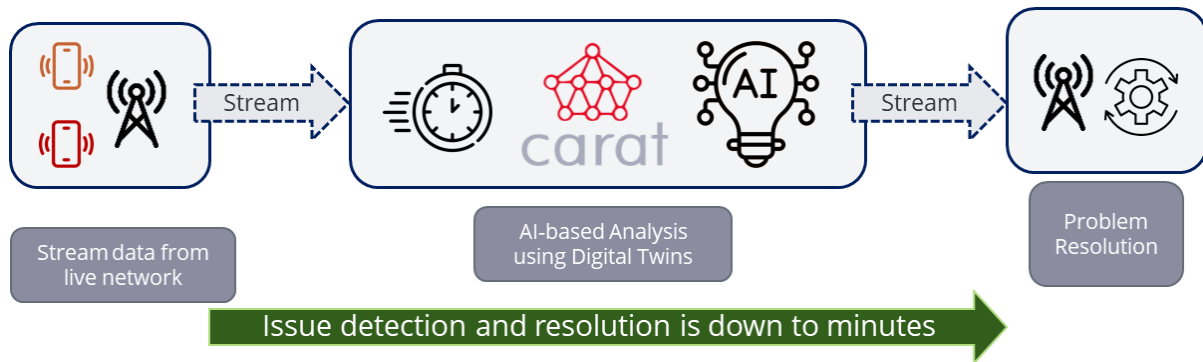


CARAT by brown-iposs

AI-Driven Autonomous RAN Optimization for 5G, Network Slicing, and Beyond

As mobile networks evolve toward 5G Advanced, network slicing, and the path to 6G, telecom operators and mission-critical network providers face exponential growth in complexity. Managing multi-vendor, disaggregated networks with diverse service requirements demands a fundamentally new approach to radio access network (RAN) optimization.



CARAT, developed by brown-iposs, is an AI-powered autonomous optimization platform that transforms network operations from reactive problem-solving to proactive, intelligent adaptation. By combining advanced machine learning with real-time analytics, CARAT delivers Level 5 autonomous optimization—enabling operators to increase efficiency, reduce costs, enhance customer experience, and prepare for next-generation network requirements.

CARAT continuously analyzes RAN behavior, comparing current performance against optimal baselines to identify and resolve inefficiencies before they impact service quality. The platform supports traditional RAN architectures, open RAN interfaces, and provides a clear evolution path toward 6G network capabilities.



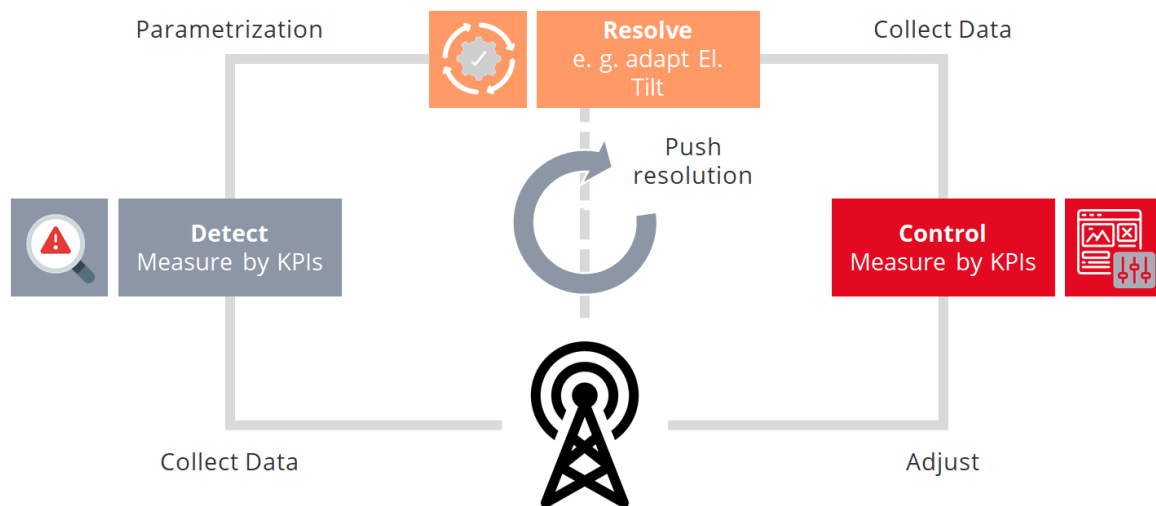
Fully Autonomous RAN Optimization – Level 5

Closed-loop optimization with zero human intervention across multi-vendor RAN

CARAT implements the industry's evolution to Level 5 for optimization of the RAN in 2G to 5G radio networks. By AI-based decision engines network parameter adjustments are autonomously executed without human intervention. Unlike traditional approaches CARAT operates continuously in real-time.

Key Capabilities:

- Automated antenna parameter optimization (tilt or power, e.g.)
- Intelligent site compensation during outages or maintenance
- Dynamic load balancing across cells and frequency layers
- Predictive optimization based on traffic patterns and historical data
- Multi-vendor environment support with vendor-agnostic decision logic



Business Impact:

- Reduced capital expenditure through better utilization of existing infrastructure
- Reduction of manual drive testing and site validation visits
- 24/7 autonomous operation with reduced night shift requirements
- Faster time-to-optimization: from weeks to minutes

Less interference – better customer experience

By continuously optimizing radio field parameters and managing interference in real-time, CARAT ensures consistent quality of experience even during network changes, traffic surges, or equipment failures.

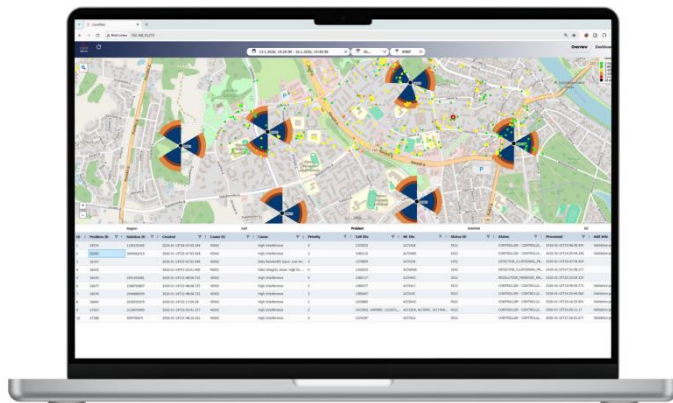
Detect Critical Network Conditions at Scale

Fast and reliable analysis of massive RAN data to identify conditions requiring optimization

Modern networks generate enormous volumes of performance data from thousands of base stations serving millions of users. CARAT's AI-driven analytics platform processes this data at scale, identifying patterns, anomalies, and optimization opportunities that would be impossible for human teams to detect manually.

Key Capabilities:

- Real-time ingestion and analysis of network counters, user performance metrics, and configuration data
- Multi-layered digital twin of network components and connected user equipment
- Hybrid AI models: lightweight edge detection combined with heavyweight distributed analytics
- Proactive identification of interference, congestion, hardware degradation, and configuration drift
- Root-cause analysis delivering actionable insights in minutes rather than days



Technical Foundation:

- ☑ Integration of network technical metrics with user experience data for comprehensive visibility
- ☑ Historical data correlation enabling predictive insights and trend analysis
- ☑ Automated change validation showing immediate performance impact of network modifications

More control – at growing complexity

As networks grow in scale and sophistication, CARAT provides the analytical capability to maintain—and exceed—performance standards without proportional increases in operational resources.

Optimization of 5G Network Slices

Slice-aware performance control aligned to SLA, QoS, and RAN behaviour

5G network slicing promises differentiated services for diverse use cases, but delivering guaranteed performance per slice requires sophisticated RAN-level optimization. CARAT provides slice-aware resource management and service-level performance assurance.

Key Capabilities:

QoS Configuration & Validation:

- Assessment and tuning of QoS Flow vs. 5QI/QFI mappings per S-NSSAI
- Validation of GBR/non-GBR characteristics, packet delay budget (PDB), and packet error rate (PER) profiles
- Review of RRM and scheduler policies influencing slice behavior
- PRB reservations, slice weights, admitted load thresholds, and ARP priorities

Slice-Aware KPI Framework:

- Radio interface performance: PRB utilization per slice, CQI/MCS distributions, PDSCH/PUSCH BLER, HARQ statistics
- Slice-specific service KPIs: throughput (mean/percentiles), per-QFI latency and jitter, packet loss, PDU session setup success rates
- Resource stress indicators: RF degradation signs (low SINR/RSRP), congestion impacts, admission control behavior under load

Intelligent Optimization:

- Probabilistic assessment of mismatches between slice performance targets and current network conditions
- Data correlation and prioritization agents that influence optimization action selection and scheduling
- Near-real-time RAN optimization with execution within one operational day
- Alignment with 3GPP RAN Slice Template parameters (capacity, isolation level, target KPI domains)

Ensured Quality – without compromise

CARAT ensures that each network slice consistently meets its performance commitments, even under challenging RF conditions or high load scenarios, enabling operators to confidently monetize differentiated services.

How CARAT Works

CARAT's architecture leverages open interfaces and standard protocols, ensuring compatibility with multi-vendor environments while supporting both traditional RAN and O-RAN architectures. This design philosophy positions CARAT as a future-proof solution on the evolution path toward 6G.

Real-Time Data Intelligence Pipeline

Data Collection:

CARAT Agents collect comprehensive data from Distributed Units (DU), Centralized Units (CU), RAN Intelligent Controllers (RIC), and legacy network elements. Data includes signal strength, traffic patterns, latency metrics, interference measurements, user throughput, session quality, and configuration parameters.

AI-Driven Analysis:

The platform continuously monitors ingested data through hybrid AI models:

- Edge Models: Lightweight algorithms running close to data sources for rapid anomaly detection
- Core Models: Heavyweight machine learning analytics on distributed compute clusters for root-cause analysis and optimization recommendations
- Digital Twin: Multi-layered representation of network state enabling "what-if" scenario analysis

Autonomous Decision & Execution:

Based on analysis results, CARAT's AI-based decision engine determines optimal network parameter adjustments and executes them through closed-loop automation—from optimization recommendations to fully automated reconfiguration according to defined policies.

Validation & Continuous Learning:

CARAT validates the impact of each optimization action, comparing predicted outcomes against actual performance changes. This feedback loop continuously improves the AI models' accuracy and decision quality.

Why CARAT Stands Out

Proven Results with Tier 1 Operators

brown-iposs' network optimization solutions have demonstrated measurable impact in production networks:

- Real-time network adaptation replacing delayed manual processes
- Automated site compensation maintaining service quality during outages
- Capital expenditure optimization through better infrastructure utilization
- Operational cost reduction via drive test elimination and automated change validation

Vendor Independence & Transparency

Unlike proprietary vendor solutions, CARAT operates vendor-agnostically across multi-vendor environments. Transparent AI logic and decision-making processes enable operators to understand, validate, and refine system behavior—building confidence in autonomous operations.

Open & Extensible Architecture

CARAT's platform integrates with existing data analytics infrastructure and supports progressive capability expansion. Operators can start with specific use cases (e.g., interference management, site compensation) and systematically extend to more sophisticated scenarios (e.g., network slicing optimization, energy management) without system replacement.

Future-Ready Platform

As the industry evolves toward 6G, CARAT's architecture supports:

- AI-native network operations aligned with 6G vision
- Enhanced automation levels supporting autonomous network goals
- Integration with emerging standards and interfaces

Flexible Deployment Models

CARAT adapts to operator preferences:

- On-premises deployment for maximum control
- Cloud-native architecture for scalability
- Hybrid models balancing performance and flexibility
- Modular licensing supporting phased implementation

Key Benefits of CARAT

Operational Excellence:

- Reduce mean time to problem resolution from weeks to minutes
- Free expert teams from routine tasks to focus on strategic initiatives
- Enable 24/7 autonomous operation without proportional staffing increases
- Eliminate manual drive testing and site validation costs

Financial Impact:

- Defer capital expenditure through infrastructure optimization
- Reduce operational costs via automation and efficiency gains
- Protect revenue through proactive quality management
- Enable new revenue streams via guaranteed slice performance

Customer Experience:

- Minimize service impact during network changes or failures
- Maintain consistent quality across varying traffic conditions
- Deliver differentiated service quality per use case/slice
- Respond to demand patterns faster than manual processes

Strategic Positioning:

- Build autonomous network capabilities for 6G readiness
- Maintain vendor independence and negotiation flexibility
- Develop organizational expertise in AI-driven operations
- Create competitive differentiation through service quality

Transform Your Network with CARAT now!

Whether you're optimizing existing 4G/5G networks, implementing network slicing, or preparing for 6G evolution, CARAT provides the AI-driven intelligence to manage complexity at scale while delivering measurable business results.

Contact brown-iposs today for a demo or tailored solution brief.

Visit www.brown-iposs.eu to learn more.

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