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- ▶ Satellite Connectivity Trends
- ▶ eSIM, iSIM, IoT & Industry 4.0
- ▶ US MVNO Growth Breakout
- ▶ Satellite for IoT, 5G & 6G
- ▶ V2X for Autonomous Cars
- ▶ Mobile Edge Innovation
- ▶ AI Risks & Really Smart Phones
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- ▶ Letter from the Editor
- ▶ IT & Telecom Technology News
- ▶ Article Index



PIPELINE / VOLUME 21 / ISSUE 4

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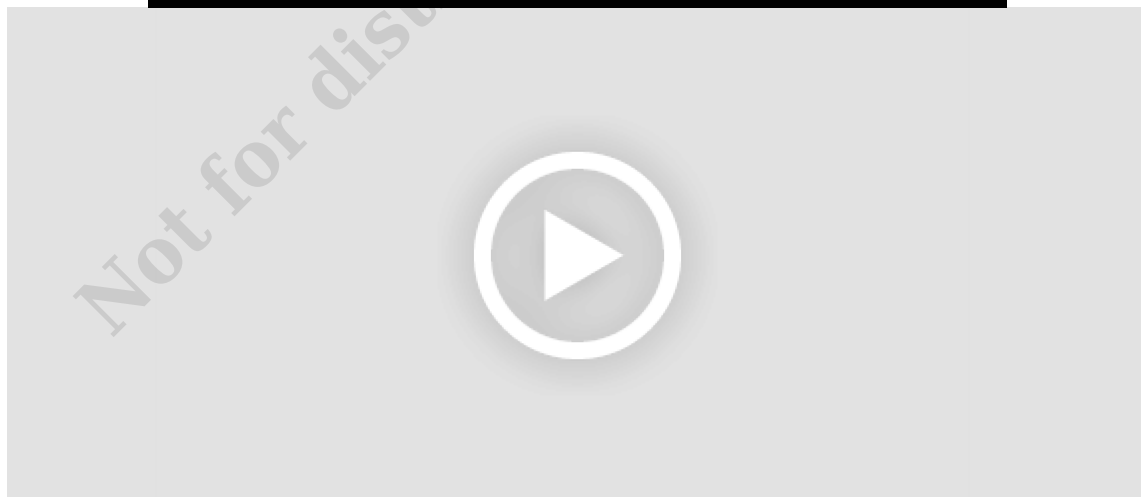
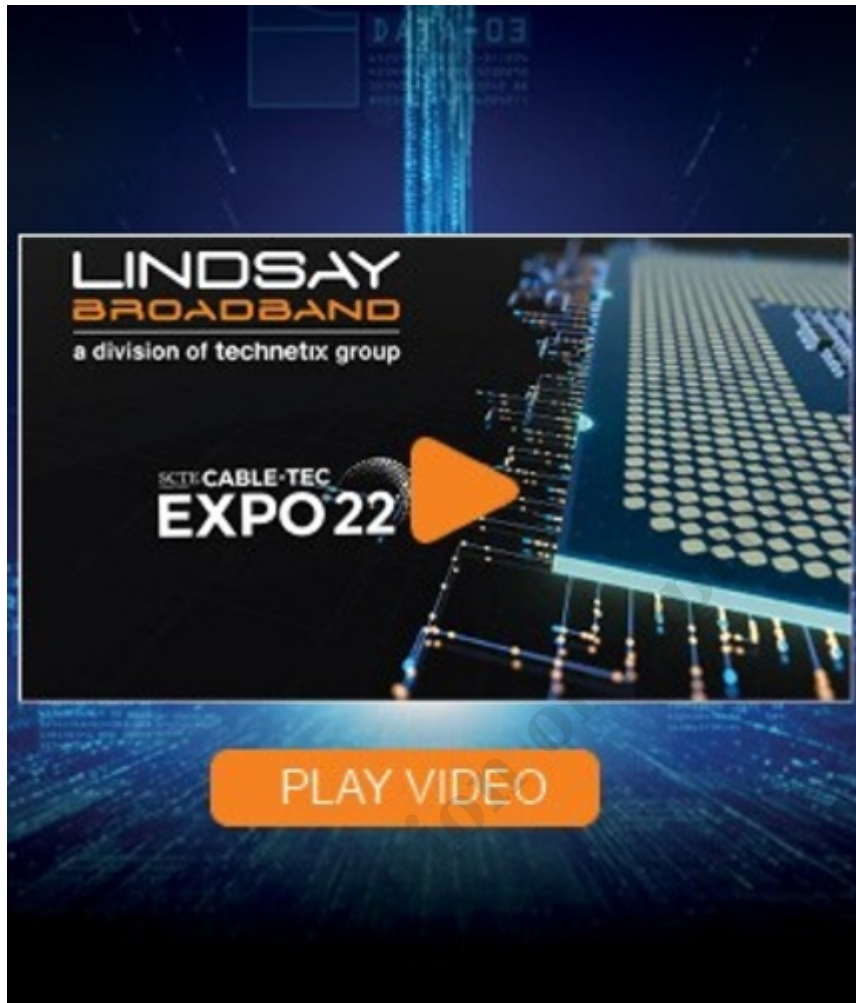
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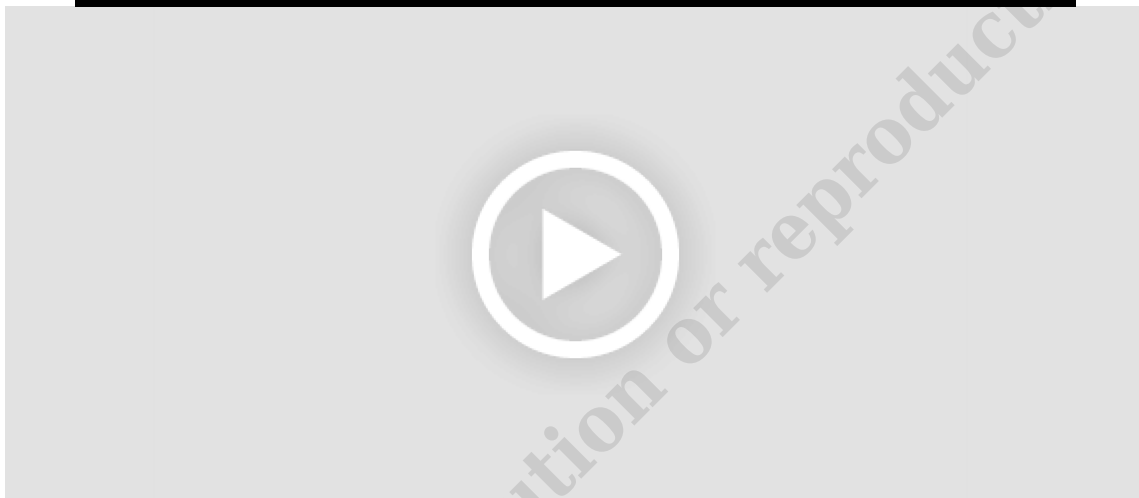
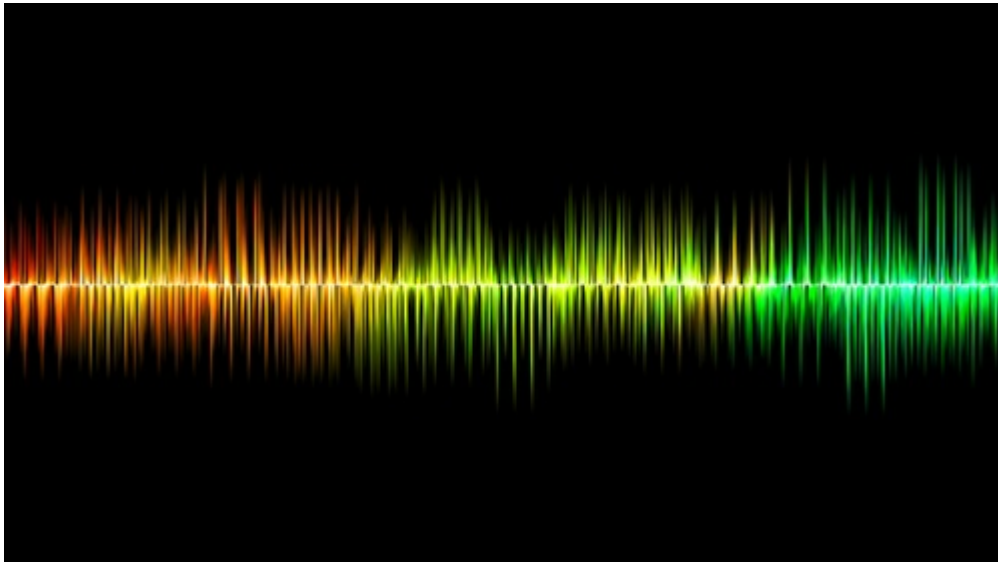
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### End-to-End Solutions for Broadband Networks

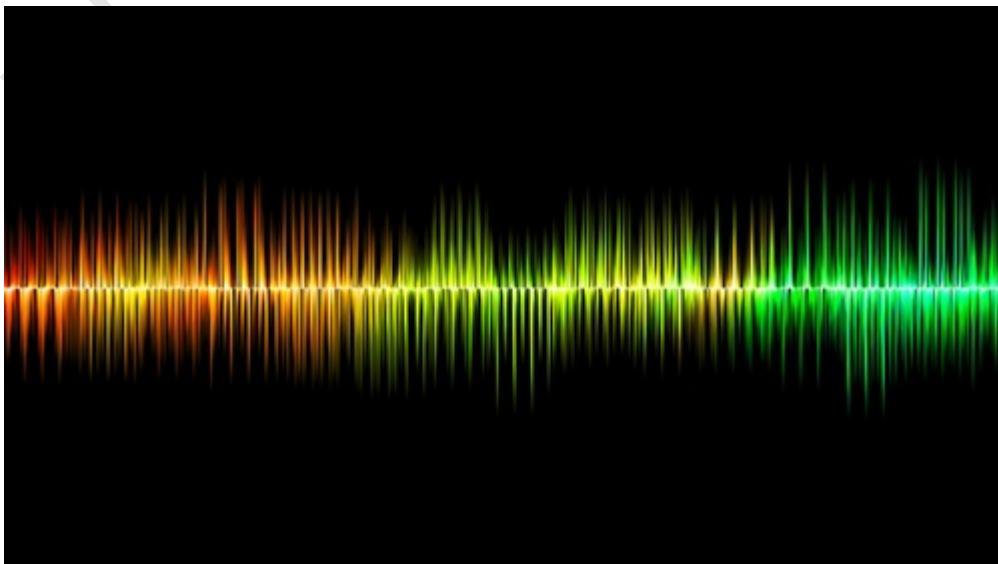
In case you missed Lindsay Broadband - a division of Technetix group at the SCTE Cable-Tec Expo, this video highlights the must-have, end-to-end solutions for your network.





## 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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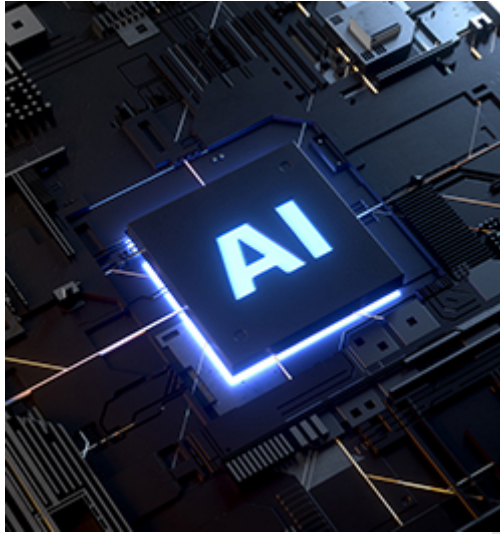
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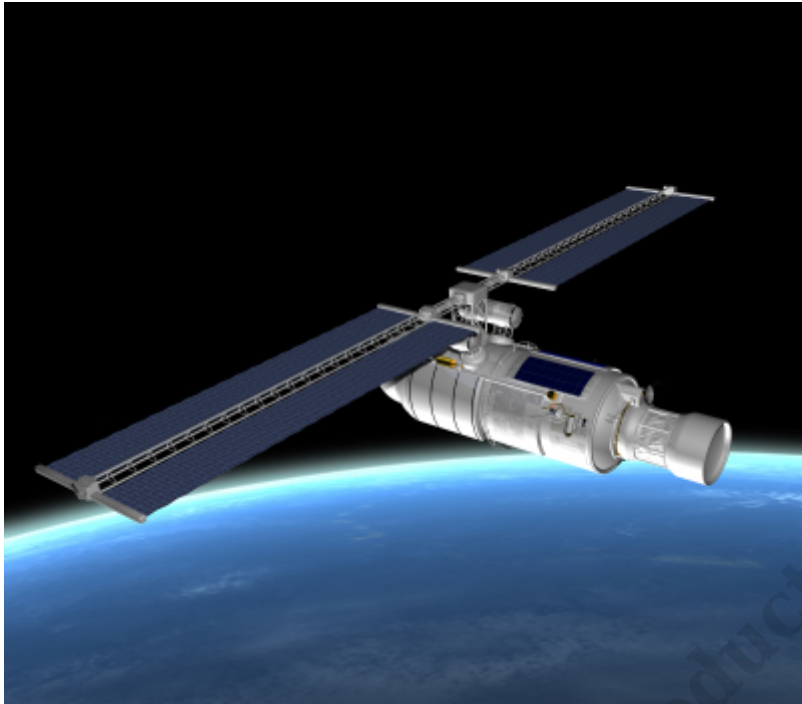
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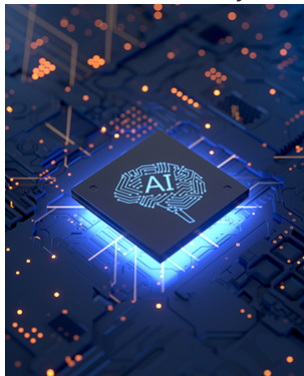
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## Case Study: GSM wireless network build

### PROJECT

GSM wireless network build

### SITUATION

When a converged telecommunications services provider faced the sale of its wireless partner properties to a large, national wireless company, it chose to expand its market penetration by building its own wireless GSM network.

The provider engaged Cycle30 to build out, integrate, and deploy all of the BSS & OSS functions to support the new GSM network and wireless services in three metropolitan areas, over an aggressive nine-month timeline.

### CHALLENGE

Critical to the ROI of the buildout was the ability to successfully acquire a number of new wireless subscribers, while retaining 99 percent of existing subscribers from the old MVNO network.

Cycle30 planned and delivered all necessary BSS, OSS and conversion functions to support two separate network and product go-live dates, dictated by a strict schedule from the provider acquiring the partner assets.

In addition, severe winter conditions across the provider's geography forced Cycle30 to compress the timeline in order to complete the conversion before winter.

### RESULTS

- Cycle30 conducted end-to-end testing of the network and conversion process to ensure a seamless customer experience while finishing the deployment
- Delivered the project on time
- Delivered the project 10 percent under budget
- Cycle30 flexed to the provider's network deployment needs, so that BSS/OSS and conversion activities accelerated progress instead of impeding it
- Provider successfully converted 48,000 subscribers to its new GSM wireless network
- Customer conversion retained 99.2 percent and added 42,000 new subscribers.

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**A Best Practices Framework for the Telecom Ecosystem**

*It is proposed to develop a best practices framework for the telecom ecosystem to boost investment in innovation and increase vendor diversity. The design and implementation of this framework should involve telecom operators, both large and small vendors, investors, government agencies and other relevant players.*

**Disclaimer**

The recommendations presented in this paper are intended to seed industry discussion with the aim of gaining wide acceptance across the industry. We recognize that not all the recommendations may be supported by all players participating in the discussions. Our intent is to identify the most important areas to achieve meaningful change, and to work towards consensus on implementing them within an effective best practices framework for the telecom ecosystem.

**Background**

Telcos need significant innovation to address their key challenges of: generating new revenue streams, reducing the energy consumption of networks, managing complexity (which is different from reducing complexity) and making networks more robust to vendor failures, cyber-attacks and environmental extremes (e.g., floods, high temperatures, hurricanes). Current telco innovation and procurement practices, rather than encouraging the innovation they need, are unfortunately deterring it. Our international consultation with telecom vendors and industry stakeholders<sup>1,2</sup> has identified key areas where telecom operators globally should improve their processes for engagement with the telecom ecosystem in order to encourage more investment in innovation more widely.

We organized a series of colloquiums with leading telecom industry veterans to consider the following questions:

- What does innovation mean in the context of the telecom industry?
- How can supply chain diversity be encouraged and supported?
- What are the barriers to innovation, and how can they be overcome?
- How can investment risk be reduced?

The discussions were held under Chatham House Rules to encourage candor and we followed this up with a series of published articles.<sup>3,4,5</sup> This paper summarizes the recommendations which emerged from these discussions and is derived from our "code of conduct" proposal published in November 2020.<sup>6</sup>

**Importance of Startups**

Our recommendations are predicated on the assumption that the telecom ecosystem benefits when startups are motivated to invest in R&D and offer innovative new products. Large companies typically begin as startups but tend to become less innovative and less responsive to their market as they grow, making them vulnerable to disruption by more innovative and nimble new players. This creates a cycle of destruction and renewal which drives advancement in every field of human endeavor.<sup>7</sup>



Regulatory considerations are crucial to the success of any communications company. Do you need expert testimony or interpretation of a tariff or FCC order? Perhaps you're worried about DALEA, CPNI and Red Flag compliance, or need a wireless, efficient or interconnection agreement. More importantly, do you need assistance in interpretation and identifying the revenue impacts of the FCC's most recent USF/ICC Reform Order?

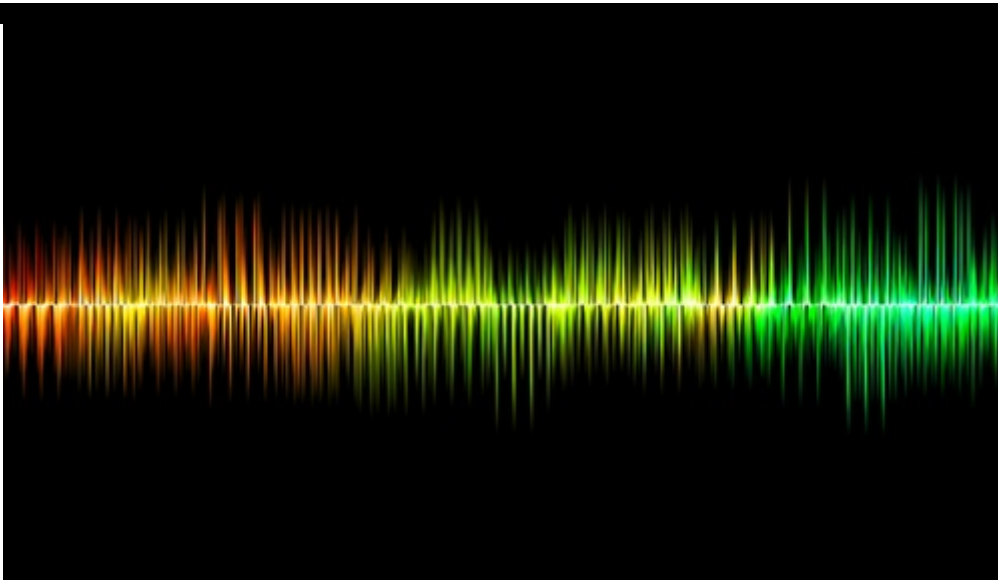
CHR's Business Compliance group provides you with the information needed to stay on top of important federal issues affecting small and rural telcos - allowing your business to remain in compliance during regulatory change.

CHR can help you with timely compliance reporting and assist with the implementation of regulatory requirements. CHR's FCC Report provides crucial information on key regulatory issues affecting your day-to-day business operations. Our Business Compliance group provides state and national regulatory services and implementation services associated with regulatory requirements. The Business Compliance group works with regulatory commissions, legislative bodies, and national and state associations to help develop and implement telecommunications policies.

Services provided by our Business Compliance group includes:

- Revenue and billing assurance
- Municipal franchise and right-of-way agreements
- Preparation and filing of FCC/state reports
- Bundling and pricing of services
- Switched and special access pricing, rating, and audits
- State and federal USF funding requirements
- USF compliance filings
- ETC compliance filings
- Traffic termination and interconnection agreements
- Regulatory monitoring
- Revenue impacts of USF/ICC reforms
- Local and access tariffs





**Why MVNOs and Carriers Aren't  
Right for Your M2M Application**





## FSP 3000 OLS

### A versatile and truly open line system

5G and cloud-based applications offer enterprises, carriers and service providers enormous potential for growth. However, this continuous and rapid change also creates the need for more network capacity and flexibility. It's essential to build today's networks on an open, flexible and scalable optical layer ready to accommodate evolving demand and innovation. Featuring a fully modular and open design, our FSP 3000 open line system (OLS) provides complete versatility and best performance in metro, core and data center interconnect (DCI) applications.

#### Truly open

Open disaggregated optical networking is one of the industry's hottest trends. By decoupling terminal functions from the line system, this approach offers complete flexibility to adopt the latest technology when and where needed. Our FSP 3000 OLS is truly open, allowing total freedom to evolve and optimize each network layer separately. Network operators can leverage and expand their infrastructure at any time with the technology of their choice. What's more, with open and standard interfaces, our FSP 3000 OLS easily integrates into software-controlled networks.

#### Build your own OLS

Our FSP 3000 OLS empowers network operators to create the solution that meets their exact requirements. With a modular architecture, multiple amplification and multiplexing options, and different chassis sizes, our FSP 3000 OLS enables customized solutions. Operators can simply mix and match the optimum filters and amplifiers and pack them into the best-fitting shelf. This makes our FSP 3000 OLS ideal for any type of network infrastructure.

#### Future-proof investment

Coherent modulation schemes are becoming increasingly diverse to maximize transport network capacity and minimize the cost-per-bit of transport. Flexible terminals with variable modulation formats and baud rates enable higher capacity-per-ohm. The ultimate network performance relies also on line system capabilities, and that's why open line systems have increasingly become important strategic assets. With a combination of high-performance features, our FSP 3000 OLS transports any coherent modulation format as well as all varying signal baud rates with best performance. The high-resolution frequency grid and modular architecture of our ROADMs guarantee a future-proof OLS that can scale and accommodate any modulation format and baud rate. What's more, our FSP 3000 OLS provides a new level of flexibility with configurations able to support direct detect technologies.

#### Your benefits

- ▶ **Open hardware**  
No technology or vendor lock-in; successfully tested in multi-vendor environments
- ▶ **Open programmable interfaces**  
Easy integration into software-defined networks with open, programmatic APIs
- ▶ **For any type of network infrastructure**  
Modular design with multiple amplifiers and filter options to meet your exact requirements
- ▶ **Purpose-built components**  
Amplifiers and filter options engineered for metro, core and DCI-specific demands, and optimum transport of latest innovation, e.g., 40GZR and high baud rates
- ▶ **Visualization and control**  
Comprehensive monitoring and diagnostic tools, spectrum visualization and fiber surveillance
- ▶ **Eco design**  
High-density design with low power consumption
- ▶ **Flexible footprint**  
Chassis sizes from 1RU to 12RU, ETSI / data center rack, AC/DC power options



## Whitepapers



**NAKINA SYSTEMS  
WHITE PAPER**

FEBRUARY 24, 2010

**CLOSING THE COMPLEXITY GAP  
A CASE STUDY IN NETWORK INTEGRITY**

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## WITCOM deploys open multi-vendor solution to power smart city initiative

### Secure open platform powers edge cloud for IoT, video and next-gen services

WITCOM provides business customers, government institutions, and ITC service providers in Wiesbaden with professional telecommunication services and secure data center services. Now WITCOM is deploying an open uCPE platform as an edge cloud to host smart city services, including IoT, traffic control, surveillance, and wholesale services.

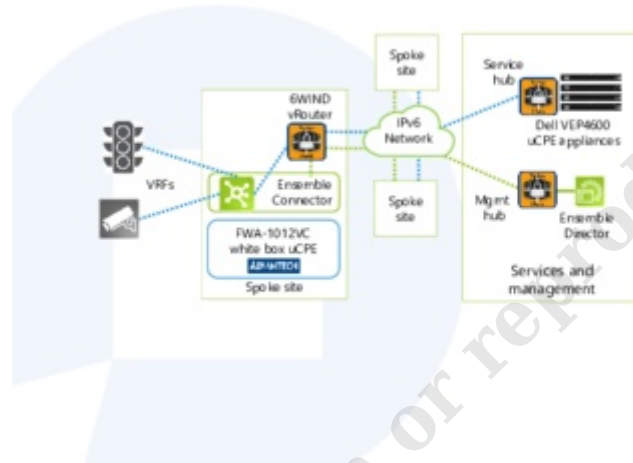
With network functions virtualization (NFV) and universal CPE (uCPE), smart city operators like WITCOM can rapidly and efficiently deploy next-generation services. And once the uCPE servers and software are deployed, the operator can use it as a platform for innovation. New services can be added dynamically, without changing the deployed hardware, drastically increasing the rate of innovation.

Adva, an ITC service provider in continental Europe, assembled a solution using best-of-breed suppliers to power this innovative deployment. Working together, the suppliers teamed up to meet WITCOM's stringent requirements for performance, cost, ease of deployment and security.

The solution is deployed on a central hub site as well as wholespoke sites (as shown below).

Security is an essential element of the solution, and is provided by the 6WIND Turbo IPsec vRouter. The vRouter is deployed in virtual machines (VMs) at each of the spokes, and at the hub as an aggregator.

The spoke sites are located in outdoor cabinets featuring the widely adopted FWA-1012VC white box uCPE from Adva. This optimized and versatile appliance integrates the Intel Atom™ C1000 processor (8 cores), and 2x 1GbE SFP and 6x 1GbE RJ45 interfaces, providing sufficient compute headroom and flexible connectivity to meet edge site requirements.



## Whitepapers

### Cellular One of Northeast Arizona Selects Info Directions' Billing, CRM and Point of Sale Solution

*Integrated OSS/BSS/POS solution to help facilities-based wireless provider improve operations and enhance service value throughout its customer support and retail units*

LAS VEGAS, CTIA WIRELESS (April 1, 2009) — Info Directions, Inc. (booth #5706), leading developer of net-centric billing, rating, order management, workflow and selling solutions for the telecommunications industry, is pleased to announce that mobile service provider Smith Bagley, Inc., dba Cellular One of Northeast Arizona has selected its CostGuard® OSS/BSS software application and Lexys Point of Sale module. Smith Bagley, Inc. will use the company's line of software solutions in the Info Directions ASP to manage rating, billing, CRM and retail operations for its growing subscriber base.

Smith Bagley, Inc. dba Cellular One of Northeast Arizona is a rural cellular communications company that provides voice and data service over a GSM network in northeast Arizona, southern Utah, and northeast New Mexico. Providing service since 1990, Smith Bagley, Inc. is committed to offering its more than 60,000 subscribers the latest in phones, accessories, content and services for mobile communications.

With the implementation of the CostGuard OSS/BSS and fully integrated Lexys Point of Sale module, Smith Bagley, Inc. will have the ability to secure a single view of customer activities and purchases from both its headquarters location and throughout its network of more than 20 retail locations. The company will leverage the shared CostGuard and Lexys Product Catalog to streamline the launch of new products and services and create upselling and cross-selling opportunities using CostGuard's patent pending Guided Assignment feature.

"We look forward to using CostGuard to further our mission of providing our customers with cutting edge products and services—from handsets to laptop aircards and everything in between. Having an integrated billing, CRM and point of sale solution gives us the infrastructure needed to improve our operations and respond quickly to the evolving demands of our subscriber base," said Melissa Covington, Director of Technical Operations of Smith Bagley, Inc. "We are pleased to find a partner like Info Directions that is committed to serving the rural/wireless market. We anticipate building a long and mutually beneficial partnership with Info Directions."

-more-

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**Whitepapers**

# TCP Technology and Testing Methodologies

By Hamadoun 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, HTTP, 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 network layers

## 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 acknowledgment (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.

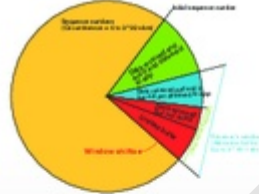


Figure 2. TCP window

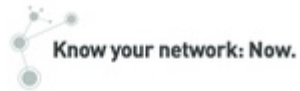
### Multiplexing

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.



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I can ensure my business customers know who they're speaking with, and customers can have the confidence to trust their caller ID and answer the phone again.

**Fraud Fighter**  
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- Verifier of caller ID
- Restorer of consumer trust in calls and texts
- Increase of call answer rates

**I am thriving**

- Provider of accurate phone number data
- Slayer of fraud and suspicious activity
- Reputation defender
- Restorer of consumer trust in calls and texts

**I am evolving**

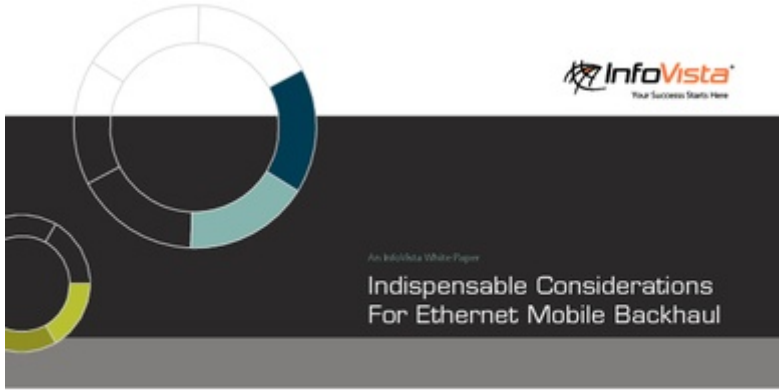
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- Steward of asset tracking and inventory management
- Guru of financial reporting and compliance
- Masterful deliverer of service

Source: Gartner, November 2016, 2017, 2018

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**CHR's Connected Services** provide the platform for next-gen networks and brings them to life. Our expertise in execution enables IP evolution—guaranteeing improved network reliability and scalability to support the services that maximize ARPU, reduce churn and generate new revenue while achieving regulatory requirements and reducing CAPEX.

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