Edge

With Realm, MongoDB Atlas, Device Sync and Wavelength, we are able to automate the delivery of relevant data to the most appropriate edge on demand.

Together with MongoDB, Verizon is delivering solutions that allow application developers to deploy low-latency application and data processing capabilities directly to the 5G network edge while seamlessly connecting to cloud services running in an AWS region.

Low latency functionality is just in reach for applications at the edge of the network by embedding AWS compute and storage services. But without a persistent storage layer to extend beyond the native storage functionality of AWS Wavelength, access to user profile data, product catalogs, IoT telemetry and personalization are sacrificed. With MongoDB Realm at the edge, data is stored, processed and synchronized with a MongoDB Atlas cluster running in the AWS Region, guaranteeing faster computing and low latency.

MEC, coupled with MongoDB services provides data processing capabilities which support a variety of use cases across the hybrid edge.

[Read more:](#) Mobile Edge Computing with MongoDB Atlas, the developer data platform, and Verizon 5G Edge



# Network Optimization: Improve Network Performance and Reliability

A new standard has been set for customer service, thanks to tech leaders like Google, Apple, and Netflix. Today's customers have an expectation of intuitive, always-on, seamless service that is a challenge for telcos to meet.

Relying on legacy technology makes it nearly impossible to answer questions like:

- Is an event likely to have a customer impact?
- Are customer-facing service SLAs being met?
- Where should cell sites be placed for maximum ROI?
- Is new equipment deployed and configured correctly?

A fully-integrated, customer-centric and data-driven approach to service delivery and assurance is needed in order to remain competitive, and investing areas like AI and machine learning will become increasingly important in order to identify correlations between disparate, diverse sources of data and to automate end-to-end network operations, including:

- Network security
- Fraud mitigation

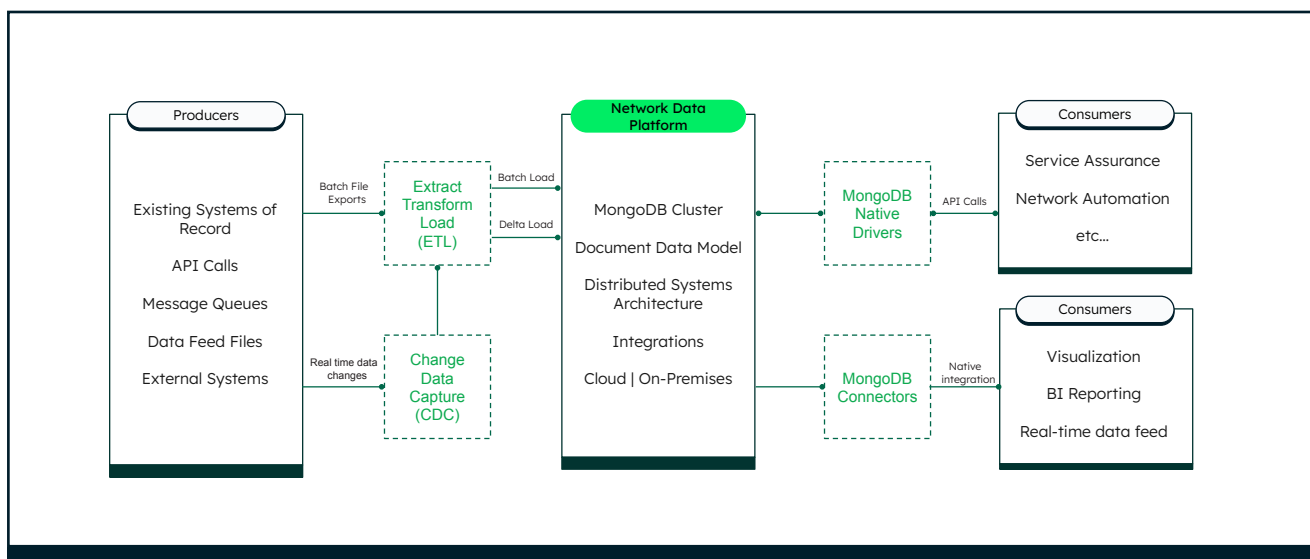
- Network optimization
- Customer experience
- ...and more

However, data scientists are still spending over 50% of their time wrangling data, while over 80% of all essential data is unstructured. For a true impact to your organization, you need to free up that time and enable data scientists to focus on mission-critical projects and innovation.

## Reducing Data Complexity

Architectural complexity, with bolted-on solutions and legacy technology, prevents you from harnessing your data and having a true impact on network performance and reliability.

MongoDB's developer data platform solves the great complexity problem by supporting a diverse range of workloads from a single data platform. Reducing the channels for data flow allows you to establish a single source of truth, gain that customer-centric approach critical to having a competitive advantage, and increase service assurance.



**Figure 2:** With continuous uptime and advanced automation, MongoDB's developer data platform ensures performance, no matter the scale.



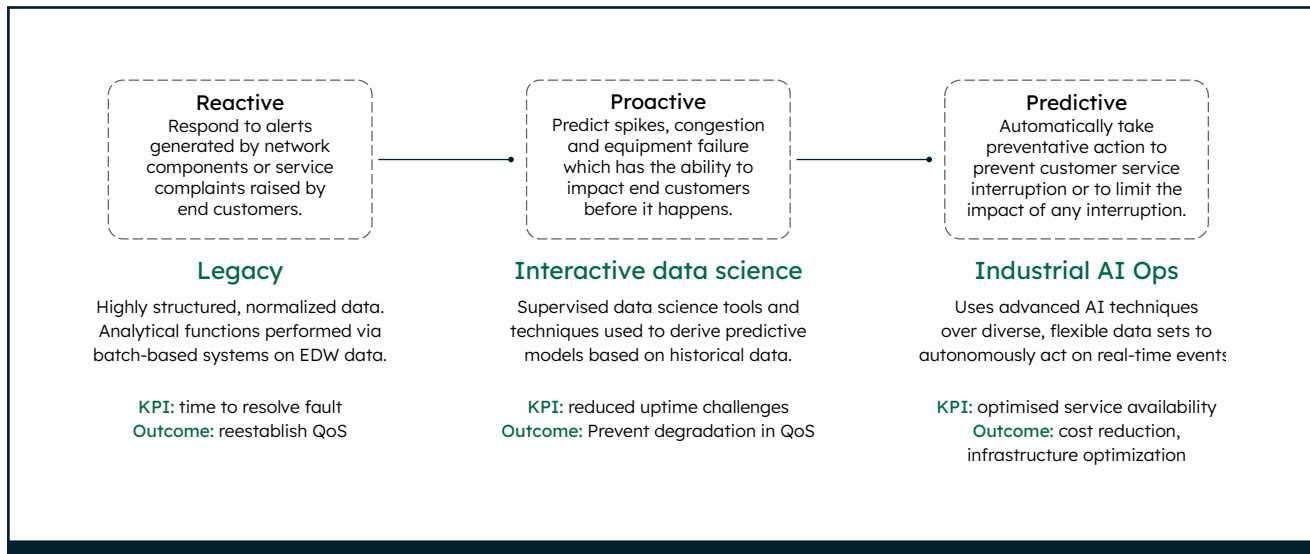


## Service Assurance Automation

In telecommunications, always-on, always-available service both for the end user and the internal IT teams is critical. While outdated service assurance processes may have been viable decades ago, the volume of data and number of users has grown exponentially, making processes of the past no longer possible. This

volume increase will continue to stress existing BSS systems and without modernization, this will hamper the development of new revenue streams.

Moving from a reactive to proactive to predictive data model, as shown in the figure below, will enhance service assurance and enable you to meet the expectations of the digital-native customer.



**Figure 3:** Enhance service assurance and enable your business to meet the demands of digital-native customers with predictive analytics.

## Network Automation

Take for example the essential task of configuration and management of Radio Access Networks. On a daily basis, engineers change the angles of antenna towers, configuration of the radio, nearest neighbor relations, etc. These are just a few examples of the type of events your system tracks and manages.

With an intuitive developer data platform, any change in the configuration is saved in the data mediation layer (DML) for anyone to see and track, making it easy for engineers to go to the DML and check the configuration for a particular tower. What was previously captured one snapshot per day, is now propagated in real time.

Another example – intent-based automation – abstracts the complexity of underlying software-defined networking components by allowing intent to be specified and providing automatic translation. This type of automation allows teams to process “intent” generated either by end user activity or via service assurance processes, and that intent is translated into the underlying network state.

Network events determine if the network is in the desired, stable state, and unintended states are addressed via automation, potentially using TM Forum Network-as-a-Service APIs.

## TM Forum Open APIs

TM Forum (TMF), an alliance of more than 850 companies, accelerates digital innovation through its [TMF Open APIs](#), which provide a standard interface for the exchange of different telco data models. The use of TMF Open APIs ranges from providers of off-the-shelf software to proprietary developments of the largest telecommunications providers.

In working with many of the world's largest communication service providers (CSPs) and the related software provider ecosystem, MongoDB has seen a significant number of organizations leveraging these APIs to develop new microservices in days, not weeks or months. Through exposing common interfaces CSPs are able to adopt a modular architecture made up of best-of-breed components (either internally or externally developed) while minimizing the time, effort, and cost required to integrate them.

The TMF NaaS APIs, in particular, hold significant potential for network automation. This API Component Suite supports a set of Operational Domains exposing and managing "Network Services." The abstraction layer between network automation tooling and the underlying network infrastructure provides a flexible, modular architecture allowing CSPs to deploy and integrate best-of-breed technologies. This reduces costs, risk, and time-to-market associated with traditional custom integration.

By specifying numerous access patterns for the data and MongoDB's advanced querying and indexing capabilities make supporting these very straightforward. In addition to the defined access patterns, the other capabilities of the data platform enable rich analytical queries to be executed for internal uses.

Learn more about how MongoDB's Professional Services team is accelerating TM Forum Open APIs in our [blog](#).



## Digital Services: Using IoT Applications to Transfer Data from Device to Edge

As the market shifts through 5G modernization, IoT connections are expected to double by 2025 to more than 24 billion connections. This surge presents a \$905 billion opportunity by 2025, according to GSMA Intelligence. As IoT connections grow, connectivity will make up a smaller slice of the total addressable market.

By 2025, GSMA Intelligence foresees connectivity accounting for 10% to 20% of the future addressable market, while IoT platforms and integration and application services will make up 60% to 80%.

Today, IT leaders are ensuring that IoT's market disruption ripples beyond telecommunications

by unlocking mission-critical use cases across multiple industries. IoT platforms allow CSPs to shift the customer relationship to provide flexible, secure, and always-on business services for IoT applications deploying billions of connected things.

Modern 5G infrastructure lends CSPs the opportunity to deliver data persistence across layers of data centers, whether they're in the far cloud, edge, or mobile/IoT network. Through modern edge-aware apps that use 5G, data is seamlessly transferred between the AWS Wavelength mobile edge, AWS parent regions in the far cloud, and 5G carrier networks. This opens the door for use cases that reach far beyond the telecommunications industry.



## Customer spotlight: Telefónica Tech

Approximately 30 million IoT devices run on Telefónica Tech’s managed connectivity platform, the [Kite Platform](#), around the globe. And with that figure expected to rise into the billions in the years ahead, Telefónica Tech needed a platform with the capacity to outpace the ever-increasing device usage.

“MongoDB went through some tough competition. It won because the technology best suited our capacity and cost needs.”

–CARLOS CARAZO CEPEDANO, CTO,  
IOT & BIG DATA AT TELEFÓNICA TECH

## IoT smart factory use case: Using AWS Wavelength, MQTT, and Realm Sync

A smart factory uses 5G and low-latency for both telemetry and command/control. By using a MongoDB Realm-based architecture at the edge and signaling over MQTT, 5G factory sensors can send messages to a nearby Wavelength Edge Zone. From there, any required machine learning-based data analytics can occur at the edge, and data can be replicated back to the AWS regions in the far cloud.

Data replication is critical, because while computing capabilities at the edge are low-latency, they are not always full-featured. The centralization of data allows several factories to combine long-term storage, analytics and multi-region sync for multiple applications.

Once an application’s data is in the edge or far cloud, devices like AR/VR headsets for mobile phones can consume this data and access it with low-latency for data applications like maintenance, alerting, and fault identification.

Latency-sensitive applications cannot simply write to MongoDB Atlas directly due to the associated round trip time to the associated Cloud region. Alternatively, Atlas Device Sync is powerful here as it can run on industrial devices as well as on servers (such as in the Wavelength Zone) and provide low-latency local reads and writes. It will seamlessly synchronize data in real-time from its local partition to the far cloud, and from the far cloud back or to other edge zones. Developers do not need to write complex sync logic; instead they can focus on driving business value through writing applications that provide high performance and low latency.

To view more real world IoT use case applications in the agriculture, automotive, and smart manufacturing industries, dive into our white paper: [Mobile Edge Computing: Realizing the Benefits of 5G with MongoDB and Verizon 5G Edge](#).

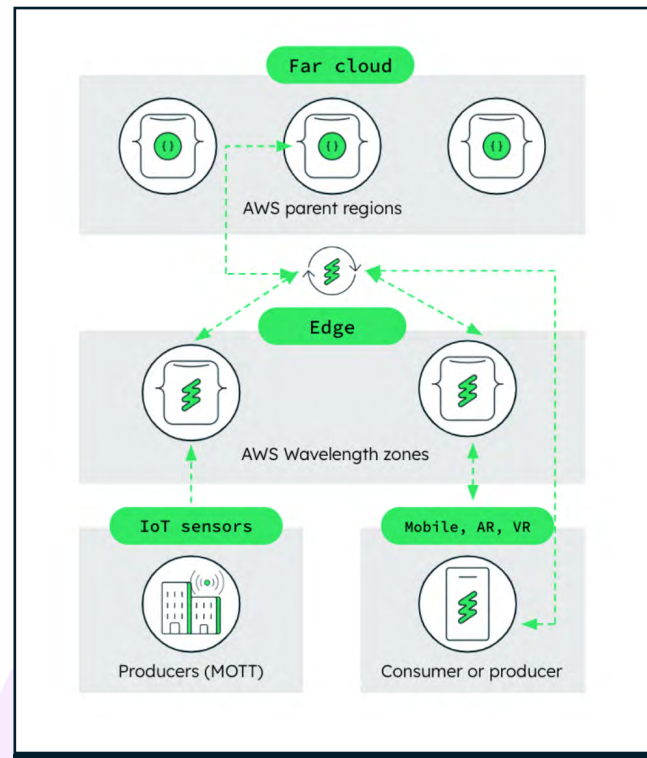


Figure 4: High-level three-tiered architecture.



# BSS Modernization: Embracing New Architectures in Billing

The backend architecture of a telco is vastly complex with many different systems involved in the authorization to use the network, to process a customer's network usage and ultimately bill the customer.

In the endeavor of telco modernization, why does MongoDB dedicate a heavy focus to billing, instead of other parts of the ecosystem?

It's a big market. The global telecommunications billing and revenue management market size stood at \$13 billion in 2019. Between 2020 and 2027, the market is forecast to expand at a compound annual growth rate of 11.6% to more than \$31 billion.

Billing is a process involving many different components, each of which is often handled by

niche technologies, but we have a significant part to play in aggregating and feeding systems with the data they need when they need it.

When most of us think about billing, what comes to mind are the monthly bills we pay to our providers. But we can also think about billing systems as an enabler for many other related use cases, all of which share the need for a solid, reliable record of customer core data. The common factor for payment processing, customer loyalty programs, service provisioning, service usage, and finally billing generation is customer core data.

Like all large corporations, CSPs are commonly made up of siloed application stacks broken out by product area, such as VoIP, mobile, cable, and so on. Most customers are billed based upon the siloed stacks, and identified by their phone numbers rather than through the multiple products used by a customer.

This convergent billing approach is typical in the telecommunications industry. And the siloed organization leads to inefficiencies and complexities. Since customers use products and services that exist within multiple silos, changes to customer data need to be propagated to multiple systems.

The lack of a single, consolidated view is often a result of historical mergers and acquisitions. Without the ability to analyze data within a single view, opportunities to capitalize on data analytics to uncover cross-selling and up-selling opportunities are lost.

Furthermore, enterprises managing multiple parallel billing implementations and the systems' associated data synchronization infrastructure can incur hefty costs and architectural complexity.

The best way to address these challenges is to rebuild billing systems to have a single view of customers and their billing-related data. At the heart of these modernization projects is the move to a new data platform.

## Customer spotlight: Vodafone

Vodafone is in the process of transforming from a traditional telecommunications business to a technology and software-focused business. It needs an army of developers to help it realize this vision and it needs to equip those developers with the right tools to create hundreds of new cloud-native apps. Underpinning these apps is MongoDB Atlas, which provides a scalable, resilient and flexible database. Atlas also supports Vodafone's IoT ecosystem, consisting of 140m+ devices.

**“We want to make sure that our developers focus on innovation and the business requirements rather than things like connectivity or IT.”**

**–FELIPE CANEDO, HEAD OF  
ENGINEERING TRANSFORMATION,  
VODAFONE**



## How CSPs move from silo to single view

Most CSPs with legacy systems and relational databases are held back from realizing the benefits of a single view of their customer bases. Most legacy systems were designed with a more rigid approach to data, which requires a predefined schema that's difficult to change after it's established. These systems are also less capable of scaling cost-effectively or distributing across servers and regions. They also cannot easily accommodate unstructured data, which by some estimates makes up between 80% to 90% of all data.

We recommend unifying silos with a data platform that enables key strategic objectives:

- Populating each data domain with data from both operations support systems (OSS) and business support systems (BSS) with a robust strategy to resolve data conflicts

- Modernizing of billing systems to allow single-view data consumption and data consistency resolution
- Establishing a single, highly scalable billing engine that will use the single view data platform as its single source of truth
- Initiating a program to retire legacy billing components, aligned to the decommissioning of functionality as it is ported to the new unified billing system

## Standard approaches to billing modernization

For organizations modernizing legacy infrastructures, two main approaches emerge. The first is to start incrementally by taking a data-centric “data layer” approach and invest in building single views that sit in front of systems of record and allow the segregation of read workloads from write workloads.

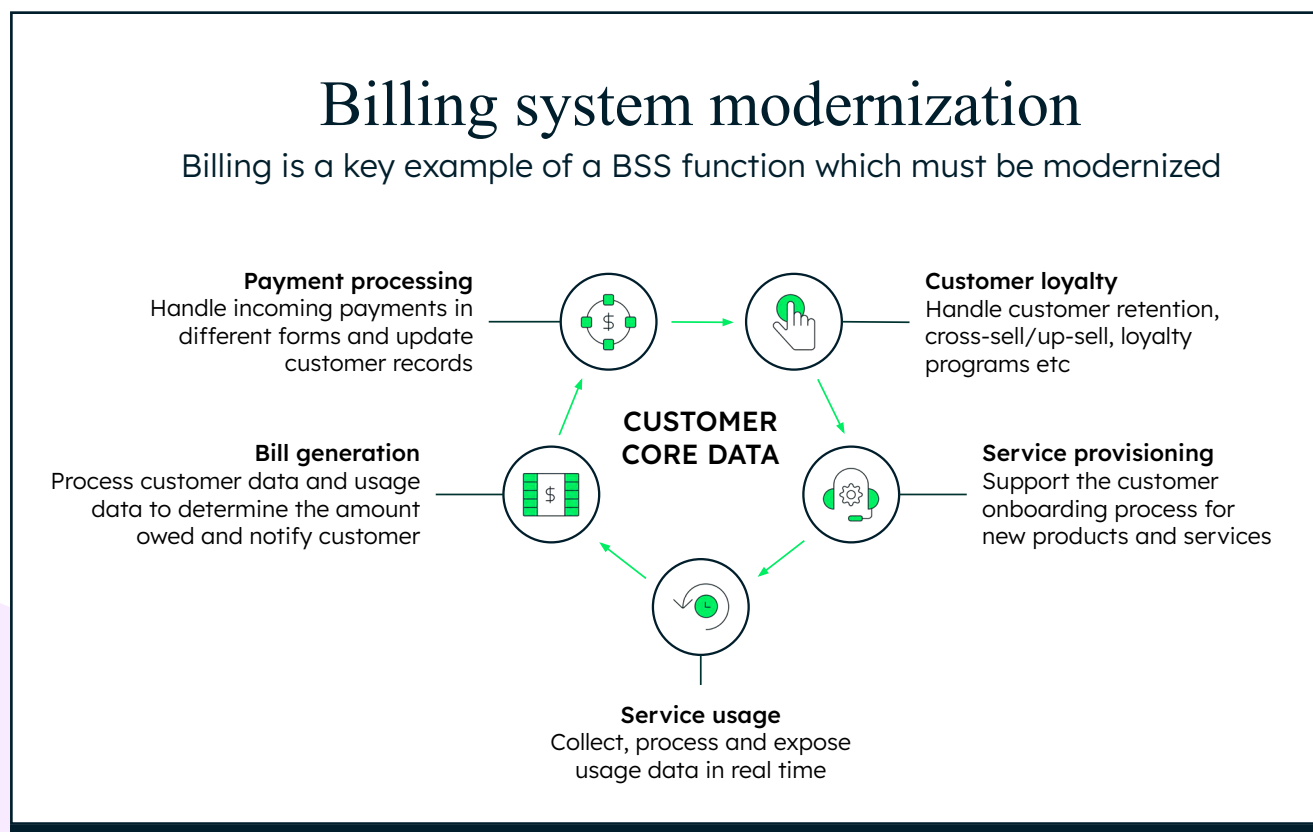


Figure 5: MongoDB's platform thinking approach to BSS modernization emphasizes billing systems.



This approach can reap in-channel efficiency and creates a low-risk transitory stage within a larger modernization strategy, but it brings along the added complexity of managing coexisting systems.

Another legacy modernization strategy in an incremental approach to breaking the monolith. In this approach, self-organized, cross-functional teams work on a single, loosely coupled business domain with microservices.

Legacy modernization isn't a zero sum game, nor is there a one-size-fits-all solution. It's common

for organizations to simultaneously pursue varied approaches in different parts of the business as blockers or dependencies appear. Every path is uniquely positioned based on the market situation and competitive environment.

Together with MongoDB, telecommunications firms can embrace and pursue multiple data management pathways while moving away from legacy systems. Accelerate growth and suppress risk with our digital transformation pathways for CSPs.

[Read more](#): The decision maker's guide to CSP billing modernization



# The MongoDB Solution

MongoDB Atlas is the developer data platform for advanced networks. As telcos lay the groundwork for modernization strategies that cover 5G, IoT, content discovery and billing systems, MongoDB's cutting edge digital solutions will deliver key technologies that help reduce costs, increase customer satisfaction and innovate with AI and IoT on low-latency networks and higher speeds.

Business Initiative	MongoDB Solution	Key Benefits
5G and mobile edge computing	<ul style="list-style-type: none"> <li>• MongoDB Atlas</li> <li>• Enterprise Advanced at the edge</li> <li>• MongoDB Realm</li> </ul>	<ul style="list-style-type: none"> <li>• Ultra-low latency applications</li> </ul>
Network optimization	<ul style="list-style-type: none"> <li>• MongoDB Atlas</li> </ul>	<ul style="list-style-type: none"> <li>• Architecture complexity reduction</li> <li>• Service assurance</li> <li>• Open APIs for rapid development</li> </ul>
Digital services	<ul style="list-style-type: none"> <li>• MongoDB Atlas</li> <li>• MongoDB Realm</li> </ul>	<ul style="list-style-type: none"> <li>• Low latency</li> <li>• Data distribution across networks</li> </ul>
BSS modernization	<ul style="list-style-type: none"> <li>• MongoDB Atlas</li> <li>• Enterprise Advanced</li> </ul>	<ul style="list-style-type: none"> <li>• Real-time data</li> <li>• Unified data facilitation and microservices</li> </ul>

Globally, MongoDB provides platform solutions for the following key telecommunications modernization initiatives:

For a modern telco, automation is key. Without a fully integrated, customer-centric and data driven approach to delivering services and connectivity, it's impossible to remain competitive. Margins are tight and consumers are cost conscious and weary of subscription-based services in a high inflation spending environment.

With data analytics-enhanced decision making aided by AI and machine learning, MongoDB gives telecommunications enterprises the tools to locate correlations between disparate data sources and automates end-to-end network operations. By leveraging AI and deep data science capabilities, MongoDB customers are

enabled to strengthen network security, fraud mitigation, and network optimization.

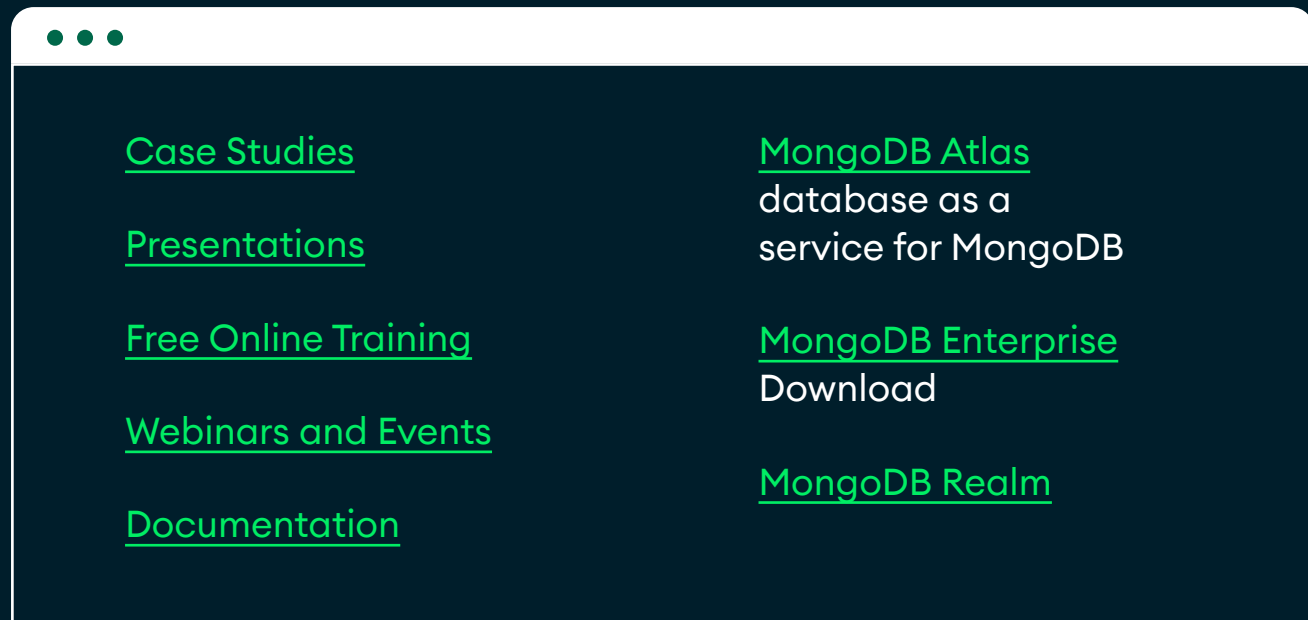
At MongoDB, we believe the new standard for the telecommunications industry is customer centricity. Your customers will continue to consume more and more data, and volume increases will stress existing BSS systems. With the added demands of 5G networks, telcos will be hard pressed to capitalize on new revenue streams without modernized data platforms.

So much of a telecommunication company's competitive advantage today is tied to how data is used to build workloads. This competitive advantage cannot be bought, and it's essential to enable sustainable innovation. Almost 70% of enterprises face failure in their digital transformation initiatives. MongoDB's developer data platform ensures success.



# Resources

For more information, please visit [mongodb.com](https://mongodb.com) or contact us at [sales@mongodb.com](mailto:sales@mongodb.com).



## Legal Notice

This document includes certain “forward-looking statements” within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, including statements concerning our financial guidance for the first fiscal quarter and full year fiscal 2021; the anticipated impact of the coronavirus disease (COVID-19) outbreak on our future results of operations, our future growth and the potential of MongoDB Atlas; and our ability to transform the global database industry and to capitalize on our market opportunity. These forward-looking statements include, but are not limited to, plans, objectives, expectations and intentions and other statements contained in this press release that are not historical facts and statements identified by words such as “anticipate,” “believe,” “continue,” “could,” “estimate,” “expect,” “intend,” “may,” “plan,” “project,” “will,” “would” or the negative or plural of these words or similar expressions or variations. These forward-looking statements reflect our current views about our plans, intentions, expectations, strategies and prospects, which are based on the information currently available to us and on assumptions we have made. Although we believe that our plans, intentions, expectations, strategies and prospects as reflected in or suggested by those forward-looking statements are reasonable, we can give no assurance that the plans, intentions, expectations or strategies will be attained or achieved. Furthermore, actual results may differ materially from those described in the forward-looking statements and are subject to a variety of assumptions, uncertainties, risks and factors that are beyond our control including, without limitation: our limited operating history; our history of losses; failure of our database platform to satisfy customer demands; the effects of increased competition; our investments in new products and our ability to introduce new features, services or enhancements; our ability to effectively expand our sales and marketing organization; our ability to continue to build and maintain credibility with the developer community; our ability to add new customers or increase sales to our existing customers; our ability to maintain, protect, enforce and enhance our intellectual property; the growth and expansion of the market for database products and our ability to penetrate that market; our ability to integrate acquired businesses and technologies successfully or achieve the expected benefits of such acquisitions; our ability to maintain the security of our software and adequately address privacy concerns; our ability to manage our growth effectively and successfully recruit and retain additional highly-qualified personnel; the price volatility of our common stock; the financial impacts of the coronavirus disease (COVID-19) outbreak on our customers, our potential customers, the global financial markets and our business and future results of operations; the impact that the precautions we have taken in our business relative to the coronavirus disease (COVID-19) outbreak may have on our business and those risks detailed from time-to-time under the caption “Risk Factors” and elsewhere in our Securities and Exchange Commission (“SEC”) filings and reports, including our Quarterly Report on Form 10-Q filed on December 10, 2019, as well as future filings and reports by us. Except as required by law, we undertake no duty or obligation to update any forward-looking statements contained in this release as a result of new information, future events, changes in expectations or otherwise.