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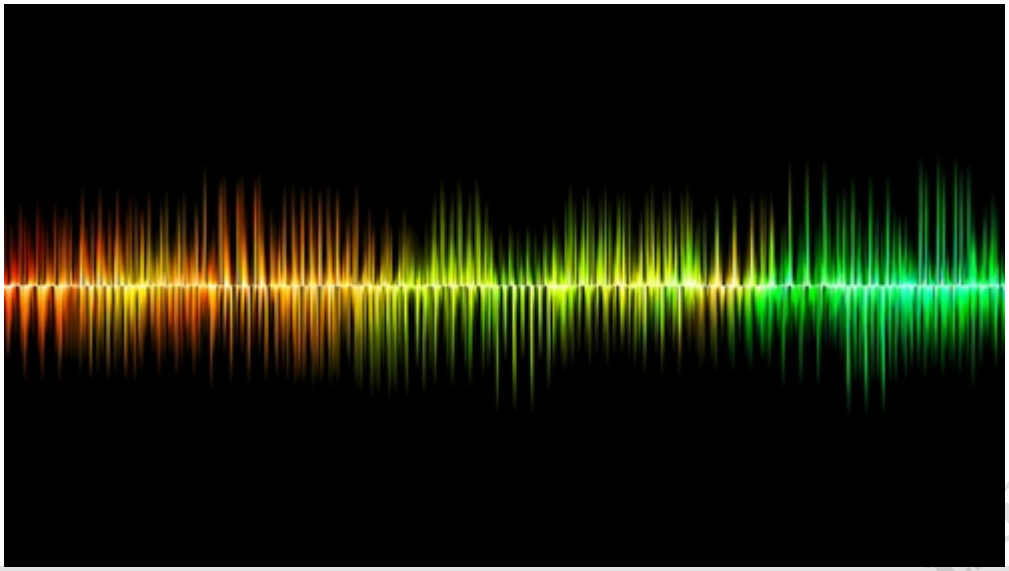
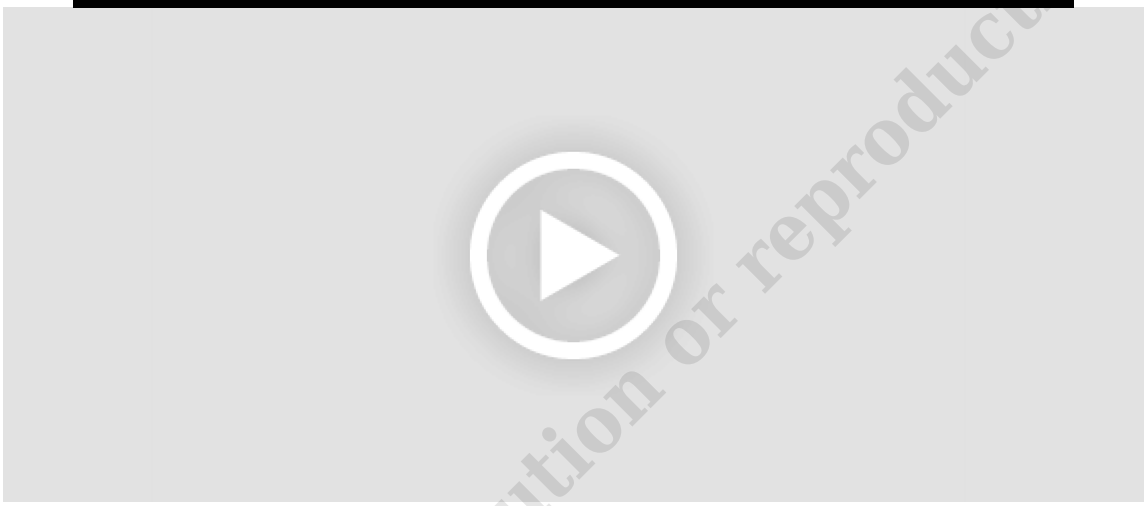
### End-to-End Solutions for Broadband Networks

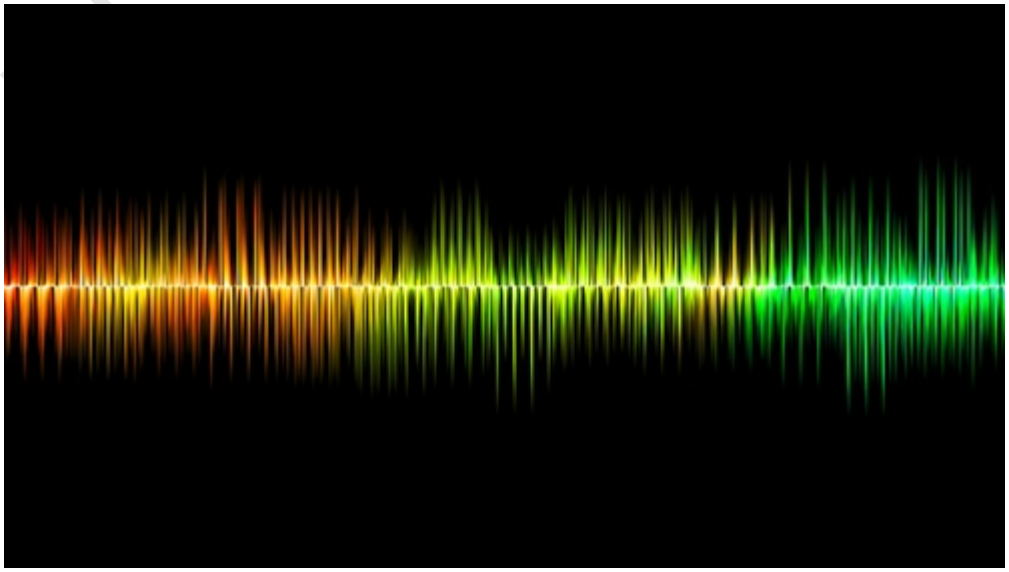
In case you missed Lindsay Broadband - a division of Technetix group at the SCTE Cable-Tec Expo, this video highlights the must-have, end-to-end solutions for your network.





**Predicting Colonial Pipeline: Mitigating Risk and Compliance**

Mitigating risk and compliance for lawful intercept using lawful intelligence is explored in this Pipeline article feature SS8. Learn how CSPs can comply with lawful intercept regulation, while empowering law information with critical, real-time data.



## Podcast: The Evolution to 6G

The world’s eyes are already looking forward to the potential of 6G. Demands resulting from innovative use cases, for instance specific requirements from different industries and other user groups, as well as overarching goals like sustainability, are driving the standardization and development of mobile technologies.

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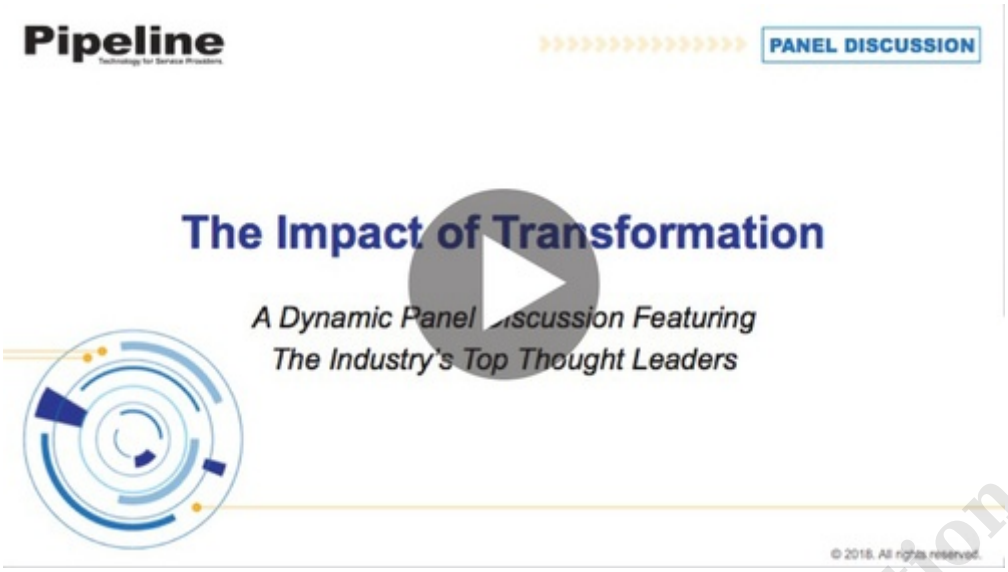






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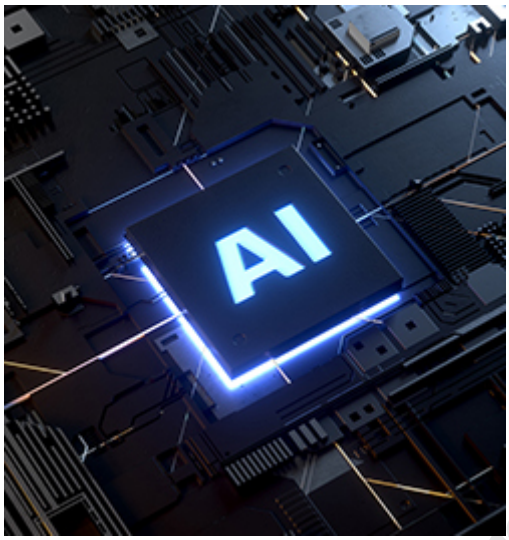


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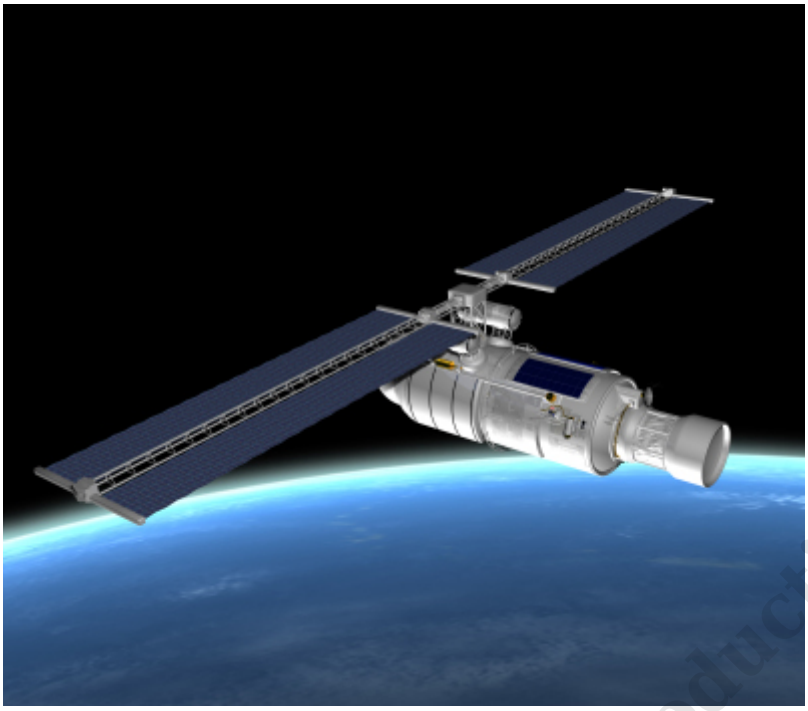

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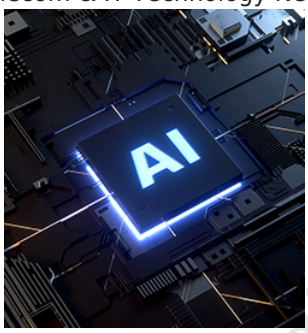


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White Paper 030

# TCP Technology and Testing Methodologies

By Hammadoun Dicko, Product Specialist, EXFO

As enterprises use more and more applications, such as Voice-over-IP (VoIP), Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP), service providers are now faced with the obligation to enforce stringent service level agreements (SLA). Furthermore, the typical SLA parameters such as throughput, latency, jitter and frame loss only cover the network performance up to the IP (Internet Protocol) layer and do not necessarily reflect the true user experience. How can service providers make sure that the end-user's most important applications make use of the full bandwidth?

## TRANSMISSION CONTROL PROTOCOL

TCP is one of the two original components of the IP suite commonly referred to as TCP/IP. It provides connection-oriented, end-to-end communication services at an intermediate level between application programs and the IP. It offers reliable communication and guarantees orderly delivery to the upper layers for non-real-time applications such as email, FTP, FTTP, etc. The term connection-oriented means the two applications must establish a TCP connection before they can exchange data.



Figure 1. OSI reference model and nomenclature

## HOW TCP OPERATES

The primary purpose of TCP is to provide reliable connection services between hosts. However, this becomes challenging on less reliable networks such as the Internet. This hurdle is overcome by the implementation of flow control, which ensures the integrity of each segment sent, and the congestion control mechanism for each byte stream, which allows the receiver to limit the amount of data a sender can transmit. To accomplish this, TCP provides the following:

### Basic Data Transfer

TCP is able to transfer a continuous stream of bytes in each direction between applications by packaging the traffic into TCP segments, which are passed to the IP layer for transmission. TCP has the ability to decide when to block or forward data.

### Reliability

TCP is able to recover from data that are damaged, lost, duplicated or delivered out of order by assigning a sequence number to each byte transmitted, and requiring a positive acknowledgement (ACK) from the far end. If the ACK is not received within the timeout interval, the data is retransmitted. In addition, the receiver uses the sequence number to rearrange segments that may be received out of order and eliminate duplicate segments. A checksum added to each transmitted segment is checked at the receiving end to discard damaged segments.

### Flow Control

The receiver controls the amount of data the transmitter can send by returning a window size value with every ACK. The window size value indicates the number of bytes the sender may transmit before receiving further permission. In addition, the sequence numbers and receive windows behave like clocks that shift every time the recipient receives and acknowledges a new data segment. The sequence number loops back to zero, once it runs out of numbers. Figure 2 is a visual representation of the sequence numbers and its maximum values in the TCP.



Figure 2. TCP window

### Multiplexing

Many processes or communications can run within a single TCP host. A network socket uniquely identifies each connection by binding ports to processes. Consequently, multiple sockets can be used during a single exchange between two hosts, thus reducing the impact of high-latency networks and the window allocation buffer limit.

EXFO | Assessing Next-Gen Networks

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Prepared for Progress Actional
February 2009

# The Total Economic Impact™ Of Progress Actional Management For Interconnected Applications

Implemented by a communication and media service provider

Project Directors: Paul Devine and Sebastian Selhorst

Headquarters
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## Inventory Discovery & Reconciliation

**If you want to get where you're going, you need an accurate map. Nakina Systems' Inventory Discovery & Reconciliation solution provides a true picture of your network's physical and logical inventory, so you can see beyond the horizon.**

### Setting sail

In today's hyper-competitive environment service providers are tasked with rolling out new services quickly — and delivering a superior customer experience. Yet rapid network expansion presents new challenges. Discrepancies between inventory and the real network are the norm, causing reduced order processing capacity, slower fault isolation and provisioning fallouts. Nakina Systems' Inventory Discovery & Reconciliation solution discovers optical, Ethernet, IP/MPLS, and other network equipment and reconciles against industry standard inventory systems to reduce fallouts and provisioning times. Without an automated discovery and reconciliation solution like Nakina's, the investment in network-wide inventory systems is impossible to monetize.

### Staying on-course

A true picture of your network topology is an absolute necessity for rapid rollout of new services, efficient operation, and a predictable customer experience. Nakina's continuous reconciliation capabilities ensure the highest levels of network integrity. The discovery engine is constantly in contact with the network, performing regularly-scheduled inventory discovery and reconciliation with network inventory databases. This constant feedback loop helps highlight inconsistencies before they become difficult problems. Nakina's customers can identify poor capacity management, lack of redundancy and many other challenges before they cause outages or other problems.

### Finely tuned instrumentation

Nakina Systems' network integrity solutions enable our customers to accelerate time-to-revenue through faster deployments. Without a high integrity image, matching capacity to demand is a hit-or-miss affair: work orders and customer orders fall out due to non-existent or oversubscribed ports; scarce capital resources are consumed when spare capacity is unused elsewhere. With an accurate and current picture of the network, there is no destination too far.

### Key Functions

Nakina Systems' Inventory Discovery & Reconciliation replaces ad hoc data with a true network integrity solution. With an accurate picture of the network, you can feel more confident about the state of the network and your ability to deliver new services on-time and on-budget.

**Multi-Vendor, Multi-Domain Topology Discovery**
- Discovers Optical, Ethernet & IP/MPLS NEs (L0/1/2/3 networks)
- Reduces provisioning times

**Full Discovered Physical & Logical Inventory**
- Topology, Lines, Protection Groups, End-End Circuits
- Eliminates fall-outs due to inaccurate inventory

**Pre & Post Circuit Qualification**
- On the fly qualification of resource availability to support Assign & Design process

**Integrated Security Solution**
- Eliminates fall-outs due to access issues and password issues
- Profile-based protection of access to network information

**Standards-based Interfaces**
- Simple, Cost-Effective Integration with 3rd Parties

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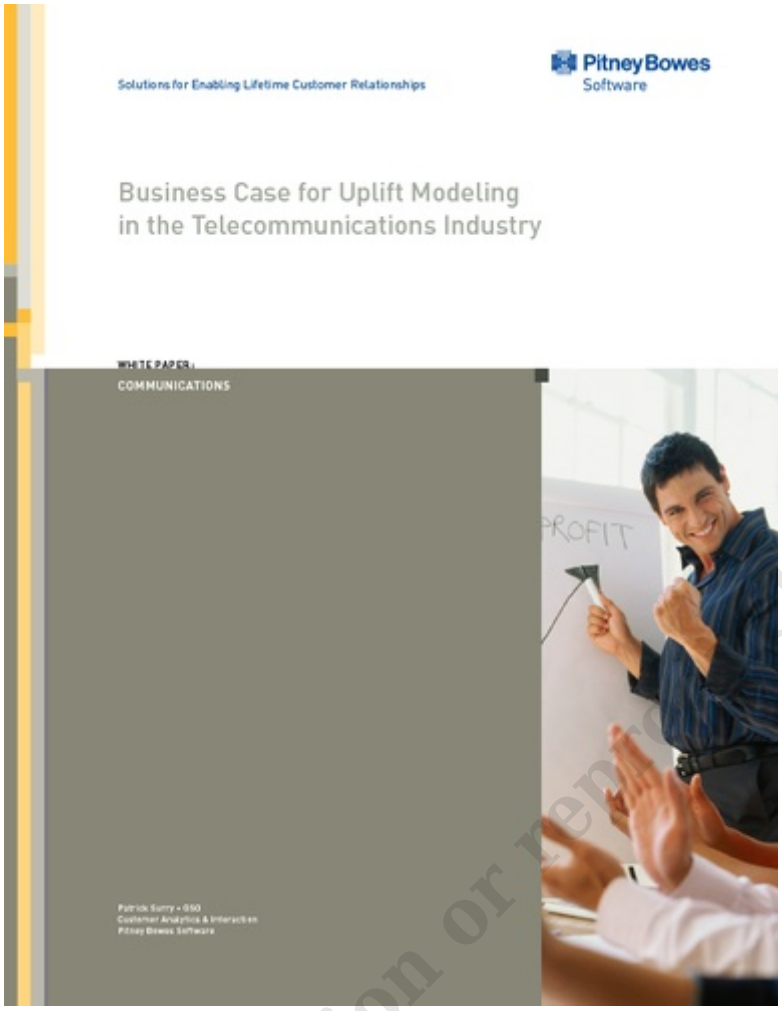
# THE LOW-LATENCY SERVICES MARKET:

## Evaluating the Emerging Market Opportunity for Service Providers and Telecom Carriers



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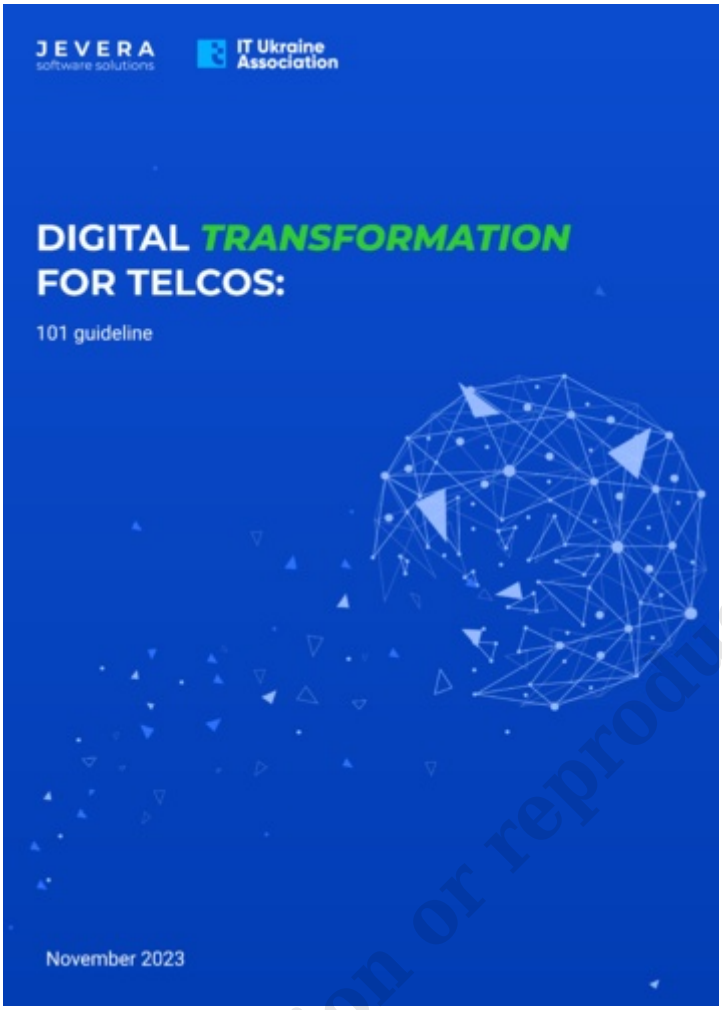


## Brochures

CHR Solutions

# software solutions

CHR provides integrated business solutions that address today's needs while positioning for future revenue streams, such as cloud based services. CHR software is available through traditional on-site licensing, through our supported cloud service model, or Software as a Service (SaaS). Our cloud based and SaaS options provide all the benefits of a traditional on-site license, and the platform hardware, operating systems, and a team of highly skilled professionals — all in a hosted environment without the upfront capital expense. SaaS and cloud based software are served from one of our four data centers and managed by CHR's 24x7 NOC services team.

## ORDER MANAGEMENT (ORDER TO CASH)

CHR's Order Management accelerates cash flow with an integrated order-to-cash process — providing a faster path to revenue, improved operational efficiencies and higher customer satisfaction. Order Management supports complex product bundling, parallel and sequential order flows and end-to-end automation from order capture to fulfillment. Our intuitive tool makes it easy to identify and correct errors. Order Management provides robust pricing and promotion capabilities to include bundling and discounting. We provide a complete solution for credit analysis, order enter, fulfillment and billing.

## PRODUCT LIFE CYCLE MANAGEMENT

Clearly defined products drive order entry and service fulfillment. CHR's Product Life Cycle Management takes a product through design, approval, release all the way to retirement. Our team of experts partner with you to craft products that meet customer demand in alignment with available technology and support infrastructure. Products are able to be built by component and managed with expiration dates. Throughout the product life cycle CHR works with you to adapt to new business models, added products and services.

## CUSTOMER CARE MANAGEMENT

CHR's Customer Care Management is a powerful tool which provides you a 360 degree view of the customer—allowing you to review all relevant information about a customer's account, add new locations, and launch a service order to add or change data. Customer Care Management offers a combination of search, inquiry and order-entry tools. Our unique "account-at-a-glance" feature provides flexibility for the CSR to manage their view of the customer—helping the CSR deliver efficient and effective service. CHR's Customer Care Management delivers the right tools and necessary authority for CSR's to solve client problems—improving quality of care and reduction in issue resolution time.

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## Whitepapers

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WHITE PAPER

# The Business Potential of NFV/SDN for Telecoms

**How a Network as a Distributed Cloud can Reshape Itself to Better Serve Customer Applications**

## *What will you learn*

- What are the potential benefits of implementing Network Function Virtualization (NFV) and software-defined networking (SDN)?
- How to transform the (access) network towards a distributed cloud platform capable to reshape itself dynamically to better serve customer applications?
- How to run network functions and customer cloud applications on the same hardware?
- What are the benefits of colocating network functions and customer applications for improving customer experience?
- Why is it essential to implement control via policies in the NFV/SDN scenario?
- How does BSS/OSS support NFV and why should OSS work in real-time?

Network Function Virtualization (NFV) appears to be a very promising, yet very disruptive, technology. At its simplest, NFV is about decoupling software from hardware and enabling the implementation to run on a farm of commodity hardware. In other words, it means placing network functions (NF) in the cloud.

### The Potential Benefits of NFV/SDN technology

From the perspective of network operators, the new technology entails the ability to become a real cloud provider in a new sense, where a network is no longer simply an access network to data centers. On the contrary, the network can become a cloud serving as a platform for customer applications, and it can dynamically reshape its architecture to meet customer needs. This revolution is possible thanks to combining NFV and software defined networking (SDN) technologies, which means that networks can adapt by being reprogrammed. Moreover, network nodes can also become part of distributed data centers that not only can host network functions, but also host applications. From the perspective of customers, this means that applications can be moved "closer to the customer," entailing lower latency and higher speed, thus leading to better customer experience.

The technology also promises to open the network to innovation from the software developer ecosystem. Instead of rigid networks that are difficult to adjust to different application needs, the network is to be programmable, ready for the era of the Internet of Things (IoT), where applications can have their own virtual networks programmed.

From the cost savings point of view, the liberation from dedicated (expensive) hardware in favor of commodity (cheap) hardware promises to reduce CAPEX (capital expenditure). Also, the idea of a purely software-based network reconfiguration should reduce OPEX (operational expenditure). This may not be that obvious if one of the goals is to make the network more dynamic, reshaped to meet the needs of applications and thus be much more complex to control, when a traditional approach to network management is taken.

*From the cost savings point of view, the liberation from dedicated (expensive) hardware in favor of commodity (cheap) hardware promises to reduce CAPEX (capital expenditure). Also, the idea of a purely software-based network reconfiguration should reduce OPEX (operational expenditure).*

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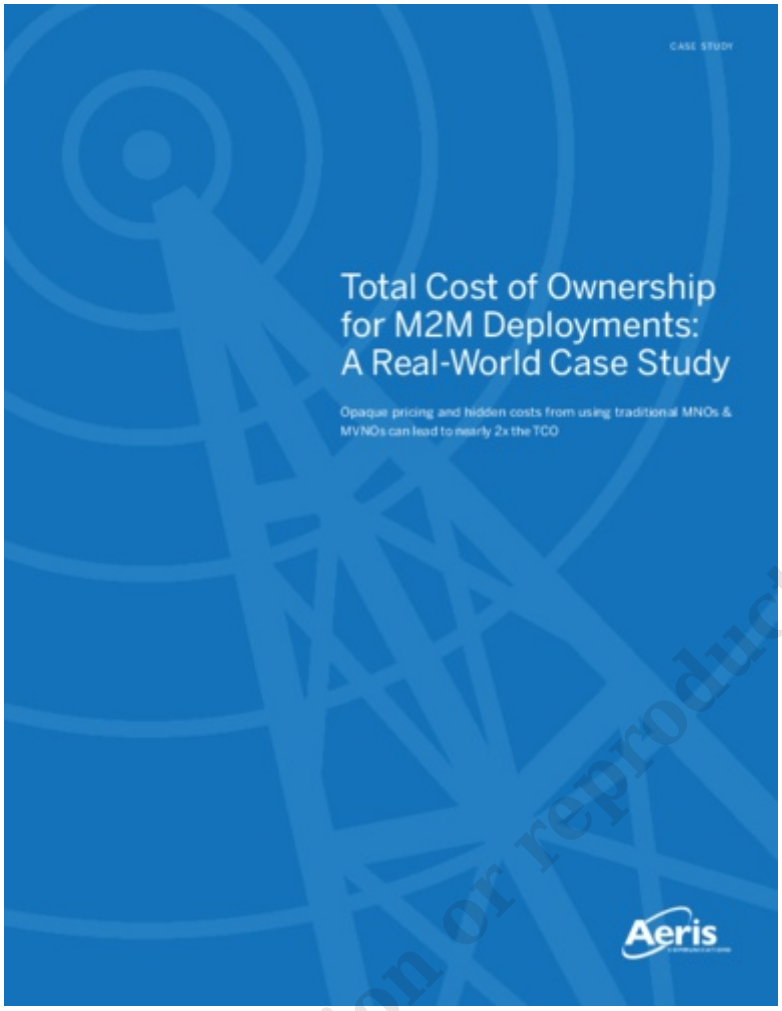
## Case Studies



# Testing the Cloud

Mark Sylor, New Technologist EXFO Service Assurance

## INTRODUCTION

Broadband, backbone and mobile wireless service providers see the cloud as an opportunity for growth. New applications running in the cloud drive new traffic to their network. The cloud also offers new revenues from new services that can be sold to customers. The business models for carriers and how they relate to the cloud are evolving quickly, but one fact is becoming clear: to achieve success in the cloud market, carriers must actively ensure that they offer a high quality of service to cloud consumers. The best way to assess cloud quality is to test the cloud.

A cloud is a shared computing platform available over the network used to run a variety of business or personal applications. The concept is hardly new; it has roots in service bureaus, outsourced data centers and utility computing. What makes the cloud work today is the rise of the web browser as a thin client that allows individual users to run any application, the wide availability of high-bandwidth networks, and virtualization technologies for computers, storage and networking. The cost savings, expanded reach, and improved quality gained by running an application in the cloud is proving to be a business success, as shown by the growth of cloud services into a market worth billions.

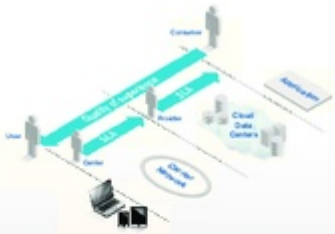



*Figure 1. Cloud players: cloud users, cloud consumers, cloud providers and cloud carriers*

Cloud services are sold to cloud consumers who have a business need. To meet that need, the cloud consumer deploys an application to be run in the cloud for a user community. The cloud itself is driven by cloud data centers that provide an environment for running the application. The data centers provide servers, storage and networking. User access to the cloud data centers is provided by cloud carriers. The cloud provider manages the cloud data centers and their servers, storage and networking. The carrier manages the interconnection between the user and the cloud data centers. The application may be owned and managed by the cloud consumer or the cloud provider.

The quality of the user's experience depends on both the carrier and the cloud provider. Together, they determine how well the application serves its users. The carrier manages bandwidth, latency, reachability, loss and other network key performance indicators (KPIs) that affect quality. The cloud provider manages processor utilization, storage, switch utilization and other resource KPIs that affect quality. But the KPIs that describe the quality of the service (QoS) provided to the consumer and the user are web download times, service availability, data delivery times, and other KPIs that are tied more directly to the service sold to cloud consumers. These service-oriented KPIs cannot be measured by any one actor; together, they either is determined by the business relationship between them. If they are independent, cloud carriers offer SLA guarantees to cloud providers. Cloud providers in turn offer SLAs to cloud consumers. If the carrier owns the cloud provider, then the single organization can offer the service-level agreements (SLA). These SLAs are one factor driving carriers and providers to test the cloud.

| Actor | Definition |
|---|---|
| Cloud User | A person or organization that uses and benefits from the cloud. |
| Cloud Consumer | An organization or person that buys services from the cloud provider to use or run an application. |
| Cloud Provider | A person or organization that provides a cloud service. |
| Cloud Carrier | A communications service provider that provides connectivity and transport between users and the cloud or within the cloud. |

*Table 1. Cloud actors*

In this complex business environment, carriers have strengths. First, they own the network that connects users to the application running in the cloud. Second, they provide the circuits that connect cloud data centers to the Internet and each other. Third, they can provide the security and privacy customers want through dedicated circuits or virtual private networks that isolate one customer's traffic from another's. Finally, they know how to offer a high-quality service backed by the guarantees of an SLA.

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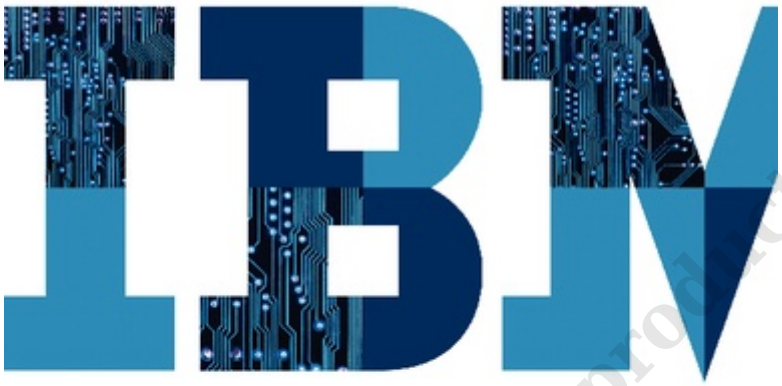

IBM

White Paper

# Common Language Drives Customer Value for All Network Technology: 5G/MEC and Virtualized Networking Included

Sponsored by: iconectiv

Karl Whitelock
January 2021

## EXECUTIVE SUMMARY

iconectiv TruOps Common Language was established to facilitate the service design and asset tracking needs of the operations and business management processes for prevailing and emerging network connectivity architectures. Common Language has been used by communications service providers for over 40 years.

Complexity from new technology evolution (e.g., network virtualization, private networks, hosted networks, 5G, multi-access edge computing [MEC], and the Internet of Things [IoT]) requires assets to be aligned with business and technical objectives to keep costs within expectations, address end-to-end (E2E) service objectives, support partner accountability, maximize interactive efficiency, and show business management responsibility. On the basis of its successful long-standing customer implementations and evolutionary approach to the network management processes, Common Language is expected to play a major role in the evolution and deployment of new facilities-based networks and the virtual aspects upon which these new technologies come to rely.

This paper explains how teams with network and partner-provided asset management responsibilities can achieve business value by maximizing the use of common nomenclature. In addition, the paper describes how a common naming strategy improves the effectiveness of real-time network operations and key business management functions. This paper also explains how Common Language can bring increased awareness when defining, launching, and managing new network-based services.

## Introduction

As network technology and business strategies continue to evolve, the greatest challenge asset-based communications service providers face is how to manage the physical and virtual assets that define the services they provide. Understanding the physical and logical placement of assets is strategic to several internal operations functions including network planning, inventory, service orchestration, catalog, activation, network assurance, service-level agreements (SLAs), policy, rating, and charging. The multilevel construct of the underlay and overlay connectivity infrastructure and the E2E partner-aided services to customers of all types brings additional layers of asset tracking complexity that must be addressed by each of these business and operations management domains.

January 2021, IDC #US47230621

ETIYA

# DIGITAL BUSINESS PLATFORM

**Digital transformation, which is the key for higher agility, efficiency, cost reduction and improved customer experience, is inevitable for CSPs to survive in the new digital economy. However, large-scale digital transformation projects are expensive and risky and may take years to complete. Meanwhile, agile competitors are eroding your market share. Speed to digitalization is imperative.**

## Why Etiya's Digital Business Platforms??

Etiya Digital Business Platforms, unlike legacy BSS, will create real value for your business. They do not only provide technical capability, but offer an infrastructure to create an all-digital customer experience, with the personalization and flexibility demanded by Connected Customers. All this in a matter of months, while ensuring business continuity and, at the same time, reducing traditional BSS costs.

### Advanced technology to enable better customer focus

Etiya's AI expertise and platform capabilities are used to differentiate the BSS platform via better customer insights, more personalized customer experiences and increased process automation. Knowing your customers' behaviour and needs allows personalized customer interactions and service targeting, and supports smart decision making during the customer journey, that will ultimately drive both customer and employee efficiency and satisfaction.

Etiya uses innovative AI technologies, including natural language processing (NLP) techniques and predictive analytics in its platform to help companies transform their businesses and reduce costs.

### Modular, flexible, cost effective and scalable digital solutions

Etiya Digital Business Platforms are 5G ready, agile, end-to-end, and fully virtualized digital platforms. They are cloud-native, full-stack platforms that are pre-integrated into partner solutions and include all Etiya's product portfolio: Customer Relationship Management (CRM), Customer Service Management (CSM), Configure, Price, Quote (CPQ), Product Catalog, Order Management, OmniChannel Management, Billing and Charging and API gateways. They support both B2C and B2B customer segment operations.

Since the platforms use a modular, API-driven architecture, they are flexible. CSPs can select to launch a full-stack new BSS platform, to replace their legacy platform, or modernize it step-by-step, by choosing which platform components they want first and add new solutions, as needed, later.

Its cloud-compatible implementation significantly reduces up-front CapEx, and all this enables fast implementation and a cost-effective digital transformation. And easy scalability also means, that the costs grow as the business grows.

Etiya real-time, automated digital platforms use microservices to speed time-to-market for new products and enable easy experimentation with new business models and service concepts.

### How does it work?

Etiya Digital Business Platforms contain three main layers: Experience, Engagement, and Enablement. Data analytics, AI, and business intelligence functions are used to add intelligence to these layers and enable personalization, process automation, and efficiency.

| Etiya Digital Business Platform Solutions | | | |
|---|---|---|---|
| **Digital Experience** | **Online self-care, E-commerce, Mobile App, Content Management** | **Open APIs** | **Data Analytics, AI, Business Intelligence** |
| **Digital Engagement** | **CRM, CPQ, Offer Management, Rewards & Loyalty, Community Management, CSM, Recommendation Engine, Order Management** | | |
| **Digital Enablement** | **Product Catalog Management, Charging & Rating Management, Billing Management, Partner Management, Policy Management** | | |


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