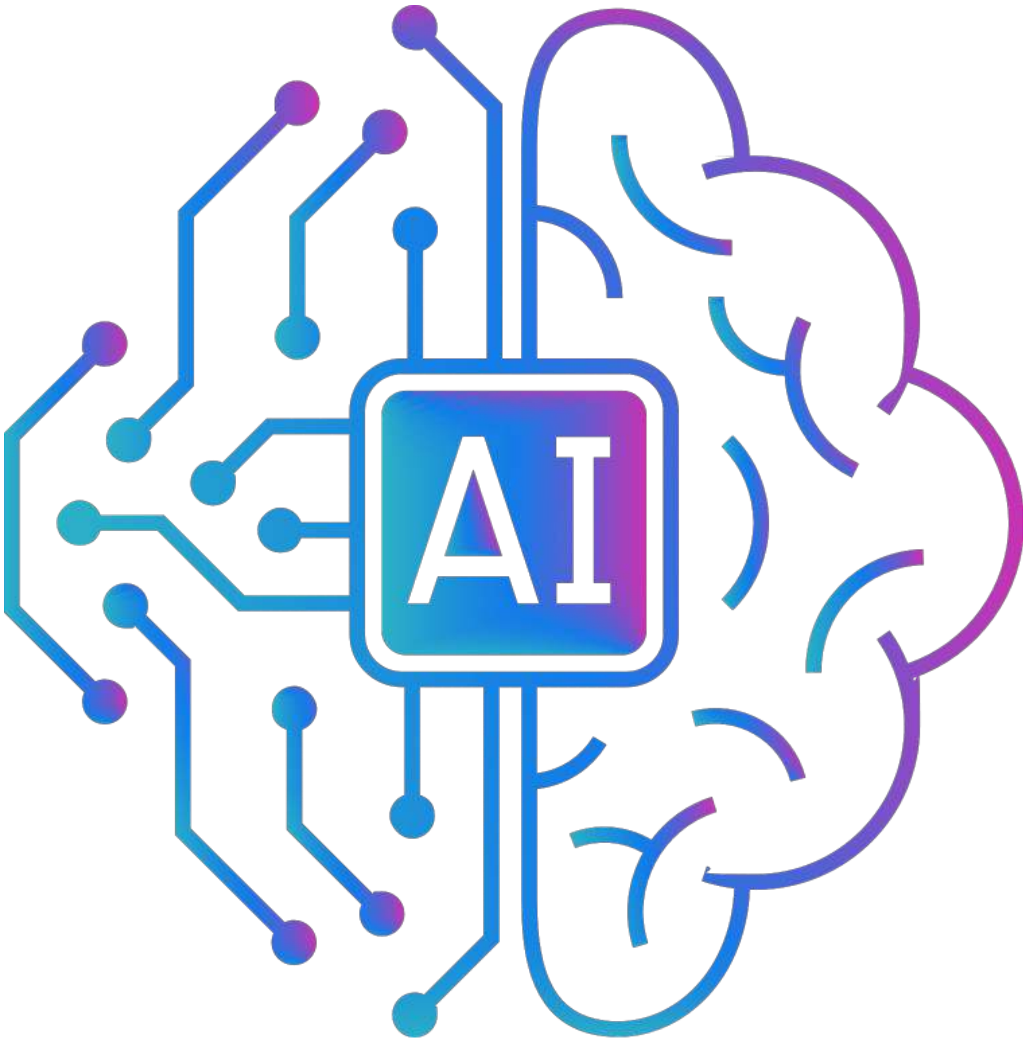
How GenAI is Revolutionizing Automated Assurance: A Game Changer



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In the telecommunications industry, continuous innovation is essential to meet the demands of an always-connected, digital world and for operators to ensure excellent customer experiences for their subscribers. At the same time, operators have invested significantly in rolling out 5G while their revenues remain flat. In addition, operators have to contend with the rise of big tech, which brings intense competition and squeezes operators' market capitalization. With all these pressures, large-scale generative artificial intelligence (GenAI) technology has the potential to catalyze much-needed growth and an industry reset. Helping telecom operators manage their operations cost-effectively while empowering them to make data-driven decisions in real-time to enhance quality and deliver superior customer experiences.

This white paper focuses on the telecom industry and the different use cases in which GenAI can be leveraged, the technology's expected evolution, challenges for telecom operators, and how next-gen assurance interfaces with GenAI to speed up time to insights for managing network operations more efficiently and more automatically.

What is GenAI?

GenAI, short for Generative Artificial Intelligence, refers to a broad category of AI techniques that can create new content (text, images, audio, videos) and data. GenAI systems are trained on massive datasets of text, code, images, or other forms of data. This training allows them to learn the underlying patterns and relationships within that data. Once trained, they can use this knowledge to generate entirely new content like the data they were trained on, but not simply a copy of existing examples.

What GenAI Can Do:

- Text generation: GenAI can generate creative text formats, such as poems, code snippets, scripts, musical pieces, emails, and letters. It can also tailor the content to specific styles or tones based on the instructions provided.
- Image generation: Some GenAI models can create new images from scratch or modify existing ones. This can be useful for creating product mockups, generating variations of existing images, or adding elements to existing scenes.
- Translation: GenAI can be used for machine translation, translating text from one language to another while attempting to preserve the meaning and style of the original text.
- Data augmentation: GenAI can generate synthetic data, which can help train other machine learning models or supplement datasets where real-world data might be scarce.

The journey to GenAI can be seen as a natural progression from its foundation in artificial intelligence (AI)/machine learning (ML)-based technology. ML was mainly rule-based in its infancy, where algorithms were hand-coded to perform specific tasks. These had limited adaptability and couldn't learn from new data. ML shifted the focus from these rigid algorithms to models capable of learning, leading to algorithms that can adapt and acquire knowledge.

GenAI takes the technology further with its ability to create new content. GenAI models are categorized by the type of content they create, including (but not limited to) language, image, audio, video, and 3D. These different models can be characterized by their capabilities. For example, the core competency of language generation includes retrieving responses through search, summarization, text translation (from one language to another, including code), and autocomplete functions. For image generation, users can convert text to images or alter existing images to produce a new image. Future GenAI models will continue the trend that has already started by moving to multimodal models that combine various data types: text, images, video, audio, etc.

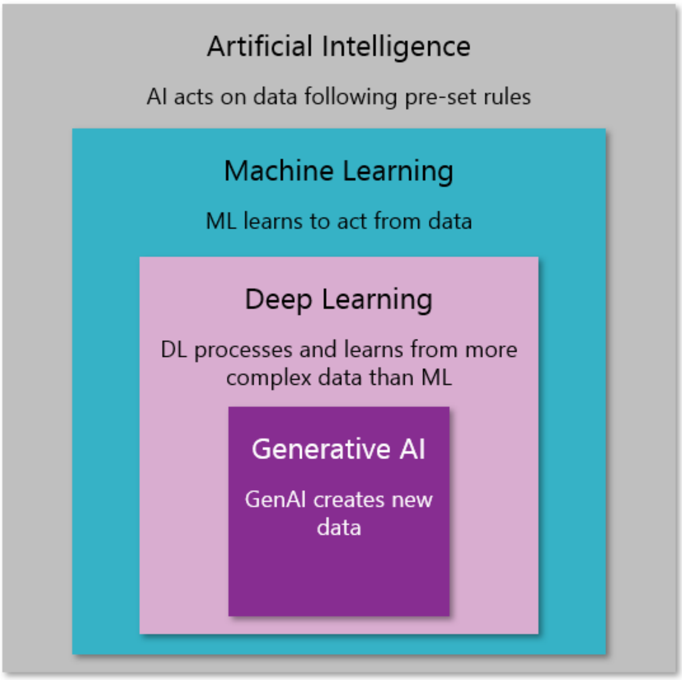


Figure 1 - The difference subsets of artificial intelligence

Telcos and GenAI: a match generated in heaven

Telecom operators are the perfect candidates for GenAI technology with the day-to-day challenges they face, which include:

- Network observability
- Network optimization
- Resource management
- Customer care and support
- Data augmentation
- Marketing and sales
- Fraud Detection and security

GenAI is already transforming how people interact with technology. To name a few companies catching the headlines, ChatGTP, OpenAI, and Nvidia are all taking the world by storm, and telecom operators are also exploring ways to tap into this same technology opportunity. However, telcos' stakes are higher and require telco-grade GenAI platforms driven by telco-specific datasets. Telcos don't have the benefit of releasing beta products that can be fine-tuned over time while being used by the public.

Currently, telcos are developing strategies for GenAI, experimenting with the technology's limitations, and exploring the best use cases. Initial GenAI use cases mainly focus on co-pilots that aid support and customer care departments. Users engage with the co-pilot on specific tasks, and based on the data on which the GenAI model was trained, the co-pilot provides support with insights and recommendations. These co-pilots help increase efficiencies and support customer experience improvements. 2024 is expected to be the year of experimentation, so more use cases will evolve.

Some early adopters in the telecom arena have been testing the water, while others have dived straight in. For example, SK Telecom, the largest mobile operator in Korea, announced that it will develop a telco-specific large language model (LLM) with Deutsche Telekom. That followed the press release earlier in the year that SK Telecom was working with and investing in Anthropic, a US-based AI startup founded by former members of OpenAI. Orange Business launched new trusted GenAI offers for its French customers. In North America, AT&T announced a new GenAI tool to employees to be more effective and creative across many use cases in a blog post.

Challenges

What challenges must be overcome to ensure operators can introduce GenAI into network operations as an interface into next-gen assurance and leverage the technology to benefit their business with real-data insights from the RAN to the core?

Model bias and fairness

One of the most pressing issues with GenAI systems is spreading unfair bias based on flaws in the training data or algorithms. Without careful consideration, models can learn and intensify existing societal biases and more from biased data. This leads to discriminatory and prejudicial outcomes that can severely impact individuals and groups. GenAI models' training data must be diverse and representative to avoid biased or unfair outcomes in network allocation, customer service interactions, or marketing campaigns. Bias can lead to AI hallucinations (see the Trusted, telco-focused data section), intentional bias, errors, omissions, and oversights.

Lack of domain knowledge

Many terms in the telco taxonomy, like user, traffic, signaling, container, and release cause, have different meanings in different contexts, and the data needs to be trained on the right data to offer operators meaningful data for GenAI. The same applies to key performance indicators (KPIs), key quality indicators (KQIs), and customer experience indexes (CEI) data that are critical for operators in how they monitor and manage their networks.

Furthermore, behind the scenes, built-in logic must ensure that false responses and information are not provided, which adds the right weight to the different data sources. For example, network standards information sourced from 3GPP should have more weight than general information discussed on an engineering forum.

Cloud-readiness

To be the most cost-efficient, the platform processing the data to train the GenAI model must be cloud-native, with some of the operator’s data being on-prem and in the cloud. Extensive capture and processing resources would be required if the platform isn't cloud-native, making for a costly, often cost-prohibitive initiative. Moreover, it will be tough to scale to the enormous volumes of data needed to train GenAI models effectively.

As more data is expected to be stored and handled in different cloud environments and more advanced models deployed and trained on top of those clouds, it makes more sense to utilize the cloud environments and GenAI offerings with cloud-native assurance solutions that seamlessly integrate into these platforms. Another challenge is addressing data privacy and governance issues, which require a more comprehensive approach.

Data Security and Privacy

Due to its vast customer data and regional laws, including GDPR, the telecom industry has very strict confidentiality rules, and this needs to apply to the use of GenAI. Strict security measures must be in place when using public models or hosting private models on a public cloud to avoid privacy intrusions.

The key is ensuring models never receive access to sensitive customer data. This requires sophisticated anonymization techniques – such as just-in-time anonymization or obfuscation – to keep customer data confidential and protect it from exposure to GenAI public models.

For example, a customer's mobile number, address, or name can be substituted with pseudo data before being sent to the GenAI model. When the model returns the response, the real data is reintroduced for communication with the user. Such security frameworks must include strict data access control measures that must be implemented across the entire GenAI ecosystem.

Trusted, telco-focused data

Data for telco needs context to have meaning for the GenAI model, which means that it needs to be correlated for the purpose of training. This is more important given the mass of data that service assurance captures, which is uniquely and profoundly valuable for telco GenAI applications. However, since the operator's data is typically dispersed across multiple, siloed sources, correlation is a cumbersome, time-consuming, and complex task. In addition, trusted data is critical. Typically, this is measured by the following six parameters:

1. Accuracy: the degree to which data correctly describes the network event in question or incident
2. Completeness: proportion of data stored against the potential for being 100% complete
3. Consistency: the absence of difference when comparing two or more representations of an item against a definition
4. Timeliness: the degree to which data is current enough to represent reality as needed to support business functions
5. Uniqueness: no item or entity instance is recorded more than once based on how that item is identified
6. Validity or conformity: the degree to which data conforms to the syntax (format, type, or range) of its definition

Part of the trust challenge is that current LLM implementations suffer from AI hallucinations. This phenomenon occurs when AI models generate incorrect or misleading results. These errors can be caused by various factors, including insufficient training data, incorrect assumptions made by the model, or biases in the data used to train the model.

The concept of AI hallucinations underscores the need for critical evaluation and verification of AI-generated information. Relying solely on AI outputs without analysis could lead to the dissemination of misinformation or flawed analyses.

Only accurate data from the network, devices, or other sources will result in GenAI applications that provide reliable and accurate outputs. This is why it's also important to implement a vendor-agnostic assurance solution that provides independent network analysis. The more you can trust the data, the more decision-ready your data will be. However, just because certain records or datasets perform well in one dimension doesn't necessarily mean they can be 100% trusted. Some data can be valid but incomplete and imbalanced, as discussed in the next section.

Imbalanced vs. balanced datasets

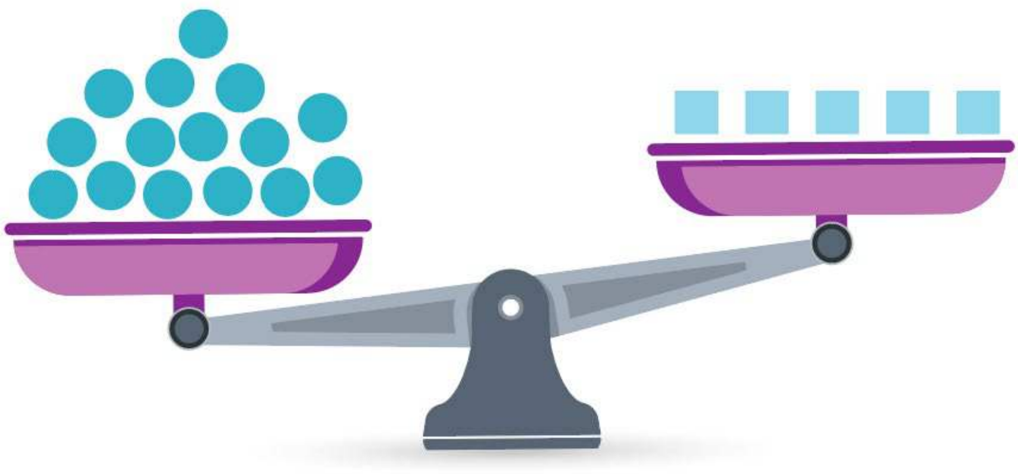


Figure 2 - Generative adversarial networks can generate synthetic data to improve telco datasets

A challenge in the telco space for AI, in general, is that although there is a vast amount of data, there is a much smaller amount of data on network errors, which means there isn't always enough data to train the models. This means the data is imbalanced in that the number of observations differs for the categories in a classification data set.

For example, let's make it simple and consider a two-class problem. If the data set contains 70% of one category and 30% of another category, it is called imbalanced data, and you don't want to train your models on imbalanced data. Feeding imbalanced data to your classifier can make it biased in favor of the majority class simply because it did not have enough data to learn about the minority.

GenAI can solve the issue of imbalanced data by using a generative adversarial network (GAN) that generates synthetic data, leading to balanced datasets.

Explainability and transparency

Generative AI has the potential to revolutionize many aspects of the telecom industry, but ethical considerations must be addressed when developing and deploying generative AI models. ChatGPT states, "enabling explainability for generative AI is essential for building trust, ensuring transparency, improving performance, and complying with legal and ethical standards."

Explainability provides insights into the inner workings of AI models, making them more transparent. This transparency is essential for ensuring fairness and accountability, as it identifies and mitigates biases or unintended consequences. Some guidelines for meeting this challenge:

- **Model simplification:** As AI models grow in complexity, comprehending their decision-making processes becomes increasingly challenging. Simplifying the model architecture by reducing the number of layers in the neural network can enhance understanding and facilitate the interpretation of the model's decisions.

- **Human oversight:** In certain scenarios, a human may be necessary to supervise and guarantee that a generative AI model is making decisions responsibly and ethically. For instance, a human could be assigned to review a model's output to ensure it does not produce harmful or biased content.

- **Referenceable data:** Training data must be referenceable and subject to audits for quality control. This process helps identify unintentional bias, avoids unfair decisions, and facilitates continuous improvement, including providing provenance for traceability purposes.

Foundations for success

Adopting the right data analytics approach is the foundation for a successful GenAI strategy for telecom operators. GenAI is nothing without accurate, robust, and trusted data attuned to the specific needs of telecom operators. AI models use data to learn patterns, predict, and perform tasks. If the training data is compromised, inaccurate, or contains errors, the model can produce biased and unreliable results, leading to a failed approach to GenAI. Automated assurance offers telco-domain knowledge, and if the assurance solution is cloud-native, it can correlate all the data across multiple clouds. In addition, it provides trusted, telco-focused data and can ensure balanced data critical for GenAI.

Assurance solutions collect and analyze massive amounts of data from RAN to the core. GenAI opens a new interface for these insights and lays down the cornerstone for implementing GenAI in your network operations and overcoming the challenges described above. As the data is utilized for critical network optimization, monitoring, and troubleshooting, assurance performs actions to ensure accuracy, such as massaging to eliminate unnecessary information, cleaning a dataset to make it useable, digesting from multiple inputs, and performing smart sampling.

Revolutionizing next-gen assurance

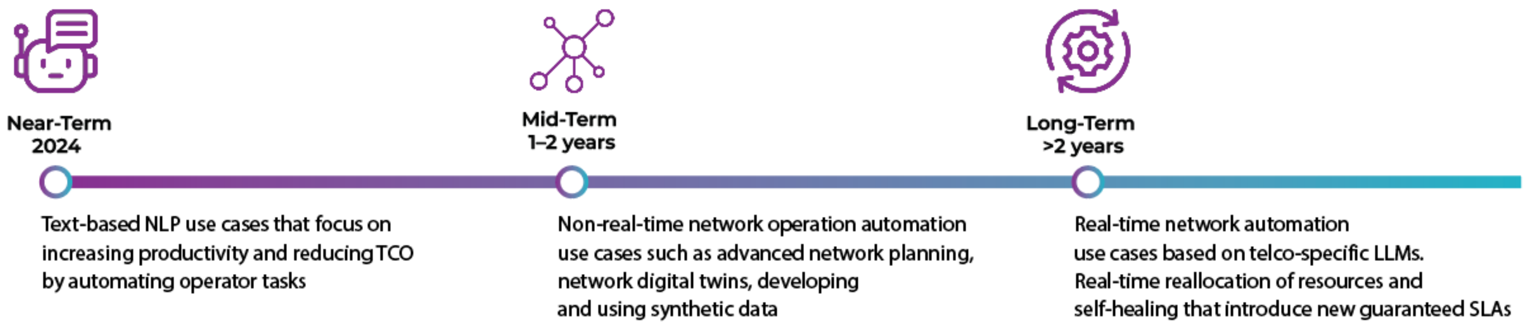
Here are some key use cases in which GenAI can assist telecom operators:

- Network optimization and resource management:
    - **Dynamic Resource Allocation:** GenAI models can analyze real-time network traffic patterns and user behavior to predict demand fluctuations. This allows for dynamic allocation of bandwidth and resources, ensuring optimal network performance and preventing congestion.
    - **Network design and planning:** GenAI can analyze vast amounts of data on network usage and demographics to predict future demand and optimize network design. This can involve suggesting locations for new cell towers or fiber optic cables, ensuring efficient network coverage in high-demand areas.
    - **Proactive network maintenance:** GenAI can analyze network data to identify potential issues before they occur. This allows for preventative maintenance and reduces the risk of network outages, improving overall network reliability.
- Improve customer care and support
    - **Personalized Customer Support:** GenAI-powered chatbots can handle routine customer inquiries, answer questions about plans and services, and troubleshoot basic issues. This frees human agents to handle more complex issues and provide personalized support.
    - **Sentiment Analysis and Proactive Assistance:** GenAI can analyze customer interactions across channels (calls, chats, emails) to identify sentiment and predict potential churn (customers leaving the service). This allows for proactive intervention and personalized offers to retain customers.
    - **Content Generation for Customer Communication:** GenAI can generate clear and concise explanations of bills, service changes, or troubleshooting steps. This can improve customer understanding and reduce the need for further call center interactions.

- Other Use Cases:
    - **Fraud Detection and Security:** GenAI can analyze network activity and identify patterns that might indicate fraudulent activity or cyberattacks. This helps telecom operators protect their networks and customer data.
    - **Marketing and Advertising:** GenAI can personalize marketing campaigns and targeted advertisements for specific customer segments based on their usage patterns and preferences. This can improve the effectiveness of marketing efforts and increase customer engagement.
    - **Data Augmentation:** GenAI can generate synthetic anonymized call detail records (CDRs) or other data for training machine learning models for network optimization or customer behavior prediction. This can be valuable when real-world data might be limited due to privacy concerns.

Fueling the drive to automation

The field of GenAI is evolving rapidly, and we believe the market will transition over the coming years from its initial phase of Natural Language Processing (NLP) to increase productivity to, in the long term, drive network automation.



Conclusion

Generative AI has the potential to revolutionize almost every aspect of the telcos' business, from marketing and sales to customer care and support and now network operations and management. The revolution is underway. Network engineers can already access previously unattainable insights and recommendations for assuring network performance in real time by tapping into automated assurance insights through a GenAI co-pilot.

In the transformative landscape of 5G, automated assurance and GenAI can be critical enablers for operators to unlock data analytics and position themselves to compete in an increasingly cluttered and competitive market. At RADCOM, we recognized GenAI's potential to bring value to the operator's business users and network teams early on.

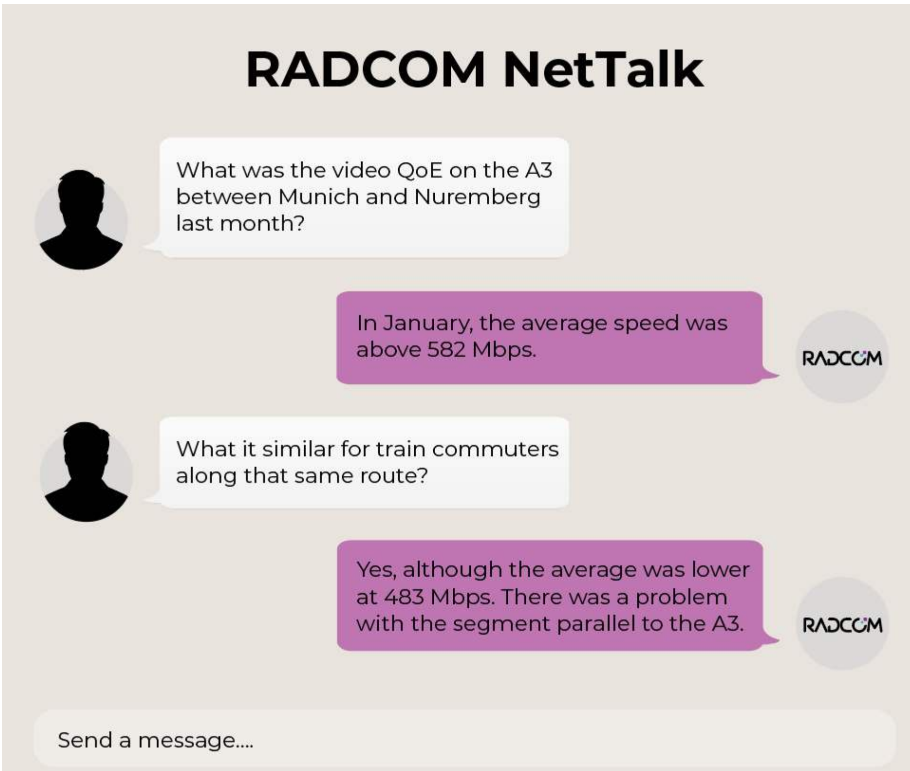


Figure 3 - RADCOM NetTalk offers a range of different use cases

Instead of interfacing with your network data through dashboards and monitoring screens, RADCOM NetTalk, our Generative AI (GenAI) applications, is part of the RADCOM ACE portfolio. Enabling operators to adopt the power of Generative AI and trusted data to manage network operations faster and cost-effectively. The applications allow you to interact directly with your network and tap into the information offered through automated assurance to drive your network operations more efficiently.

Benefits that RADCOM NetTalk offers telecom operators:

- Simplify time to insight from large volumes of network data
- Improve network experts' efficiency
- Reduce TTM for new requests and complex analysis
- Improve user experience
- Extend the user circle for data analytics

Our automated assurance platform is inherently designed to overcome the challenges of cloud readiness and trusted data. The cloud-native solution correlates all the data it captures, ensures data accuracy, digests inputs from RAN to the core, and performs smart sampling to provide trusted data for assurance and GenAI purposes. RADCOM also works with all the leading public cloud providers, such as Amazon Web Services, Google Cloud Platform, and Microsoft Azure, so operators can choose whichever provider they want and implement GenAI on top of their assurance solution.

RADCOM NetTalk offers the following co-pilots:

Proactive network optimization: RADCOM NetTalk correlates network data to data in the operator's BI systems. It narrates the story to engineers, creating and explaining graphs and charts, delivering insights, and providing recommendations. This way, engineers can identify the root cause of a network issue, develop the right remedy, and determine whether this is a one-time incident or a recurring failure faster and more accurately than ever before.

Churn prediction: RADCOM NetTalk analyzes the data to identify behaviors of interest and correlates this with the subscriber's responses to surveys, contact center call summaries, and churn lists. Then, a satisfaction and churn risk model is created to reveal sentiment that has yet to be expressed but indicates the likelihood of churn.

Adherence to 5G standards: RADCOM NetTalk correlates standards-related data with network issues to inform engineers whether a failure is related to a configuration or setup that doesn't adhere to industry standards. With this capability, extracting the required insights from all these highly voluminous standard sources quickly and efficiently is possible.

Visit our website to learn more about how RADCOM can help you leverage GenAI's power and to schedule a demo.

Glossary

Term	Description
Artificial Intelligence (AI)	The simulation of human intelligence in machines programmed to think and learn.
Context Learning	Using internal data to provide prompts to a pre-trained model to enable it to understand the problem or task and provide telecom-relevant responses requires a medium amount of data to be trained.
Fine-Tuning	Updating and adding parameters to a pre-trained model using a new dataset result in the model learning and adapting to nuances; it requires a large amount of labeled data to be trained, though smaller than the data set the model was initially trained on.
Generative adversarial network (GAN)	Used after training to generate totally new content, synthetic data, and models of physical objects that preserve the likeness of the original data. GANs are composed of two neural networks: one — called the generator — specializes in generating objects of a specific type (e.g., images of human faces or dogs, or models of molecules); the other — the discriminator — learns to evaluate them as real or fake.
Generative AI or GenAI	Generative AI is artificial intelligence technology that can create original content (e.g., text, image, audio, video) based on a prompt. It differs from non-generative AI because it can create new content rather than, for example, follow a predefined set of rules or make a prediction or classification.
Generative AI Application	User experience platform in which the user interacts with the generative AI tool to produce output from the underlying model.

Term	Description
Generative AI Foundation Models	Artificial intelligence models trained on large datasets allow AI models to learn the underlying patterns and structures of data and generate new content that is both realistic and contextual.
Hallucinations	Incorrect or misleading results that AI models generate. These errors can be caused by a range of factors, including insufficient training data, incorrect assumptions made by the model, or biases in the data used to train the model. The concept of AI hallucinations underscores the need for critical evaluation and verification of AI-generated information, as relying solely on AI outputs without scrutiny could lead to the dissemination of misinformation or flawed analyses.
Inference	The operational phase of the generative AI model where a trained AI model applies its learned knowledge to new, unseen data to make predictions, decisions, or generate content. Unlike in the training phase, the model is learning from examples, during inference, the model is utilizing its learned patterns to perform the specific tasks it was designed for. For example, a language model that has been trained on a vast amount of text can perform inference by generating a new essay, answering a student’s query, or summarizing a research article.

Term	Description
Large Language Models (LLMs)	Large Language Models (LLMs) are AI systems specifically designed to understand, generate, and interact with human language on a large scale. These models are trained on enormous datasets comprising a wide range of text sources, enabling them to grasp the nuances, complexities, and varied contexts of natural language. LLMs like GPT (Generative Pre-trained Transformer) use deep learning techniques, particularly transformer architectures, to process and predict text sequences, making them adept at tasks such as language translation, question-answering, content generation, and sentiment analysis.
Machine Learning (ML)	Machine learning (ML) is a subset of AI that uses algorithms and statistical models to improve systems' performance with experience without being explicitly programmed. It is a form of non-generative AI.
Model	Models are the computational structure and algorithms that enable Generative AI to process data, learn patterns, and perform tasks such as generating text, images, or making decisions. Essentially, it is the core framework that embodies an AI's learned knowledge and capabilities. A model in AI is created through a process called training, where it is fed large amounts of data and learns to recognize patterns, make predictions, or generate outputs based on that data. Each model has its specific architecture (such as neural networks) and parameters, which define its abilities and limitations.

Term	Description
Model-As-A-Service (MaaS)	A cloud-based end-to-end solution that allows companies to deploy and maintain machine learning and generative AI models in a production environment.
Multimodal Generative AI	Multimodal Generative AI accepts multiple data types, such as text, images, video, and audio, and can output to different data types. This compares to the first types of generative AI, which use only one input type, such as text, and produce only one output type, such as text.
Natural language processing (NLP)	A branch of AI that enables computers to comprehend, generate, and manipulate human language.
Parameters	Parameters in an AI model are the internal variables that it learns from the training data. These parameters are fundamental elements that define the model's behavior and determine how it processes input data to generate output. In neural networks, parameters typically include weights and biases associated with the neurons. Each neuron in a neural network is assigned a weight for its input, indicating the importance or influence of that input on the neuron's overall calculation. The bias is an additional parameter that enables the neuron to adjust its output independently of its input. During the training process, the model adjusts these parameters to minimize the difference between its output and the actual data. The more accurately these parameters are tuned, the more effectively the model can perform its intended task.

Term	Description
Prompt	The input given to an AI model to initiate or guide its generation process. This input acts as a directive or a set of instructions that the AI uses to produce its output. Prompts are crucial in defining the nature, scope, and specificity of the output generated by the AI system. For instance, in a text-based Generative AI model like GPT (Generative Pre-trained Transformer), a prompt could be a sentence or a question that the model then completes or answers in a coherent and contextually appropriate manner.
Prompt Engineering	Crafting input prompts to guide AI models, such as Generative Pre-trained Transformers (GPT), in generating specific and desired outputs effectively. This process includes formulating and structuring prompts to make the most of the AI's understanding and capabilities, thus enhancing the relevance, accuracy, and quality of the generated content.
RADCOM NetTalk	Generative AI (GenAI) applications part of the RADCOM ACE portfolio. Enabling operators to adopt the power of Generative AI and trusted data to manage their network operations faster and cost-effectively.
Reinforcement Learning (RL)	A type of learning algorithm where an agent learns to make decisions by performing actions in an environment to achieve a certain goal. The learning process is guided by feedback in the form of rewards or punishments — positive reinforcement for desired actions and negative reinforcement for undesired actions. The agent learns to maximize its cumulative reward through trial and error, gradually improving its strategy or policy over time.

Term	Description
Retrieval Augmented Generation (RAG)	A technique that combines the strengths of both retrieval-based and generative models. An AI system first retrieves information from a large dataset or knowledge base and then uses this retrieved data to generate a response or output. Essentially, the RAG model augments the generation process with additional context or information pulled from relevant sources.
Rule-Based AI	AI that follows pre-defined rules to make decisions or perform specific tasks is non-generative.
Structured Data	Tabular data (e.g., tables, databases, or spreadsheets) that can be used to train some machine learning models effectively.
Tokens	Tokens are the smallest units of data that an AI model processes. In natural language processing (NLP), tokens typically represent words, parts of words (like syllables or sub-words), or even individual characters, depending on the tokenization method used. Tokenization is the process of converting text into these smaller, manageable units for the AI to analyze and understand. When using AI Tools such as ChatGPT they will often quote how much a query costs in terms of tokens.

Term	Description
Transformer	A transformer is a type of architecture in deep learning, a subfield of AI that represent a departure from previous models which processed data sequentially. Instead, transformers use a mechanism known as 'self-attention' to process entire sequences of data (like sentences in a paragraph) simultaneously. This approach allows transformers to capture complex relationships and dependencies in the data, regardless of their distance within the sequence. Transformers can weigh the significance of different parts of the input data. This capacity for handling contextual relationships in language makes them effective for a variety of natural language processing tasks, including but not limited to translation, content generation, and text summarization. The 'T' in ChatGPT (or, generally, GPTs) stands for Transformer.
Tuning	Tuning describes the process of adjusting a pre-trained model to better suit a specific task or set of data. This involves modifying the model's parameters so that it can more effectively process, understand, and generate information relevant to a particular application. Tuning is different from the initial training phase, where a model learns from a large, diverse dataset. Instead, it focuses on refining the model's capabilities based on a more targeted dataset or specific performance objectives.

Term	Description
Training	Training is the process through which a machine learning model, like a neural network, learns to execute a specific task. This is accomplished by exposing the model to a substantial amount of data, known as the training dataset, and allowing it to iteratively adjust its internal parameters to minimize errors in its output. During training, the model makes predictions or generates outputs based on its current state. These outputs are then compared to the desired results, and the difference (or error) is used to adjust the model's parameters.
Unstructured Data	Data that lacks a consistent format or structure (e.g., text, images, and audio files) typically require more advanced techniques to extract insights and analytics.

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RADCOM (Nasdaq: RDCM) delivers real-time network analysis, troubleshooting, and AI-driven insights to ensure a superior customer experience. Utilizing cutting-edge technologies for over 30 years, we are the operators' eyes into their network, supporting them as they transition to new network technologies such as the cloud and 5G. Delivering dynamic service assurance for an accelerated digital transformation.

We offer the most advanced 5G portfolio for large-scale networks, providing operators with an innovative, efficient, and on-demand approach to network monitoring that meets the challenges of assuring the customer experience in the 5G era. Our leading solution, RADCOM ACE, is explicitly designed for telecom operators, delivering Automated, Containerized, and End-to-end network visibility. We enable operators to seamlessly manage and optimize their network operations using our innovative technology.