



CONVERGENCE

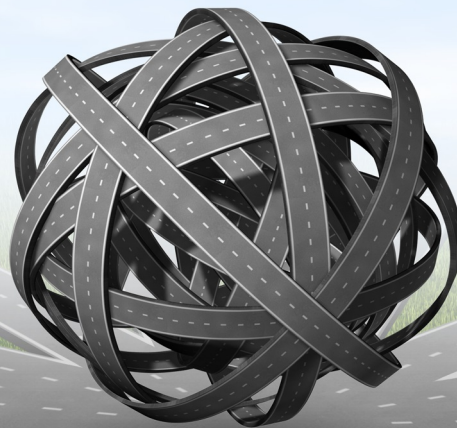
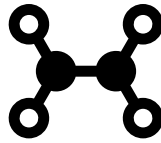


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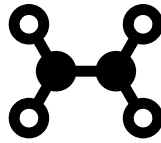
EXECUTIVE OVERVIEW

As telecom continues to evolve Communication Service Providers (CSPs) face enormous challenges brought on by rapidly changing technology, immense competition from multiple mediums, strong influence from social media and competing OTT services. It is no longer feasible for CSPs to limit their services and reach to subscribers based only on a few core services, CSPs must now provide a broad suite of services that appeal to both enterprise customers and consumers across mobile, VoIP and satellite connections.

Converging real-time billing, signalling protocols, value added services and application programming interfaces has fuelled the ability for CSPs to offer a multitude of services and payment methods, device-agnostic and global roaming access and self-management, which all coalesce to build value, reduce churn and maximize subscriber usage. Through more comprehensive services, greater device access, new payment methods and self-management the need for subscribers to look to third parties for missing services is greatly reduced. Through convergence the need for a disjointed user-experience as well as the need to manage multiple subscriber accounts and services over disparate systems is eliminated.

At IVR Technologies we understand the challenges facing today's CSPs and how these challenges differ based on country specific regulations, barriers to access, culture and/or infrastructure. We believe in the power of convergence and the belief that subscribers should be able to self-manage their services, combine their business and individual communication needs over mobile, VoIP and satellite connections and have streamlined accounting through unified billing and multiple payment methods. Convergence is a revenue driver and force multiplier that benefits many types of operators (e.g. MNO, MVNE, MVNO, VoIP OTT, SATCOM) across many types of industries (e.g. oil and gas, maritime, defence, aviation, travel, etc.)

When implemented and marketed properly convergence has the power to set a CSP's network apart from their competition through CAPEX and OPEX cost reductions, network efficiency and resiliency as well as by satisfying as many of their subscribers' communication service needs as possible, which negates the need for subscribers to look to third parties in order to fill service, access and/or payment gaps.



EVOLUTION OF TELECOM

A lot has changed in telecom over the past 20 years or so. Over this time we have seen most telecom markets undergo deregulation and we have seen the industry's transition from single, fixed circuit switched analog lines to packet switch networks and broader mobility penetration as well as a wealth of new and exciting services. For the CSP the pace of innovation has been unprecedented and keeping up with it can be overwhelming from an engineering, maintenance and financial perspective.

In the past there was a limited number of network operators worldwide due to government regulation and very high barriers to entry, which while lucrative for the operator was extremely limiting and constraining for the consumer. If an individual was lucky enough to reside in a service area and could afford the service he/she could only subscribe to basic voice calling.

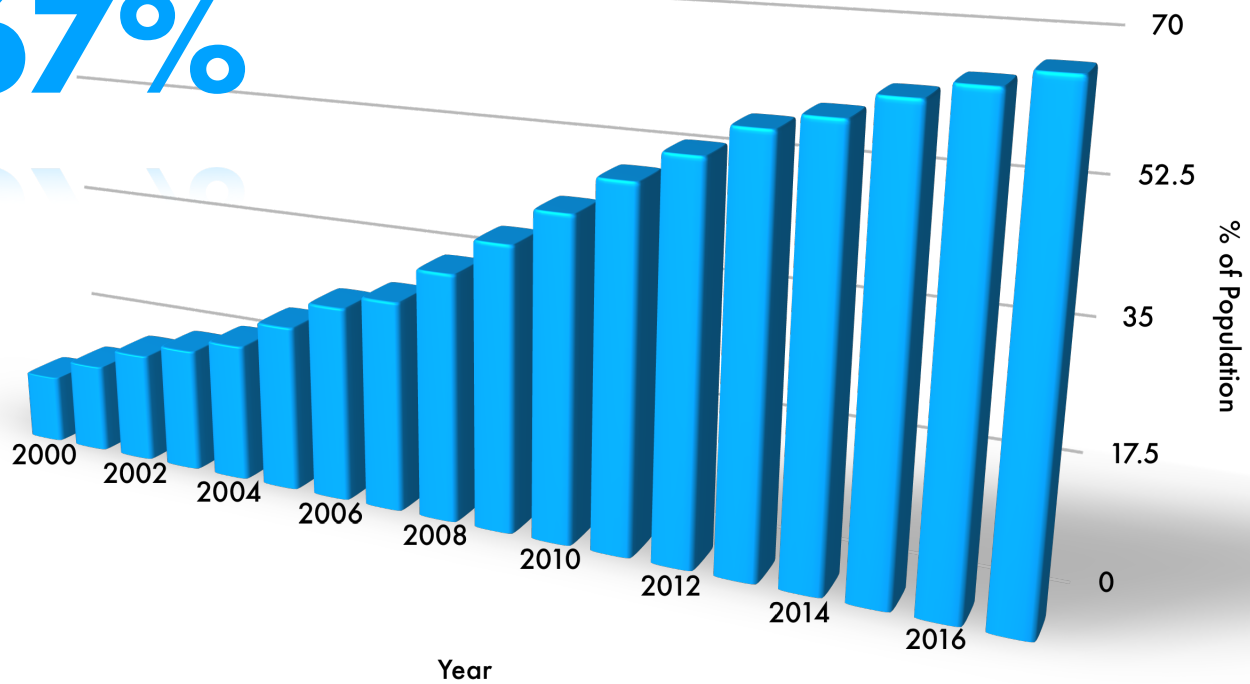
Most markets have now deregulated attracting investment from the private sector, which has spurred innovation and led to a plethora of new services, broader consumer choice, lower cost, better quality of service and an improved subscriber experience.

As telecommunication networks evolve globally successful CSPs can now provide their subscribers with services over mobile, VoIP and satellite connectivity ranging from voice, data, mobility, TV, internet, entertainment, banking, home automation, M2M, IoT and residential/commercial security. Converging services to the subscriber and the device with global access are base requirements for any CSP offering and is fundamental in order to gain a competitive advantage, build profits, reduce churn and grow their subscriber base.

According to DazeInfo, as of Q2 2017 there were 5 billion unique mobile subscribers worldwide with 67% penetration. This is a staggering statistic and shows the level of penetration and just how critical mobile technology and the mobile subscriber has become over a relatively short period of time.

Total Subscriber Penetration (% of population)

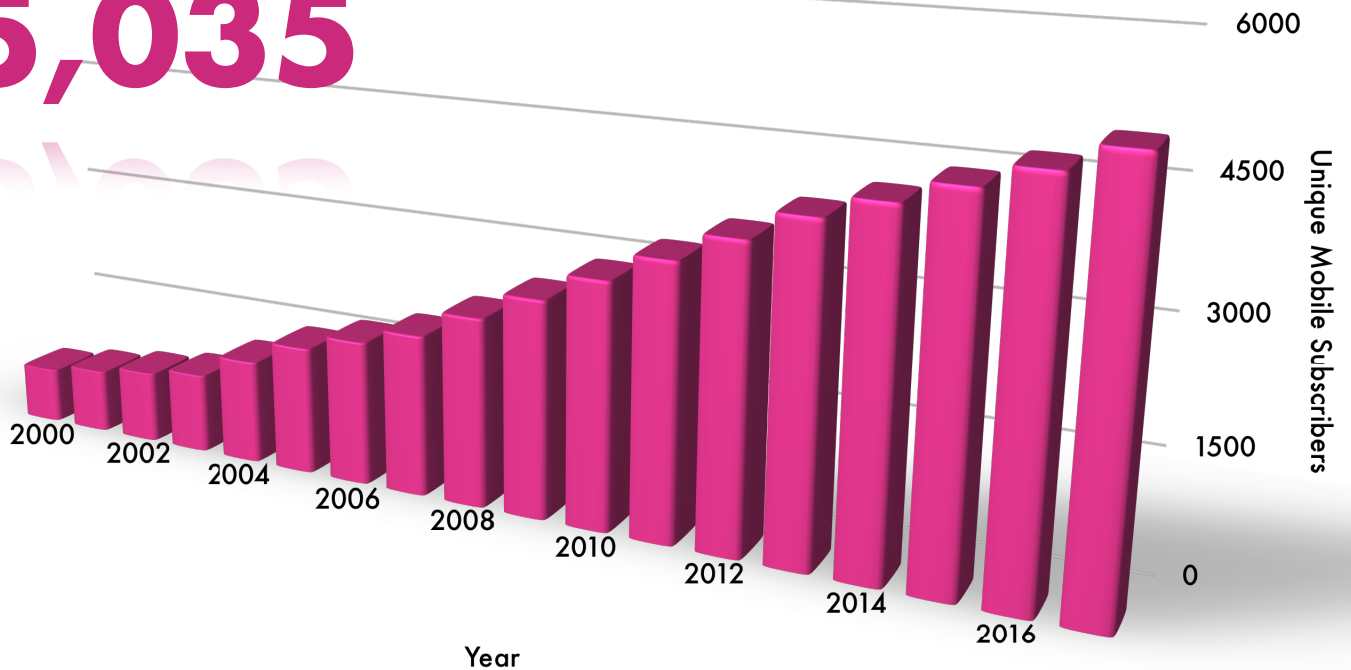
67%



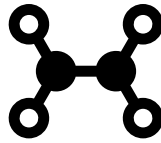
Source: DazeInfo

Total Unique Mobile Subscribers (millions)

5,035



Source: DazeInfo



CONVERGENCE

Convergence brings together access, software, applications and connectivity into a unified product offering designed to satisfy existing and/or unidentified consumer demand. The goal of convergence is to develop attractive services that are in-demand or that satisfy anticipated future demand over a broad number of devices and/or access methods in a way that the consumer can enjoy the consumption of these services without being aware of the underlying technology required to deliver these services. Convergence facilitates greater digitization of a consumer's life with tangible benefit through greater connectivity, mobility, resiliency, control flexibility and efficiency.

Convergence comes in many forms, and there are several functions that operators need to consider when creating or upgrading their networks. Today's mobile, VoIP and satellite networks consist of disparate systems, most of which do not fully integrate at the back-end and typically have some elements based on post and/or real-time processing.

Consider an MVNO who relies on network APIs for post CDR processing and who does not have access to network signalling, or a VoIP operator who cannot communicate directly with the mobile core network to converge their service offerings. While each type of operator can stand on their own, they often fail to converge billing, signalling, services and APIs, which can lead to a host of business and technical issues while imposing significant commercial limitations.

REAL-TIME BILLING

A converged services platform that includes a tightly coupled real-time billing engine along with real-time network signalling provides the operator with greater flexibility and control in how they bill for services. Real-time billing can be unified to provide a variety of services for a single subscriber account, as well as enabling streamlined credit and policy management for tiered billing models (e.g., wholesaler/reseller/retail models). When billing convergence is achieved each consumed service can be billed independently from the other but through a consolidated and unified account. For example, a mobile call can be billed differently from a call over satellite, or a SIP Wi-Fi/3G call; an on-net call can be billed differently from an off-net call; data originating over one partner carrier's network can be billed preferentially from another partner; and USSD callback requests can be billed differently from ones originating

via SMS.

Without convergence operators are limited in their ability to be creative and competitive in the pricing of their services and if limited to post CDR processing it becomes even more challenging and labor intensive to manage their billing/collection operations consistently and predictably across the network, which also creates a financial exposure in credit challenged markets. Perhaps most importantly converged billing simplifies the creation of new services to existing subscribers, which results in enhanced profitability and improved competitive advantage.

SIGNALLING PROTOCOLS

Real-time access to network signalling is a major benefit to the successful operation of a next-generation mobile, VoIP and satellite network. A converged services platform that supports SS7, SIGTRAN, DIAMETER, CAMEL, USSD and SIP allows the operator to service and cost-effectively originate and terminate voice, data and SMS traffic across devices on both home or host networks based on which route/method offers the best quality and/or cost advantage. Real-time signalling provides the operator with the ability to authenticate subscribers, bill for services, provision SIMs, route call traffic, support multi-IMSI SIM profiles and enable value-added services while insulating themselves from potential fraud and subscriber service overruns. With the ability to mix and match signalling regardless of the call type the operator gains a competitive edge through the ability to generate revenue from a greater array of in-demand subscriber services whether it be voice, data, SMS or any combination thereof.

VALUE ADDED SERVICES

Today most operators are competing on price, which is a race to the bottom. In this pricing model every operator loses – while they may gain subscribers in the short term, reaching break-even, or even profitability using razor-thin margins is risky and highly elusive. So how does an operator gain subscribers, reduce churn, build margins and make money? The answer is convergence.

Through convergence the operator can provide a suite of services that are all tied and billed to a single subscriber account that can be self-managed from a web portal over any device, using a single e-wallet, and these converged services can be marketed to both the consumer and the enterprise alike.

The following are some of the consumer and enterprise converged services that can be used to build subscriber loyalty and capture the market share:

Consumer Services

- Domestic mobile SIM
- Single and multi-IMSI global roaming travel SIM
- Data and M2M SIM ● OTT SIP Wi-Fi/3G (4G/LTE) softphone
- Mobile Dialers
- Voicemail
- Find Me/Follow Me services
- Prepaid calling card
- Callback
- International Long Distance

Enterprise Services

- Auto-attendant
- Audio-text
- Voicemail and PBX services
- Inbound call center with agent queuing and skills-based routing
- Conferencing
- Find Me/Follow Me services

CONVERGENCE

for









Next Generation Mobile and VoIP Networks

SIGNALING CONVERGENCE

powers

A Wide Range of Service Combinations to Rapidly Meet Multiple In-Demand Services



- ✓ Authenticate Subscribers 
- ✓ Bill for Services 
- ✓ Provision SIMs 
- ✓ Route Call Traffic 
- ✓ Support Multi-IMSI SIM Profiles 
- ✓ Enable Value Added Services 
- ✓ Eliminate Fraud 
- ✓ Eliminate Service Overruns 

To Service and Cost-Effectively Originate and Terminate Voice, SMS and Data TRAFFIC

SS7
SIGTRAN
DIAMETER
CAMEL
USSD
SIP

Real-time access

BILLING CONVERGENCE

powers

Greater Billing Control and Flexibility
Creative & Competitive Pricing
Faster Service Creation

- ✓ Wide Variety of Services under a Single Account
- ✓ Streamlined Credit and Policy Management for Tiered Billing Models
- ✓ Independent Service Billing



Talking SIP™
Mobility


SERVICES

REAL-TIME
BILLING ENGINE










NETWORK
SIGNALING

SERVICE CONVERGENCE




powers

Single Account, Single Interface & Single Payment Medium 
Single Point Self-Service

Consumer Services

- Domestic Mobile SIM 
- Single & Multi-IMSI Global Roaming Travel SIM 
- Data and M2M SIM 
- OTT SIP Wi-Fi/3G (4G/LTE) Softphone 
- Mobile Dialers 
- Voicemail 
- Find Me/Follow Me Services 
- Prepaid Calling Card 
- Callback 
- International Long Distance 

Enterprise Services

- Auto-Attendant, Audio-text, Voicemail and PBX Services 
- Inbound Call Center with Agent Queuing and Skills-based Routing 
- Conferencing 

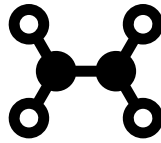
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APPLICATION PROGRAMMING INTERFACE (API)

Application programming interfaces or APIs open up a world of possibilities for convergence through the integration of third party applications, services, websites and/or portals. Driving new and unique services, improving the subscriber experience and streamlining customer service can be facilitated through open APIs that can unify back-office systems and subscriber management portals into a unified administration or subscriber portal and user experience.

When networks are built in an open way using open and extensible tools, instead of in a proprietary and walled garden approach, the market opportunity is greatly expanded through streamlined business operations, open ecosystem development, improved network profitability, end user empowerment and reduced overhead.



THE POWER OF CONVERGENCE

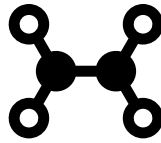
One of the latest advancements is the convergence of next-generation voice over IP services into the mobile core network. This convergence facilitates the augmentation of existing subscriber services with rich class 4 and class 5 features such as third-party call control, visual voice mail, WiFi Calling, and over the top mobile applications into the mobile network, which empowers the mobile subscriber and offers the mobile operator higher ARPU and more efficient network utilization.

Another powerful feature that convergence offers is the ability to route calls between the mobile network and VoIP SIP networks. By being able to selectively route ingress and egress calls between these two networks, convergence leverages the ubiquity and access of the mobile network with the cost-savings, network efficiency and built-in redundancy of the VoIP SIP network.

Through convergence mobile carriers can now originate calls from a VoIP SIP network for local presence anywhere in the world, where the call can terminate to one or more mobile handsets based on a preset routing plan or based on which handset or IMSI is currently active. This functionality is well suited for a subscriber looking to offer his family back home a toll-free local access number that he can be reached on. Alternatively, for an SME implementation, a company can set up a toll-free access number that provides a local presence in a foreign region without the costs, commitment and complexity normally associated with setting up traditional local service.

On the egress side MVNEs and MVNOs can utilize convergence to dynamically route calls on and off of the mobile network to a SIP trunk whenever it is advantageous to do so. CAMEL requests can be redirected from the mobile network to the VoIP SIP network based on time of day, day of week and cost as well as based on originating MSC, MCC, MNC, active IMSI and/or dialed destination for ultimate routing control and flexibility. Mobile carriers now have the control and flexibility to decide if it is better to allow the host network to service the request or seamlessly redirect the call to the home VoIP SIP network using a local or toll-free access point to realize the cost savings and/or network efficiency that a SIP trunk offers.

Convergence is a powerful advancement that allows mobile carriers to leverage the strength and benefits of the VoIP SIP network, while having it seamlessly integrated into the mobile network -- the end result is significant cost savings, network efficiency, resiliency, service expansion and additional sources of revenue.



THE BENEFITS OF CONVERGENCE

CONSUMER BENEFITS

Convergence offers tremendous and exciting benefits for the consumer in terms of selection, empowerment, cost savings, simplicity, resiliency and efficiency.

The following are some of the consumer benefits of convergence:

Unified Self-Service Management of Services

Convergence provides access to services through an app and/or responsive web portal for service signup, account payment, management of service and features and e-wallet management across any device using a single login.

Device Independent Repository for Messages

Convergence provides the ability to send and receive text messages and retrieve voicemail without those messages being stored on a specific device or require the use of dedicated devices or applications for message access/management.

Consolidated E-wallet with Single Point of Payment

Convergence ensures subscribers only need to store one credit card for payment or remit cash payment to a single vendor regardless of the number of services subscribed to. Convergence also drives e-wallet capabilities by allowing the stored value in the subscribers account to be used for such things as airtime transfer to third parties, money remittance, bill payment and account recharge.

Call Routing Across Devices

Convergence makes possible the ability for multiple devices to ring simultaneously for a given call with the ability for the subscriber to schedule routing and do not disturb based on their individual needs. Rates can be reduced based on whether inbound and/or outbound calls are directed over VoIP when available.

Global Roaming

Convergence provides the ability for subscribers to roam internationally without the typical bill shock and without the need to purchase a local SIM or use a separate device which is of great value. Convergence helps achieve unification of services and messaging where subscribers do not need to have a disjointed user experience as they leave their home network.

Lower Cost of Service

When subscriber services are converged the operator can cross subsidize services helping to drive down subscriber costs by routing via VoIP when calling internationally for cost savings and network efficiency.

Seamless Use Across Multiple Transport Mediums

Convergence promotes the use of services across transport mediums where subscribers can now use the same account, device and CSP for services provided over a VoIP, mobile, Wi-Fi and/or satellite connection.

OPERATOR BENEFITS

Convergence also offers benefits for the operator in terms of reduced administrative costs, reduced subscriber churn, network resiliency, profitability and agility.

The following are some of the operator benefits offered by convergence:

Reduction in Operational Costs

Convergence helps to significantly reduce the cost to operate a network by reducing the number of technical components and vendors required to operate a next-generation network. When the subscriber is empowered through self-management the need for human customer service resources is greatly diminished. Since there are fewer network touchpoints in the converged network issues are addressed by fewer parties in less time and as a result network performance and uptime is improved.

Reduction in Subscriber Churn

Through convergence, when subscribers have more of their communication services being provided by a single operator greater loyalty and inertia to movement is achieved resulting in a considerable reduction in subscriber churn.

Improved Profitability

Convergence helps to reduce operational cost and drives profits through increased consumer

service subscriptions that reduce subscriber churn, lowers reoccurring customer acquisition costs and leads to increased profitability.

Improved Network Resiliency

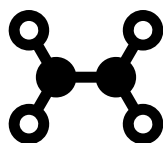
Convergence and the use of multiple packet switched protocols provides operators with the ability to originate and terminate traffic via multiple virtual trunk groups/types with automatic route advance to help drive down cost but it also ensures greater network uptime and resiliency through the ability to configure multiple ingress and egress paths on a dedicated or standby basis.

Ability to Quickly Respond to Competitive Threats

Whether it be new services, billing plans, payment methods, or account management the network built with convergence and open extensibility ensures the CSP can be agile when responding to rapidly changing market needs and requirements.

Ability to Expand into New Markets

Entering new markets can be expensive, difficult and highly competitive. An open, extensible and flexible converged services platform offers the CSP flexibility in regards to deployment architecture, how to approach regulatory compliance and the composition of the service offering for local markets. A platform that provides this level of flexibility positions the CSP for success so more focus can be put into sales and marketing rather than on the platform and the underlying technology.



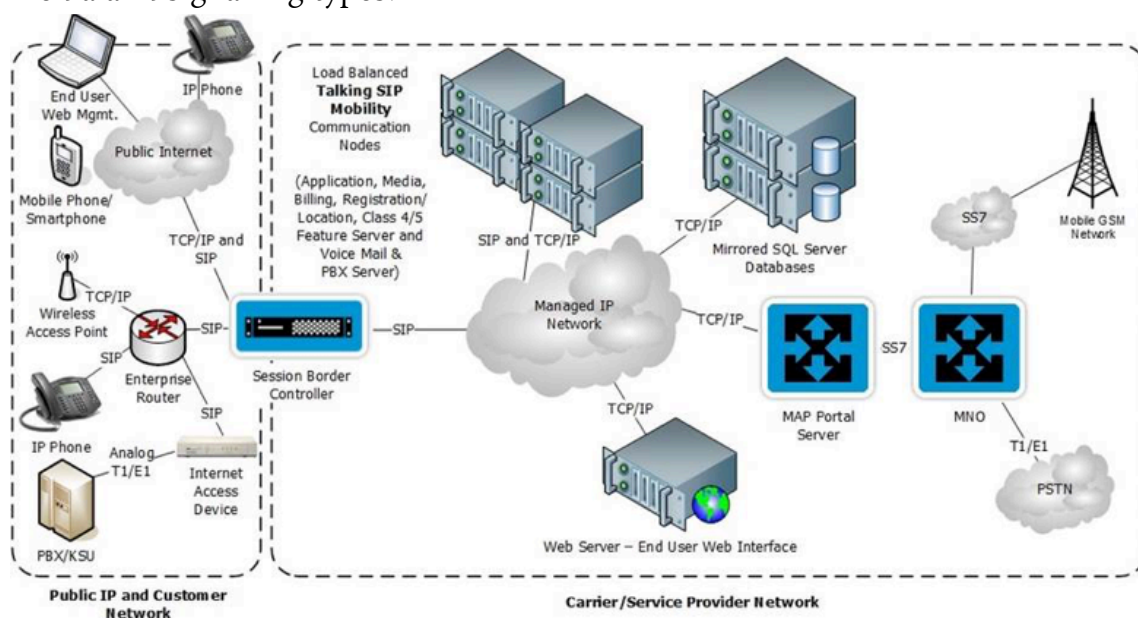
USING CONVERGENCE TO SET YOUR NETWORK APART

Enabling a mobile, VoIP and satellite network with convergence provides the operator with the greatest opportunity for success by expanding and diversifying revenue centers by attracting both consumers and enterprise customers across industries using a single platform.

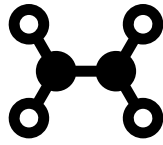
From the subscriber's perspective convergence allows consumers to be able to go to a single source to satisfy their telecom needs and it provides them with the ability to manage their services from a single portal and make payment from a single credit card regardless of the number of services subscribed to. The converged experience helps drive subscriber traction, increases ARPU and builds subscriber loyalty.

From the operator's perspective convergence allows the operator to integrate consumer and enterprise applications/services from a single platform, using a single billing account and with real-time billing and reporting convergence can help reduce network operational complexity, CAPEX, and OPEX.

Below is an example network diagram that highlights different access devices across multiple media and signalling types.



Example Network Diagram



CAVEATS AND CONSIDERATIONS

Investing in network convergence can come at a significant cost and therefore it is important to position yourself for success from the start. The correct converged services platform is one that ensures your network can easily accommodate future services and can provide value and an improved subscriber experience not only today but well into the future.

The following are some main caveats and points of caution and/or consideration that the Communication Service Provider needs to consider when looking to introduce convergence into their network:

TECHNOLOGY VENDOR SELECTION

Vendor selection is critical and there are many more things to consider besides price. Time in business, customer references of similar projects, depth of expertise, ability to deliver projects on time and within budget are important factors for consideration when selecting a converged services platform vendor. Selecting a vendor who competes solely on price introduces the risk that they may not be around for the long term or that the savings occurs on the development or customer service side of their business, which manifests itself in a lack of innovation, a lack of stability or scalability and/or protracted downtime.

REGULATORY COMPLIANCE

Some countries require the subscriber database, signalling and equipment to reside in country while others do not, therefore the CSP must take this into consideration when building out the network so that regulatory compliance is achieved. The technology and supported deployment models (e.g. network slicing, cloud, centralized, de-centralized, containers and hybrid architectures) must be flexible and nimble enough to accommodate future regulatory or government regime changes.

FUTURE PROOFING

When a network is built with convergence and extensibility in mind the ability to expand beyond the current service suite, adapt to new protocols and continuously improve subscriber self-management help to future proof the network and avoids the need to decommission network elements or needlessly make further capital investment into the network.

NETWORK AND SERVICES EXTENSIBILITY

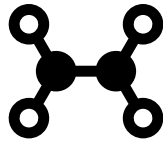
Questions to consider in regards to network and service extensibility include:

- How easy and cost-effective is it to add new services, switching capabilities and network/subscriber management functionality to the network?
- Can the network/platform be extended to address new competitors and subscriber demands?

The ability for the CSP to easily enhance the network and services offered should be a main point of consideration when selecting the technology upon which to build the network, in addition to APIs, a published database schema and third party tool compatibility.

NETWORK AND SUBSCRIBER AUTOMATION

Integration with the company CRM for subscriber management, service/issue ticket management, direct to subscriber messaging and customer service with automation provide a responsive and proactive approach to improving the customer experience. Subscriber self-service account management, auto recharge, and billing notifications when consumption is approaching usage thresholds all help to reduce customer-service resource requirements for the operator and when properly implemented can improve the overall subscriber experience.



CONCLUSION

Our approach and intention with this whitepaper was to provide both a subscriber and an operator perspective on the benefits of convergence.

Harnessing the power of convergence requires that the network function in concert starting from layer 1 signalling all the way to subscriber management and the application or the interface the subscriber uses to consume services.

The subscriber's commitment to a service is based on how intuitive the app or interface is, how efficiently they can manage and consume services, the number of devices or modalities they can use to access services, and whether it improves their communication experience. While price is very important it is not everything as subscribers will pay more for services that they derive additional value, more control, improved resiliency and an improved user experience, all of which convergence provides.

Through convergence the operator realizes a return on investment based on a reduction of human resource requirements, increased network uptime, improved customer service satisfaction, reduced operational expense and the ability to meet existing subscriber demand and the ability to adapt to satisfy future demand and customer needs.

The level of the seamless integration of services across communication mediums and the success of that integration is measured in the amount of time a subscriber spends engaging with the service, their level of loyalty and inertia to movement to another provider and how oblivious the consumer is to the underlying services and platforms used to provide those services. When the services are provided with improved quality and enhanced customer service customer satisfaction increases, the average revenue per user grows and subscriber acquisition costs are reduced through word of mouth and social media brand promotion.

While there are many technology vendors with converged solutions available in the market today, CSPs must take the time to clearly assess and define their requirements and conduct a thorough review of the vendor. The due diligence process should include evaluating the vendor's years in service, market experience, existing deployments, partnership network/ ecosystem, technology offering and account references. This thorough evaluation process is crucial to ensure the CSP gains the necessary confidence in their selection choice and how

their precious capital is invested to position themselves for success in the acquisition, configuration and deployment of a next-generation converged services platform.

With over 5 billion unique mobile users and 67% worldwide penetration of mobile phones the results are in and mobility is clearly the winner. The CSPs that make the digital transformation and seamless convergence of their service offerings will be positioned for the highest probability of success, while the CSPs who look to compete solely on price will stagnate and eventually fail.

This is an exciting time in communications and CSPs with the passion to innovate and drive service demand through convergence and a competitive and value-based offering centered around end-user self-management, consumer empowerment and best in class customer service will rise above their competitors to realize the greatest market success.

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