PLANET NETWORK INTERNATIONAL

Advanced solutions for telecom regulatory authorities

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CONFIDENTIAL · TECHNICAL REFERENCE

Complete Technical Reference

RPM System · D.QoS Platform · Tariff Audit System

Comprehensive technical deep-dive for telecommunications regulatory authorities

Regulatory performance monitoring · Public transparency · Tariff compliance

2G · 3G · 4G · 5G | Huawei · Nokia · Ericsson · ZTE

TAS IN PARTNERSHIP WITH Roscom

Roscom Limited · United Kingdom

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Agenda — technical deep-dive

A **Introduction & Solution Overview**
Platform architecture, dual-system approach

B **RPM System — The Regulator's Engine**
Data collection, multi-vendor, KPI processing

C **Data Integrity & Monitoring**
Source availability, reliability, alarms

D **KPI Management & Analytics**
KPI Builder, Graph Builder, NMS modules

E **QoS Scoring, Ranking & Enforcement**
Scoring, leaderboard, cell-level penalties

F **Topology & GIS Mapping**
GPS management, admin boundaries, coverage

G **AI-Powered Analytics**
PNAi natural language, anomaly detection

H **D.QoS Public Transparency Platform**
Web portal, mobile app, citizen engagement

I **Tariff Audit System (TAS)**
CDR audit, tariff verification, fraud detection — with Roscom

J **Standards, Architecture & Support**
ITU-T compliance, training, deployment

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A

Introduction & Solution Overview

Platform architecture and the dual-system approach

The regulatory monitoring challenge

Drive Testing (QoE)

FIELD-BASED MEASUREMENT

STRENGTHS

- Measures real end-user experience
- Captures handover & roaming behaviour
- Validates coverage claims on the ground

LIMITATIONS

- Periodic snapshots, not continuous
- Limited geographic & time coverage · high cost
- Cannot enforce at cell level 24/7

NMS / OSS Monitoring (NP)

THE ENGINE FOR CONTINUOUS ENFORCEMENT

- 24/7/365 monitoring of every cell
- Every operator, every vendor, every site
- Cell-level KPI enforcement (ITU-T E.800 Sup. 9)
- Automated warning & penalty tracking
- Network availability — critical for the 5G era
- Data-driven enforcement with audit trail
- Fair benchmarking via MIX KPI aggregation

Drive testing and NMS monitoring are complementary — together they deliver the complete regulatory picture.

Dual-platform architecture — two user groups

RPM System — The Regulator's Engine

Secure VPN access for regulatory staff · real-time 3GPP PM file processing · multi-vendor KPI computation · cell-level enforcement dashboard · automated audit report generation · QoS scoring & MNO ranking.

D.QoS Platform — The Public Interface

Public web portal (no VPN required) · native mobile app (iOS & Android) · MNO leaderboard & QoS rankings · interactive coverage maps & antenna view · citizen complaints & surveys · hourly sync from RPM with cloud backup.

Feature	RPM System	D.QoS Platform
Purpose	Real-time network monitoring & enforcement	High-level daily QoS oversight & transparency
Audience	Regulator technical staff & analysts	Public, citizens, consumer groups, media
Access	Secure VPN, role-based authentication	Public website & mobile application
Data refresh	Real-time 3GPP PM file processing	Hourly sync from RPM + cloud backup

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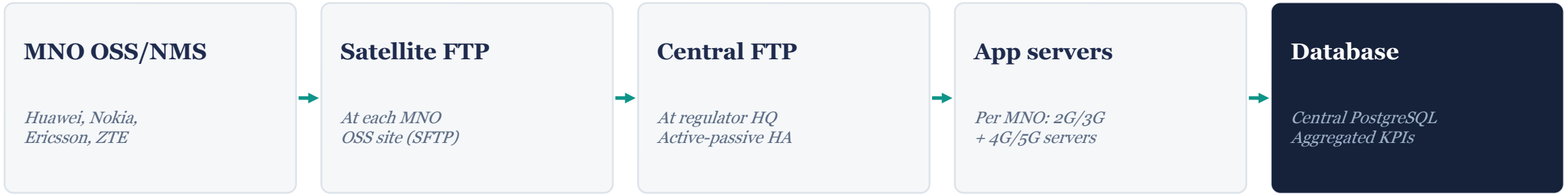
RPM System
The Regulator's Engine

Data collection, multi-vendor integration, KPI processing pipeline

RPM System architecture



Principle	Specification
Modularity	Independent modules — upgrade, replace or extend without affecting other components
Scalability	Horizontal & vertical scaling; additional servers deployable without downtime
High availability	99.9% uptime target · active-passive redundancy · cloud backup synchronisation
Technology stack	PostgreSQL database, Laravel framework, Red Hat Enterprise Linux (RHEL)
Response time	Dashboard loads < 3 s · DB queries < 2 s for standard KPI retrieval
API integration	RESTful & SOAP API endpoints for external system integration

Multi-vendor OSS/NMS integration

Vendor-agnostic KPI normalisation through standardised 3GPP PM file parsing.

Vendor	Technologies	PM file format	Status
Huawei	2G, 3G, 4G, 5G (GSM, UMTS, LTE, NR)	3GPP XML or CSV (TS 32.435/432)	Mandatory — Day 1
Nokia / NSN	2G, 3G, 4G, 5G (GSM, UMTS, LTE, NR)	3GPP XML (TS 32.435)	Mandatory — Day 1
Ericsson	2G, 3G, 4G, 5G (GSM, UMTS, LTE, NR)	3GPP XML / ASN.1 (TS 32.435/436)	Mandatory — Day 1
ZTE	2G, 3G, 4G, 5G (GSM, UMTS, LTE, NR)	3GPP CSV (TS 32.432)	Mandatory — Day 1
NEC / Baicells	4G, 5G (LTE, NR)	3GPP XML (TS 32.435)	Optional

MIX KPI Module — network-level aggregation

- Combines counters from different vendors (e.g. 80% Nokia + 20% Ericsson) into unified network-level KPIs
- Compliant with 3GPP TR 32.814 (OSS integration) and OSSii CO-OP KPI specifications
- Automatic vendor-agnostic normalisation — fair benchmarking of MNOs irrespective of vendor mix

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Data Integrity & Availability Monitoring

Source availability, reliability indicators, alarms & notifications

PM data availability dashboard

Feature	Specification
Hourly file monitoring	Checks hourly whether 3GPP PM files are received from each vendor, per application, per MNO
Source availability tracking	Real-time dashboard: Country → MNO → Vendor → Technology → Application
Synchronisation status	File count, total size, last sync timestamp, sync status per data source
Connection health	Host IP, port, database name, response time (ms), online/offline status
Manual sync	Administrators can trigger manual sync for specific data sources when required

Reliability Indicator (RI) module

24-hour validation — Verifies all cells reported complete 96 × 15-minute measurements per day

Cell coverage % — Share of cells with complete vs missing/partial data per MNO

Missing data ID — Identifies exact cells and time periods with missing data for MNO follow-up

Exclusion rules — Incomplete cells automatically excluded from admin-level KPI aggregations

Alarms & notification system

Alarm type	Specification	Delivery
Missing data alerts	Notification within 1 hour if expected PM files are not received from any MNO/vendor	Email
Threshold breach alerts	Configurable alerts when QoS KPIs fall below regulatory targets	Email + SMS
System availability	Immediate notification for server downtime, DB connectivity or app failures	Email + SMS
Performance alarms	Cell-level alarms based on ITU-T QoS categories (NA, SA, SR, SI)	Dashboard + Email
Alarm audit trail	Complete history with resolution timestamps & responsible personnel	Report

Performance alarm thresholds (cell level)

ITU-T cat.	Performance alarm	Threshold	Technology
NA	Downtime for radio access	> 6 hours in a day	2G/3G/4G/5G
SA	Call connection success rate	< 95%	2G/3G
SA	Data service access failure rate	> 2%	4G/5G
SR	Call drop rate	> 2%	2G/3G
SR	Data service drop rate	> 3%	4G/5G

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KPI Management & Analytics

KPI Builder, Graph Builder, NMS data modules

KPI Builder — no programming required

Feature	Specification
Counter selection	Browse and select from all available 3GPP counters across vendors, with search & filter
Formula editor	Visual editor: +, −, ×, ÷, aggregations (SUM, AVG, MAX, MIN), conditional logic
KPI validation	Automatic validation of formulas against sample data before production deployment
Version control	KPI formula changes tracked with audit trail and rollback capability
Pre-configured ITU-T KPIs	All ITU-T QoS evaluation KPIs pre-configured out of the box

Graph Builder module

Visualisation types

Line, bar, pie, gauge, stacked, heatmaps

Custom dashboards

Personalised views, multiple graphs & KPIs

Multi-MNO compare

Side-by-side KPI comparison across MNOs

Time series

Hourly, daily, weekly, monthly, yearly

Export

PNG, PDF, Excel for reports

NMS data modules

NMS Summary

High-level overview dashboard with network-wide KPI summaries by MNO, technology and region. The quick snapshot for regulatory executives.

NMS Details

Drill-down to cell-level KPI details with filtering by region, technology and time period. Hourly/daily views per administrative level.

NMS Benchmark

Comparative benchmarking with side-by-side comparison of MNO performance across all KPIs — fair comparison with MIX KPI support.

QoS vs Coverage

Correlation analysis between QoS metrics and coverage indicators, identifying service-quality patterns and coverage gaps.

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QoS Scoring, Ranking & Enforcement

Composite scoring, MNO leaderboard, cell-level penalty system

QoS scoring & ranking

QoS Scoring module

- Configurable weights for voice, data, SMS
- Aligned with ITU-T QoS & ETSI TR 103 559
- Colour-coded: exceeds / meets / below target
- Historical trending & regional breakdown

QoS Ranking module

- Real-time MNO leaderboard with position changes
- Separate rankings: voice, data, availability, overall
- Regional rankings by administrative area
- Publishable to D.QoS for public transparency

ITU-T QoS evaluation categories

NA **Network Availability**

Cell uptime, downtime tracking, radio-access availability

SA **Service Accessibility**

Call setup success, data access rates, congestion

SR **Service Retainability**

Call & data session drop rates, service continuity

SI **Service Integrity**

DL/UL throughput, voice quality (MOS), data speed

Cell-level enforcement — ITU-T E.800 Supplement 9

Status	Definition	Consequence
Cell in fault	Cell fails targets for ≥ 50% of days (random or consecutive) per month	Flagged in system
1st warning (month M)	Cell in fault status for ≥ 16 days in the observed month	Notification to MNO
2nd warning (month M+1)	Cell remains in fault for 2 consecutive months	Formal warning + 60-day repair time
Penalty (month M+2)	Cell in fault for 3 consecutive months without remedy	Statutory sanctions applied per cell

Enforcement dashboard features

Feature	Details
Warning/penalty cell tracking	Count of 1st warning, 2nd warning and penalty cells per MNO, per technology
Days-in-fault tracking	Days each cell is in fault for current and previous months (M, M−1, M−2)
Repair-time countdown	Remaining days in the 60-day window for 2nd-warning cells before sanctions
Statutory sanctions calculator	Automatic fine calculation from penalty-cell count and sanction rates
Lenity rules	A cell triggering several alarm criteria is counted only once for sanction purposes

Mandatory KPIs & thresholds — fully configurable

2G (GSM) voice KPIs

Cat.	KPI	Threshold
NA	Cell downtime	< 6 h/day
SA	TCH congestion rate	≤ 1%
SA	Call setup success rate	≥ 98%
SR	Call drop rate	≤ 2%

3G (UMTS) KPIs

Cat.	KPI	Threshold
SA	Voice call setup success	> 98%
SR	Voice call drop rate	≤ 2%
SA	Data access success rate	≥ 98%
SI	DL HS throughput	> 1 Mb/s

4G (LTE) data KPIs

Cat.	KPI	Threshold
NA	Data service availability	> 98%
SA	Data access success rate	> 95%
SR	Data service drop rate	< 3%
SI	Min DL / UL throughput	> 5 / > 1 Mb/s

5G (NR) KPIs

Cat.	KPI	Threshold
NA	Cell availability (%)	Configurable
SA	SgNB addition success rate	Configurable
SR	SgNB abnormal release rate	Configurable
SI	DL / UL throughput (Mbps)	Configurable

5G NR monitoring is already deployed and proven in production with ZICTA (Zambia). All thresholds are fully configurable per regulator requirements.

QoS Audit Report generation

Report component	Specification
Executive summary	Total 1st-warning, 2nd-warning and penalty cells for the period, with reference month
PM data Reliability Indicator	Daily RI percentage showing data completeness — RI should be > 70% for a valid audit
Performance alarm distribution	Charts of how many times each alarm was triggered during the month
Statutory sanctions section	Synthesis of warning/penalty cells with potential fines calculated and fines due
Detailed cell lists (annex)	Exportable CSVs: detailed report, 1st warning, 2nd warning, penalty — with Cell_ID & days in fault
Percentage analysis	% of warning/penalty cells vs total cells, by vendor and technology

Reports exportable in PDF, Excel, Word and CSV. Automated monthly generation with scheduled email distribution.

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Topology Management & GIS Mapping

Site GPS management, administrative boundaries, coverage visualisation

Topology module & GIS mapping

Topology module

- Centralised GPS coordinate repository
- Monthly topology file updates from MNOs
- Orphan-cell detection & automatic alerts — excluded from admin KPIs
- Site reconciliation vs MNO-provided lists
- Network-element tracking (eNB, gNB, BSC, RNC)

GIS mapping features

- Full administrative boundary hierarchy
- Drill-down from country to sub-location level
- Up to 5 synchronised map windows
- Coverage maps by technology (2G–5G) + signal-strength overlays
- D.QoS antenna map: street-level cell view

Topology file requirements from MNOs

Requirement	Recommendation
Update frequency	Weekly or monthly topology file submissions from MNOs
File format	Excel (.xlsx) or CSV with standardised columns
Required columns	Site_ID, Site_Name, Cell_ID, Cell_Name, e(g)NB_ID, Lat, Long, Tech, Status, Category
Submission	Secure upload to the RPM System or designated FTP server

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AI-Powered Analytics

PNAi natural-language queries, anomaly detection, predictive analytics

PNAi — the AI assistant for QoS data

Natural-language database queries for executives — no SQL knowledge required.

Capability	Specification
Natural-language queries	Ask questions in plain English or French and receive accurate answers from actual QoS data
Zero hallucination	Responses derived exclusively from real database data — no fabricated figures permitted
ITU-T compliance	Trained on ITU-T SG12 recommendations for QoS, NP and QoE frameworks
Regulator context	Understands regulator-specific KPIs, thresholds, admin boundaries and compliance rules
Chat history & audit	Searchable history of all conversations, with audit trail for regulatory accountability
Anomaly detection	Automatic detection of unusual KPI patterns indicating network or data issues
Root-cause analysis	AI-assisted identification of likely root causes for KPI degradation
Trend forecasting & alerts	Predictive models for QoS degradation and capacity pressure, with early warnings

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D.QoS Platform Public Transparency

Web portal, mobile application, citizen engagement features

D.QoS web portal — no VPN, open to all citizens

Feature	Specification
Public access	Publicly accessible web portal for citizen access to QoS information
MNO leaderboard	Public ranking of MNOs based on QoS performance, updated hourly
KPI trend charts	20-day rolling KPI trends per MNO with historical comparison
Coverage maps	Interactive GIS maps showing network coverage by MNO and technology
Service accessibility	Dashboard of SA and NA metrics for each MNO
Antenna module	Street-level visualisation of cell antennas with coverage sectors
Hourly updates & cloud backup	Fresh data synchronised from the RPM System every hour, with cloud redundancy

D.QoS mobile app & citizen engagement

Mobile application

- Native Android (8.0+) and iOS (13+)
- Location-based QoS at the user's GPS position
- MNO comparison at any selected location
- Push notifications & QoS alerts for outages
- Complaint submission with auto-location & photo

User interactions module

- QoS complaints with location tagging
- Complaint follow-up & MNO assignment
- Configurable QoE surveys for citizens
- Crowdsourced data correlated with network KPIs
- Complaint status tracking for users

Built-in support & administration

Feature	Details
Ticket system	Built-in helpdesk for logging, tracking and resolving system issues, with escalation
Role-based access	Granular permissions: administrator, analyst, viewer, enforcement officer…
Audit logging	Complete trail of all user actions: logins, exports, configuration changes

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Tariff Audit System (TAS)

CDR auditing, tariff verification, fraud detection — delivered with Roscom

TAS overview — protecting consumers from billing fraud

CDR audit & verification

Analyse CDRs from MSC, SMSC, SGSN, GGSN/PGW for billing accuracy. Cross-reference unrated vs rated CDRs.

Tariff plan validation

Verify operators charge per their declared tariff rule books — rounding rules, eligibility, business rules.

Revenue assurance

Detect under-reporting of traffic volumes; ensure correct regulatory fees from actual network usage.

Fraud detection

Identify SIM-box fraud, bypass routing, interconnect abuse, unauthorised international termination.

TAS data inputs from MNOs

Input type	Description
Unrated CDRs	Raw CDRs from MSC, SMSC, SGSN, GGSN/PGW — before billing-system processing
Rated CDRs	Prepaid & postpaid billing exports — after the operator's billing system has applied tariffs
Tariff rule book	Latest rates, eligibility rules, rounding rules and business rules for all plans

TAS technical architecture — proven at INCM (Mozambique)

Deployed in production with Vodacom, Movitel and TMcel.

MNO OSS

Unrated & rated CDRs via SFTP / VPN

→

RPM+ Engine (host)

Full CDR parsing, validation & reconciliation

→

Osprey™ VM (Roscom)

Decode & analyse filtered SIM CDRs from TCG campaigns

→

Regulatory output

Dashboards, audit reports, compliance certificates

Roscom TCG integration

Test Call Generators deployed at multiple locations with SIMs from each operator. Automated test campaigns for voice, SMS and data (2G–5G); Osprey™ controls execution with real-time triggers and scheduled runs.

D.QoS integration

The D.QoS mobile app feeds QoS coverage metrics and user measurements into TAS. MNO tariff offers curated from operators' public websites are displayed in the D.QoS app for consumer comparison.

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Standards, Architecture & Support

ITU-T compliance, technology stack, training, vendor qualifications

Standards compliance

Standard	Application
3GPP TS 32.401	Performance Management (PM) concept and requirements
3GPP TS 32.432 / 32.435 / 32.436	PM file format definitions (measurement, XML, ASN.1)
3GPP TR 32.814	OSS integration reference architecture for multi-vendor networks
OSSii CO-OP KPIs	Cooperative KPI formulas for multi-vendor counter aggregation
ETSI TR 103 559	QoS scoring and ranking methodology for telecom networks
ITU-T E.800 + Suppl. 9	QoS framework · cell-level enforcement: warning & penalty cell tracking
ITU-T E.804	QoS aspects for popular services in mobile networks
ITU-T Y.1540 / Y.1541	IP packet transfer and network performance objectives
ITU-T SG12	Study Group 12: QoS, NP and QoE frameworks

Value-add capabilities — the same platform, more mandates

USF site verification	Create USF clusters, monitor per cell/BTS, verify sites are on-air via PM file generation, map coverage with GPS, track roll-out status (planned / installed / live).	Available
Election monitoring	Continuous NMS monitoring covers elections inherently: define electoral clusters as points of interest, hourly KPI alerts for critical areas, optional dedicated election-mode dashboard.	Available
Emergency comms readiness	Network-availability dashboards track cell uptime and outages. Define critical-infrastructure clusters, downtime alerts, resilience reporting with mean restoration times.	Available
Site reconciliation (OSS vs NMS)	Topology Update Assistant flags MNO extras (in topology but not generating PM) and orphan sites (generating PM but not in topology).	Available

Modular by design — built to adapt

Topology module

GIS mapping, GPS data, admin boundaries

KPI Builder

Custom KPI formulas from raw 3GPP counters

MIX KPI module

Multi-vendor network-level aggregation

Enforcement

Warning/penalty cell tracking & sanctions

Report generator

Automated audit & monthly QoS reports

Graph Builder

Custom dashboards & visualisations

New modules can be developed and deployed without rebuilding the system. PNI's in-house development team builds custom modules for regulator-specific requirements — USF monitoring, election readiness, emergency communications, or any regulatory challenge that arises.

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Trusted across Africa — 12+ regulators in production

NCA
Ghana

ZICTA
Zambia

INCM
Mozambique

BOCRA
Botswana

POTRAZ
Zimbabwe

ESCCOM
Eswatini

ARCEP
Gabon

ARCT
Burundi

ARPT
Guinea

ARCEP
Benin

ARPTC
DR Congo

NatCA
Sierra Leone

12+
Regulatory deployments

4
Major vendors supported

2G–5G
All technologies covered

24/7
Continuous monitoring

Training, support & technology stack

Area	Details
Training programme	Comprehensive training for regulator personnel: system administration and user operation
On-site & remote support	On-site support during deployment and initial operation; 24/7 remote support for critical issues
Documentation	Complete system documentation: user manuals, administrator guides, SOPs
Warranty & maintenance	Minimum 1-year warranty; 5-year maintenance & support contract option thereafter
In-house dev team	PNI developers customise the solution and build new modules for regulator-specific needs

Technology stack

DATABASE

PostgreSQL

FRAMEWORK

Laravel

OS

RHEL / Enterprise Linux

ARCHITECTURE

Virtualised rack servers

API

RESTful + SOAP

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Thank you

We look forward to demonstrating how PNI can empower your authority with data-driven QoS enforcement and independent tariff verification.

NEXT STEPS

- Live demonstration of the RPM System & D.QoS platform
- Reference calls with existing African regulator clients
- Tailored technical and commercial proposal with implementation timeline
- On-site assessment and deployment planning

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