



Ensuring superior customer experiences
and business value for telecom operators

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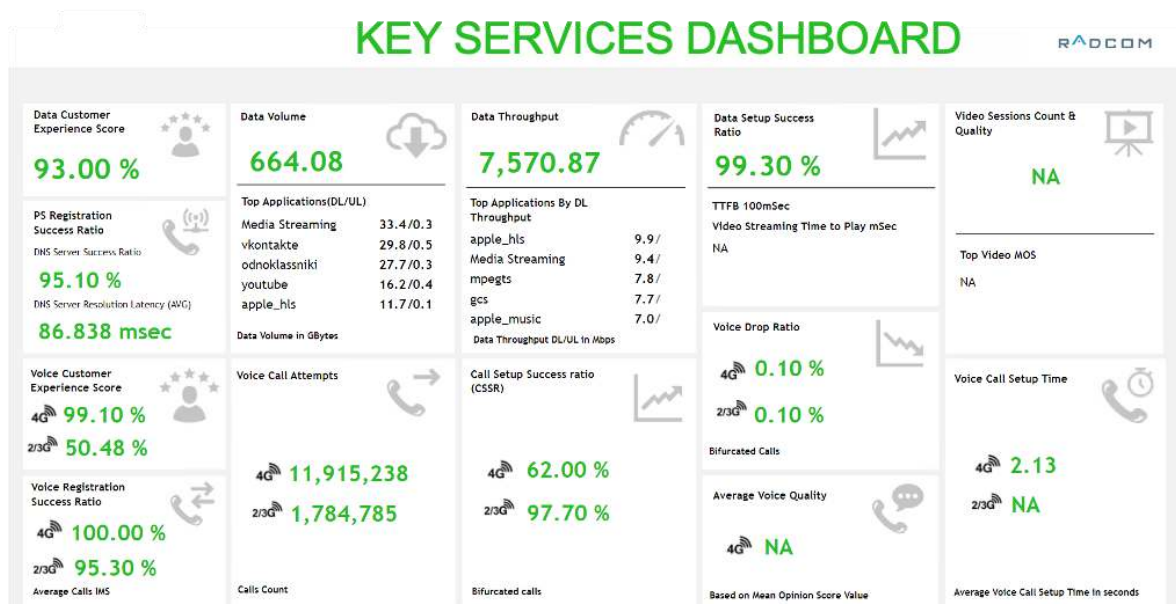
Introduction

With unrelenting competitive pressures, operators' OPEX and CAPEX expenditure is driven by the need to keep up with technology advancements – and not purely for commercial objectives - as operators continue advancing their 4G networks while also supporting the launch of 5G. In this highly competitive environment, operators face substantial challenges in transitioning to new technologies, efficiently assuring the customer experience, and reducing their OPEX and CAPEX expenditure for lean network operations.

Operators are transforming themselves into Digital Service Providers (DSPs). Delivering exciting and disruptive services that create new revenue sources and business models that re-envision the customer experience and is driven by data and analytics. This digital transformation is empowered by:

- An ecosystem focused on service agility and cost savings
- An on-demand, more personalized subscriber experience
- Data-driven decision-making
- An automated, proactive approach to assurance for LTE-advanced and 5G

However, the foundation for an operators' success is on the customer experience, which requires the right service assurance approach to be implemented to gain the analytics to produce relevant insights from these complex networks. Today, the customer experience is everything and the foundation for new business use cases and critical revenue streams.



Operators must gain a service-level awareness and understand the customer experience through their subscribers' eyes. For example, is the subscriber trying to watch streaming video on a device that recently had its firmware updated and is now suffering from repeated buffering? In this case, monitoring the resource and network layer is not enough. To understand why the video is not streaming adequately, we need to see the end-to-end service layer. Operators can do this by integrating a probe layer into their assurance strategy that allows them to understand the end-to-

end service quality, includes real-time subscriber analytics, and provides troubleshooting tools to deliver a great customer experience.

This real-time subscriber and service analysis provides a different dimension to the network-focused data. Network counters don't look at the customer experience and don't give the end-to-end picture, and there is no correlation. Therefore, the operator can't use this data to understand the end-to-end service quality. They don't have the raw trace that includes checking real-time and historical data per user at the packet level troubleshoot. Probes capture all signaling and user data events in the networks and integrate them into the operators' assurance solution.

Automated, AI-driven assurance: RADCOM ACE

RADCOM's solution is deployed at multiple operators globally, such as AT&T, Beeline, Globe, Rakuten, and Telefonica, and has received wide industry recognition, winning a Frost & Sullivan Product Differentiation Innovation Awards three times, winning multiple TMC Labs Innovation Awards, and winning the TMC Award for NFV Innovation. RADCOM utilizes advanced, cutting-edge technology such as AI and machine learning to monitor and troubleshoot network anomalies proactively, automatically perform root cause analysis, and provide insights into encrypted traffic for such services as video streaming, tethering, and gaming.

RADCOM ACE provides operators with a next-generation assurance solution to improve customer interactions across all services, enhance the overall customer experience, and optimize network performance in real-time to deliver high-quality services efficiently and at scale. RADCOM was the first vendor to transition to a next-generation, automated assurance solution and has been chosen by top-tier operators looking for next-generation solutions.

"AT&T is migrating network probe functions to the cloud with service assurance software from RADCOM. Virtualizing service assurance functions will boost performance optimization and help identify and isolate network issues to maximize customer experience."

Susan A. Johnson, Senior Vice President, AT&T Global Supply

"RADCOM's automated assurance solution allows us to monitor service and subscriber, fulfill analytics on our network performance end-to-end from RAN to Core and IMS, all in a cloud-native virtual environment..."

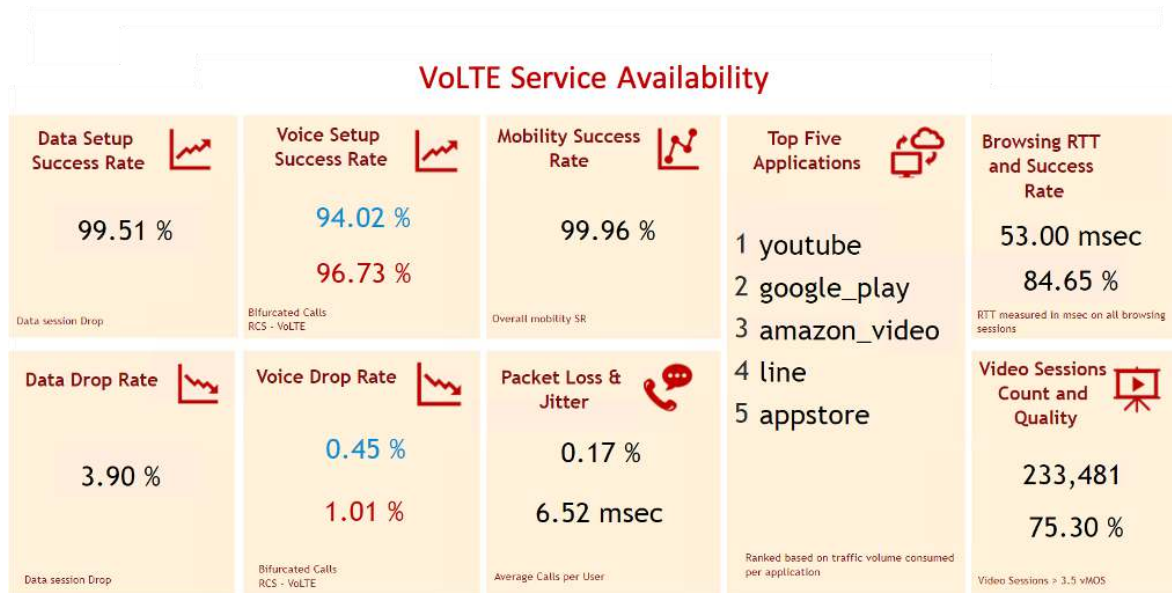
Deploying RADCOM ACE on our network helps us identify service issues in real-time and troubleshoot them, tasks which are essential for smoothly migrating our customers to the new 5G network and onboarding new customers while maintaining the highest quality of service."

Tareq Amin, Chief Technology Officer, Rakuten Mobile

This document will lay out the reasons why moving to RADCOM's next-generation solution – RADCOM ACE - offers operators a substantial reduction in the total cost of ownership vs. traditional assurance solutions, significant return on investment, while also enabling advanced assurance features, like traffic sampling, built-in artificial intelligence and machine learning for automated KPI-based anomaly detection, visibility into encrypted traffic and more. RADCOM's solution will provide significant benefits from day one and is future-proof for advanced standalone 5G requirements to ensure the customer experience for years to come.

Reduce Mean Time to Repair (MTTR)

RADCOM ACE enables you to find and address issues before they impact customers and reduce your MTTR. This is enabled by RADCOM's proactive approach to assurance that utilizes built-in AI/ML to improve network uptime by an average of ~10-15%. Also, RADCOM ACE enables teams to perform preemptive rather than reactive maintenance. This frees up engineers' time to focus on more customer-affecting issues and improves maintenance efficiency, saving up to 10% OPEX.



Furthermore, through probe-based data, RADCOM ACE provides an end-to-end view of the service quality with rapid drill down from a macro to the micro view of the individual subscriber or packet-level with call tracing and protocol analysis. This allows the quick resolution of customer-affecting issues and root cause analysis.

Improve network quality automatically

Network traffic growth is driven by both the rising number of smartphone subscriptions and an increasing average data volume per subscription, fueled by increased viewing of video content. Monitoring all this data and pinpointing customer-affecting network degradations is like looking for a needle in a field of haystacks. With so many different services, devices, network traffic, and combinations, traditional service assurance solutions with manual processes fail.

70% of operator time is devoted to the discovery and root cause of network issues

With built-in modular AI, RADCOM ACE utilizes the data collected through its probes. It then applies AI/ML to offer multiple, telecom specific use cases. These use cases significantly reduce the time to detect and resolve network degradations and faults.

Optimizing network performance

Anomaly or outlier detection is a method of searching for data that does not match an expected behavior or a pattern in a given data set. Network anomaly detection methods can be classified into five categories:

- Statistical-based
- Classification-based
- Clustering and Outlier-based
- Soft computing-based
- Knowledge-based

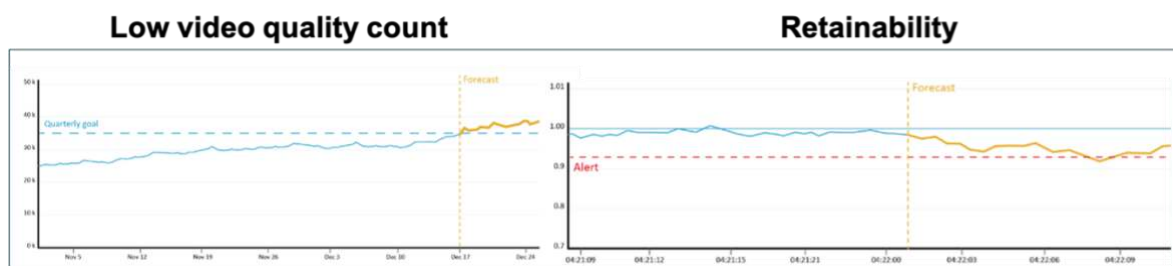
Release Cause Anomaly Analysis

An example of KPI-based anomaly detection is for release cause. An advanced algorithm is applied to identify anomalies in the release cause count between all network elements and the associated severity over time. It is thus removing 'outliers' from the release cause baseline. The baseline outlier removal facilitates an accurate baseline prediction, improves the detection of network anomalies, and removes false positives. Also, in calculating a baseline, and a confidence area, it is possible to see points in time beyond the confidence area based on past data. These exceptions can be translated into additional alerts. By utilizing these AI-driven insights, engineers remain focused on handling critical customer-affecting issues rather than handling "alerts" that have no real effect on subscribers.

RADCOM's system continually monitors the release cause count between all network elements and applies advanced machine learning algorithms to determine whether an outage anomaly has occurred. The number of impacted subscribers determines the severity of this anomaly, and an alarm is triggered accordingly. Once this alarm has been received, the network engineer is directed to the Release Cause Distribution dashboard to analyze the outage's cause and apply corrective measures. This automated anomaly detection can save up to ~10% in OPEX and takes a proactive approach to maintain operational excellence and efficiency.

Smartly plan network capacity

After generating baselines in different network performance and service quality areas, AI-driven assurance can use this information for more use cases. The most common is predictive analytics. As the solution already knows how to generate the right forecast in the short-term (for say, release cause), it's also possible to create a long-term forecast for various performance and quality indicators and use it to plan future network capacity smartly.



It is allowing more data-driven decision making that will be critical for network management and operations. Furthermore, by incorporating more sophisticated AI algorithms, which consider

seasonal seasonality, it will also be possible to create forecasts for an extended period. For example, one month or a whole quarter.

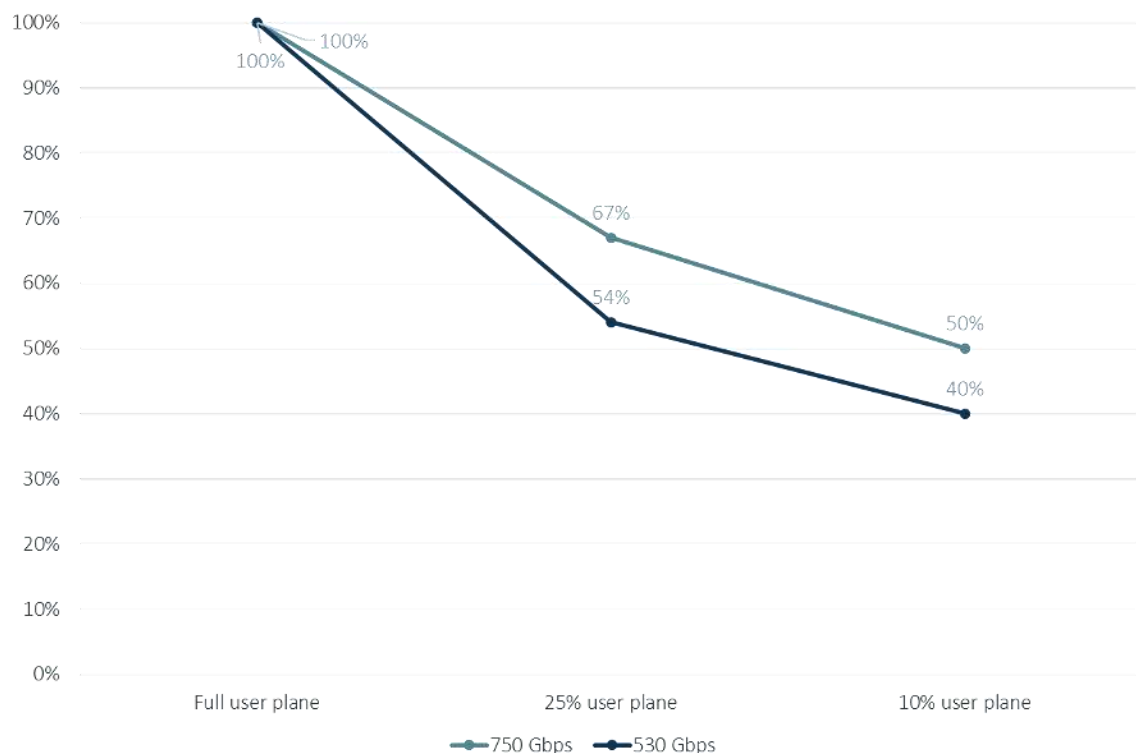
To ensure 4G and 5G network quality, you need to deploy AI-driven assurance solutions with built-in AI/ML. This will provide the most efficient way to embed artificial intelligence into the network that will help engineers manage their networks and separate the network “wheat” from the chaff automatically. This will free engineers up to spend more time on the critical task of optimizing the network performance and solving network degradations to ensure superior customer experience and operational excellence. It also lays down the foundations for an open/closed-loop approach to managing network operations.

Smartly monitor the customer experience

Traffic sampling for CAPEX savings

Traffic sampling saves operators significant assurance CAPEX by capturing traffic samples of user plane traffic while capturing the full control plane traffic. This is a much more efficient approach to service assurance that always ensures the customer experience. An operator can monitor 100% of VIP subscribers and, say, 50% of other subscribers. This can significantly reduce assurance CAPEX and be adjusted according to the operators' needs (i.e., when a new service is launched). For example, by sampling 25% of the traffic, you save ~40% CAPEX.

RADCOM analyzed the hardware (for COTS deployments not virtual) required to support the monitoring of 750 Gbps and 530 Gbps of traffic for three use cases: capturing 100% of user plane traffic, sampling 25% of user plane traffic, and sampling 10% of user plane traffic.



The user plane traffic can be limited by:

- A maximum amount of Gbps to be transferred to the probes (e.g., 100 Gbps, 150 Gbps, etc.)
- A specific percentage of the total user plan traffic (e.g., 10%, 25%, 50%)

Achieve unified service and revenue assurance

RADCOM ACE offers you a unified view of the 4G and 5G network and focuses on end-to-end customer-centric indicators across a multitude of dimensions and utilizing the built-in AI/ML for automated anomaly detection, predictive analytics, and insights into encrypted traffic. From customer care, roaming, interconnect traffic, churn prevention, monetization use cases, video streaming assurance, and more. This provides CAPEX savings and additional benefits as one end-to-end solution can be deployed instead of several siloed solutions.

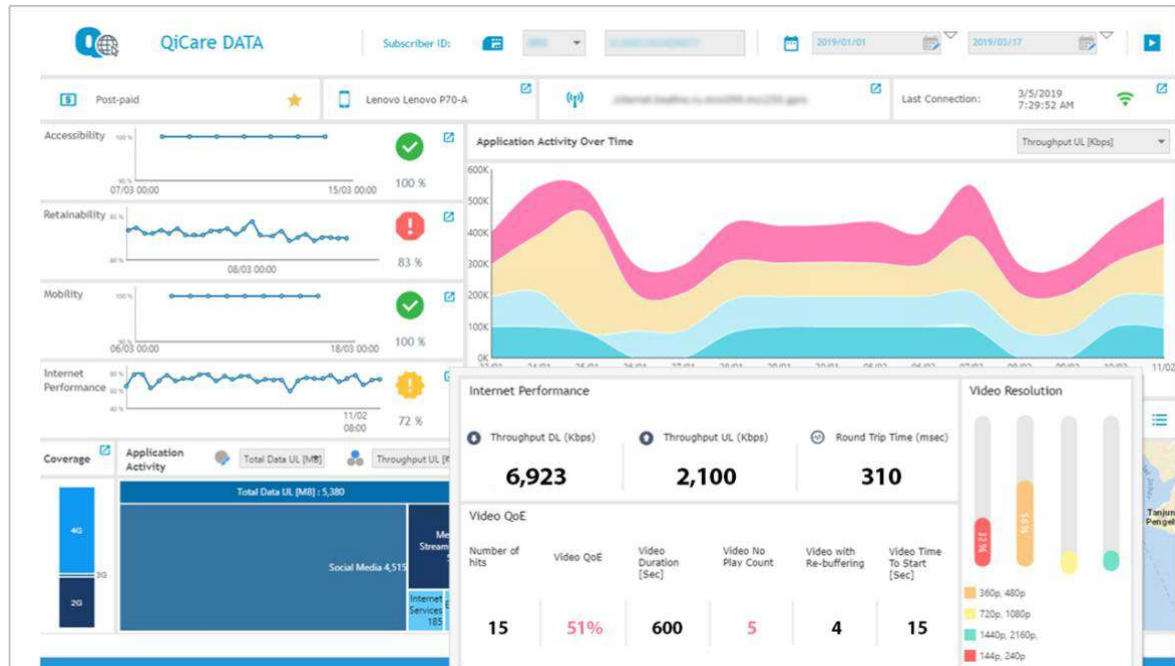
Churn prevention

Churn costs the telecom industry billions of dollars every year, which means you must hold on to the customers you have and reduce churn as much as possible significantly as it can cost up to 5 times as much to acquire a new customer as it does to retain your current ones. Often the reason for churn is that a subscriber has a negative experience. Either they reach out to support and receive an unsatisfying response to their issue, or they simply churn without reaching out. RADCOM's field-proven churn prediction insights can forecast at least 50% of the customers that will churn by correlating customer quality of experience over time, continual monitoring of connection speeds, and detecting whether customers visit a competitor's website. By delivering this churn reduction can proactively reach out to these customers, resolve issues and turn them into satisfied customers. RADCOM's solution prevents up to 1% of any churn.

Key Benefits:

- Identify subscriber's likely to churn
 - Churn score based on subscriber behavior patterns and QoE
 - Statistical analysis to automatically identify factors predicting churn
- Be proactive in preventing churn
 - List of subscribers likely to churn sent to customer support and promo systems
 - Identify and resolve customer 'pain' points
 - Improve Quality of Experience before customers complain

Customer care



RADCOM ACE enables you to significantly improve your First-Call Resolution (FCR) for Tier 1 Customer Care by providing rich quality of experience indicators into the hands of Customer Care. This allows most support issues to be solved by Tier 1 support and reduces the number of escalations to Tier 2 or engineering. This boosts your customer service and support, offers higher customer satisfaction, increases customer care efficiency, and saves you valuable OPEX.

Roaming and interconnect



RADCOM ACE provides you with roaming and interconnects assurance for a comprehensive view of the traffic that transverses your and other networks for roaming and interconnect situations. This aids you select roaming partners, leverage preferred partner value, make informed marketing decisions when introducing new services, negotiate agreements, and validate roaming and interconnect billing revenue. These insights also enable you to monitor your mobile virtual network operators (MVNOs) to detect billing errors impacting your revenues.

Data monetization

RADCOM's solution provides rich insights used for data monetization. For example, by subscriber profiling or user segmentation. For marketing, these insights can be used for OTT app promotions by the customer profile (for example, SMS ad for special rates for WhatsApp voice calls and receive three months free calls) as well as for customer care to offer proactive care for subscribers or VIP groups with low OTT QoE. Profiling involves the extraction of subscriber lists according to specific criteria and can be used for various applications such as:

- Real-time creation of subscriber lists in accordance with profiles. Profile filters may include
 - Time range, devices, locations, network elements, VIP groups, APNs, brands
- Use case scenarios for marketing
 - Promotions to old iPhone subscribers to upgrade to a new iPhone
 - Free promotions for subscribers browsing competitors' websites
 - Real-time web banner promotions such as "unlimited Facebook."
- Use case scenarios for Customer Care
 - SMS notification for outbound roamers with high data use
 - Proactive care for subscribers with low QoE
 - Call customers who can't connect to 3G or can't browse

It provides an understanding of the real customer experience across all your services and how to resolve customer-impacting service degradations. Offering insights in real-time for streaming

analytics and closed-loop management of your customer experience services and delivering batch data for more detailed analysis and network optimization.

Fraud and network abuse

With operators suffering an estimated global loss of over \$300bn from uncollected revenue and fraud, the need to safeguard the network and assure that fraud and network abuse is apparent. Fraud (such as SMS spamming) also damages your brand and reputation, so you need to protect subscribers from receiving unsolicited messages or fraudulent texts. RADCOM ACE provides analytics that helps you combat telecom fraud with real-time, end-to-end network surveillance capabilities covering a wide range of fraud types such as.

- Bandwidth hogs - users who use substantially more bandwidth than other users on the same network
- SMS spammers - junk messages delivered to a mobile phone as a text message
- Tethering abuse – users that utilize significantly more mobile data than other users and conceal this tethering activity
- SIM abuse such as SIM Box – VoIP calls made via the internet is redirected onto mobile networks, bypassing the interconnect toll charging points. Additional types of network abuse are dual SIM and SIM replacement SIM
- VoIP Fraud - the unauthorized use of paid VoIP services charged to someone who isn't expecting it; whether the CSP or another customer

Gain a vendor-agnostic, independent view of the network

Probes are network vendor-agnostic and show a measurement that is consistent across all the network elements. Providing an independent auditor that will paint a vendor-agnostic picture of the end-to-end service quality, challenging if relying just on network element counters that depend on the network equipment to monitor itself, and the data output varies from vendor to vendor.

By deploying a probe-layer as part of the service assurance solution, the operator gains an end-to-end view of the service that prioritizes network issues according to their service and customer impact. By understanding the impact on the subscriber, operators can troubleshoot issues faster and improve customer experience.

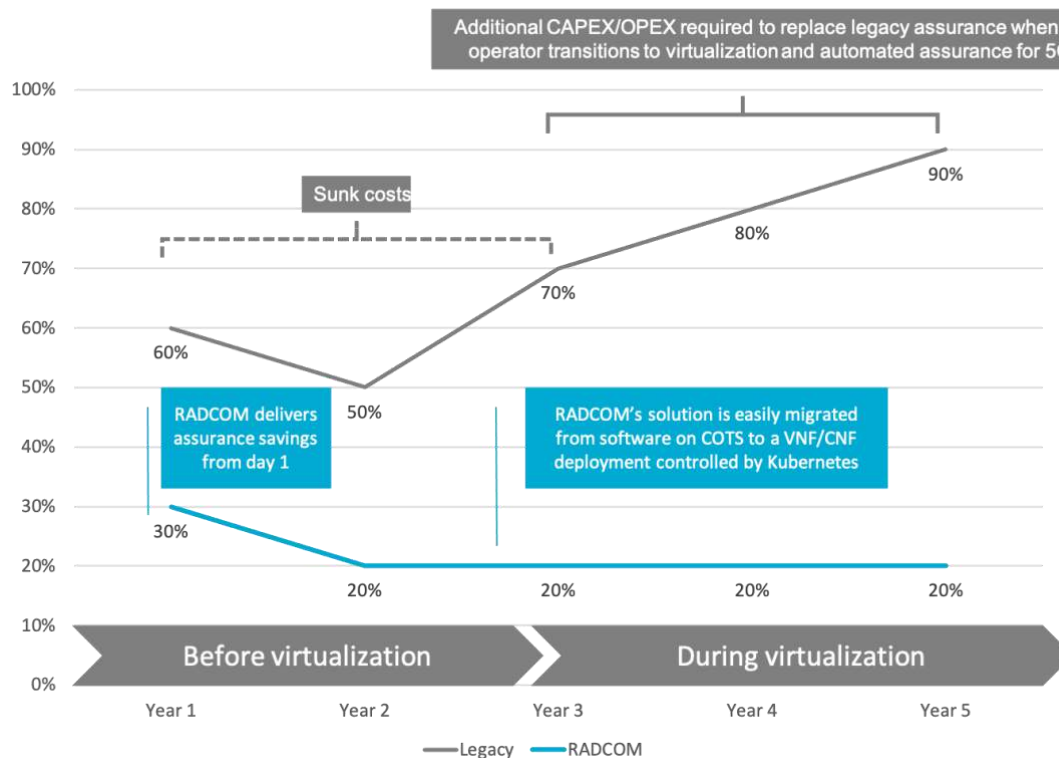
Service assurance probes provide operators with an end-to-end view across different network tiers (edge, core, IP), cross-domains (physical and virtual). They are essential for assuring the customer experience in today's competitive market, watching all the traffic that flows through the network, and correlating the data into individual customer sessions to understand the service quality experienced in each call and data session (VoLTE call, web browsing, video streaming).

Future-proof investment

Short and long-term business value

RADCOM ACE is an automated service assurance solution that provides operators with significant CAPEX and OPEX savings compared with other assurance solutions.

With the 5G core being cloud-native, in the long-term, the industry will move to virtualization. The following graph shows a five-year forecast of how RADCOM ACE saves operators high costs compared with other assurance solutions from day one and across the deployment's lifecycle.



The data was provided by one of our top-tier customers. However, the information is displayed as a percentage figure and not the actual expenses incurred to protect customer confidentiality. The forecast is based on the operator transitioning to a cloud-native network in the third year. So, if this operator had stayed with their legacy solution, there would have been a three-year period of the operator sinking additional costs (including significant annual maintenance) into a solution that would have to be replaced when the operator began transitioning to virtualization as the legacy solution had no visibility into virtual traffic. Also, as legacy vendors charge by network capacity and subscriber traffic, the CAPEX and OPEX investment in the legacy solution was projected to increase year-over-year because of capacity requirements as well as a technology investment.

RADCOM's solution was deployed on standard COTS servers, and once the operator was ready to transition to virtualization, the solution was easily migrated to a VNF or CNF deployment. Due to RADCOM's risk-free pricing, the operators' investment was actually forecast to go down after their initial year one investment. Even this initial investment in RADCOM's solution saved the operator about 30-40%. Not all operators will swap out their entire legacy solution and replace it with RADCOM, but the same cost savings apply when RADCOM is deployed to assure a new part of the network. Furthermore, the operator will then have a future-proof solution that offers the operator a significant return on investment as they transition to 5G.

5G-ready

RADCOM ACE is built for 5G with full support for standalone SA 5G (auto-service detect, SBA architecture, SBI deciphering and complex CUPS correlation, Packet Forwarding Control Protocol (PFCP), new aggregations, and dimensioning). This is also reflected in our recent contract win with Rakuten, Japan, one of the industry's first standalone 5G contract announcements. For more details, refer to the [press release](#).

Furthermore, RADCOM ACE is an entirely cloud-native, containerized portfolio, built using a microservices-based architecture allowing for scaling, updating, or even the complete replacement of each part and offers high real-time performance, elastic scalability, and resilience with stateless and lightweight functions within the telco cloud.

Risk-free subscription model

This subscription model provides you a fixed annual spend for any network capacity growth and an optional software license capitalization (buyout) at the end of the contract term. From day one and across the entire lifecycle of the solution's deployment, RADCOM provides you with a risk-free pricing model based only on functionality and advanced technology that decouples assurance costs from network capacity growth, subscriber numbers, and reliance on dedicated hardware. You pay a simple multi-year annual fee with a nonlinear pricing model that provides the forecastable assurance and visibility costs.

RADCOM's subscription offers you:

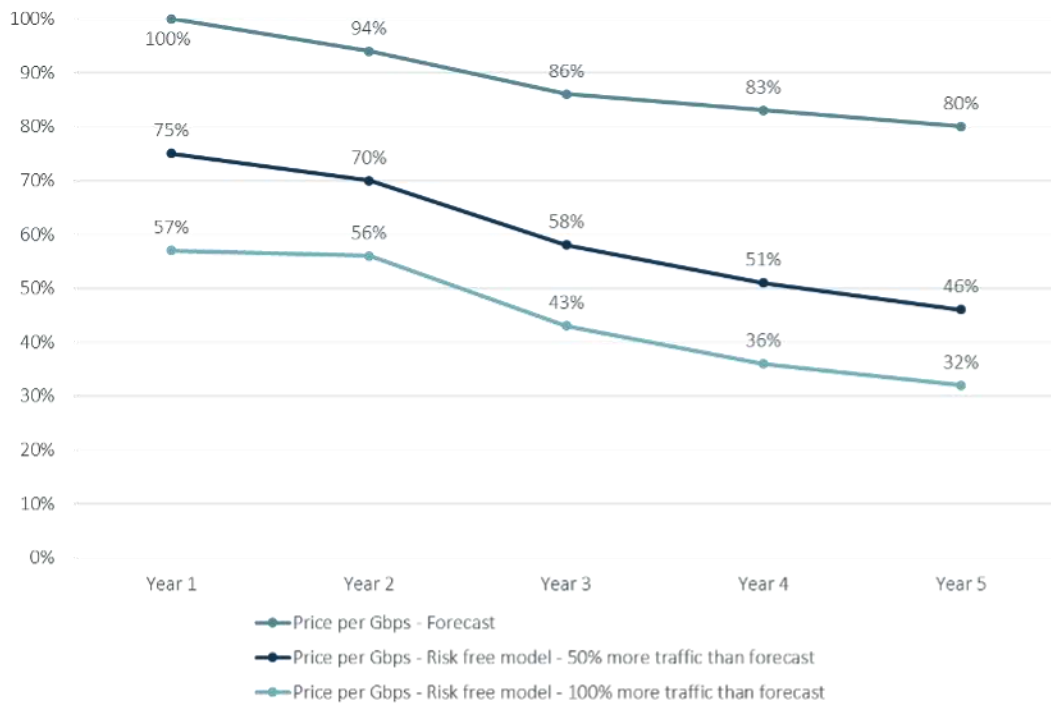
- Annual multi-year subscription fee by technology
- Risk-free, forecastable payment over multiple years
- Price irrespective of capacity and subscriber growth
- CAPEX and OPEX savings from day 1

"By deploying RADCOM's risk-free pricing, we saved \$8M in CAPEX expenditure while ensuring a great customer experience and becoming the top provider in the country."

Leading APAC operator

RADCOM offers operators an attractive pricing model that disrupts traditional service assurance and network visibility pricing, with flat-rate and predictable pricing models for a high total cost of ownership savings for operators.

The graph shows the difference between the standard model pricing, where you pay as you grow with capacity growth, vs. RADCOM's risk-free model. Typically, legacy service assurance vendors offer a price per Gbps, and naturally, the operator's network expands, which increases service assurance costs exponentially. Often this then means that the operator must reduce assurance costs by limiting their assurance coverage. However, RADCOM thinks differently. RADCOM offers a risk-free pricing model that enables the operator to monitor all services cost-effectively.



RADCOM's risk-free model gave this operator the peace of mind that even if their network capacity and subscriber forecast deviate from their expected prediction (in the graph it shows if the estimate is off by 50% or 100%, which is often the case), RADCOM's solution will have them covered. Not only that, but the actual cost per Gbps goes down because the number of subscribers and network capacity to be monitored goes up significantly without increasing service assurance costs, so RADCOM's value to the customer increases while the total cost of ownership is reduced.

RADCOM's technical expertise has helped it to attract some of the biggest names in the operator community as customers, including AT&T, while its new strategy, and its pricing model, has turned heads and helped it secure new long-term customers, wrote Ray Le Maistre, Editor-in-Chief, Light Reading

Read the Light Reading article [here](#)

Summary

RADCOM ACE offers operators a pricing model that significantly reduces the total cost of ownership and cost-efficiently provides end-to-end assurance coverage while being designed for the challenges of today's dynamic and data-intensive networks. With no specific hardware dependencies, RADCOM's solution breaks out of traditional assurance limitations to deliver new capabilities that will ensure the customer experience for 4G, 5G, and beyond. Some of the return on investment and network improvements that RADCOM will provide you are:

Factor	Impact	OPEX/CAPEX Savings Improved Network Efficiency
Anomaly detection, integrated solution -> reduce MTTR	Time to detect network faults is reduced -> less downtime -> operational excellence and efficiency	Reduce OPEX Reduce Churn
Automation and RCA	Free engineering resources to handle quality tasks	Reduce OPEX
Data availability	Option for data monetization and advanced services	Increase revenue
Objective monitoring system (independent of the network vendor)	Better network -> more customers an option for premium pricing -> increase revenues and reduce churn	Reduce churn by ~1%
One integrated solution for everything / all applications	QoE metrics -> making the right information available to the care people on time -> Solve more problems by Tier 1 CSRs (vs. higher tiers) -> Improved customer care efficiency	Reduce OPEX Reduce churn
Predictive Analytics - preventive/proactive approach	Improve network element's up-time Increase network capacity (less power consumption, fewer cell sites, less hardware) -> Improve network planning	Reduce OPEX and CAPEX Increase network uptime by ~10% Reduce # of sites by 1-2%
Revenue Assurance	Interconnect, Roaming, MVNOs settlements	Increase by ~0.5%
Risk-free subscription model	A fixed annual spend for any network capacity growth -> reduce package fee -> optional SW license capitalization (buyout) at the end of the contract term	Risk-free subscription model

Factor	Impact	OPEX/CAPEX Savings
		Improved Network Efficiency
Sampling	Reduce the service assurance solution's hardware	Reduce assurance CAPEX 25% Sampling rate -> reduce ~40% of the required HW