

using digital twins

to improve the customer experience

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setting the scene

Digital Twins (DT) technology has been used in a variety of industries for decades, but is probably most often identified with applications in aerospace manufacturing, architecture and computer-aided design. Broadly, the concept is simple: apply the use of digital tools to simulate a physical object or system to glean valuable insights that can then be applied to the physical object or system.

But in reality, nothing is simple, especially in the highly complex and ever-evolving business of telecoms. A wide variety of digital modeling constructs and input types are already being used in telecoms, but there are also opportunities to use digital twins to improve everything from customer experience (CX) to real-time network visibility and even autonomous networks.

“A digital twin is a digital representation of a physical object – a representation that we always look at in its environment,” says Anna Herlt, a partner at McKinsey, [in a recent podcast](#). “What’s important is that you link the digital twin with real data sources from the environment and are able to update the twin in real time.”

McKinsey points to several common digital twin “archetypes”:

- **Product twins**, which are representations of products
- **Production plant twins**, which could be a representation of the entire manufacturing facility
- **Procurement and supply chain twins**, often called network twins
- **Infrastructure twins**, such as digital models of databases, transport infrastructure and IT.

This e-book defines how digital twins differ from processes such as business modeling or virtual testing and explains them in the context of telecoms. We also explore their implications in CX – looking at their ability to inform service assurance, network engineering and orchestration – and provide guidance for operators as they integrate digital twins into their operations.

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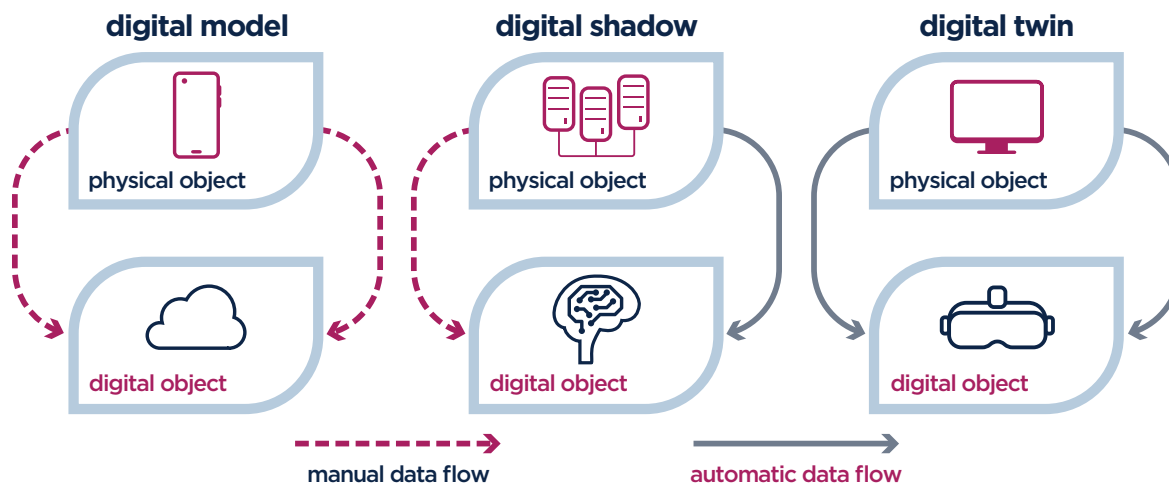
what's special about digital twins?

Applying digital tools to model physical objects and processes is not new; tools such as dashboards, retroactive performance reports and “green light/red light” status indicators have been used to do so for many years. What makes digital twins special is the manner in which data is collected and flows between the physical object and its digital mirror image.

What makes digital twins special is the manner in which data is collected and flows between the physical object and its digital mirror image

In the graphic below three iterations of digital modeling are depicted. In traditional digital modeling, the collection and flow of data from both physical and digital objects is a manual process. For example, a service assurance engineer performs a query of a virtualized network element, that query runs for an indeterminate time, the data is then returned and analyzed, and then change data is manually sent back to the physical object.

Levels of integration for digital model, digital shadow and digital twin



A digital shadow adopts more automation. In this instance, while data collection from the physical object is still queried, an automatic data flow exists between the physical object and its digital representation. This results in faster response times and provides the digital model with more granular analysis that can be manipulated and studied to gain insight into the performance of the physical element. This is often referred to as virtual testing.

The final step is the digital twin, an automated connection between a physical object and its digital mirror. Data collection occurs in real-time, enabling the digital twin to adapt automatically to changes that occur in the physical layer.

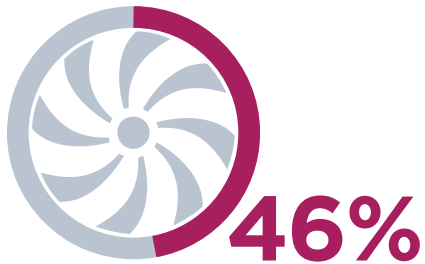
“A digital twin is an amalgam of information in the form of images, videos, text, graphs, stats and our experiences to accurately represent not only a physical asset or system, but also the ways they are interacting with the surroundings and with other elements that are part of a bigger ecosystem,” says Mohammed Fahim Momen, General Manager, Assurance and Fulfillment, Robi Axiata. “Thus, we obtain a more holistic view to plan, configure, operate and optimize that asset. By asset, I mean network elements as well as the underlying equipment of different network domains like radio, transport, core and also IT.”

In the next chapter we look at the strong growth in the digital twins market, driven by some familiar names.

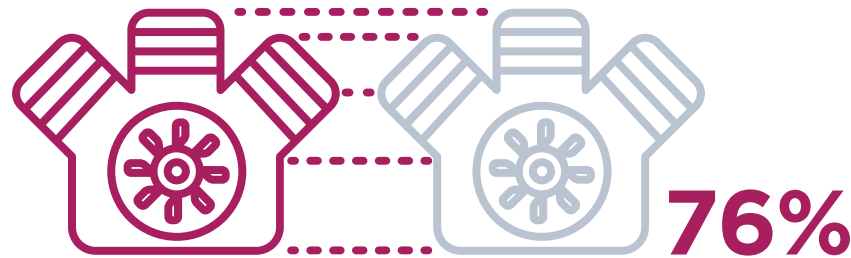
A digital twin is an automated connection between a physical object and its digital mirror

a rapidly growing market

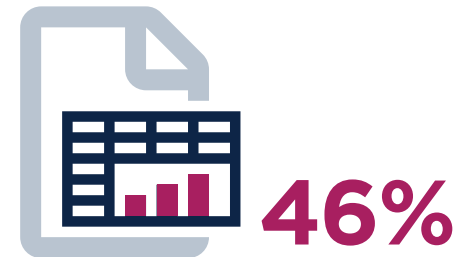
The scope of applications for digital twins is rapidly widening, from smart cities to financial industry logistics, manufacturing and telecoms. Research from Verizon, for example, shows that three quarters of respondents from manufacturing companies say digital twins will be important or extremely important in the next 12 months (see graphic).



46% of organizations world-wide considered predictive maintenance either critical or very important.



76% of manufacturing respondents said that digital twins will be important or extremely important to their firm's priorities in the next 12 months.



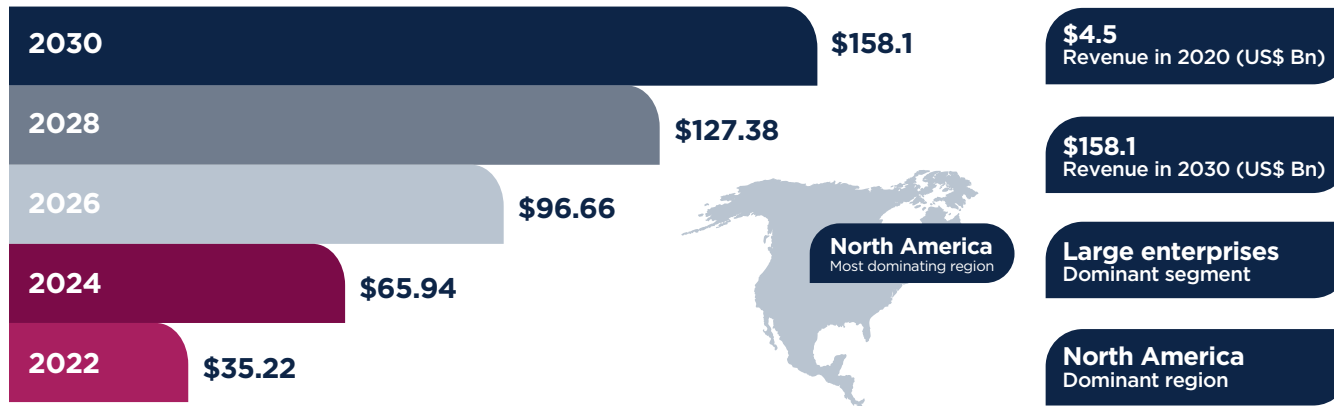
46% of financial and insurance industry respondents said they were either implementing digital twins or planning to implement in the next 12 months.

TM Forum, 2022 (source: Verizon Wireless)

Part of the compelling power of digital twins lies in their ability to autonomously collect and mirror critical data that might otherwise go unqueried or unexamined. "In the near future we can expect digital twins to proactively search for data, harvest data, and request that sensors capture certain types of data with customized sensitivity," says Roberto Saracco in an IEEE publication.

Such advances are forecast to stimulate strong growth in the technology. According to Strategic Market Research, the global digital twin market is expected to grow from \$35.2 billion in 2022 to \$158.1 billion in 2030 (see graphic).

Global digital twin market



Some companies are betting big on growth in digital twins technology as a result. Microsoft, for example, has launched an entire solution around IoT, with its [Azure Digital Twins](#) platform. It promises to “model buildings, factories, farms, energy networks, railways, stadiums – even entire cities”.

And IBM and Siemens in 2020 [announced a solution](#) to help OEMs and equipment owner/operators improve how they design, maintain and service their assets. “The combined capabilities of IBM and Siemens can help companies create and manage a closed-loop, end-to-end digital twin that breaks down traditional silos to service innovation and revenue generation,” said Peter Bilello, President & CEO of research and consultancy firm CIMdata, at the launch. IBM’s [Digital Twin Exchange](#) enables companies to share digital twin downloads to make it easier to manage connected assets, equipment and IoT solutions.

In the next chapter we find out how digital twins fit into the wider telecoms market.

how do digital twins fit into telecoms?

Early generations of network operations centers (NOCs) were attempts at representing physical systems in data (graphics and text), to monitor the network and provide actionable insight into performance and assurance. Much has changed, though, as the arrival of 5G, virtualized network functions and cloud computing solutions have introduced greater levels of complexity.

“Networks have become more complex, with multiple layers, multiple vendors, multiple technologies – all interlinked – putting much pressure on real-time monitoring and stretching the capacity of operators to efficiently manage the network,” says Fahim Momen at Robi Axiata. “This is one of the most important areas I believe we can leverage digital twins to not only attain more efficiency but also to create unique as well as incremental values” as more insights accumulate.

Network and customer experience (CX) data often live in separate silos, and operators face challenges in integrating and divining insights from these distinct data sets. For instance, predicting network degradation for a specific customer on the move is currently very difficult. Likewise, connecting the performance degradation of a network element to a specific customer in real time is extremely hard. This is just one way digital twins promise to improve quality of service as operators iterate the technology into greater portions of their businesses.

Dr. Mark Mortensen, Principal Analyst, ACG Research, sees digital twins at the leading edge of telecoms product development. “Instead of doing a typical A, B, C, D trial on social and waiting to review your feedback, you can actually just bash it against the digital twin model and say, ‘Yes, there is a pretty good likelihood that in this segment we can make a business case service’,” he says. “That’s pretty innovative and that’s what’s interesting; you’re not running simulations against consolidated information or summarized information, but individuals.”

“We can leverage digital twins to not only attain more efficiency but also to create unique as well as incremental values.”

Mohammed Fahim Momen,
Robi Axiata

While there are direct applications for digital twins in CX and product development (see p.10), CSPs also operate robust businesses that support other verticals with connectivity and data intelligence. In many cases, these implementations of digital twins are the sandbox that will provide a roadmap for more complex implementation in the network.

Telstra and Microsoft, for instance, have been collaborating for the past two years to apply digital twins to solutions in asset tracking, telematics, supply chain and smart cities. Telstra says it plans to make digital twins of 90% of its mobile structures by FY25 and “lead the market in how digital twins can be leveraged to optimize customer outcomes”.

Ericsson, meanwhile, has linked up with Nvidia to leverage 5G in what it calls the “digital twins omniverse”. They are building city-scale digital twins to help simulate the interplay between 5G cells and the environment for maximum performance and coverage. The two companies see applications for their platform in telehealth, self-driving cars and manufacturing, for example.

TM Forum, meanwhile, has been helping operators unlock 5G smart city revenues with its Catalyst project Open Digital Twin Framework for Smart City Ecosystem. The proof of concept is designed to help CSPs enter the smart city market in the role of a smart city operator by using an open digital twin framework to facilitate and orchestrate a standardized smart city ecosystem.

The Catalyst team defined the Open Digital Twin Framework (download the white paper), a reference software architecture for smart city operation that describes the digital model, function and interactions of its physical entity. It categorizes the common functions that a digital twin should implement and classifies the intelligent data model that a digital twin can build. The goal is to provide an integrated object framework for developers to build domain-specific digital twins with interoperability for agile solutions development in 5G-enabled smart cities.

In the next chapter we look at how digital twins can be applied to developing future networks.

Find out more and watch the video



Using digital twins to improve the customer experience

Some recent applications of digital twins in telecoms can be found in customer experience (CX). Operators are constantly looking for more effective ways to attract, retain and anticipate the needs of customers. Etiya, for example, has implemented digital twin technology as part of its AI platform, Cognitus, to move beyond traditional customer segmentation to highly personalized insights to improve CX (see p.15 for more information).

Etiya applies innovative AI techniques and predictive analytics in its platform to generate a digital twin of a customer, modeling data points such as age, gender, service usage, social media engagement, technology interest and hobbies. This digital twin engenders personalized customer interactions and service targeting, and supports more informed decision-making during the customer journey. For example, in a retail environment a sales associate can rely on the digital twin to make customer recommendations regarding phone and plan type, and loyalty or retention programs.

In other instances, the digital twin fills in significant knowledge gaps that can impact CX, like support calls, chats and online interactions. By applying those insights, agents can more quickly resolve problems, anticipate preferred solutions and build rapport with customers. Similarly, routine customer engagements, such as emails or text communications, can become highly personalized and more engaging based on the application of digital twins technology.

applying digital twins in networks

The way assurance and testing work in the 5G world is complex, and while digital twins will certainly move into these operational spaces in the network, it will take time and many iterations. But using digital twins to understand network operations could already enable CSPs to get ahead of their competitors.

“Knowing your network inside out is always the key that gives an operator competitive advantage and [enables it to] cut out customized solutions to both B2B and B2C customers. And digital twins are the thing that will enable operators to do so,” says Fahim Momen at Robi Axiata. “Operators in general should go about implementing digital twins in an incremental and iterative manner. This is where I see the role of digital twins. Once we have an holistic view through digital twins of a particular network element, we can plan, predict and operate it better.”

A recent [TM Forum article](#) points to the future of digital twins usage in the network, moving towards greater automation. “Maybe network operations will first benefit from digital twins,” says Xiaowen Sun, a researcher with China Mobile Research Institute. “Our real network cannot achieve online decisions and almost all the network operations need human involvement. If...[we can] make decisions based on sufficient calculation and verification in the digital twin environment, it will make network operations more accurate and reliable.”

Sun was project leader in [another TM Forum Catalyst](#) where members used a digital twin network (DTN) to demonstrate how telcos can build network twins to help manage automation required by B2B2X and industrial 5G services. The proof of concept used real-time data and knowledge from network operations, then created an intelligent network to facilitate network planning, construction, optimization and the autonomous operation of events.

“If...[we can] make decisions based on sufficient calculation and verification in the digital twin environment, it will make network operations more accurate and reliable.”


Xiaowen Sun, China Mobile Research Institute

Find out more and watch the video

Digital network twin for data-driven 5G services
tmforum



Sun Xiaowen, China Mobile
Project manager



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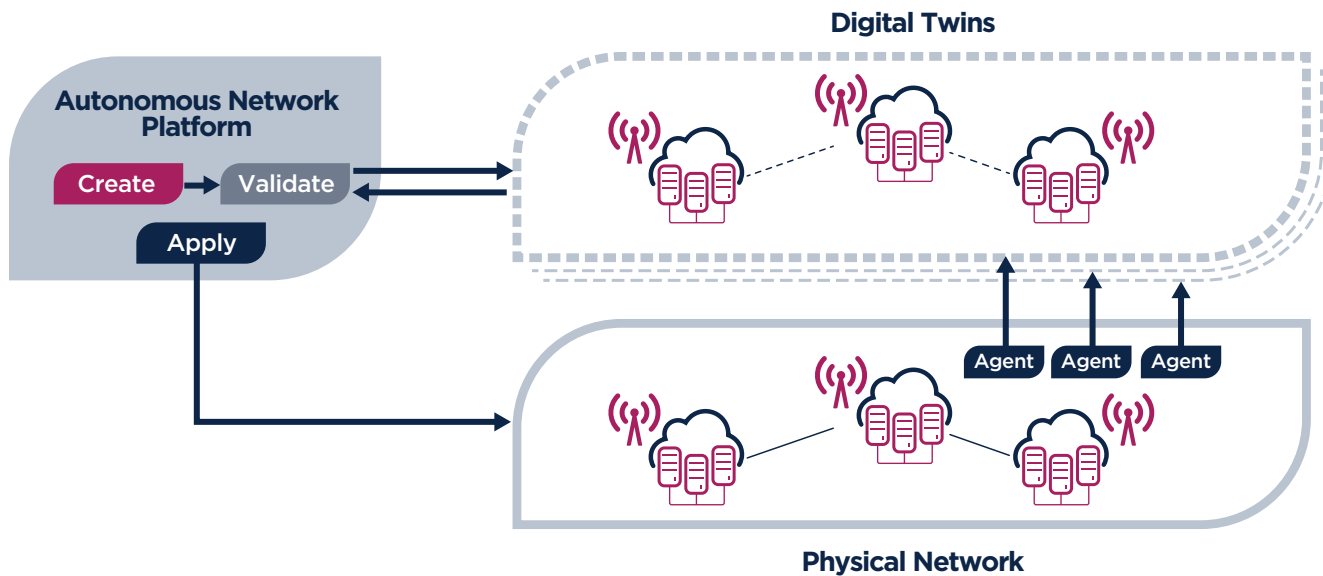
catalyst project

towards greater automation

Mortensen at ACG Research predicts engineers will begin by first cloning digital twins to discover innovative ways to optimize their networks. “Engineering people will go in...and actually clone that digital twin. This is going to be a big thing, by the way, these sandboxes.”

Cloning digital twins for testing in multiple sandboxes is an innovative concept, as it provides a solution to fundamental issues regarding autonomous systems: closed-loop AI systems cannot answer questions about their decision-making. The workaround is to observe several iterations of an autonomous, digital twin-based network element in a sandboxed environment and learn which produces the most favorable results.

As the industry moves toward autonomous network platforms, a basic visualization might look like the one in the graphic.



The TM Forum digital twin network Catalyst outlined a three-step blueprint for transitioning to a digital twins-driven network (DTN):

- The first [step] is to model the physical network, then digitalize it to create a visualization of the physical equipment's status and operation in real time
- The second step is to construct a knowledge graph of interactions between different network elements used to develop network simulation and orchestration
- The third step is to train related AI models for specific DTNs based on different use scenarios and establish a DTN operation environment which covers different types of automated network operation. This shifts the network from being managed by human experts to AI-driven decision-making.

network management innovation

One initial functional area for digital twins innovation is the radio network, which is unpredictable and volatile. A wide variety of factors from interference to atmosphere, which are difficult to model, create challenges in maintaining quality of service. This is why operators' spending on radio networks represents such a huge portion of capex and opex. It's also the area which requires the largest workforce investment.

Fahim Momen sees digital twins as one of the most important tools to better manage network infrastructure. "Just imagine the possibility it opens up once we can accurately assess and predict the quality of services of radio network elements both active and passive," he says. "This is equally true for transport networks, both microwave and optical. We can extend the digital twins-based network management models starting from [radio] access [network and all the way] to [the] core."

Digital twins are already being used by operators to improve customer experience, design better product offerings, create operational efficiencies and support businesses in verticals ranging from manufacturing to telehealth. And their use in network operations is set to grow further as CSPs roll out more complex infrastructure.

This was reflected in another TM Forum Catalyst designed to address some of the key challenges relating to the planning, construction, maintenance and operation of shared 5G network infrastructure. The project set out to show how a multi-operator network and customer data could be used to improve customer experience management in shared 5G networks, with effective privacy safeguards in place.

In the final section we give some pointers to successfully implementing digital twins.

"Just imagine the possibility it opens up once we can accurately assess and predict the quality of services of radio network elements both active and passive,"

Mohammed Fahim Momen,
Robi Axiata

key steps to success

Incorporating digital twins into diverse functional units will be an iterative process, which will include different types of digital twins based on their specific application. Each instantiation will deliver greater insights into both the functions being automated and optimized as well as guidance for future implementations of digital twins technology.

Here are some key considerations for CSPs.



Preparing for digital twins requires an exhaustive and ongoing process of understanding the product or process that will be modeled. In addition, constructing and defining automated data flows is essential. This will likely include interlinking data sets in entirely new ways.



Operators should implement digital twins in an incremental and iterative manner, beginning in areas such as customer experience. Skill sets will also need to be updated over time. As networks become further virtualized, a deep understanding of digital twins technologies, as well as new modeling and mapping techniques, will become critical in engineering roles.



Since digital twins report insights, but not rationale, operators should perform A/B testing of critical infrastructure elements to determine how they will perform prior to implementation. Radio access networks and transport will require novel real-time data collection, reporting and autonomous reactivity with digital twins.

transforming CX with digital twins

Customers always look for a seamless experience in their interactions with organizations, while their expectations are changing rapidly with the developments in digital technologies. So how can organizations adapt to this rapid change?

As it is a well-known requirement, organizations must offer a personalized experience to deliver a seamless customer experience and increase customer satisfaction. That is how they can differentiate themselves from their competitors and provide a competitive advantage in the long term. To fulfill this requirement, they need to adopt the necessary technologies like Artificial Intelligence, Predictive Analytics, and Customer Journey Management that help their organizations move beyond personalization. Digital twins are increasingly getting popular as a method to provide personalized experiences with the help of AI technology. By using the Digital twin of customers, organizations can gain actionable insights into the next actions their customers will take.

A customer's digital twin contains data that will allow to make the simulation of the customer's behavior and predict their future behavior. Above all, this data is dynamic, updated as new information comes in and it is used by many departments within the organization such as marketing, sales, and customer experience teams, helping to provide a more seamless and frictionless customer experience.



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Etiya Digital Twin Engine

The Digital Twin engine, built on Etiya Artificial Intelligence Platform Cognitus, enables digital twins to be modeled, monitored, analyzed, and constantly updated with new data. In this way, it allows for visualizing, grouping, and managing the behavior of the customers. Digital twins directly contribute to the improvement of companies' processes by providing high-value-added analytical insights. In addition, they also allow system users to combine this information with different scenarios and make them functional.

Properties of Etiya Digital Twin Engine

Individual: Each customer has its digital twin model representation tracking history and performance over the customer's lifetime

Continuous: Digital Twin models are continuously updated with new data, interactions, and actions. At any moment, a digital twin represents the current state of a customer

Scalable: A Digital Twin model tracking a single customer learns from similar customers.

With the Etiya Digital Twin engine, Cognitus makes it possible to create recommendations for each customer by using AI and ML technologies. These recommendations can be made for similar items, trending or promoted items, cross-sell and upsell opportunities, and discount packages, or they can be based on similar users, basket content, or relevant sales points.

Etiya Digital Twin engine helps organizations in different verticals to quickly create digital twins from their existing data and integrate them into their systems. Digital twin engines can be used in different areas including customer experience management, segmentation and targeting, demand and resource forecasting, predictive maintenance, cost optimization, simulation, risk management, and process optimization.

Etiya Digital Twin engine helps organizations in different verticals to quickly create digital twins from their existing data and integrate them into their systems.

Award-Winning Digital Twin Project

In 2019 Etiya won the Outstanding Catalyst Innovation Award with its digital twin project.

The Purpose of the Digital Twin Catalyst project was to create a full digital twin of a telco operator including the organization, processes, network, and customers. By making simulations on the digital twins, the project aimed to reach more accurate decisions during the decision-making process.

In this project, Etiya provided a framework in which AI data models can be used to create digital twin vectors for each customer. Then it used this concept to create customers' insights to do proper recommendations or to personalize the support services to customers.

First of all, Etiya created feature sets related to loyalty, churn, and sales by using TM Forum standards. Then it extracted the attributes of each feature and applied deep learning to these attributes and reached the digital twin vectors. Finally, when the digital twins were created in each feature, it reached the customer's DNA via the sum of the features.

Customer DNA can be used to simulate, predict and forecast customer behavior and the next best actions for the customer. This data allows companies to provide personalized offers and services to their customers and superior customer experience.

Etiya Artificial Intelligence Platform | Cognitus

Etiya AI Platform Cognitus provides standardization, simple and centralized management, effective automation, and operational efficiency with its advanced capabilities and Machine Learning (ML) and Natural Language Processing (NLP) services.

Cognitus provides fast customization and scaling of the products, solutions, and services it offers, with its configuration capabilities. Cognitus can bring automation and intelligence into your business processes by easily adapting itself to different products in your organization, either in the cloud with the AlaaS business model or at the center of your organization with the on-premise business model.

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Cognitus in Telecommunication

AI usage in CSP operations accelerated with the digital transformation initiatives to enable higher use of self-service in customer operations and remote work for employees.

Etiya provides turnkey, end-to-end digital transformation to CSPs worldwide with its CX-focused and AI-driven Digital BSS. It incorporates innovative AI technologies, with natural language processing (NLP) and machine learning (ML) services, including prediction and recommendation, in its portfolio.

CSPs can use Cognitus in various scenarios in their customer interactions and marketing & sales operations. Some of these scenarios include:

- The use of AI / ML for more efficient customer interaction handling, advancing the capabilities of virtual assistants, intelligent chatbots, voice assistants, and interactive voice responses for customer support
- Personalization, identification of best offer for cross-sell and upsell, and offering the best price, along with churn prediction to various customer segments
- Social listening and video analytics to gain more actionable insights about customers

Cognitus provides many benefits to CSPs through its advanced ML and NLP services.

- Easy identification of potential problems and improvement points at customer/user contact points and operations
- Increased sales, usage rates, and customer loyalty, thanks to customer experience enriched with personalized forecasts and recommendations
- Uninterrupted and seamless user experience through multi-channel integrated processes
- Competitive advantage with increased customer/user satisfaction

Company Highlights

Etiya is a leading software company providing customer experience-focused, AI-driven Digital Transformation with its award-winning product portfolio. Founded in 2004, Etiya has more than 1400 employees and offices in 3 continents and 7 countries. Its microservice-based architecture, DevOps methodology, and AI-driven portfolio provide a competitive advantage to its customers by bringing agility and flexibility into their business.

Etiya's products have been successfully implemented and proven in Tier 1 service providers and have the scalability to handle millions of orders per day.

Its business processes and business entities are certified to the latest TM Forum standards, TM Forum Framework version 21.0, and achieved the highest number of conformant TM Forum Business Process Framework Level 3 Certifications and SID entities of any vendor.

It has won many awards from 3rd party independent institutions like TM Forum with its product portfolio and the customer experience-based projects provided to customers.

Etiya exists to move in an agile way beyond existing standards in its relationships with customers, in innovation, and in its ambition to expand and grow.

Exceed, Every Day



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