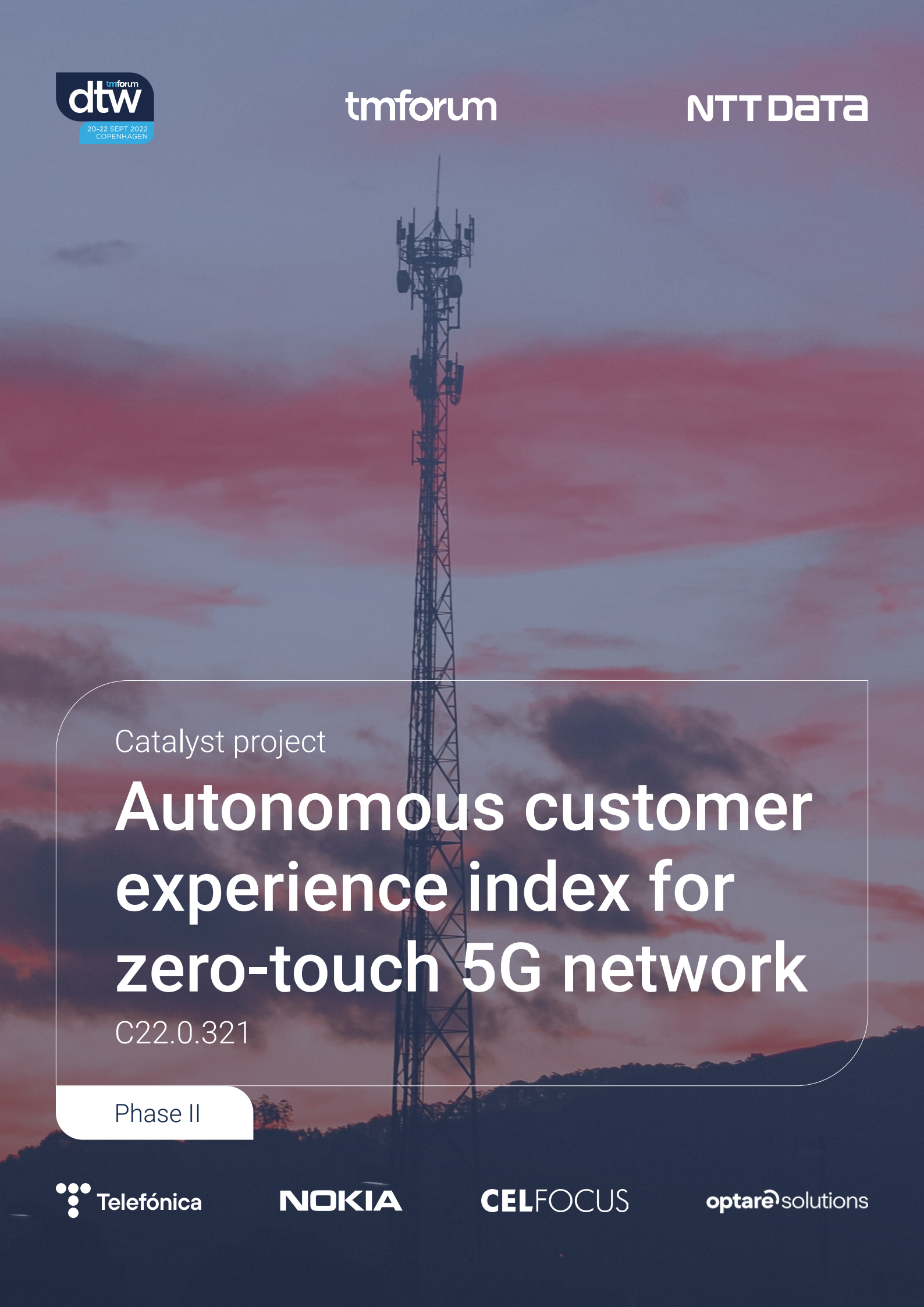

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NTT DATA

Catalyst project

Autonomous customer experience index for zero-touch 5G network

C22.0.321

Phase II

Telefónica NOKIA CELFOCUS optare solutions

The commercial challenge

The telecommunications industry is facing major new challenges, as service providers seek to manage the growing complexity of networks, which today include open architectures, increased virtualization and the growing role of 5G technology. Yet these challenges also bring potential opportunity, enabling network operators, and Communications Service Providers (CSPs) in particular, to deliver added value services to sectors, individual enterprises and billions of consumers, with higher levels of quality and efficiency.

The key to turning challenge into opportunity is Autonomous Networking, using the full range of emerging technologies to build networks that diagnose, heal, optimize and configure themselves, automatically, delivering the best possible Customer Experience at all times. Use of Artificial Intelligence, enabled by Machine Learning, means that telecom operators can deliver more sophisticated services, with higher levels of quality and efficiency, as both customer demand and network potential evolve into the future.

The concept

The Catalyst project: Autonomous Customer Experience Index for zero-touch 5G network – Phase II explores ways to use Artificial Intelligence and Machine Learning (AI/ML) to deliver higher levels of quality and enhanced customer experience within increasingly complex, high-performance networks. The project is designed to develop a zero-touch, customer-centric network environment that delivers higher performance based on the Customer Experience Index (CEI), a customer-oriented KPI (Key Performance Indicator), which combines network and customer data, together with new use cases leveraging AI/ML techniques for zero-touch network monitoring and operation.

The project ensures that automated systems monitoring network performance align precisely to real customer experience, which is often a subjective measurement, normally monitored through such non-technology methods as opinion surveys. In this way we can be certain that automated measurement and interventions are calibrated to match KPI performance as experienced by customers, enabling higher levels of autonomous operation, leading to continuous service improvement.

The blueprint for a future framework is now in place. We are convinced the challenges can be rapidly overcome, leading to a better future for CSPs as added value service providers.

The technical challenges

The Catalyst project represents a first step in what could be a game-changing approach to network design and delivery for CSPs. Through AI/ML enabled automation of anomaly detection and response, with contextualization of data for planning, the package of innovations proven and tested in this project will help CSPs raise margins and gain competitive advantage in the market. A number of challenges exist and have been addressed by the Catalyst project.

These include continued development of AI/ML enabled algorithms and other automated tools, ensuring that customer experience can be continually enhanced through automated monitoring and intervention. In addition, the project is building an advanced planning toolset to ensure that rich data gathered both from network operations and all devices connected to the network can be efficiently used to improve service performance at the very earliest (planning) stage.

Building the partnership

Telefónica acted as champion in this Catalyst project, recognizing the challenges faced by network operators through emerging technology, together with the essential contribution that can and should be made by higher levels of automation and autonomous working. Telefónica created the Autonomous Network Journey Program to accelerate development of Autonomous Networks, and supports this Catalyst project within the scope of this strategy.

The Telefónica vision, shared by all partners in this project, is the need to anticipate customer pain points and proactively implement autonomous solutions to avoid service degradation that may negatively impact on Customer Experience. The partners collaborating in this Catalyst project offer unique experiences, knowledge and techniques. The strength of the project rests in the way these rich contributions have been coordinated and combined to deliver measurable outcomes.

The partner team successfully operated in a highly collaborative manner on the NTT DATA development platform. This shortened process stages, accelerated development time and enabled rapid feedback to enhance project quality.

NTT DATA

NTT DATA acted as project leader and coordinator, while providing technical leadership across the full scope of activity. NTT DATA is one of the world's leading specialists in networking technologies, with expertise in mobile telephony, 5G capability and network intelligence, which positions us perfectly for the all-important coordination and management role. In addition, NTT DATA has contributed to the technical solution by developing service orchestrator and actuator modules for closing the loop of the zero-touch autonomous network, leveraging the company's considerable experience in network operations.

Nokia

Nokia has built a toolset that enables CEI measurements to be calibrated accurately to match the real experience of customers. This ensures that automatically measured values truly reflect customer experience, especially when integrating data obtained from the network via probes, Deep Packet Inspection and performance management covering crowdsourcing data.

Celfocus

Celfocus, a company with more than 20 years of experience delivering complex transformation programs in Telco worldwide and deploying cognitive automation solutions for service and network assurance, contributes to specific use cases by using AI/ML techniques that utilize both unsupervised and supervised algorithms to detect statistical anomalies and generate anomaly-labelled datasets. Celfocus also manages the admission control of new network slice requests. This approach uses clustered data, while applying algorithms based on Deep Reinforcement Learning, which are constantly aware of current network usage.

Optare Solutions

Optare Solutions applies CEI data provided from the Nokia toolset, together with network data and metadata, enriched by detected anomaly data, to identify potential issues early. This makes it possible to isolate root causes and provide information related to detected issues by applying ML models and using AI capabilities deployed in the Root Cause Analysis (RCA) component. This real-time automated intervention corrects any customer service degradation before the end users become aware of any issues.

In addition, Optare Solutions can perform data clustering from CEI data to contextualize the information (defining the type of service, location and other factors), so that contextualized data can be used for automatic dimensioning and scaling of the RAN.

For service orchestration, management and actuation, NTT Data receives input triggers and related information, then defines the appropriate policies for actuation over the network to close the loop and achieve zero-touch network processes.

Implementing new concepts

The Catalyst project is designed to test the technical feasibility of building a trusted CEI that can be monitored and managed through automated systems. This enables a complex communications network to operate autonomously, designed to meet outstanding quality standards with Zero Touch operation. This test involved three distinct use cases built on top of the CEI, as shown below:

Use case 1:

Build CEI index with multiple data inputs

To calibrate network/service performance as measured by operational systems with what the customer actually experiences has traditionally been a complex and difficult process. It also involves a lot of time-consuming, low-tech methods.

Nokia has taken a lead role in building a trustworthy, reliable CEI that can be measured through automated systems and processes. The Catalyst project first incorporates Deep Packet Inspection (DPI) and passive probes as data sources, which are then enriched with RAN and other core networking data to give a clear picture of how accessible the network is to all potential customers at any given moment. Lack of access, dropped calls, quality issues can therefore all be noted, recorded and used to clarify customer satisfaction levels.

The team then accesses service data from Tutela, a specialist in crowdsourced data, with access to billions of quality measurements from mobile devices worldwide, using this to populate Telefónica measurement model to define CEI as based on real networking data. The Catalyst project validates the model and data flows to ensure that automated measurements conform to perceived customer experience. This enables us to deploy a CEI that, for the first time, is optimized for autonomous networking.

Once the CEI is defined and validated, it is possible to address two major challenges from CSPs through use cases.

Use case 2:

Anticipate customer pain points

In developing an effective method for resolving potential issues before they impact on customers, we are able to monitor the entire data lake formed by the CEI, with all network data, metadata and crowdsourced input, to ensure that output is based on the richest data sources and is always accurate and current.

The use case workflow begins with anomaly detection for network issues, by adapting the Celfocus Anomaly Detection Framework (ADF) to leverage on CEI metrics to train the AI Models. The models enable the delivery, for all the antennas in the network, of two types of insights: firstly, it can predict if an antenna is working under anomalous conditions or not, based on a set of network KPIs that can be scaled to virtually any data source; secondly it produces an initial Root Cause insight by indicating which service is most likely to be causing the anomaly.

Using data from CEI, outputs from Anomaly Detection complemented with Network and Problem Management information, Optare Solutions trains AI models to identify issues and problems linked to the customer service and provide the Root Cause Analysis for them with a proposed resolution. After that, NTT DATA's Service Order Management (SOM) and Actuator modules are used to define policies for application to the network, enabling real-time intervention according to the autonomously identified cause of the issue.

Not only does this lead to a virtuous circle, in which management of technical issues leads to enhanced customer satisfaction, it also provides a feedback loop that improves network planning as a next stage of development. Data is clustered and contextualized, leading to better input for planning and, eventually, the potential for *designing faults out of the network* in the future.

Use case 3:

Use automated systems

The third use case aims to develop practical and deliverable zero-touch methods for issue analysis and resolution, and for more effective network planning.

Optare analyses all network data and uses clustering and/or statistical methods to group customers with similar features. Following a similar approach, techniques are applied to identify relative network usage for hourly and daily aggregations per service types. This information powers the Celfocus Admission Control Framework (ACF), a state-of-the-art Deep Reinforcement Learning framework to support 5G network management/planning. By knowing information like maximum capacity and current network state, expected service permanence or future expectation of service requests, the algorithm accepts or rejects real-time or scheduled service requests in function of the price to maximize the revenue for the CSP. Moreover, the framework can seamlessly scale to multiple objective functions, like energetic efficiency, minimal latency, maximum served users, among others.

Again, the loop is closed by NTT DATA's SOM and actuator modules, enabling real-time autonomous configurations over the network, while applying deep reinforcement learning to manage admission of new 5G network slicing requests. This is the essential first step towards faster, more effective network planning, in which high bandwidth, cloudlike services can be provided at speed, with high levels of reliability and at great speed.

Effective delivery

This Catalyst project is establishing some of the key building blocks for enhanced network design, performance and customer satisfaction, leading to competitive advantage for CSPs as added value service providers. The logical stages to be followed are:

1

Ensure CSPs have access to the CEI method and framework that accurately connects network data to the true customer experience. This opens up the potential for automated monitoring and continuous improvement through use of smart algorithms.

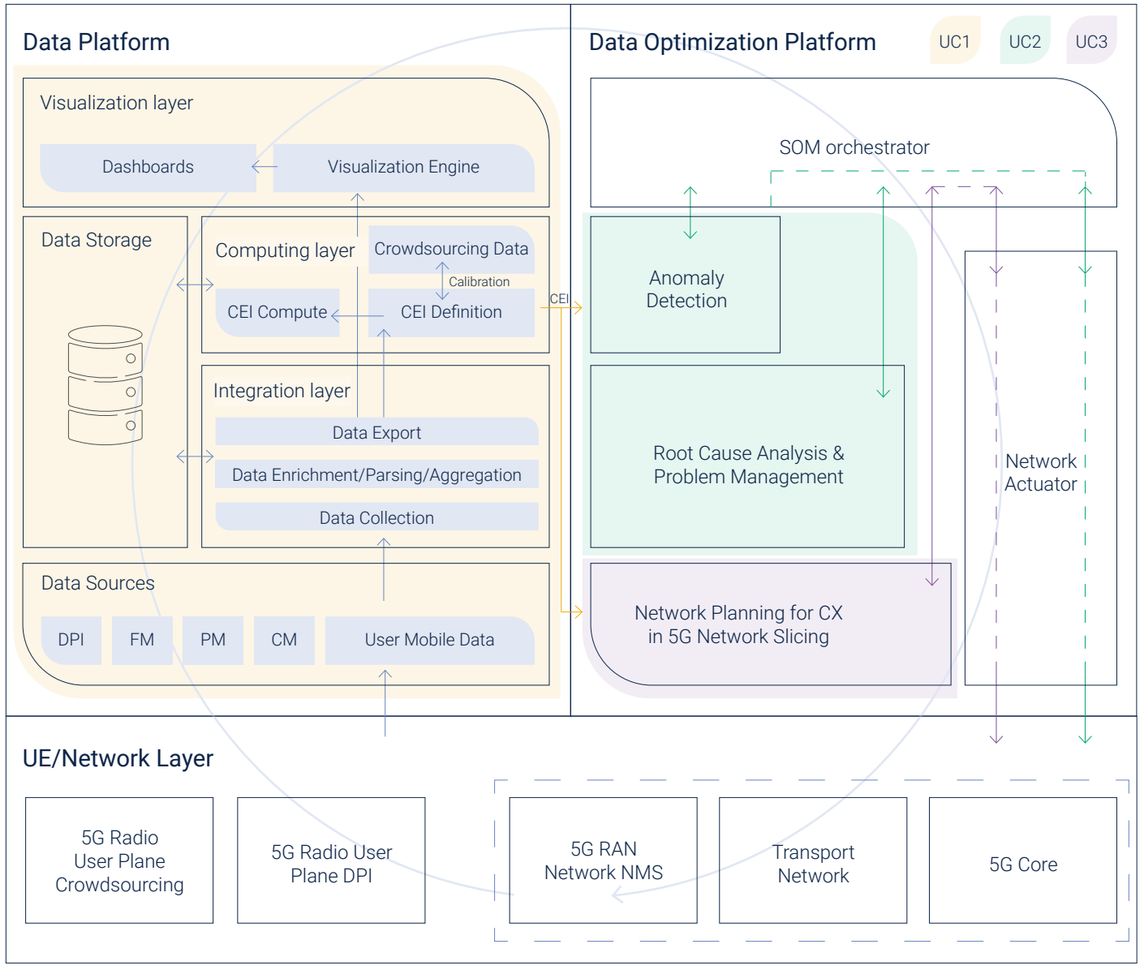
2

Build an effective, easy to deploy method for identifying anomalies and resolving service issues using AI/ML enabled systems. This enhances satisfaction and provides data that can be used in the final stage.

3

Gather contextualized data in a single lake, with input from networks, usage and devices, enabling CSPs to enhance their planning and design activities, while making it simpler to deliver Network Slices by 5G, maximizing the revenue and customer experience perception and delivering added value services.

Architecture



Potential development

The Autonomous Customer Experience Index for zero-touch 5G network – Phase II Catalyst project aims to provide a strong and practical foundation for future CSP services. In the near future it is essential that they position themselves for margin growth in a marketplace that is evolving fast and growing even faster.

Automated systems will be at the heart of high quality, high performance, high satisfaction services in the near-term future. The capabilities included in this Catalyst project form the basis for the tools and methods needed to give CSPs a more productive and profitable future.

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