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PIPELINE | VOLUME 20 | ISSUE 4

# PL

**SATELLITE IOT**  
**FOR MISSION-CRITICAL APPLICATIONS**

THE COURSE TO

# 6G

**NEXT GEN**  
**WIRELESS LAN**

DELIVERING

# 5G

**MOBILE CHARGING**  
**2024 WI-FI TRENDS**  
**WIRELESS SUSTAINABILITY**

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**IN-BUILDING**  
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### The Impact of Transformation



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**Astound Business Solutions Launches Ciena Powered Commercial 400G across the U.S.**

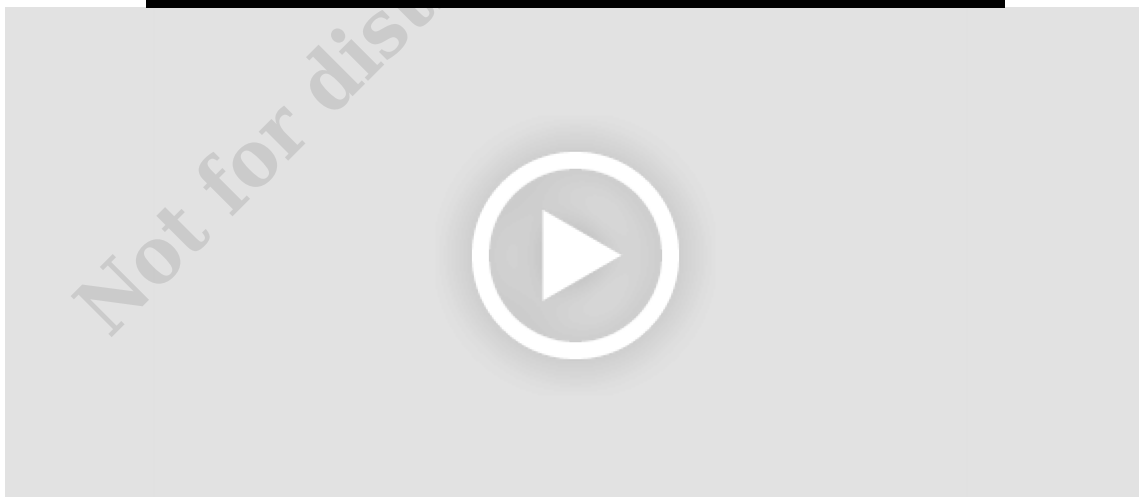
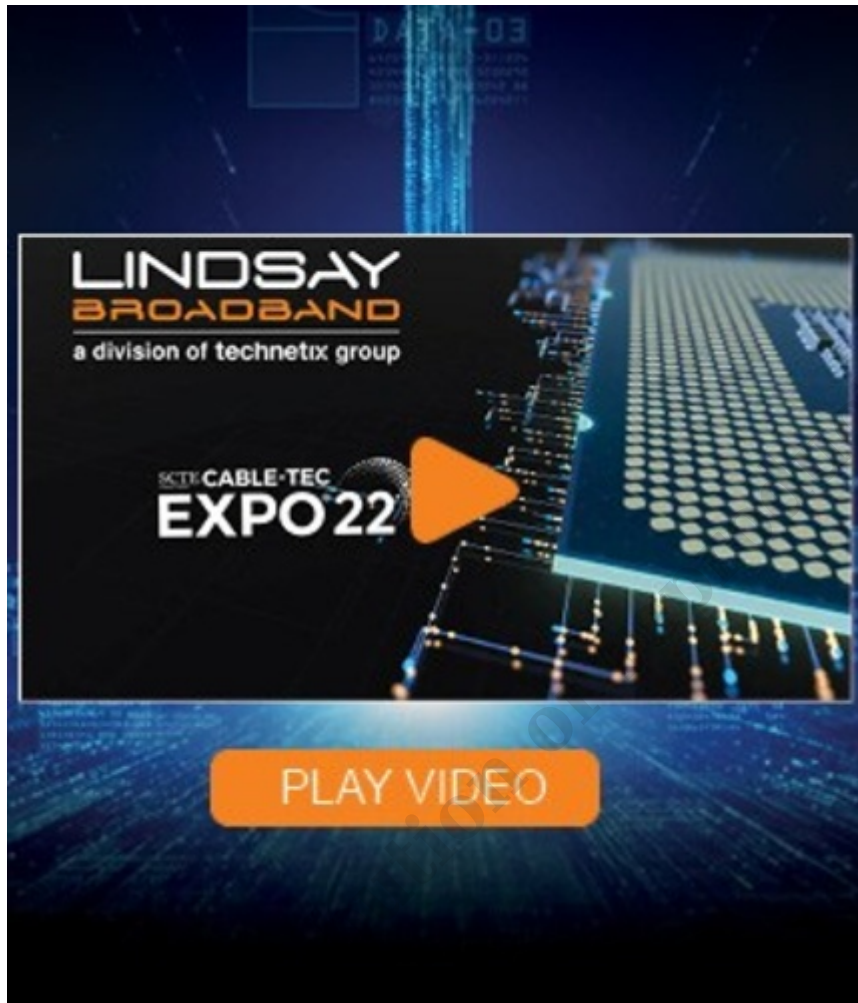
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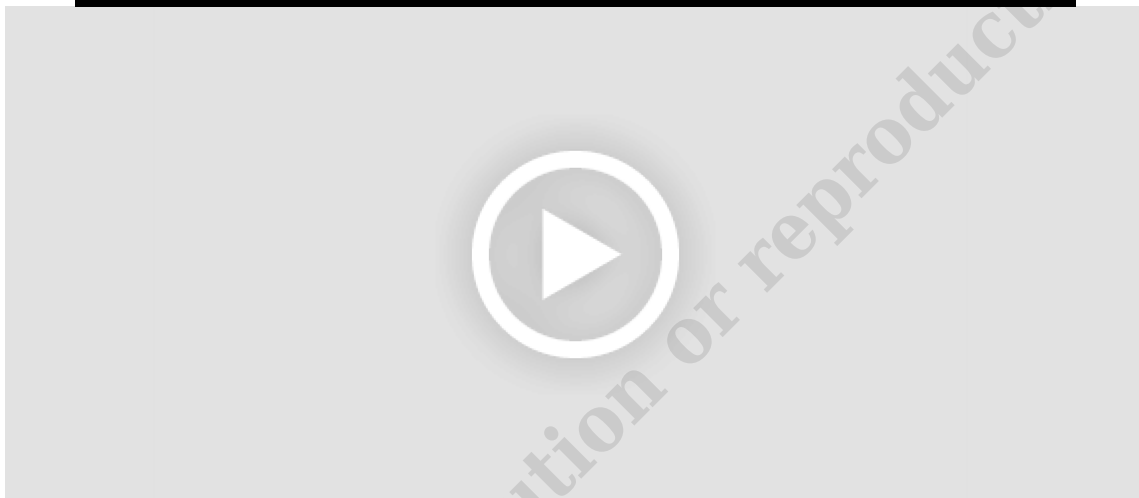
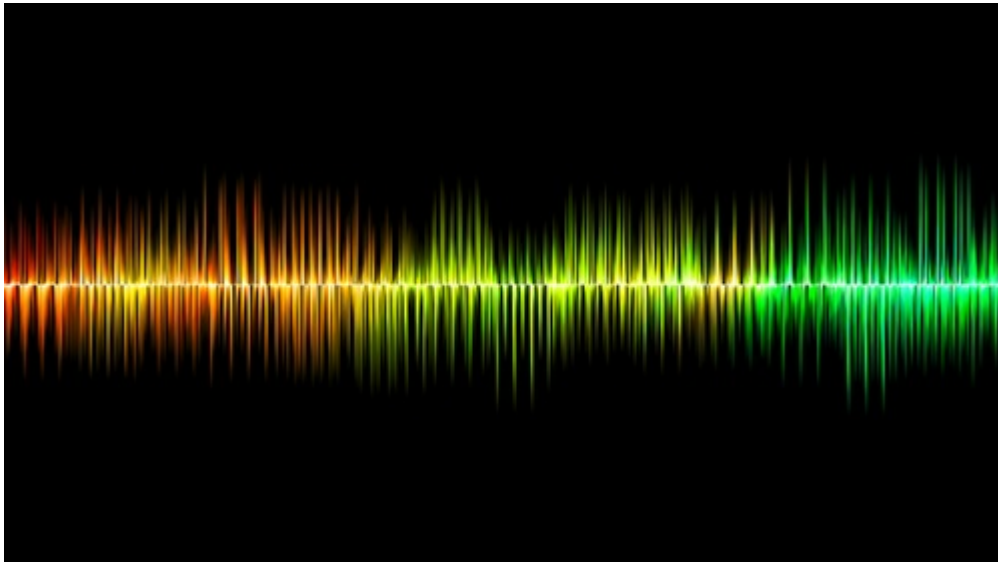
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### End-to-End Solutions for Broadband Networks

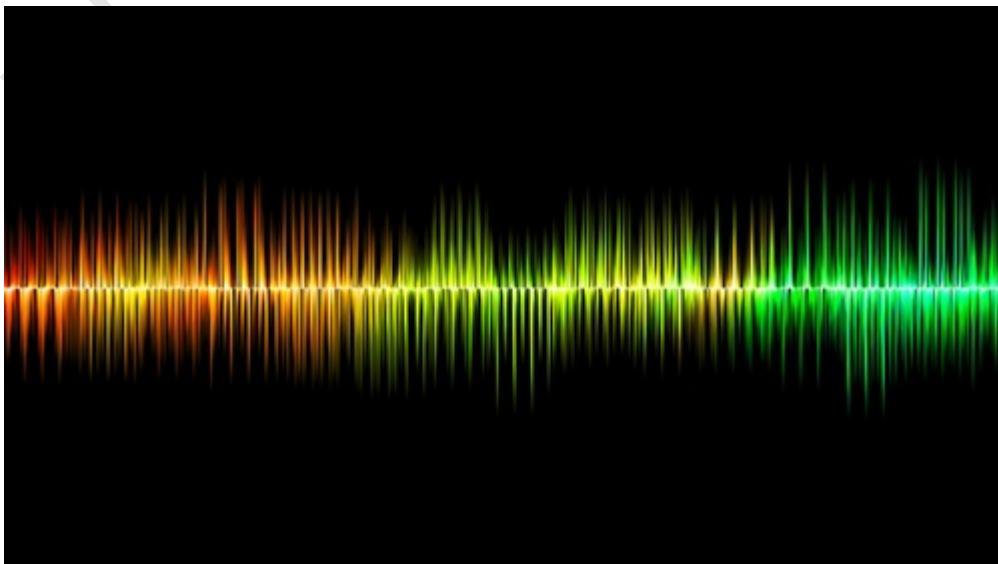
In case you missed Lindsay Broadband - a division of Technetix group at the SCTE Cable-Tec Expo, this video highlights the must-have, end-to-end solutions for your network.





## 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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## The Impact of Transformation

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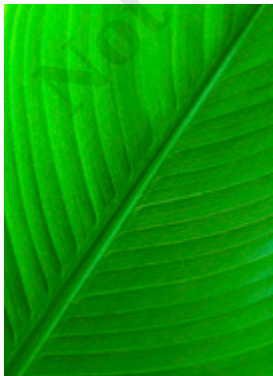
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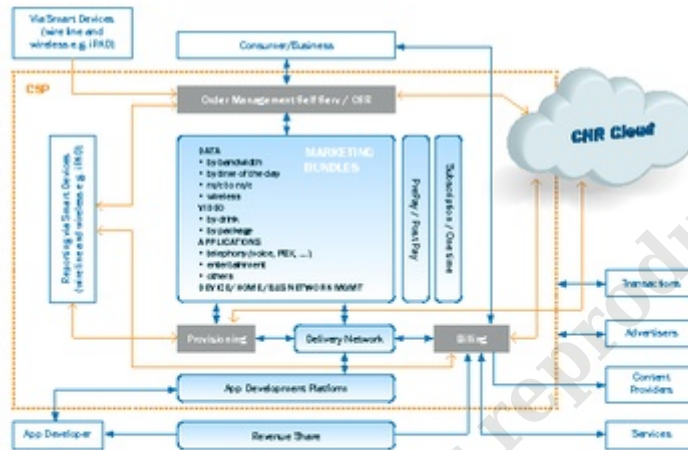
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**3 WAYS YOU WILL OVERPAY FOR YOUR MOBILE WORKFORCE MANAGEMENT SOLUTION AND 3 STRATEGIES TO AVOID IT**



# W<sup>2</sup>CM Smart Replay

Near Senak, Product Manager, EXFO

## INTRODUCTION

Along with the phenomenal growth in volume of data on the mobile Internet, there has been an increase in the different types of data flowing through wireless networks. In addition to traditional types of data, such as file transfer protocol (FTP), hypertext transfer protocol (HTTP), voice-over-Internet protocol (VoIP), e-mail and video streaming, there has been a constantly increasing list of over-the-top (OTT) smartphone applications generating new types of data, including peer-to-peer (P2P) data from applications such as BitTorrent and Kazaa. In an effort to differentiate themselves, operators have also been offering their subscribers their own unique applications, which in turn contribute to the variety of data on wireless networks.

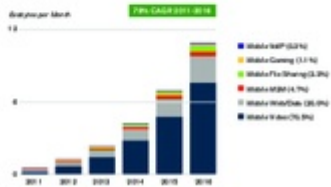


Figure 1. The explosive growth in mobile data.

This vast amount and variety of data has created a need for it to be managed effectively. There are several motivating factors to do so, chief among them being:

- ▶ Honoring service-level agreements (SLAs) and delivering committed quality of service (QoS) to customers
- ▶ Efficiently managing network resources
- ▶ Generating revenue as opposed to being just a "dumb pipe" for data
- ▶ Securing the network

Let's look at each one of these aspects in a little more detail.

## HONORING SLAS

Operators have SLAs with their customers to guarantee a certain minimum performance from their networks. To be able to meet these commitments, the network elements have to be able to ensure that the required amount of resources is made available when needed. A recent study has shown that 5% of users consume 60% of bandwidth. This type of usage pattern can endanger an operator's ability to meet its SLA commitments to the rest of its subscribers. Operators have a strong incentive to manage the data usage of such heavy data users (e.g., by throttling the throughput rates available to such users).



Figure 2. Mobile network operators (MNOs) need to proactively manage network usage.

Honoring SLAs may also mean being able to identify data associated with key customers and giving it preferential treatment in the network. There are strict guidelines in the LTE specifications about the handling of data with different levels of QoS. Gateways in the network have to correctly implement these techniques to ensure that committed QoS is delivered.

## EFFICIENT MANAGEMENT OF NETWORK RESOURCES

Another motivation for operators is to manage their CAPEX. Operators are making huge investments in building out their networks to keep up with the growth in data consumption. Unmanaged data usage coupled with the need to deliver on SLAs would result in operators having to deploy more equipment to handle the load. A better alternative is to manage the data usage. The LTE 3GPP specifications introduced the concept of maximum bit rates (MBR). The idea is to limit the maximum throughput used by a subscriber. This is a very critical technique for operators in order to prevent abuse of network resources by a few "bad" subscribers.

## REVENUE GENERATION

With an explosion in over-the-top (OTT) applications on the Internet, operators risk becoming mere "dumb" pipes carrying user data back and forth. This is not an enviable situation for operators, considering the enormous investments in infrastructure required to keep up with growth in data usage. Operators want to find ways to generate revenue from the data flowing through their pipes. They can do this by providing the same services as the OTT players, for instance voice-over LTE (VoLTE), but with significantly better and more predictable quality. Operators may want data associated with their own applications to be given preferential treatment as compared to equivalent OTT applications. Additionally, they can add value to the data already flowing through their network (e.g., by signing retransmission deals with service providers in exchange for prioritizing their data, or through targeted advertising based on the content of user data, similar to what Google does with Gmail).



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Our Enghouse Data Services team specializes in providing seamless project management support for an organization's own team. Data Services works with an organization's staff to assist in the tracking and completion of tasks on a daily basis to meet specific and prioritized needs.

### DATA VALIDATION & QA

The Enghouse Data Services team offers specialized tools that enable validation of source data before conversion to the target. These specialized tools can highlight problem areas that need to be corrected (e.g. data integrity rules) that might be broken by migrating to the target system.



### DATA TRANSFORMATION

In a complex data cleansing and migration effort, data very often needs to be transformed between one or more formats. The Enghouse Data Services team accurately transforms the most challenging data, whether spatial or non-spatial.



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NetDesigner streamlines the complex process of planning, implementing, operating, and optimizing next generation networks. Components of NetDesigner can be deployed on a standalone basis or integrated to enable end-to-end automation.

NetDesigner is an Esri GIS-based geospatial network design and management solution for complex, multi-domain networks. NetDesigner optimizes resources, enhances workflow, improves customer service, and maximizes operational efficiency, allowing for unprecedented cost savings.



#### Centralized repository and single workspace

NetDesigner offers a consolidated workspace and a single, accurate data repository to enable planning, design, construction, and operations for a next generation network.

#### Automated design

Design automation within NetDesigner enables engineers to develop a baseline network design

within hours instead of weeks. Design parameters can be customized by changing business rules to meet unique requirements.

#### Powerful business intelligence and planning

NetDesigner allows users to plan "what-if" scenarios, simulating what it would mean to bring network resources to underserved communities and targeted businesses. Users can integrate with visual, schematic map elements, and third-party data (e.g. ARRA, Connected Nations, demographics, census data, wire-center information, FCC data, flood plain barriers, environmentally sensitive areas, etc.) to get a comprehensive and visual overview of a proposed or as-built network. The Bill of Materials functionality allows users to quickly acquire project costs and/or material costs of any design and generate equipment reports.

#### Modular, flexible, standards-based solution

NetDesigner is modular and can be deployed as a standalone solution or integrated with other applications to manage fiber, wireless, copper, coax, and hybrid networks, structures, and other assets. Using standard out-of-the-box APIs, NetDesigner may be integrated with systems such as OSS, BSS, ERP, Facilities Management, and many others to automate end-to-end service provisioning, customer relationship management, and network operations.



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CUSTOMER ORDER ORCHESTRATION –  
CROSS-INDUSTRY 2.0 BUSINESS MODEL ENABLEMENT



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## Customer Centricity in the Telecommunications Industry

Transformation from Product-Centric to Customer-Centric  
and Creating Competitive Advantage Along the Way

WHITE PAPER

COMMUNICATIONS

Kayla McShane • Vice President, North America  
Pitney Bowes Software



### Brochures

## PTP Test Applications

Harmendun Dicks, Product Specialist, Transport & Datacom Business Unit

4G/LTE deployments and increased bandwidth requirements in Carrier Ethernet services are the driving force behind the new backhaul network technology. Synchronization is required for cellular and wireless network operations because base stations must be synchronized in order to hand off calls between base stations, minimize dropped calls and ensure proper billing. Since precision time protocol (PTP) provides both phase and frequency, it is quickly becoming the synchronization technology of choice for packet networks.

### WHAT IS IEEE 1588V2/PTP?

PTP provides high clock accuracy in a packet network by continuously exchanging packets with appropriate timestamps. In this protocol, a highly precise clock source, referred to as the grandmaster clock, generates timestamp announcements. It also responds to timestamp requests from boundary clocks, thus ensuring that the boundary clocks and the slave clocks are precisely synchronized with the grandmaster clocks. By relying on the holdover capability, the precision of the integrated clocks and the continuous exchange of timestamps between PTP-enabled devices, the frequency and phase accuracy can be maintained within a sub-microsecond range, thus ensuring synchronization throughout the network.

The objective of PTP deployment is simple: by exchanging timestamps, the slave clock can determine its offset from the grandmaster clock and thus adjust itself. This provides frequency and phase synchronization through packet distribution.



Figure 1. PTP network

### PTP USE CASES

PTP is a packet-based technology. As the synchronization packets used by PTP are forwarded throughout the network between the grandmaster and hosts, they are subject to delay (latency), delay variation (packet jitter) and frame loss. Despite applying high priority to synchronization flows, synchronization packets will still experience congestion as well as routing and forwarding issues (e.g., out-of-sequence packets and route flaps). The host clock's holdover circuit must be stable enough to maintain synchronization in the event that synchronization packets experience these network events.

In addition to testing packet metrics to make sure they meet the service level agreement (SLA), in some cases, it may also be critical to validate the frequency measurements of the sync signal. A few use cases are detailed herein. Table 1 summarizes the different synchronization testing applications.

Service Turn-Up	When	Who	Tests	Duration	Product
Ethernet backhaul and PTP client turn-up	Performed every time a tower is put in service	Field technician	- EtherSAM (Y1564) - PDG GE measurements - Client emulation	30 minutes at 7 hour	NetFilter Series
Sync network installation	Performed when a sync network is being deployed or when a new grandmaster is added	Network engineer	- Wander measurements - DC PDG offset - Slave/client emulation	24 to 48 hours	SyncWatch PRO
<b>Troubleshooting</b>					
Basic troubleshooting	Packet metrics issues/detective slave client	Field technician	- EtherSAM (Y1564) - PDG GE measurements - Client emulation		NetFilter Series
Advanced troubleshooting	Incorrect clock output/detective grandmaster	Network engineer	- DE, MTIE - DC PDG offset - Slave/client emulation		SyncWatch PRO

Table 1. Synchronization applications

**EXFO** | Assessing Next-Gen Networks

Brochures



## 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-reach rates. 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 flexgrid 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**  
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- ▶ **Flexible footprint**  
Chassis sizes from 1RU to 12RU, ETSI / data center rack, AC/DC power options



## Whitepapers



### White Paper

## Real-Time Streaming Analytics for Telecom: The Essential Guide

#### Prepared by

Ari Banerjee  
Senior Analyst, Heavy Reading  
[www.heavyreading.com](http://www.heavyreading.com)

#### on behalf of



[www.vitria.com](http://www.vitria.com)

## Whitepapers





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 hypercompetitive 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 delays. Nakina Systems' Inventory Discovery & Reconciliation solution discovers optical, Ethernet, IP/MPLS, and other network equipment and reconciles against industry standard inventory systems to reduce errors 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 inaccuracies 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 over-allocated 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-Domains Topology Discovery

- Discover Optical, Ethernet & IP/MPLS N/Ws (OTN/OTN/OTN networks)
- Reduce provisioning times

#### Full Discovery of Physical & Logical Inventory

- Topology, Links, Protection Groups, End-End Circuits
- Eliminate fall-outs due to inaccurate inventory

#### Pre & Post-Circuit Qualification

- On-the-fly qualification of resource availability to support Assign & Design process

#### Integrated Security Solutions

- Eliminate fall-outs due to access issues and password issues
- Profile-based protection of access to network information

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- Simple, Cost-Effective Integration with 3rd Parties



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These are challenging times for the telecoms and media sectors. Fierce competition is lowering margins. Converging technologies are making product differentiation problematic. Cost pressures are mounting. Customers are treating products as disposable commodities while brand loyalty is fast becoming a thing of the past.

Facing these difficulties, Communication Service Providers (CSPs) are discovering that delivering innovative, profitable products is an increasingly demanding task, but one that has become paramount to their ability to effectively compete and deliver in this fast evolving industry.

Enterprise Product Management is about taking control over these challenges and providing the key to how CSPs go to market and with what products and services.

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**The Sky's the Limit:  
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the Time for Cloud**

A Whitepaper

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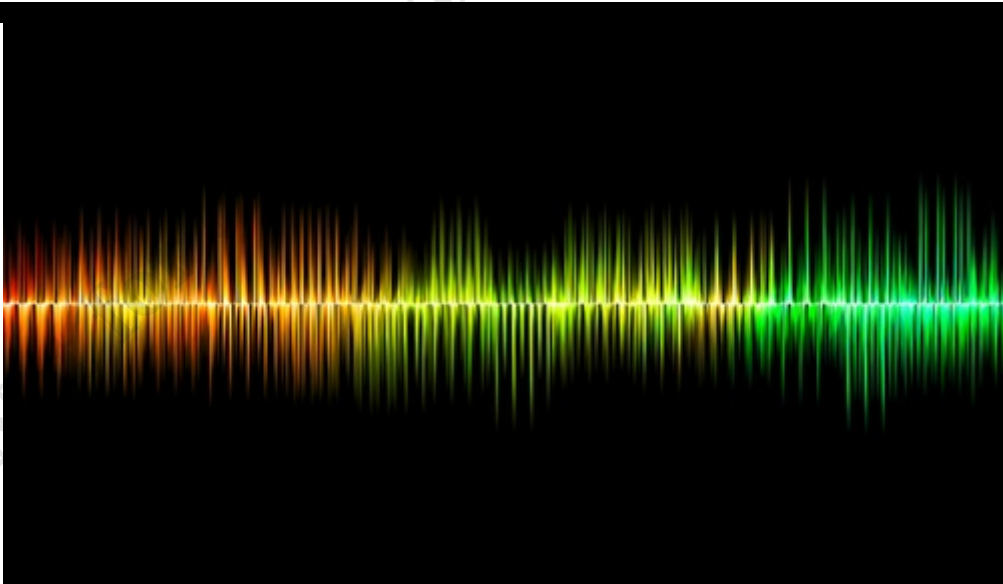
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**Customer:** Mohave Wireless, LLC  
**Web Site:** mohavewireless.com  
**Customer Size:** 15,000 subscribers  
**Country/Region:** United States  
**Industry:** Telecommunications  
**Partner:** Info Directions, Inc.

**Customer Profile:**  
 Mohave Wireless is a rural cellular communications company that provides voice and data service over a CDMA network in Mohave County of northwestern Arizona.

**Business Situation:**  
 Mohave Wireless needed to eliminate manual processes related to orders, fulfillment and collections and gain greater visibility into their billing processes.

**Solution:**  
 The CostGuard OSS/ISS software solution from Info Directions manages billing, workflow, customer care, traction, collection, order management and selling activities to produce efficiencies throughout the back office.

- Benefits:**
- Captured over \$400,000 in lost revenue
  - Eliminated manual billing processes
  - Reduced retail transaction times by 25 percent
  - Enabled retail advantage in the ability to offer new products

For more information about Info Directions products and services, please visit [www.infodirections.com](http://www.infodirections.com)

## Communications Provider Retrieves over \$400,000 in Revenue, Cuts Transaction Time by 25 Percent

### background

Mohave Wireless is a rural cellular communications company that provides voice and data service over a CDMA network in Mohave County of northwestern Arizona—a market that includes Kingman, Bullhead City and Lake Havasu City. Providing local cellular service since 1992, Mohave Wireless is committed to delivering enhanced phone service including robust voice and call quality, while providing the latest mobile products and services to its subscriber base.

With approximately 15,000 subscribers and nine retail locations, Mohave Wireless was experiencing enormous growth as the predominant service provider for the county. The company was suffering under the weight of an inefficient back office system that required manual processes related to orders, fulfillment and collections.

Mohave Wireless was previously operating on a billing system that was not user-friendly or intuitive. Employees were frustrated with the amount of time it took them to enter a simple order and were spending extra time gathering customer information on paper to later key into the system. The previous solution was difficult to navigate and allowed an archaic “green screen” interface that resulted in inconsistent data that led to be corrected manually. With this system, bill runs were always processing on a specific day and did not allow the company the flexibility of managing their own billings leads. Mohave Wireless was searching for a way to eliminate repetitive processes and create an infrastructure for proactive monitoring and management of orders, with maximum efficiency and speed while reducing the time and cost that personnel had to spend on such processing.

Simultaneously, the company wanted to ensure that it was capturing and correctly estimating usage over-ages that they could not distinguish with their current solution. Leadership understood that it needed an automated system that could effectively manage selling, billing, CRM and retail operations for its growing subscriber base.

### solution

The system that Mohave Wireless adopted is the CostGuard OSS/ISS solution from Info Directions. CostGuard manages selling, billing, workflow, customer care, traction, collection, order management and selling activities for telecommunications service providers. Its Web-based solution both manages billing support functions and provides workflow automation features to produce efficiencies throughout the back office.

The two companies jointly evaluated each step in Mohave Wireless’ business processes, from sales and order capture to fulfillment, customer care, and tracking. Info Directions is *open, and professional*, which made for the smoother billing conversion we have ever experienced,” said Jerry Herbert, General Manager for Mohave Wireless.

By providing advice and system insight, Info Directions helped Mohave Wireless improve their business processes and maximize the benefits of their CostGuard solution. With this guidance, Mohave Wireless was able to take advantage of features such as mobile tickets and Guided Assignment to enhance the efficiency of their system. “The new system is easy to train employees using Guided Assignment. This makes it easier to understand new products and services and offer them to customers with confidence,” said Jill Brown, Sr. Financial Analyst for Mohave Wireless. CostGuard’s Guided Assignment feature helps salespeople and customer care representatives suggest additional services or accessories based on a customer’s previous selections.



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A VODACOM CASE STUDY

# CAPACITY ISSUES DRIVE MEDIATION SYSTEM REPLACEMENT



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# Engineering Services

**SERVICES**

- Broadband Viability and Feasibility Studies
- Loan and Grant Application Assistance
- Network Planning & Design for Fiber, Wireless, Hybrid
- Outside Plant Design Engineering (Architecture, Field Notes, Design, Permitting)
- GIS/CAD Services
- Construction Plans, Specs & Management

**MARKETS**

ILEC	Global Carriers
CLEC	OEM
Cable	Municipalities
Wireless	Utility
IOC	IOC
Small/Medium Businesses	

**NETWORKS**

Wireline	Cable
Wireless	LAN/WAN

**ENVIRONMENTS**

- Central Office
- Headend/Hub
- Network Ops Center
- Outside Plant
- Switching Center
- Customer Premise
- APOP/Data Center

**We identify and implement infrastructure solutions that meet your technical needs, timelines, and financial requirements!**

CHR understands that traditional communications isn't just Voice, Data, and Video services anymore. Knowledge and expertise of current and emerging technology is our business, and our staff is experienced in applying those technologies to replace revenues that are eroding under pressure from changing demographics and competition. We don't provide a quick fix, we partner with you every step of the way and work to provide long-term solutions.

“CHR's designs build better in comparison to other Engineering companies.”  
— a Utility Construction Director

**Who Are We, You Ask?**

CHR is a leading provider of engineering, billing software, and managed services for communications service providers. Our legacy was built by providing comprehensive services to the independent and rural carriers for all of their network and business needs. We have taken that knowledge and created specialized programs, most notable being Outside Plant, FTTH, wireless, access equipment, network and switching design. Our industry experts help clients grow revenue and reduce cost through operational efficiencies and enhanced customer experience.

**Our Experience is Your Advantage**

- 75+ years of service to broadband providers
- Professional Engineers certified in 44 states
- Surpassed 2 million FTTH packages designed
- Secured over \$2.5 billion in private and government funding
- Completed over 300 RUS loan designs; helping clients acquire Federal funds
- Prepared applications and design engineering for 50+ RUS/FCC-funded projects

**Why CHR?**

CHR provides holistic program and project management and has the experience and success to deliver overall network deployment projects. We are an industry leader with intimate knowledge of large and small broadband providers, including power, fiber, radio, and cable. Our infrastructure Engineers and Project Management resources are experienced in construction, which heavily influences our design methods, resulting in lower build costs.

CHR can deliver an end-to-end solution or a subset of individual projects, such as engineering designs. A project manager will be assigned to work with our subject matter experts to lead your project from beginning to end, delivering all aspects. We take on complete ownership of delivery, including managing all partner agreements and performance.

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