

Surgically Mitigate RAN Video Pain

**Introducing CUTO, a radio-aware,
AI-based RAN optimization solution**

Ian Redpath



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Summary



Mobile video traffic is growing, placing communications service providers (CSPs) in a bind. Video traffic consumes an outsized proportion of the radio access network (RAN) resource, affecting the quality of service (QoS) for all users. Traditional network upgrade solutions are expensive in both time and capital.

Cisco Ultra Traffic Optimization (CUTO) is a proven, radio-aware AI-based RAN optimization software solution. CSPs can expect an immediate RAN capacity throughput gain without costly and time-consuming spectrum overlay or RAN hardware upgrades.

CUTO optimizes all large flow traffic including video and large flow software and operating system updates. CUTO is RAN-technology agnostic and works with all cellular networks including 3G, 4G, 5G and fixed wireless access (FWA). It is future-proof, optimizing encrypted and nonencrypted traffic including TCP and Quick UDP Internet Connections (QUIC) protocols. CUTO is vendor agnostic and can be deployed on the Cisco packet core or in a standalone configuration. CSPs strive to extract the maximum performance out of the network while minimizing capex and operational expense. Top notch network performance underpins the user experience and maintains customer satisfaction and retention.

An optimally performing network is also key to the digital economy and a nation's competitiveness within the global digital economy. Pragmatically managing network economics will free up resources for the pursuit of closing the digital divide.

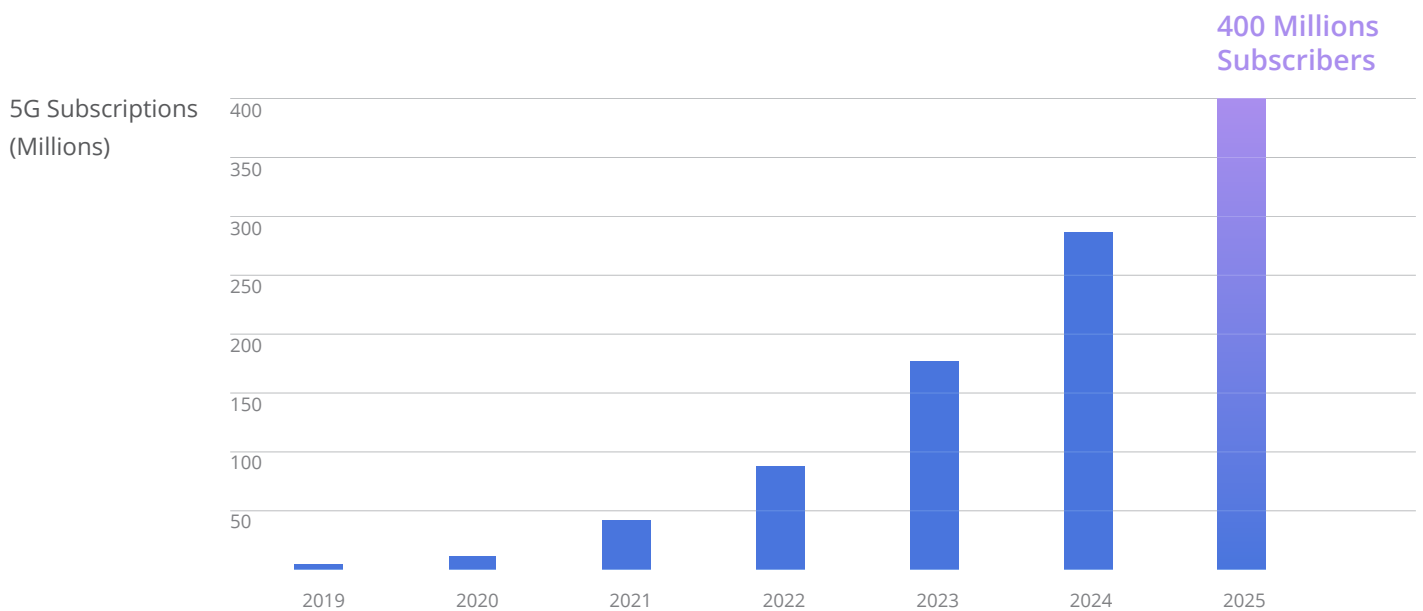
Video growth on the RAN

Industry evolution: Explosive transition to 5G

The growth potential of 5G is exceptional with a multitude of varied underlying drivers. 5G will enable applications that currently do not exist, taking advantage of much greater bandwidth with ultra-low-latency performance. The industry offers a suite and sequence of applications that take advantage of more and more advanced capabilities over time. The new applications will drive new revenue streams, further digitizing the global economy.

Additionally, 5G is intertwined with national competitiveness and national pride. In the 5G race, some countries will lead, and others will follow. Lead countries are making the maximum low/mid- and high-band spectrum available for their domestic ecosystems to develop, and they will have a strong influence in shaping global 5G development. In the Asia & Oceania region, multiple lead countries are pushing the 5G agenda. Omdia is projecting 5G subscriptions to ramp impressively in the Asia & Oceania region.

Figure 1: 5G subscription forecast for leading Asia & Oceania nations (excluding mainland China)



5G subscription forecast of leading Asia and Oceania markets including Australia, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, Taiwan and Thailand

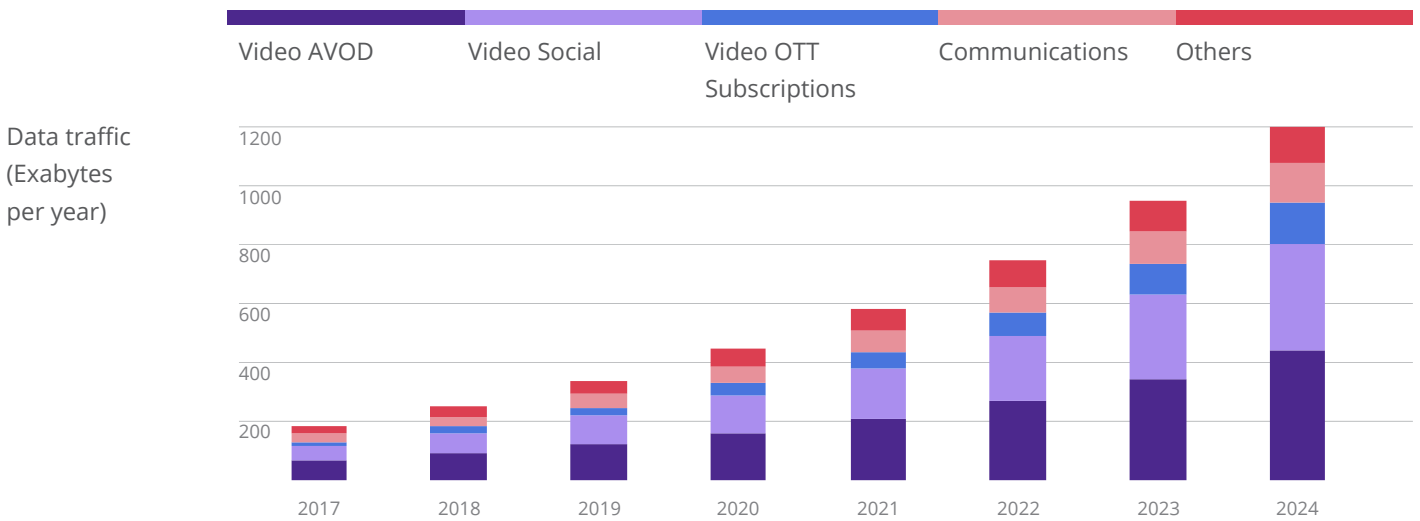
Source: OMDIA

Increasing consumption of video over RAN

Today's mobile users have a bevy of consumable video to choose from, and this choice will only grow. Video-based collaboration tool usage has recently exploded. Social-media-based video continues to grow. Stream-able video content is available from the likes of Disney, Apple, and Amazon. Mobile consumption of sports video is ever popular. The high-bandwidth RAN has made instantaneous consumption even more widely accessible, and consumers have taken to video consumption. When this is paired with unlimited data plans, consumers are untethered and no longer held back from watching video over the RAN network. They are consuming many types of video content including ad-based video on demand, social media video, and over-the-top (OTT) subscription-based video. Video is an essential element of the communications and infotainment experience.

Figure 2: Video over RAN continues to consume available bandwidth

Oceania, Eastern and South-Eastern Asia (excl. Mainland China) traffic, 2017-24



Source: Omdia Network Traffic Forecast

Heightened user expectations will stress networks

The good news for CSPs is that the 5G marketing hype cycle has worked. The bad news for CSPs is that the 5G marketing hype cycle has worked. User expectations for a premium bandwidth experience are sky high. From the user's perspective, their investment in a new, 5G-capable, \$1,200 smartphone had better be matched by a noticeable improvement in performance. Users are also expecting advanced services and applications, such as 8K video, to perform flawlessly. Heightened user expectation places immediate pressure on RAN network performance.

National Policy Goals

Asia & Oceania high-speed connectivity initiatives

Governments have long recognized the critical importance of a modern broadband infrastructure. Electricity, modern transport, and now broadband are essential infrastructure for a modern economy. Going further, a modern broadband infrastructure is an essential platform for a country's citizens to compete in the global economy.

Achieving 100% coverage will require the continued expansion of both the fiber and mobile networks, including FWA. Mobile network extension will be essential to reach sites that will never be served by fiber and to serve sites more economically than fiber can, and 5G FWA enables greater coverage at economic cost points that will help in reaching sites beyond the reach of fiber.

In many countries, there is also a digital-divide challenge. Leading cities are often the first to receive a modern broadband infrastructure, while cost challenges impede broadband rollout progress in more remote communities. A high-speed, high-QoS wireless network is an essential element of the solution. Wireless access is essential when it offers a better economic or performance fit than a fixed solution. In more remote areas, broadband wireless may be the only economic option. Countries are either contributing directly to advance national competitiveness goals or encouraging industry to do so.

Omdia is tracking national broadband and digital strategies worldwide. In the Asia & Oceania region, many leading nations have initiatives to raise the broadband connectivity bar for much of their populations. For very brief highlights, see Table 1.

Table 1: Leading Asia & Oceania national broadband policy initiatives



Australia

National Broadband Network (NBN) objective to deliver up to 1Gbps speeds via "Focus on Fast" campaign. By October 2020 25% of hybrid fiber coaxial network footprint was up to 1Gbps.



Hong Kong

As of July 2020, the household broadband penetration rate was at 95.2%, and as of August 2020, the average fixed broadband speed was over 205Mbps.



India

The National Digital Communications Policy (2018) aims to achieve 50Mbps for all and 10Gbps connectivity to all gram panchayats (villages) by 2022.



Indonesia

The National Medium-Term Development Plan 2020–2024 aims to extend broadband coverage to 30% of households and fiber to 60% of districts.



Japan

National coverage target of at least 100Mbps for mobile broadband and 1Gbps for fixed broadband.



Malaysia

National Fiberisation and Connectivity Plan leverages fiber optics and wireless technologies. The goal is for 98% of populated areas to have 30Mbps speeds by 2023.



New Zealand

Ultra-Fast Broadband initiative to reach 87% of households in 390 towns with 1Gbps by 2022. By September 2020, 62% of premises had been reached.



Pakistan

The Telecommunications Policy 2015 aims to provide widespread broadband services over fixed and mobile networks by 2025.



Philippines

The National Broadband Plan (2017) targets accelerating fiber and wireless technologies, providing at least 10Mbps speeds to all households by 2020.



Singapore

The goal is to achieve 90% of the population connected with competitively priced 1Gbps broadband. As of September 2019, 93.1% had been reached.



South Korea

GiGAtopia vision: targets were 1Gbps fixed broadband and 10Mbps for mobile broadband. As of August 2020, average fixed speed was 160Mbps.



Taiwan

National Communications Commission (NCC) has been promoting broadband to villages. In March 2018, fiber-to-the-home coverage at 100Mbps was over 90%.



Thailand

As of 2019, broadband penetration per household was over 42.1%. As of August 2020, the average fixed broadband speed was over 173Mbps.



Vietnam

The Wireless Broadband Master Plan (2016) targets 95% household coverage of 3G/4G by 2022. The fixed broadband speed target is 25Mbps.

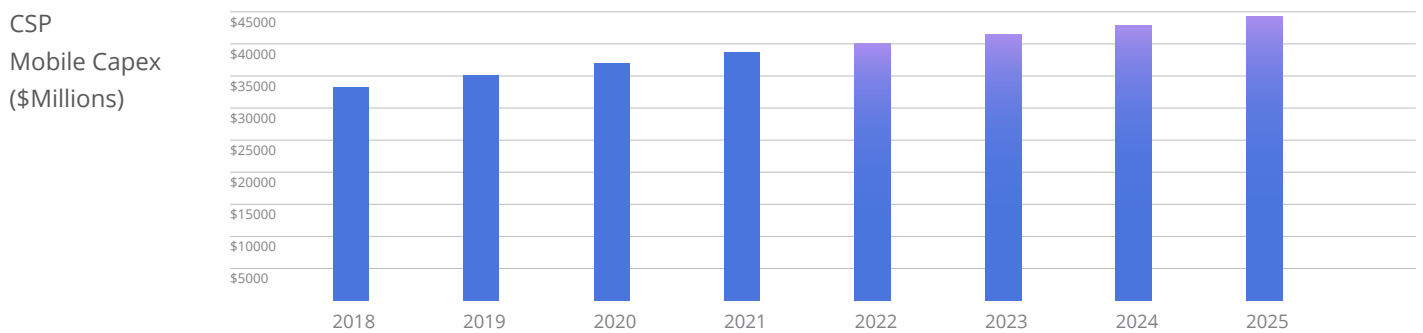
Source: Omdia National Broadband and Digital Strategies Tracker – 2020

Asia & Oceania network modernization

Capex projections for network upgrades

Network modernization initiatives cover all aspects of networks. CSPs must prioritize investments from the perspectives of long-term strategy and near-term revenue goals. Access network investments are ongoing and include residential fixed broadband, RAN upgrade to 5G, and enterprise connectivity. Access upgrades necessitate core networks as well, including IP core upgrades, optical network upgrades, and implementing next-generation orchestration and control. The Asia & Oceania region is continuing with aggressive network modernization initiatives. Omdia is projecting impressive and upward capex growth to support the multitude of network modernization efforts.

Figure 3: Oceania, Eastern & South-Eastern Asia (excluding mainland China) capex, 2018–25

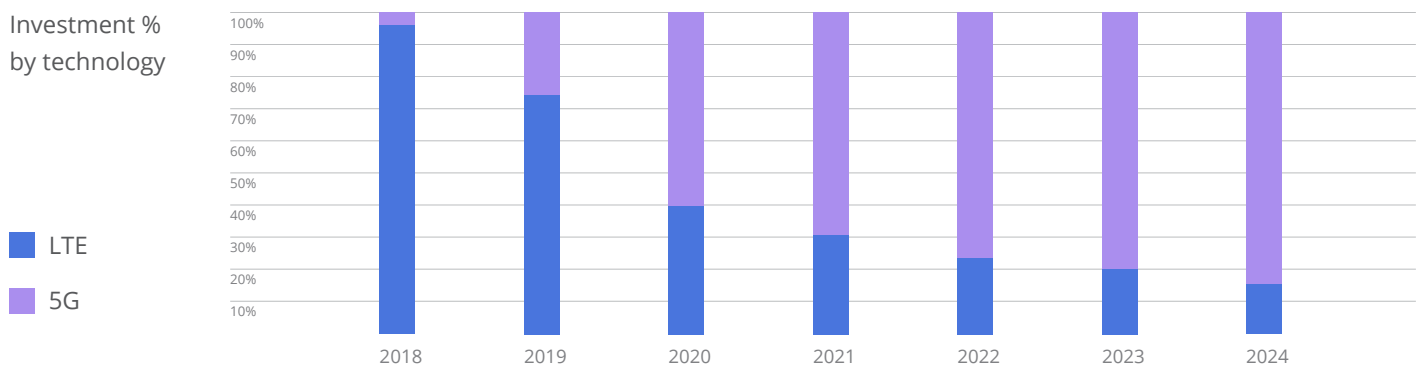


Source: Omdia Revenue and Capex Forecast

The transition to 5G

The industry is also in the midst of the shift from LTE-led to 5G-led investments. See Figure 4 for Omdia’s projection on the LTE to 5G shift for the RAN and mobile packet core.

Figure 4: LTE to 5G network equipment investment transition



Source: Omdia

FWA is another key technology in the CSP toolkit

Fixed wireless access technology has emerged and has solidified its position in many ecosystems. Omdia is forecasting substantial growth for FWA subscriptions:

26% CAGR
2019-25
North America and Europe

30% CAGR
2019-25
Asia & Oceania

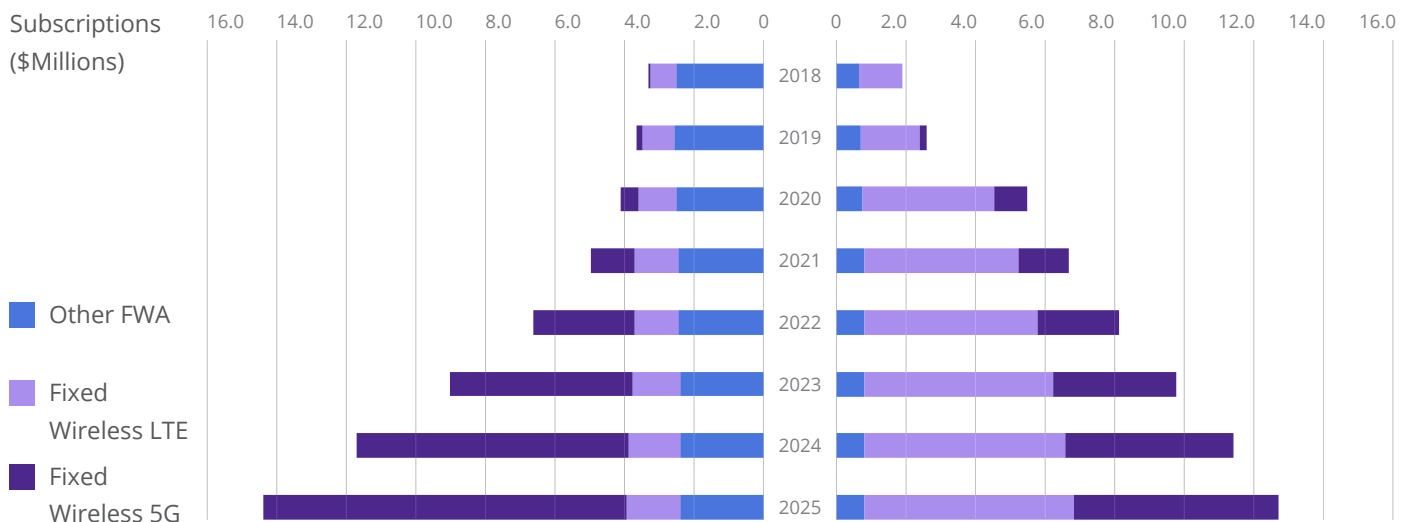
FWA has followed an interesting market progression with some regional distinctions. In both North America and Western Europe—which have strong histories with fixed networks—LTE FWA had a limited deployment record. However, 5G FWA is changing the network planning calculation. The reach and economics of 5G FWA make it a much more compelling solution, and Omdia is projecting an impressive subscription growth rate.

In Asia & Oceania, countries such as Australia, Japan, and New Zealand with strong fixed networks did not invest heavily in LTE FWA but will invest in 5G FWA based on technical and economic performance. Countries such as Malaysia and the Philippines have, to date, invested less in their fixed access networks but did deploy LTE FWA and are planning on ramping 5G FWA. Vietnam has leapfrogged earlier technologies and is planning to ramp 5G FWA directly.

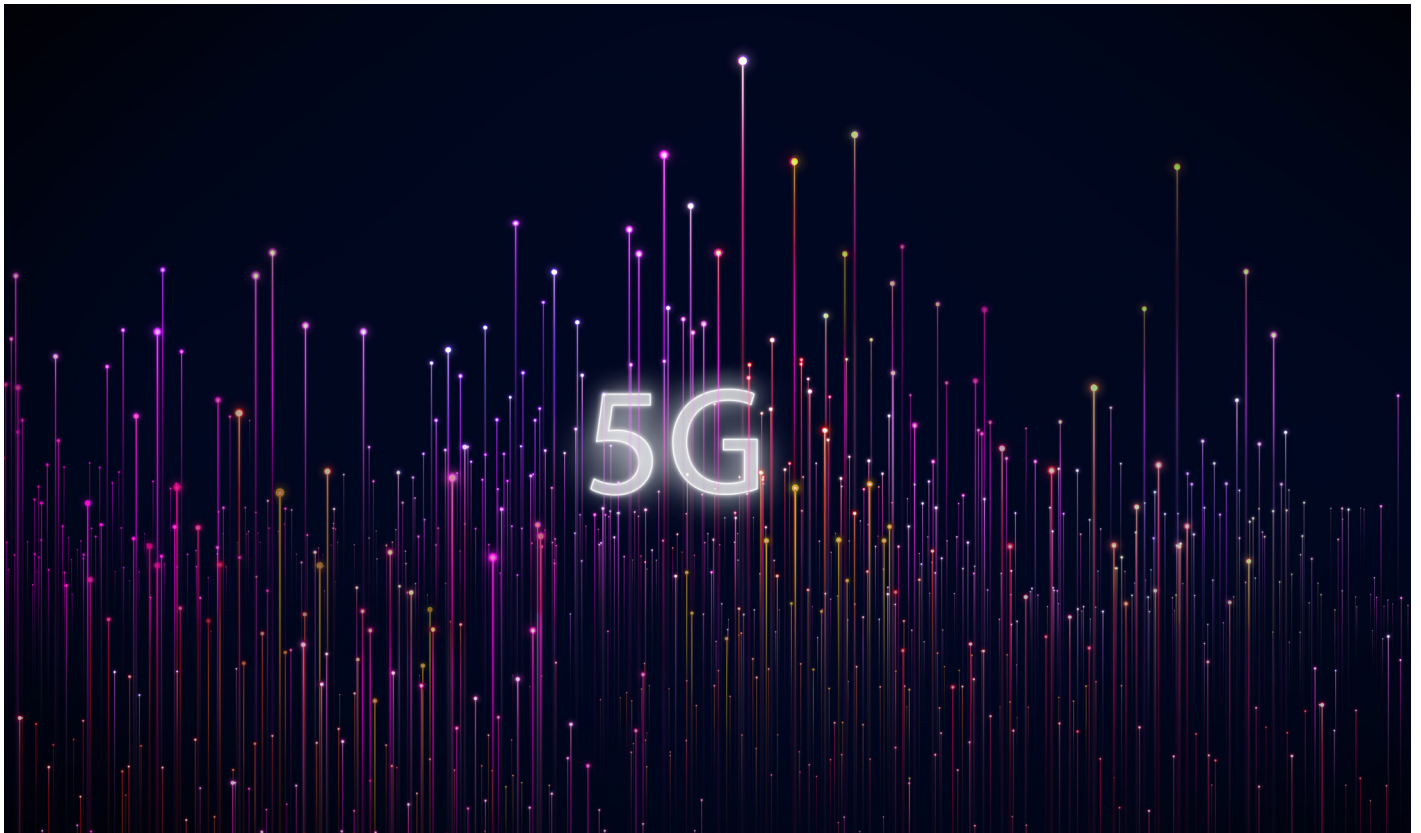
Figure 5: North America, Western Europe, Asia & Oceania, FWA subscriptions, 2018-25

North America & Western Europe FWA Subscriptions

Asia & Oceania FWA Subscriptions



Source: Omdia



Carrier investment challenges

The 5G investment challenge

Rollouts of 5G will be based on ROI fundamentals. On the cost side, 5G will ultimately present the CSPs with a formidable bill; the industry is working feverishly to lower costs. Revenue certainty is essential. The industry is working to answer the question: What are the essential set of applications that are going to drive concrete revenue flows? It will be a portfolio of new services, introduced in time, taking advantage of more and more 5G RAN capabilities as they become ready. There can be some prebuild of the 5G network, but there will be fiduciary discipline. While transformational, 5G will also follow an evolution from the networks of today. Planning transport for 5G will be a major industry challenge over the few years.

The CSPs will all have differing network starting points and differing assets, which will lead to differing target architecture optimizations and models for edge compute. Ultra-low-latency services will be the next-level stressor on networks, placing further demands on transport networks. The evolution of 5G is a classic multivariate network planning challenge. The industry needs to optimize and compromise on many different dimensions.

RAN user experience and operational challenges

Major 5G strategic investments are on the way, but in the meantime, CSPs have today's networks to manage and monetize. One current pain point for many mobile operators is video traffic delivery over their current RAN networks. Video flows are a small proportion of overall quantity of flows of email, web browsing, and messaging traffic, but video consumes a very significant proportion of the available bandwidth. It only takes a small number of video-consuming users to dramatically affect network performance. As video traffic rises, it can lead to performance degradation for all the users within the entire serving area. Video today accounts for more than half of data volume.

Ensuring high quality of user experience for all users at all times

The CSPs' goal is to maintain a high-quality user experience for all users over a given geography on shared radio channels even as traffic volume grows. All network users are due their fair share of bandwidth. A common industry metric is bps per user per square km. Video has an outsized impact on network performance for all users within a given region. The CSPs live in the world of growing traffic, which leads to pressures to grow the network and increase capital outlay.

CSP fiduciary objectives: Mitigate unfettered capex and opex growth

Many CSPs are now in a bind:

- Traffic, video traffic in particular, has grown and will continue to grow.
- QoS must be maintained for all subscribers.
- The CSPs do not have unlimited capital and time to address QoS issues.

CSPs must deliver more throughput without a punishing capex burden. Additionally, CSPs need to increase throughput without taking expensive and time-consuming actions on the outside plant. The standard levers for improving bps per user per square km are "heavy lifting" and expensive. CSPs can

License new spectrum

- Never quick, never cheap, and will also incur equipment costs

Densify the network adding more cells

- Never quick, this is a carefully planned long-term exercise
- More equipment costs and incurs site acquisition and operational costs

Deploy earlier-generation load-balancing techniques and other operational tactics:

- Early techniques developed preceded the widespread usage of encryption.
- Video optimization requires vast amounts of hardware and processing power.
- Throttling bandwidth overall is a "hammer" tool, not a precise surgical scalpel.

All of the standard levers listed above will incur substantial capex and opex. CSPs need a more surgical, precision-based solution. The ideal solution would address the problem quickly with minimal operational and capital pain and restore a high QoS for customers.



Cisco Ultra Traffic Optimization (CUTO)

What is CUTO

CUTO is a radio-aware RAN Optimization solution that uses machine learning technology to detect and mitigate congestion on mobile networks. The result is a much faster network, higher data speeds for subscribers, and a reduction in network build requirements.

CUTO is deployed in the mobile core and provides game-changing economic benefit for the RAN. CUTO is available in the Cisco packet gateway and on a standalone server basis (both commercial off the shelf and virtualized).

How does CUTO help

CUTO network optimization software helps because

- CUTO optimizes all large flow traffic including video and large flow software and operating system updates.
- It reduces inefficiencies in the network and maximizes spectral efficiency, driving performance gains for consumers.
- CUTO is cloud-native, requires no radio OEM integration, and can be rapidly deployed network wide in a matter of hours.
- CUTO-accelerated 5G applications run much faster in the mid/low bands.
- CUTO deployments are fast and non-disruptive, leading to immediate network performance benefits.

A key feature of CUTO is the agnostic nature of the rapidly deployable software-based solution:

- CUTO is RAN-technology agnostic and works with 3G, 4G, 5G, and FWA.
- CUTO is RAN-vendor agnostic and compatible with all leading RAN solutions.
- CUTO is traffic agnostic and works on nonencrypted and encrypted traffic, including TCP and QUIC protocols.
- CUTO can be deployed on a Cisco mobile packet core or as a standalone solution.

As a software solution that is deployed centrally in the core of the mobile network, CUTO is able to help CSPs bring congestion relief in a very short time without the complexity of upgrading or renovating RAN cell sites.

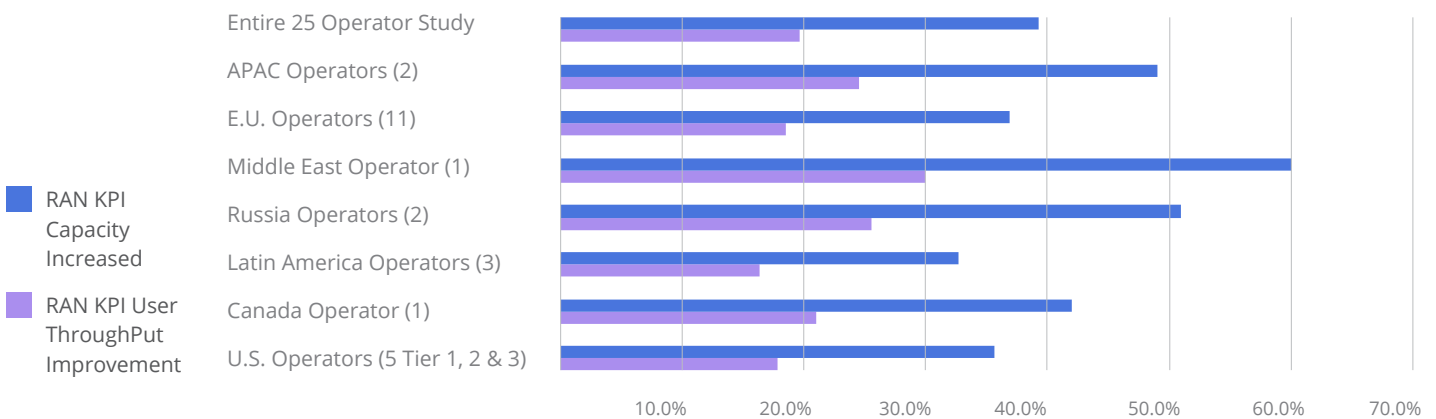
CUTO CAPEX and OPEX benefits

Many CSPs have successfully deployed CUTO. In a recent set of trials and deployments with a leading set of 25 network operators worldwide, operators reported user throughput improvements and capacity increases.

On average, across the 25 participating operators in the trials, user throughput increased by 20% or more, and capacity increased almost 40%.

Figure 6: CUTO enables RAN KPI performance improvements

CUTO-enabled RAN KPI performance improvements



Source: Cisco, a synopsis of CUTO trials with 25 Network Operators worldwide

Spark of New Zealand has deployed and operated the CUTO solution for the past two years and reported immediate gains in capacity for its cell sites and throughput for its subscribers.

Figure 7: Spark New Zealand testimonial

“The CUTO solution developed by Cisco on their mobile pocket core has provided immediate gains in radio network capacity and performance. We deployed the solution nationwide prior to Rugby World Cup when the streaming of live games created peaks of network demand. We wanted to maximize the user experience for mobile customers, but also ensure critical services - like voice - were protected.”



Campbell Fraser
Tribe Leader of Technology Spark

Source: Spark New Zealand press release, February 25, 2020

Appendix

Methodology

Primary sources for this white paper include the Spark New Zealand testimonial at <https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=2057039>.

Cisco was an additional source for the CUTO content and the synopsis of the global CSP RAN network trials. Omdia expertise and market forecasts contributed, including

5G Mobile and Fixed Subscription Forecast: 2020–25

Network Traffic Forecast: 2019–24

Omdia National Broadband and Digital Strategies Tracker – 2020

World Cellular Information Service Data Dashboard

Communications Provider Revenue & Capex Forecast: 2020–25

Fixed Wireless Access Subscription Forecast: 2020–25

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Cisco's networking solutions connect people, computing devices and computer networks, allowing people to access or transfer information without regard to differences in time, place or type of computer system. If anyone can lay claim to a 'heritage' in an industry as young as global networking, then it is Cisco. Not only does 85 percent of Internet traffic travel across Cisco's systems, we also use the Internet to run our own business online, from product orders and inventory management through to staff communications and travel expenses.

So as you explore the possibilities for your business, start at the beginning. Cisco Systems built the Internet so we know exactly what it takes to get your business online. Take advantage of our experience and knowledge to get the Internet working effectively for your business.

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