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ESSENTIAL TOOLS IN THE TELECOMMUNICATIONS ECOSYSTEM

A GUIDE FOR OPERATORS

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1. Abstract

The telecommunications industry has undergone significant evolution over the past few decades. In recent years, there has been a trend towards convergence in the telecommunications industry. This involves the integration of various technologies and services, such as voice, data, and video, into a single platform. This has enabled new services, such as cloud computing and the Internet of Things (IoT). The industry will continue to evolve in the future, as new technologies and services emerge, and as the demand for connectivity and digital services continues to grow.

Overall, Telecommunications is a rapidly evolving industry that is constantly adapting to new technologies and changing customer demands. To remain competitive in this market, telecommunications operators need to optimize their network operations, improve their customer experience, and enhance their overall business performance.

Telecommunications operators can achieve these goals by leveraging the expertise of software vendors. Software vendors can provide customized software solutions, integrate existing systems, provide advanced analytics, offer technical support, and provide continuous upgrades to their software solutions.

Some of the specific areas where software vendors can help telecommunications operators include:

- 1) **International Voice Platforms:** Software vendors can provide international voice platforms that enable telecommunications operators to offer their customers voice communication services across borders, using advanced routing technologies and competitive pricing.
- 2) **A2P Messaging Platforms:** Software vendors can provide A2P messaging platforms that enable telecommunications operators to offer their customers messaging services, such as SMS and MMS, for marketing and other purposes.

- 3) **Virtual Numbering DIDs:** Software vendors can provide virtual numbering DIDs that enable telecommunications operators to offer their customers virtual phone numbers, enabling them to receive calls from anywhere in the world, without needing a physical presence in that location.
- 4) **APIs in Telecommunications:** Software vendors can provide APIs in telecommunications that enable telecommunications operators to integrate their systems, offer new services, and improve their customer experience.
- 5) **Fraud Detection and Prevention:** Software vendors can provide fraud detection and prevention solutions that help telecommunications operators identify and prevent fraudulent activity, protecting their customers and their business.

In conclusion, software vendors can play a critical role in helping telecommunications operators improve their network operations, enhance their customer experience, and remain competitive in a rapidly evolving market. By leveraging the expertise of software vendors, telecommunications operators can stay ahead of the curve and meet the changing needs of their customers, while maximizing their business performance.

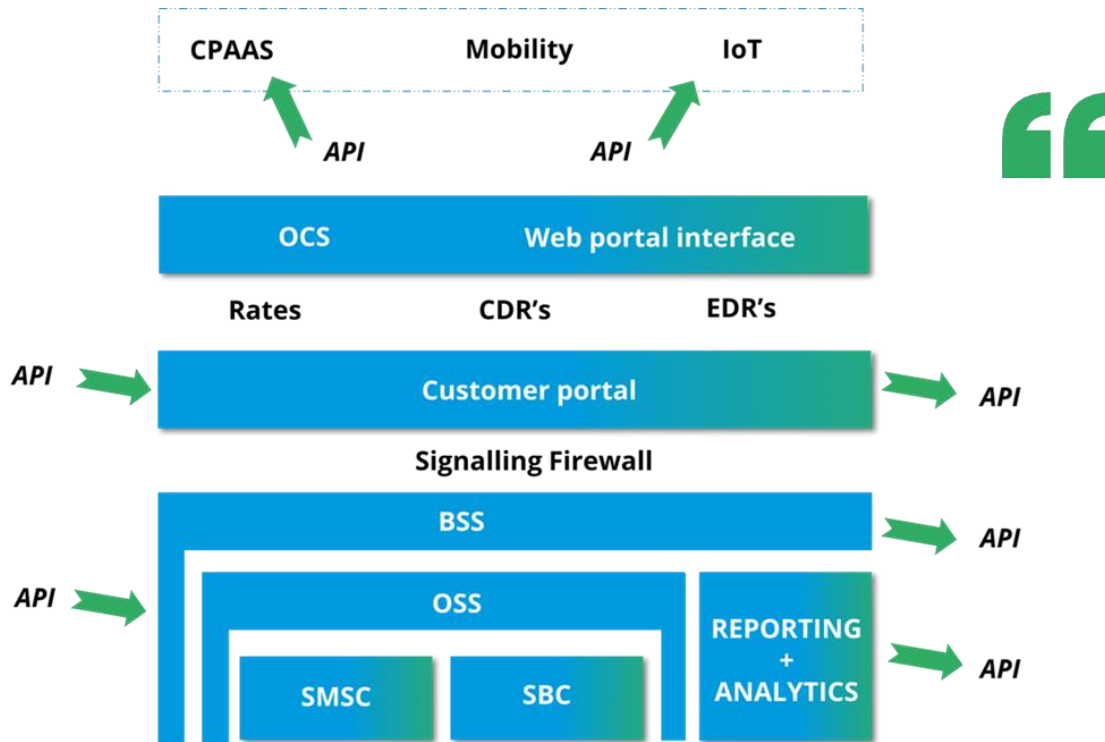
2. Challenges in the telecommunications ecosystem

Telecommunications operators face several challenges in the ever-changing telecommunications industry, including:

- 1) **Technological change:** telecommunications operators must keep pace with rapid technological change, including the emergence of new communication technologies and the growing demand for more advanced services.
- 2) **Network security:** as telecommunications networks become more complex, they also become more vulnerable to security threats such as hacking, viruses, and data breaches.

- 3) **Customer experience:** telecommunications operators must focus on delivering a high-quality customer experience to meet the increasing expectations of their customers, including fast connectivity, responsive customer service, and personalized service offerings.
- 4) **Competition:** the telecommunications industry is highly competitive, with many players vying for market share. Telecommunications operators must continuously innovate and differentiate themselves to remain competitive.
- 5) **Regulatory compliance:** telecommunications operators must comply with a variety of regulations at the local, national, and international levels, which can be complex and costly.
- 6) **Infrastructure costs:** building and maintaining telecommunications infrastructure can be expensive, particularly in areas with low population density or challenging terrain.
- 7) **Data management:** telecommunications operators need to manage and analyse large volumes of data to optimize their network operations and improve the customer experience.

To address these challenges, telecommunications operators must invest in technology, talent, and infrastructure. They must also work closely with industry partners, including software vendors, to leverage the latest technologies and best practices in the industry.



3. SBCs and software applications: critical components of the telecommunications industry

The advent of software-based solutions has led to the development of new technologies that are changing the way telecom operators work. One of the most significant developments in this area is the introduction SBCs (Session Border Controllers).

A Session Border Controller (SBC) is a network element used in telecommunications to control the signalling and media streams involved in establishing and terminating real-time communication sessions between two or more endpoints. It is typically deployed at the edge of a network to secure and manage communication traffic between different networks or between different segments of the same network.

SBCs play a critical role in modern telecommunication networks, particularly in Voice over Internet Protocol (VoIP) and Unified Communications (UC) environments. Some of the primary uses of SBCs include:

- 1) **Security:** SBCs provide a range of security functions to protect against attacks, unauthorized access, and other security threats. These functions include firewalling, encryption, and access control.
- 2) **Quality of Service (QoS):** SBCs can prioritize traffic and manage bandwidth to ensure that real-time communication sessions are of high quality and not impacted by other traffic on the network.
- 3) **Interoperability:** SBCs can provide protocol translation and media transcoding to ensure that different endpoints can communicate with each other despite using different communication protocols or media formats.
- 4) **Network Address Translation (NAT) traversal:** SBCs can help overcome the limitations of NAT devices, which can cause problems for real-time communication sessions that use private IP addresses.
- 5) **Routing and policy enforcement:** SBCs can route traffic between different networks or segments of the same network based on pre-defined policies, which can help optimize network resources and enforce regulatory compliance.
- 6) **Signalling:** SBCs are used to provide signalling services in VoIP networks. They are used to translate signalling protocols between different networks, ensuring that calls can be established between different systems. SBCs can also be used to implement advanced signalling functions, such as load balancing and failover.

In addition to SBCs, some specific software applications are also essential in the telecommunications industry. Software applications are used to provide a range of services, including billing, provisioning, and network management.

- Billing applications are used to manage the billing process for telecom operators. They are used to generate invoices, track payments, and manage customer accounts. Billing applications are critical in ensuring that telecom operators can manage their revenues effectively.

- Provisioning applications are used to manage the process of activating and deactivating services for customers. They are used to manage the entire lifecycle of a service, from activation to termination. Provisioning applications are critical in ensuring that customers receive the services they have subscribed to.
- Network management applications are used to manage the telecom operator's network. They are used to monitor the network, diagnose faults, and perform maintenance tasks. Network management applications are critical in ensuring that the network is running smoothly and that faults are detected and resolved quickly.

SBCs and software applications are critical components of the telecommunications industry. SBCs are used to provide a range of services, including session border control, media processing, and signalling. Software applications are used to manage the billing process, provisioning of services, and network management. The adoption of SBCs and software applications has transformed the way telecom operators work, enabling them to provide more efficient and reliable services to their customers.

4. Telecommunication management systems

A Telecommunications Management System (TMS) is a software platform designed to manage and monitor various telecommunications networks, systems, and services. It provides tools and functionalities for managing the entire telecommunications infrastructure, including voice, data, and video services.

A TMS typically includes several modules that can be customised according to the specific needs of the organisation. Some of the common modules of a TMS are:

- 1) Inventory Management:** this module provides a comprehensive view of all the assets, components, and resources of the telecommunications infrastructure, such as switches, routers, cables, and circuits.

- 2) **Fault Management:** this module provides tools for monitoring and detecting faults in the network, such as equipment failures, network congestion, and service disruptions. It also provides mechanisms for resolving these issues, such as automatic fault recovery and manual intervention.
- 3) **Performance Management:** this module provides tools for monitoring and analysing the performance of the network, such as traffic volume, latency, and packet loss. It also provides mechanisms for optimizing network performance, such as traffic shaping and load balancing.
- 4) **Configuration Management:** this module provides tools for managing and configuring the various components of the telecommunications infrastructure, such as switches, routers, and firewalls. It also provides mechanisms for deploying new configurations and maintaining version control.
- 5) **Billing Management:** this module provides tools for managing and processing billing data, such as customer usage, tariffs, and payments. It also provides mechanisms for generating invoices, managing customer accounts, and collecting payments.
- 6) **Routing Management:** this module manages and directs traffic within the network. It uses algorithms to determine the optimal path for traffic to travel from the source to the destination, considering factors such as network congestion, quality of the routes, reliability, etc. It also provides additional features such as network monitoring and QoS controls.
- 7) **Security Management:** this module provides tools for managing and enforcing security policies and protocols, such as authentication, authorization, and encryption. It also provides mechanisms for detecting and responding to security threats, such as intrusion detection and prevention.

A TMS is an essential tool for managing the complex and diverse telecommunications infrastructure of modern organizations. It provides a

centralized platform for managing various network services, ensuring optimal performance, and maximizing the return on investment.



5. Essential tools for telecommunication operators

a) Switch

A switch is a device that connects telephone lines, trunks, and other communication circuits together to enable the routing of voice, data, and other types of communication between different users or endpoints. The switch is responsible for managing the connections and routing the traffic to the appropriate destination.

There are several types of switches used in telecommunications, including:

- 1) **Private Branch Exchange (PBX):** a PBX is a private telephone network used within an organization, enabling users to make internal calls and external calls using a shared access to the public switched telephone network (PSTN).
- 2) **Public Switched Telephone Network (PSTN) Switches:** these are switches used by telecom service providers to provide connectivity between end-users, such as residential and business customers.

- 3) **IP Telephony Switches:** these are used for voice-over-IP (VoIP) communication and enable the transmission of voice traffic over IP networks.
- 4) **Soft switches:** a software-based switch that runs on a computer or server and is used to control voice, video, and other types of communication over IP networks.

Switches play a critical role in enabling the routing of communication traffic and ensuring that users can communicate effectively. Modern switches have advanced features such as call routing, signalling, quality of service (QoS), security, and scalability, enabling telecom operators to provide high-quality communication services to their customers.

b) International voice platform

An international voice platform is a telecommunications service that enables carriers and service providers to connect and exchange voice traffic across multiple countries and regions. It allows users to make voice calls to and from different parts of the world, using a single network or platform.

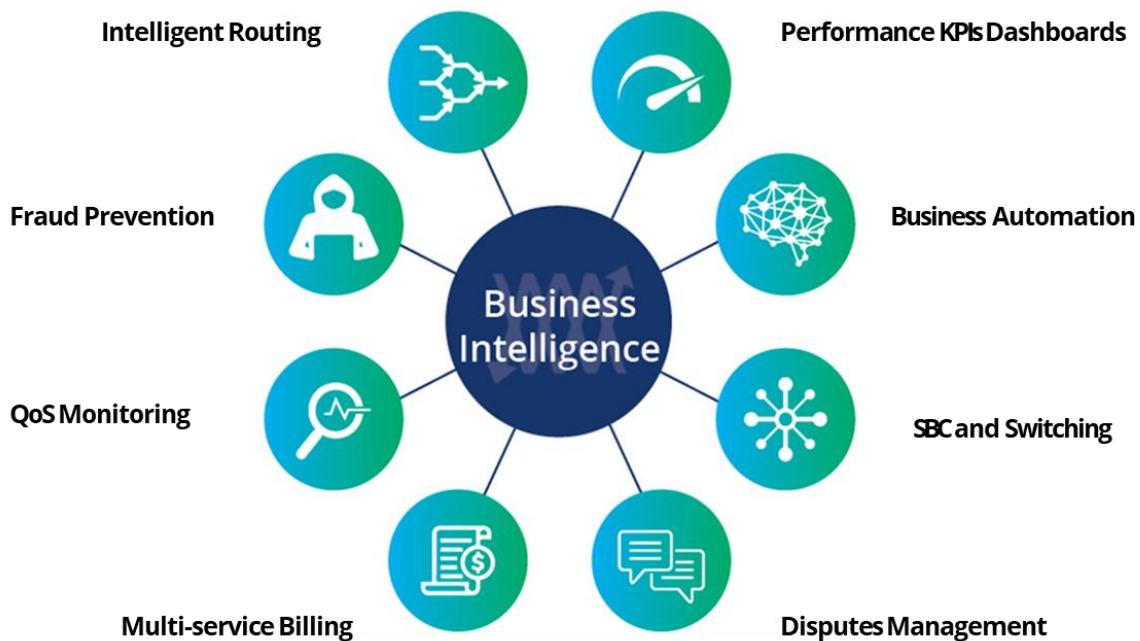
An international voice platform typically includes the following features:

- 1) **Carrier Interconnects:** this is the backbone of the platform, which connects different carriers and service providers around the world. It allows them to exchange voice traffic and route calls to their destination.
- 2) **Number Portability:** this feature allows users to keep their phone numbers when they travel or move to a different country. It ensures that they can receive calls from their contacts without any disruptions or changes.
- 3) **Quality of Service (QoS):** this feature ensures that voice calls are of high quality and clarity, with minimal latency, jitter, and packet loss. It provides a seamless and reliable voice communication experience for users.
- 4) **Billing and Settlement:** this feature enables carriers and service providers to bill and settle for the voice traffic that they exchange on the platform. It

ensures that they are compensated for their services and that revenue is shared appropriately.

5) Analytics and Reporting: this feature provides carriers and service providers with detailed analytics and reporting on their voice traffic, such as call volumes, durations, and destinations. It helps them to optimize their network performance, manage their costs, and make informed business decisions.

An international voice platform is essential for carriers and service providers that operate in multiple countries and regions. It enables them to provide their users with seamless and reliable voice communication, regardless of their location. It also provides them with a competitive advantage in the market, as it allows them to offer international voice services at a lower cost and with higher quality than their competitors.



c) A2P messaging platform


An A2P (Application-to-Person) messaging platform is a software service that allows businesses to send text messages to their customers or end-users. It is typically used for automated messaging, such as alerts, notifications, and marketing messages.

A2P messaging is a cost-effective and efficient way for businesses to communicate with their customers, as it allows them to reach a large audience quickly and easily. A2P messaging is also highly customizable, as businesses can personalize their messages and target specific groups of customers based on their preferences, behaviour, and location.

An A2P messaging platform typically includes the following features:

- 1) **Message Gateway:** this is the interface through which businesses can send and receive messages. It typically supports various messaging protocols, such as SMPP, HTTP, and REST API.
- 2) **Message Templates:** this feature allows businesses to create predefined message templates for various use cases, such as appointment reminders, verification codes, and marketing messages.
- 3) **Message Personalization:** this feature allows businesses to personalize their messages by including custom fields, such as the recipient's name or account information.
- 4) **Message Scheduling:** this feature allows businesses to schedule messages to be sent at a later time, such as for reminders or promotional offers.
- 5) **Reporting and Analytics:** this feature provides businesses with detailed reports and analytics on their messaging campaigns, such as delivery rates, open rates, and click-through rates.

An A2P messaging platform can be used in various industries apart from telecommunications, such as banking, healthcare, retail, and logistics. It is an

A person in a light blue uniform is holding a tablet. The tablet screen shows a white envelope icon on a blue background. To the right of the person, there are three white chevron arrows pointing to the right.

Deliver New Experiences

Enterprises can create an advantage over competitors by adding A2P messaging to their portfolio for seamless communication with end users. They can move from outdated and unwanted communication channels to improve engagement, with messages delivered straight to the customer's preferred device.

essential tool for businesses that want to improve their customer engagement, increase their operational efficiency, and drive revenue growth.

d) APIs

API (Application Programming Interface) refers to a set of protocols, tools, and standards that allow software applications to interact with telecommunications networks and services. It enables developers to access and use telecommunications services, such as messaging, voice, and data, in their own applications or systems. In the telecommunications industry, APIs play a critical role in enabling carriers to automate and accelerate their business processes, by providing a standardised interface to access and use their services.

APIs in telecommunications can provide a range of benefits, including:

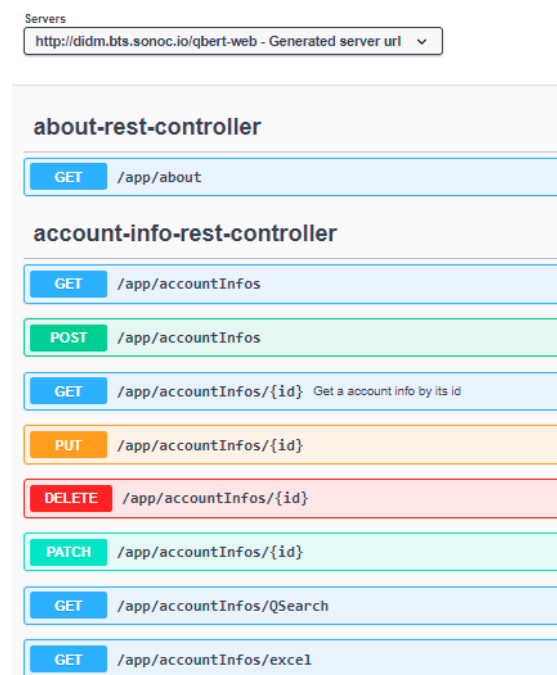
- 1) **Integration:** APIs allow developers to integrate telecommunications services into their own applications or systems, enabling them to create more robust and feature-rich products.
- 2) **Automation:** APIs enable developers to automate certain telecommunications tasks, such as sending messages or processing payments, saving time and reducing the risk of errors.
- 3) **Customization:** APIs allow developers to customize telecommunications services to better suit their needs and the needs of their users.
- 4) **Scalability:** APIs can help telecommunications providers scale their services more efficiently, by providing a standard interface for third-party developers to access their services.
- 5) **Innovation:** APIs can enable new and innovative telecommunications services, by providing access to underlying network capabilities and resources.

Some examples of telecommunications APIs include:

- Messaging APIs: these allow to send and receive text messages, multimedia messages, and chat messages.

- Voice APIs: these allow to initiate and manage voice calls, and to access features such as voice recognition and text-to-speech.
- Payment APIs: these allow to process payments for telecommunications services, such as top-up credits or subscriptions.
- Location APIs: these allow to access location-based services, such as maps and geolocation.

In conclusion, APIs are essential in enabling carriers to build a programmable future, by automating and accelerating their business processes. They provide carriers with a competitive advantage in the market, by enabling them to offer more innovative, scalable, and customisable services to their customers and partners.



e) Virtual numbering (DIDs)

Virtual numbering DIDs (Direct Inward Dialling) is a service that allows businesses to use phone numbers from different geographical locations, without having to set up a physical office in each location. It enables businesses to have a local presence and to receive calls from customers in different areas, while still managing all their calls through a single phone system.

Virtual numbering typically work as follows:

- Businesses purchase virtual numbers from a service provider, which are assigned to them based on the desired geographical location.

- Calls made to the virtual numbers are routed to the business's existing phone system or call centre, which can be located anywhere in the world.
- When a customer dials the virtual number, the call is automatically forwarded to the business's phone system, where it is handled by a live agent or an automated voice response system.

Virtual numbers can provide several benefits for businesses, including:

- 1) **Local presence:** by using local phone numbers, businesses can create a local presence in different geographic locations, which can help them to build trust and credibility with customers.
- 2) **Cost savings:** virtual numbers are typically cheaper than traditional phone lines, as they don't require physical infrastructure or maintenance.
- 3) **Scalability:** virtual numbers can be easily added or removed based on the changing needs of the business, without requiring any physical changes.
- 4) **Call management:** virtual numbers can be integrated with call management systems, such as call forwarding, call recording, and call routing, to provide a seamless customer experience.

Software vendors can simplify the task of management virtual numbering with tools to enable customers to efficiently manage, sell and deliver numbers to wholesale and enterprise customers. These tools must provide simple access and assign numbers with full visibility into pricing, number portability and invoicing. As communication platform as a service (CPaaS) growth accelerates, and SIP phone adoption continues, it is critical that customers can access and deploy numbers quickly and efficiently around the globe.



f) Telecom fraud

Fraud in telecommunications is a substantial issue that can result in significant financial losses for telecom companies, their customers, and partners. Telecom fraud can take many forms, including but not limited to:

- 1) Subscription fraud:** this involves criminals using stolen or fraudulent identities to obtain services, such as mobile phones or data plans.
- 2) Call forwarding fraud:** this involves criminals forwarding calls to premium rate numbers, resulting in the victim being charged a significant amount of money.
- 3) International revenue share fraud:** this involves criminals setting up fake companies or routing calls through unauthorized channels, resulting in the revenue being shared between criminals and unsuspecting telecom operators.
- 4) Phishing and smishing scams:** these involve criminals using deceptive techniques, such as email or SMS, to trick victims into divulging personal information, such as login credentials.

There are several strategies that telecom companies can use to tackle fraud, including:

- 1) **Fraud detection and prevention:** telecom companies can use advanced analytics and machine learning algorithms to detect and prevent fraudulent activity in real-time.
- 2) **Authentication and identity verification:** telecom companies can implement multi-factor authentication and identity verification solutions to ensure that only authorized users are accessing their services.
- 3) **Education and awareness:** telecom companies can educate their customers and partners about the risks of fraud and provide them with information on how to protect themselves.
- 4) **Collaboration:** telecom companies can work together to share information and best practices on fraud prevention, enabling them to detect and prevent fraudulent activity more effectively.

Software vendors can help Telecom companies tackle fraud by developing advanced fraud detection and prevention strategies, implementing authentication and identity verification solutions, educating their customers and partners, and collaborating with other telecom companies. By implementing these strategies, Telecom companies can reduce the risk of fraud and protect their customers, partners, and bottom line.

Telecom Carriers need to tackle multiple fraud types & scenarios

Signaling Manipulation Changing the way calls are established, charged and billed	Grey Routing Routing the traffic through an unauthorized intermediate country or CSP	Tromboning Diverting the traffic across restricted routes through cheaper countries	Flash Calls Routing traffic through an unauthorized P2P voice channel instead to the right channel: either A2P SMA or Flash Call
WANGIRI Triggering a significant number of unanswered short calls to incentivise call backs	IRSF Performing unauthorized calls to international premium rate numbers (IPRN)	Artificial inflation of traffic Artificially inflating traffic by using spam messages, missed calls. etc	False answer supervision Using mechanisms falsely indicating a call has been established

6. Conclusion

Software vendors can help telecommunications operators in several ways:

- Providing customised solutions: software vendors can provide customised solutions tailored to the specific needs of the telecommunications operator. This can help the operators to optimise their network operations, improve their customer experience, and enhance their overall business performance.
- Integrating existing systems: software vendors can help telecommunications operators integrate their existing systems, allowing them to operate more efficiently, reduce costs, and improve their network performance.
- Providing advanced analytics: software vendors can provide advanced analytics capabilities, enabling telecommunications operators to analyse their network traffic, identify trends, and make data-driven decisions that improve their network performance and customer experience.
- Offering technical support: software vendors can provide technical support to telecommunications operators, ensuring that they can resolve issues quickly and efficiently, and minimising the impact of downtime on their customers.
- Providing continuous upgrades: software vendors can provide continuous upgrades to their software solutions, ensuring that telecommunications operators have access to the latest features and capabilities, and enabling them to remain competitive in a rapidly evolving market.
- Improved network visibility: software vendors can provide real-time visibility into network performance, enabling carriers to monitor network traffic, identify issues and optimise network resources.
- Increased efficiency: software vendors can automate many routine network operations tasks, enabling telecom carriers to improve their operational efficiency, reduce costs and improve their overall business performance.

By leveraging the expertise of a software vendor, telecommunications operators can improve their network operations, enhance their customer experience, and remain competitive in a rapidly evolving market.

