中華電信
Chunghwa Telecom

Chunghwa Telecom: RAN Fault Management Level Assessment

ANLET: GB1059A v2.0.0

Overall Score

Cognitive Activity (IAADE)	Service Capability	Weight	Question	Answer	Overall Score
Intent	Intent-driven	10%	Does the wireless network fault management system have the capability of automatically generating fault management task targets, policies and evaluating the implementation effect based on intent? Note: Based on the specified fault management intent (such as the out-of-service duration), the system determine the fault management targets (such as the proportion of pre-event trouble tickets and fault locating duration) and fault management policy(such as redundancy backup). Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	B	3.7
Awareness	Data collection & Alarm filtering	10%	Does the wireless network fault management system support automatic data collection & alarm filtering in various fault scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	A	
	Fault Prediction	15%	Does the wireless network fault management system support fault prediction in various fault scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	A	
Analysis	Fault identification & Impact analysis	20%	Does the wireless network fault management system support fault identification & fault impact analysis in various fault scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	A	
	Demarcation & Locating	20%	Does the wireless network fault management system support root cause diagnosis and fault locating in various fault scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	A	
	Solution generation	10%	Does the wireless network fault management system support generation of fault recovery solutions in various scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	B	
Decision	Evaluation and decision-making	10%	Does the wireless network fault management system support evaluation and decision-making in various scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	A	
Execution	Solution implementation	5%	Does the wireless network fault management system support automatic execution of troubleshooting solutions in various scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.	A	

Intent-driven

Question：

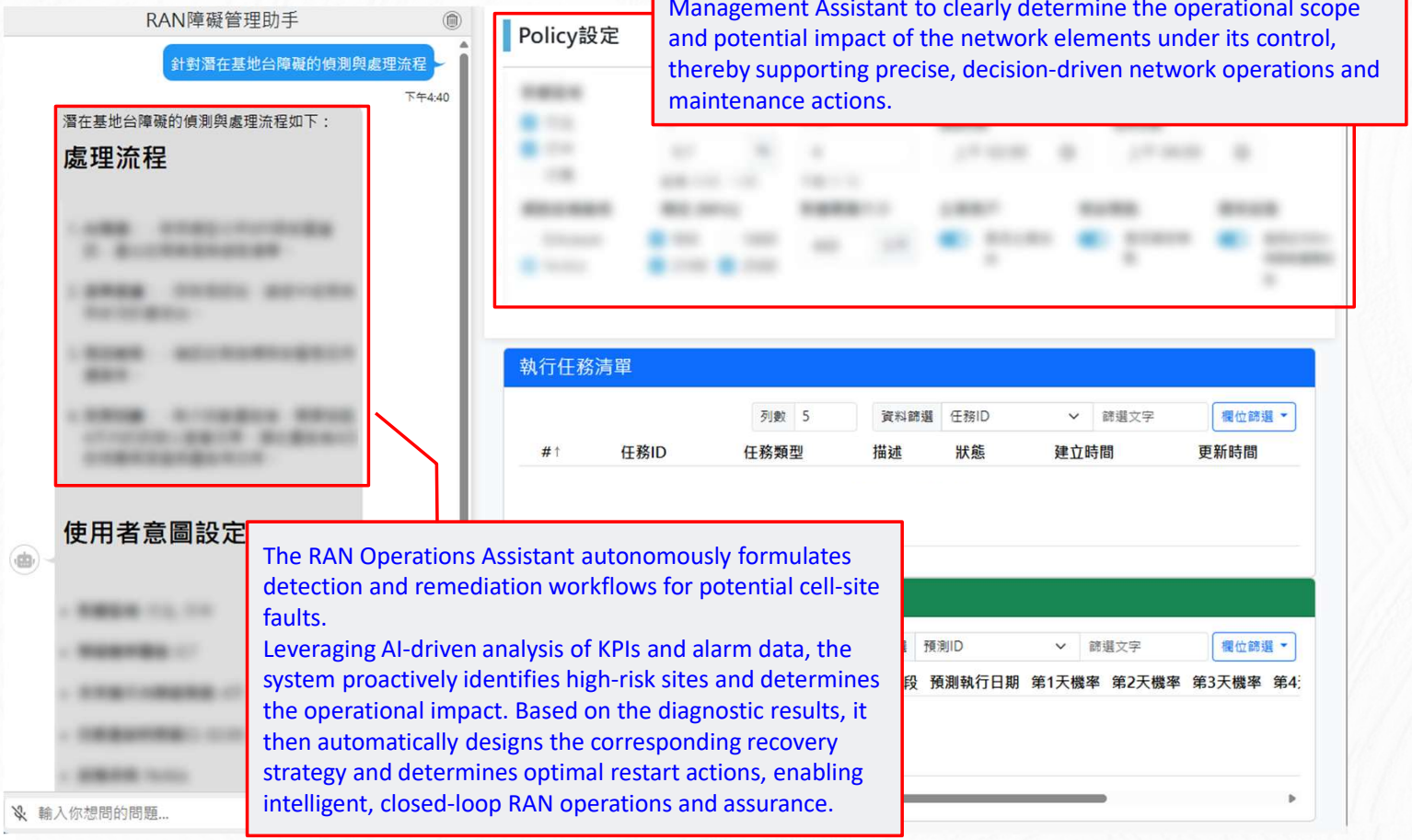
Does the wireless network fault management system have the capability of automatically generating fault management task targets, policies and evaluating the implementation effect based on intent?
Note:
Based on the specified fault management intent (such as the out-of-service duration), the system determine the fault management targets (such as the proportion of pre-event trouble tickets and fault locating duration) and fault management policy(such as redundancy backup).
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

Option：

Option A	✓ Option B	Option C
The system automatically generates fault management task targets and policies based on intent. Fault management targets and policies need to be manually confirmed. The system automatically evaluates the implementation effect.	The system automatically generates fault management task targets based on predefined rules. Fault management targets and policies need to be manually defined. The effect is manually evaluated after the intent is implemented.	Fault management task targets and policies are manually defined based on expertise. Manually evaluate the effect after the intention is implemented.

Intent-driven

Evidence：



Intent-driven automated policy generation enables the RAN Fault Management Assistant to clearly determine the operational scope and potential impact of the network elements under its control, thereby supporting precise, decision-driven network operations and maintenance actions.

The RAN Operations Assistant autonomously formulates detection and remediation workflows for potential cell-site faults.
Leveraging AI-driven analysis of KPIs and alarm data, the system proactively identifies high-risk sites and determines the operational impact. Based on the diagnostic results, it then automatically designs the corresponding recovery strategy and determines optimal restart actions, enabling intelligent, closed-loop RAN operations and assurance.

Data collection & Alarm filtering

Question：

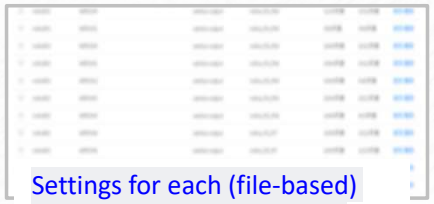
Does the wireless network fault management system support automatic data collection & alarm filtering in various fault scenarios?
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

Option：

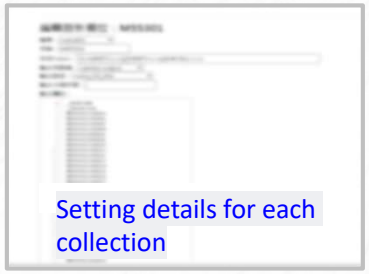
✓ Option A	Option B	Option C	Option D
The system can automatically collect data (alarm, configuration, and performance data etc.), associate alarms, and filter alarms.	The system can automatically collect data (alarm, configuration, and performance data etc.), associate alarms, and filter alarms based on manually defined rules	Manually select and use the system to collect data and filter out invalid/redundant alarms.	People use the system to collect data and manually filter out invalid/redundant alarms.

Evidence：

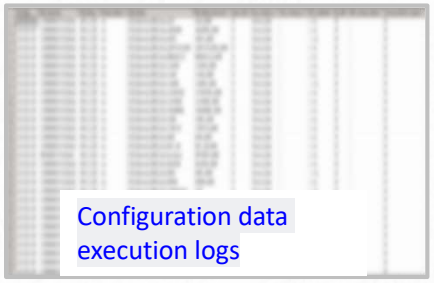
- Automatically collect alarms, performance, and configuration data from different networks and sites, and perform automated correlation.
- Data sources include network management systems and network element interfaces.
- Establish traceable relationships between data sources and data flows.
- Enable real-time alarm quality monitoring and issue alerts for abnormal data sources (e.g., missing data).
- Achieve 100% automated data collection.
- Automatically filter invalid and redundant alarms based on system rules.



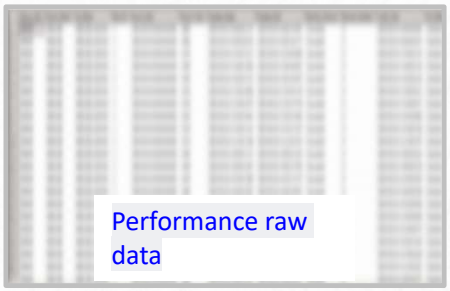
Settings for each (file-based) performance/configuration data collection record



Setting details for each collection



Configuration data execution logs



Performance raw data

Original alarm data records

Data collection & Alarm filtering

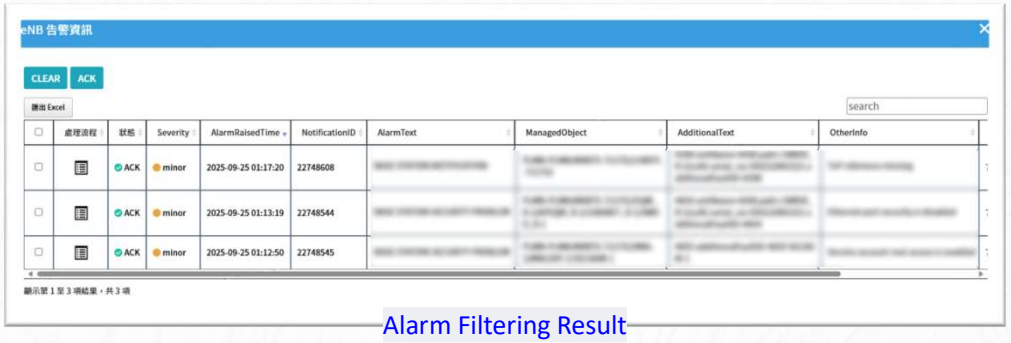
Evidence：

ID	NMS	Object Class	AlarmID	Rule Expression	Status	Display	Color	Description	Note	簡訊
	HP_Openview				☐	☐	Black			
970	HP_Openview		1007		☑	☑	Red		20191120 shinhung add.	(0)
969	HP_Openview		1007		☑	☑	Orange		20191120 shinhung add.	(0)
968	HP_Openview		1007		☑	☑	Orange		20191107 shinhung add.	(0)

Alarm Filtering Rule

網路類別	企業名稱	網元類別	網元名稱	網元編號	網元拓樸	區域	機房	維運單位	供應商
5G					CORE	北區			Ericsson
5G					CORE	北區			Ericsson
5G					CORE	北區			Ericsson
5G					CORE	北區			Ericsson
5G					CORE	北區			Ericsson
5G					CORE	北區			Ericsson
5G					CORE	北區			Ericsson

Automated collection covers all network elements under management.



Alarm Filtering Result

Fault prediction

Question：

Does the wireless network fault management system support fault prediction in various fault scenarios?
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

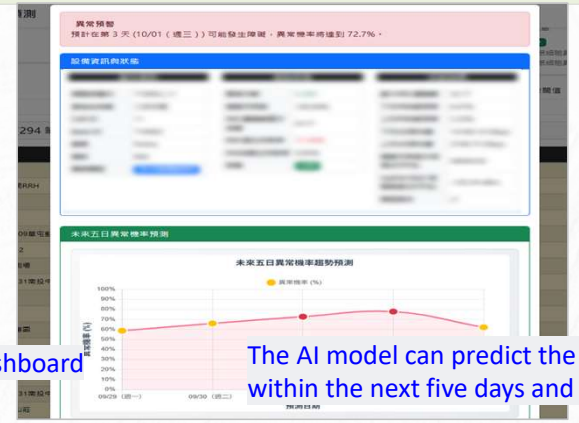
Option：

✓ Option A	Option B	Option C	Option D
The system can automatically identify potential risks and predict the fault occurrence time based on intelligent models. For example, the system can predict that the fronthaul optical module will be faulty within XX days.	The system can automatically identify potential risks based on intelligent models (intelligent rules) ,but cannot predict the fault occurrence time.	The system can identify potential risks based on manually defined rules. For example, the system can identify potential risks of fronthaul optical modules based on preset optical power thresholds.	Potential risks need to be manually identified based on expertise.

Evidence：

- Base Station Software Fault Prediction Model
  - ✓ Used to estimate the probability of “software faults” occurring at a base station within the next 5 days.
  - ✓ Data sources for analysis include alarms, alarm work orders, and traffic KPIs.
  - ✓ Prediction accuracy: >95%.

Base Station Software Fault Prediction Dashboard



The AI model can predict the risk of faults in base station within the next five days and issue early warnings in advance.

Fault prediction

Evidence：

■ Base Station Fronthaul Transmission Fault Prediction Model
- ✓ This model is designed to assess the probability of future fronthaul transmission faults in base stations.
- ✓ Data sources for analysis include Alarm records、Optical power attenuation、Traffic-related KPIs
- ✓ The model conducts a comprehensive analysis based on : Historical fault occurrence time and frequency, Work order records, Environmental data correlations
- ✓ Prediction accuracy>= 90%

Prediction of Fronthaul Transmission Faults

Fault prediction

Evidence：

■ Fault Prediction Model demonstrate the prediction capability for the “Out of Service” scenario

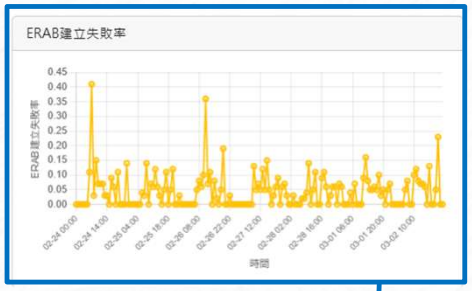
✓ We selected the sleeping cell fault scenario as a representative case to demonstrate the prediction capability for the “Out of Service” scenario.

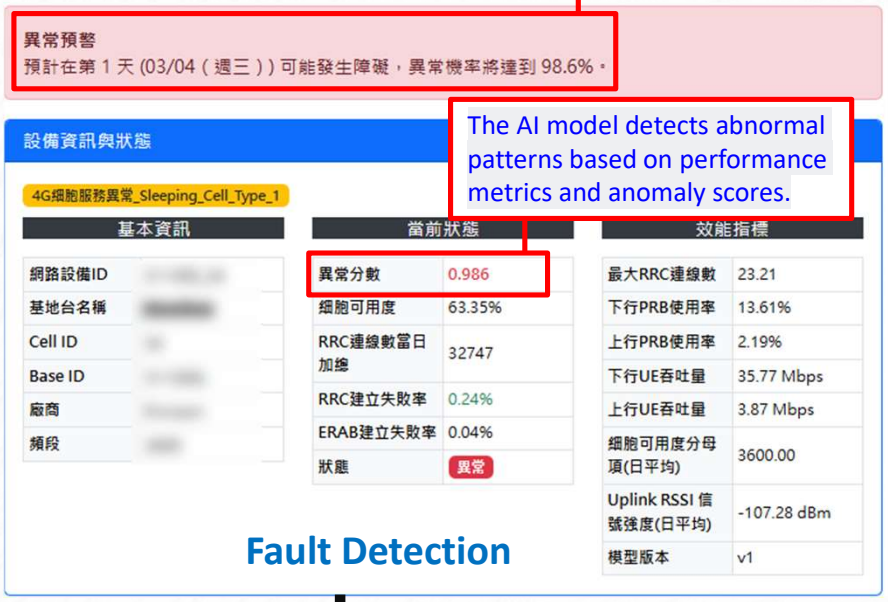
The AI model predicted that the equipment would malfunction on March 4.

The AI model predicts the “Out of Service “ probability for the next seven days. The model indicates that the device is highly likely to experience a sleeping cell fault on March 4.

Historical KPI data show the ERAB establishment failure ratio was high last week for the potentially abnormal equipment.

The AI model detects abnormal patterns based on performance metrics and anomaly scores.





Fault Detection

02-24

03-03

03-04

Time

The probability of a out of service occurrence reaches 98.6%.

Fault identification & Impact analysis

Question：

Does the wireless network fault management system support fault identification & fault impact analysis in various fault scenarios?
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults

Option：

✓ Option A	Option B	Option C
The system automatically identifies faults and subsequent impact based on intelligent rules.	The system can automatically identify faults and subsequent impact based on manually defined rules, for example, identifying intermittent faults based on a frequency experience threshold and aggregating periodic alarms based on a period threshold.	Faults and impact need to be manually identified based on expertise.

Evidence：

- Fault Identification Capability
  - ✓ Rule-Based Detection: Uses real-time alarm messages and KPIs as primary criteria to quickly locate cells and base stations experiencing faults.
  - ✓ Machine Learning Detection: Integrates Isolation Forest and Random Forest, leveraging traffic features, rolling averages, and time-series characteristics for intelligent detection. Capable of automatically identifying potential faults even with unlabeled data.
  - ✓ Both rule-based and machine learning detection cover multiple fault scenarios and can continuously optimize identification results through historical data.

Fault identification & Impact analysis

派工總筆數：109　障礙站點數：49(A:3 / B:9 / C:14 / D:20)　已恢復站點數：60

OBJ	處理情形	BBU ID(站台名稱) 接取方式 接取設備	站點名稱 LID 維運等級		設備組態 細胞清單	專線狀態	目前負責單位
eNB	未派工				AirScale	TRIS	
				B	21/23/25/31/24/11/12/32/33/13/22	DOSS	
eNB	未派工				AirScale	TRIS	
				D	71/73	DOSS	
eNB	派修中				FSMF	TRIS	
				C	37/27/21/33/31/23	DOSS	
eNB	派修中				AirScale	TRIS	
				A	21/23/14/33/31/22/12/11/13/34/24	DOSS	
eNB	派修中				RBS6601	TRIS	
				C	12/11/13/21/22/23	DOSS	
eNB	派修中				FSMF	TRIS	
				D	13/11	DOSS	
eNB	派修中				FlexiZone	TRIS	
		525054L(南投					

Assign SLA-based maintenance levels to work orders to reinforce service quality standards.

AI-driven Model Fault Detection and Dispatch System

1.1 NE disconnection

eNB	派修中		FSMF 11

1.2 NE out of service

gNB	派修中		AirScale 111

1.3 Cell faults

Cell	未派工		Radio2217/KLPF_NAR01 21/11

1.4 Fronthaul network faults

專線	派修中		S011_033 AHDB;FXDB

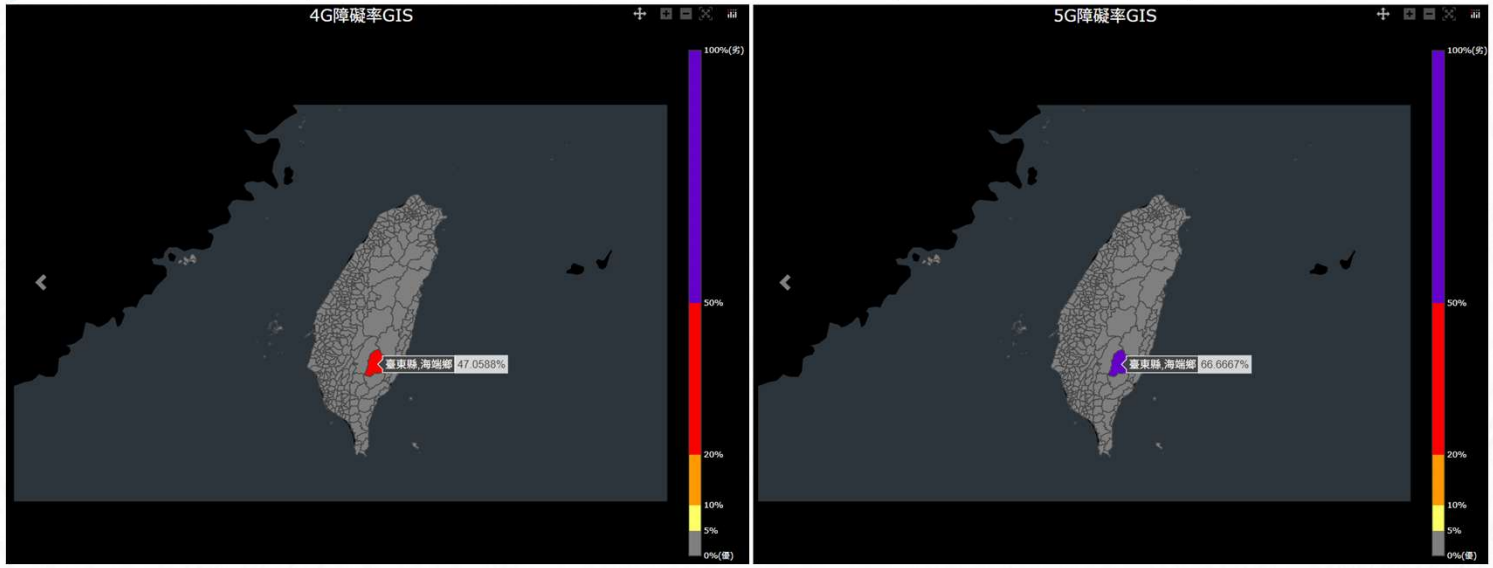
Fault identification & Impact analysis

Evidence：

■ Regional Service Impact Analysis
- ✓ Automatically outputs the fault ratio for each RAT network based on system classification.
- ✓ Combines CEM (Customer Experience Management) user feedback information to provide real-time visibility into service coverage in fault-affected areas.

基地台障礙率/服務涵蓋率報表(更新時間：2025/9/26 上午 11:30:07) GIS地圖分佈查詢

鄉鎮市區	4G障礙率(%)	5G障礙率(%)	服務站點障礙率(%)	服務涵蓋率(%)
臺東縣 / 海端鄉	47.06	66.67	34.78	69.87



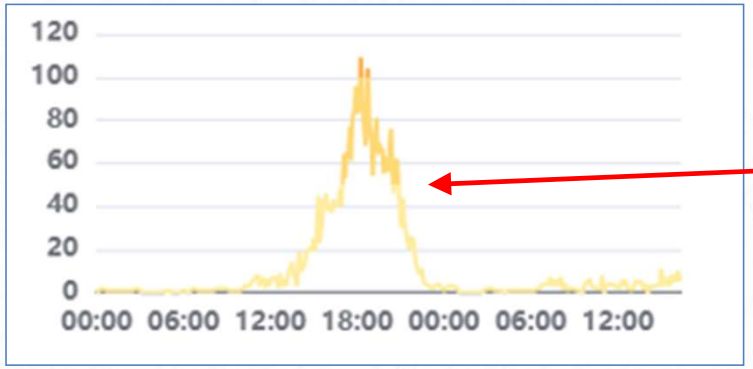
Regional Service Impact Analysis

Fault identification & Impact analysis

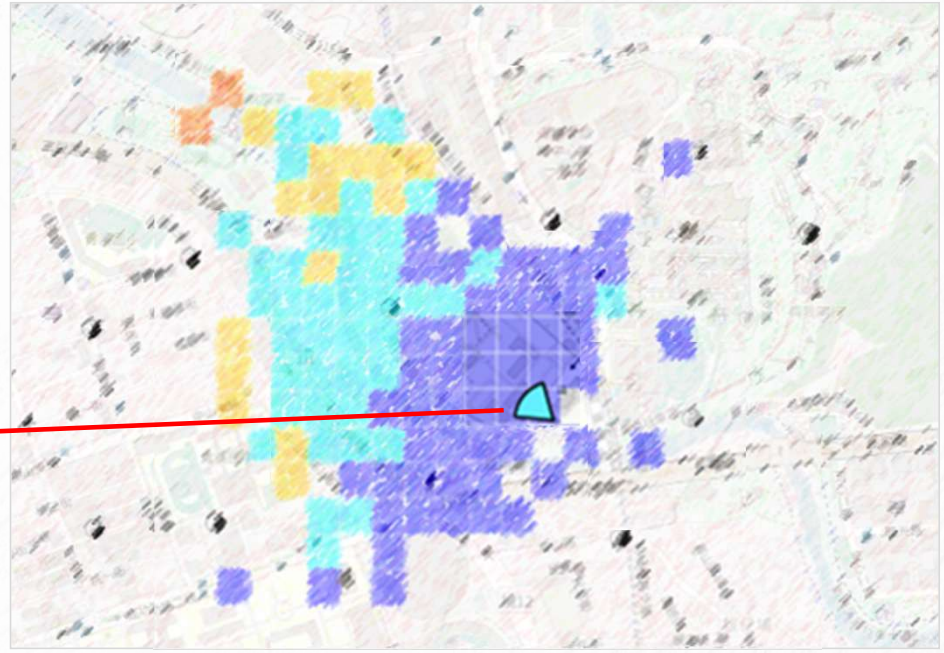
Evidence：

■ Calculation of the Number of Affected Users Due to Cell Outage

- ✓ Due to the multi-layer coverage characteristic of mobile networks, when a cell outage occurs, only users located in grids with signal strength greater than –90 dBm are counted as affected users.
- ✓ For grids with weaker signal strength (< –90 dBm), service coverage is provided by surrounding normally operating cells. Therefore, mobile service for users in these grids is not impacted.



Single Grid Time-Based User Distribution



Grid Size: 50 m²

Demarcation & Locating

Question：

Does the wireless network fault management system support root cause diagnosis and fault locating in various fault scenarios?
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

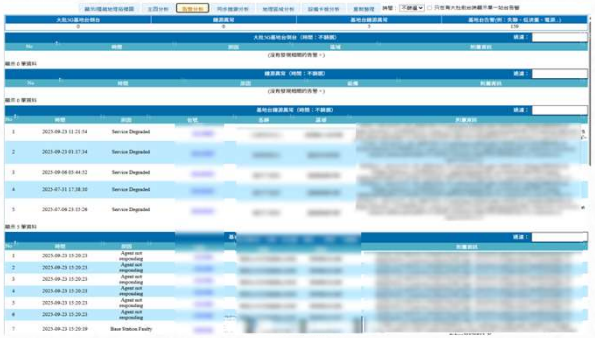
Option：

✓ Option A	Option B	Option C	Option D
The system automatically demarcates and locates faults based on intelligent models	The system automatically demarcates the fault or locates multiple causes based on intelligent diagnosis models. Manual confirmation is required.	The system can demarcate and locate faults based on manually defined rules, such as experience-based fault trees and troubleshooting processes.	Fault diagnosis needs to be manually performed based on expertise.

Evidence：

- Cross-Domain Alarm Correlation and Demarcation Between RAN and Transport Networks
  - ✓ Real-Time Base Station Alarm Analysis Using Large-Scale Intelligent Alarm Models
  - ✓ Alarm Root Cause Demarcation Across Wireless and Transmission Domains
  - ✓ Applicable to Scenarios Such as NE Disconnection, Service Unavailability, Cell Failures, and Fronthaul Network Faults

Analyzing Current Base Station Alarms to Localize Wireless or Transmission Faults



Root Cause Analysis of Base Station Faults

Geospatial Analysis of Base Station Faults and Impact Assessment

Demarcation & Locating

Evidence：

■ Root Cause Localization for Single-Domain Alarms
  ✓ Provided Alarm Root Cause Diagnosis Function

--NE disconnection

eNB 派修中

AlmNo	SiteName	SiteRegion	WBTS	AlmTxt	CancelTime	NotifId	UserInfo	DiagInfo
Severity	SiteAddress	RNC	EquName	Nokia(Ericsson) Alarm Time	IntId	SupplInfo	ObjectName	NMOSS Time
732643047		EricssonOSS		eNodeB Disconnected				INDETERMINATE
MAJOR							ManagedElement	2025/10/9 09:00

--NE out of service

gNB 派修中

AlmNo	SiteName	SiteRegion	WBTS	AlmTxt	CancelTime	NotifId	UserInfo	DiagInfo
Severity	SiteAddress	RNC	EquName	Nokia(Ericsson) Alarm Time	IntId	SupplInfo	ObjectName	NMOSS Time
7100				BASE STATION HARDWARE PROBLEM				
**				2025/10/9 07:16				

--Cell faults

Cell 未派工

AlmNo	SiteName	SiteRegion	WBTS	AlmTxt	CancelTime	NotifId	UserInfo
Severity	SiteAddress	RNC	EquName	Nokia(Ericsson) Alarm Time	IntId	SupplInfo	ObjectName
4839306230		EricssonOSS	812506L	Input Power Failure		646936181	
MINOR		LAR		2025/10/9 09:17		Input voltage outside unit operating range.	FieldReplaceableUnit

--Fronthaul network faults

專線 派修中

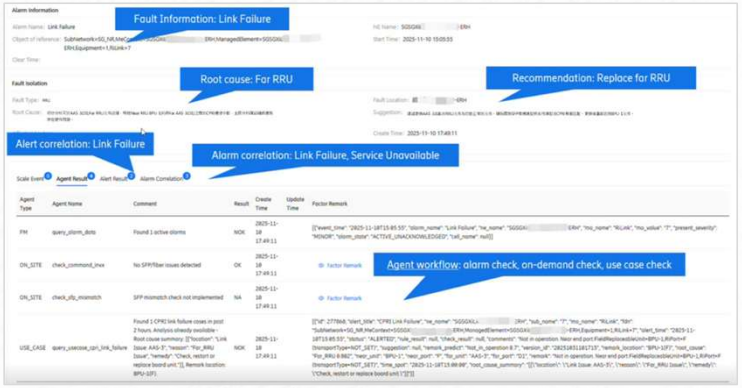
機房	設備類別	設備編號	Shelf編號	Slot編號	Card編號	Port編號	Mtris時間	告警狀態	告警訊息
	FOM		0	1	0	1	2025/10/9 08:11	occur	

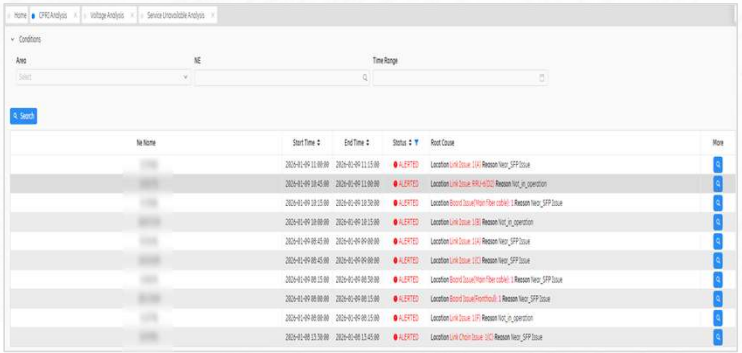
Base Station Alarm Root Cause Analysis

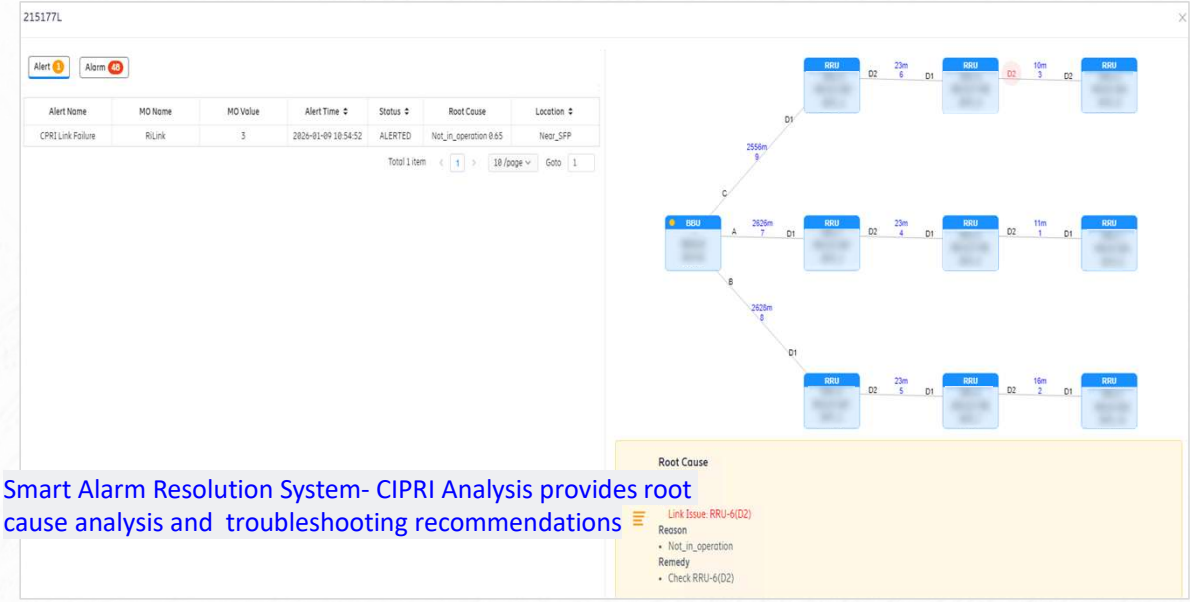
Demarcation & Locating

Evidence：

- Smart Alarm Resolution System
  - ✓ AI-Driven Alarm Analysis: Smart Alarm Resolution System analyzes the alarm data in real time. It considers historical data, network performance metrics, and known issue patterns to identify the root cause of the alarm.
  - ✓ Precision Diagnosis: Built-in LLM analysis can identify the alarm causes and generate troubleshooting recommendations.







Smart Alarm Resolution System- CIPRI Analysis provides root cause analysis and troubleshooting recommendations

Solution generation

Question：

Does the wireless network fault management system support generation of fault recovery solutions in various scenarios?
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

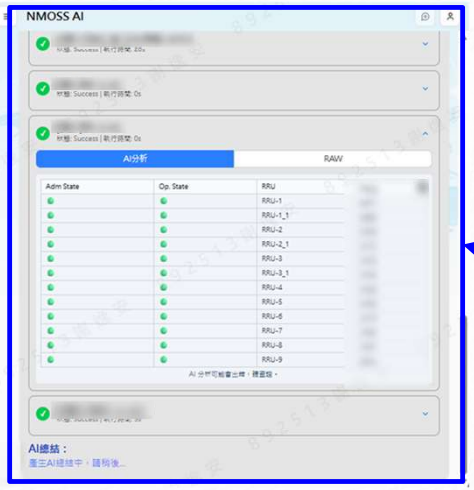
Option：

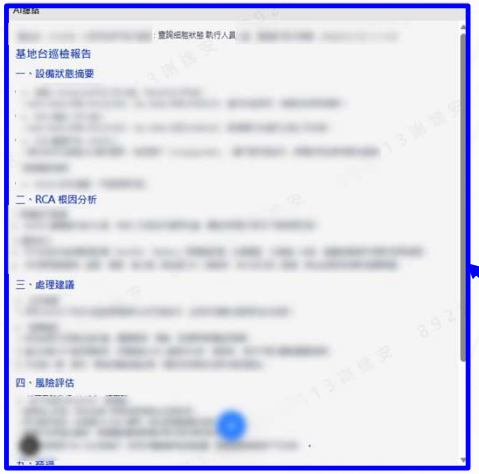
Option A	✓ Option B	Option C
The system automatically generates the optimal recovery or fault rectification solution through intelligent analysis, such as the neighboring cell RF compensation recovery solution.	The system automatically generates multiple possible recovery or rectification solutions, such as the remote recovery solution, neighboring cell RF compensation service recovery solution. Manual confirmation is required.	The recovery solution needs to be manually identified.

Evidence：

- Intelligent Repair Recommendations
  - ✓ The system automatically correlates multi-layer data from eNodeB, MME, and transmission equipment to identify root causes , and significantly reducing fault localization time.
  - ✓ AI automatically generates repair suggestions based on the severity of anomalies.
- Risk Assessment
  - ✓ Before implementing repairs, the system evaluates user impact to ensure decisions balance stability and user experience.

Solution generation



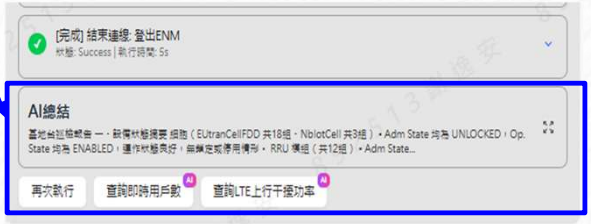


■ **Smart Selection**
- Quickly select the target solution using a card-based interface or natural language.

■ **Procedure Inspection & Real-time Analysis**
- AI analysis tags: Generative AI organizes raw data into easy-to-read tables or text summaries for quick understanding.

■ **AI Summary Report after Inspection**
- The system consolidates all RAW data and AI analysis results to produce a complete AI summary report, proactively recommending possible next actions to improve maintenance efficiency and accuracy.

■ **AI Summary Report Structure**
- Overview: Overall equipment health status
- RCA (Root Cause Analysis): Detailed analysis of anomalies
- Recommendations: Best repair or adjustment plans
- Risk Assessment: Predict potential risks to reduce failure probability
- Conclusion: Summarize inspection results and next steps



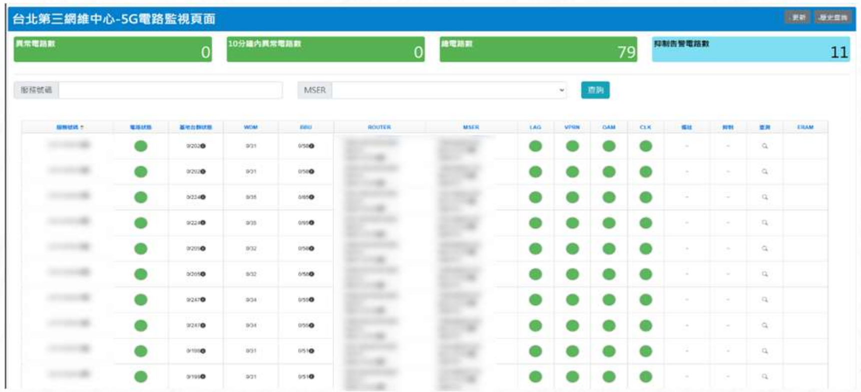
Solution generation

Evidence：

- Automatic Base station Software Fault Restart
  - ✓ Uses daily KPIs as the primary criteria to quickly predict cells with software faults within the next seven days and develop a nighttime restart plan.
  - ✓ Automatically executes base station restart at 03:00 AM daily.
- Transport network fault handling
  - ✓ Use daily KPIs as the primary criteria to monitor optical network degradation and dispatch work orders to inspect MFH passive optical components.

Vendor	BaseID	Predict_Time	Reboot_Time	Ticket_ID	Restarted_Status	Restarted_Time	Alarm_FM_Content	Alarm_PM_Content
[illegible]	[illegible]	2025-09-30 14:00:01.237	2025-10-01 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常
[illegible]	[illegible]	2025-09-30 14:00:01.237	2025-10-01 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常
[illegible]	[illegible]	2025-09-30 14:00:01.237	2025-10-01 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常
[illegible]	[illegible]	2025-09-30 14:00:01.237	2025-10-01 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常

Predicted Restart List



Root Cause Diagnosis of Base Station Circuit Alarms

Evaluation and decision-making

Question：

Does the wireless network fault management system support evaluation and decision-making in various scenarios?
Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

Option：

✓ Option A	Option B	Option C
The system automatically evaluates and determines the optimal recovery or fault rectification solution through intelligent analysis, such as the neighboring cell RF compensation recovery solution.	The system automatically evaluates multiple possible recovery or rectification solutions, such as the remote recovery solution, neighboring cell RF compensation service recovery solution Manual confirmation is required	The recovery solution needs to be manually evaluated and decided.

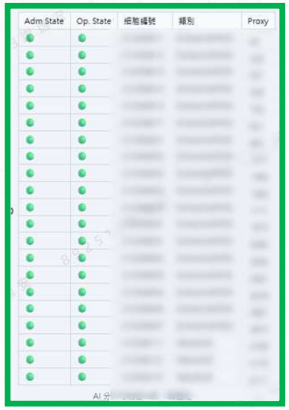
Evidence：

- AI decision-making capability
  - ✓ Supports judgment and handling recommendations in O&M scenarios
- AI inspection analysis can perform intelligent assessments for multiple scenarios
  - ✓ AI analyzes raw inspection results (Raw Data)
  - ✓ AI models can evaluate multiple scenarios across different fault types
  - ✓ Automatically generates AI analysis conclusions to produce decision-making reports

Evaluation and decision-making

Performance Check Results

The equipment performance check results are analyzed by AI.



AI Analysis Results

程序(Procedure)	指令(Command)
查詢LTE上行干擾功率	
查詢LTE上行干擾功率	S1 干擾功率
查詢LTE上行干擾功率	S2 干擾功率
查詢LTE上行干擾功率	S3 干擾功率
查詢LTE上行干擾功率	S4 干擾功率
查詢LTE上行干擾功率	S5 干擾功率
查詢LTE上行干擾功率	S6 干擾功率
查詢LTE上行干擾功率	S7 干擾功率
查詢LTE上行干擾功率	S8 干擾功率
查詢LTE上行干擾功率	S9 干擾功率
查詢LTE上行干擾功率	B2_900 干擾功率
查詢LTE上行干擾功率	C2_1800 干擾功率
查詢LTE上行干擾功率	C5_1800 干擾功率
查詢LTE上行干擾功率	D2_2600 干擾功率
查詢LTE上行干擾功率	D4_2600 干擾功率
查詢LTE上行干擾功率	E9_2100 干擾功率
查詢LTE上行干擾功率	B3_900 干擾功率

Used for multiple abnormal O&M procedures

TRAFFIC DATA
(e.g. call logs, data usage, performance metrics)

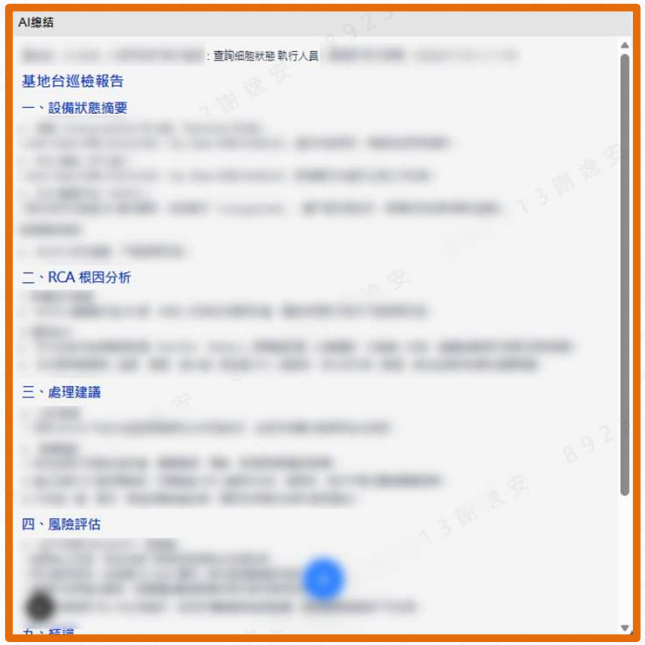
TROUBLEOTFHOING PROCEDURES
(e.g. manuals, step-steytep guides

PROMPT
(Natural Language Query/Instructions)

LARGE LANGUAGE MODEL
Decision Making Engine

AI Summary Report

1. **Overview**
2. **RCA (Root Cause Analysis)**
3. **Recommendations**
4. **Risk Assessment**
5. **Conclusion**



AI-generated decision report is produced.

Solution implementation

Question：

Does the wireless network fault management system support automatic execution of troubleshooting solutions in various scenarios? Fault scenarios include NE disconnection or out-of-service, cell faults, and fronthaul network faults.

Option：

✓ Option A	Option B	Option C
The system can automatically execute instructions.	Humans use the system to execute instructions.	The recovery solution needs to be manually implemented

Evidence：

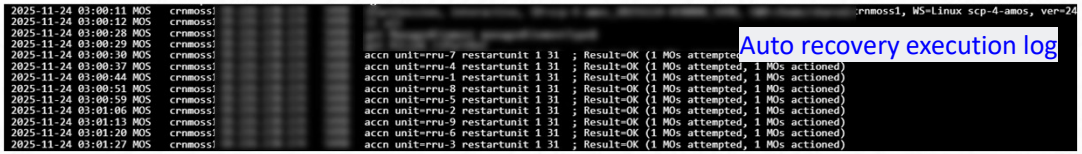
- Base Station Self-Fault Detection and Analysis
  - ✓ When the system detects a potential issue, it automatically executes corresponding recovery actions based on the nature and location of the fault to restore service.
- Execution Result Feedback
  - ✓ Restart records are logged into the system and monitored through network management statistics.
  - ✓ If the action is ineffective, an alarm is generated to notify maintenance personnel.

Solution implementation

Evidence：

- ■ Software Fault Prediction and Automatic Recovery
  - ✓ When the system detects a software fault in the base station, the platform automatically executes recovery operations to restore service.
  - ✓ The platform integrates autonomous recovery mechanisms and daily operational tasks, providing automatic recovery verification to ensure recovery effectiveness.
  - ✓ Average recovery success rate exceeds 95%, effectively improving system stability and operational efficiency.
- ■ Execution and Result Verification
  - ✓ Recovery records and system-generated reports are provided for query and validation purposes.

Automated Monitoring and Statistics



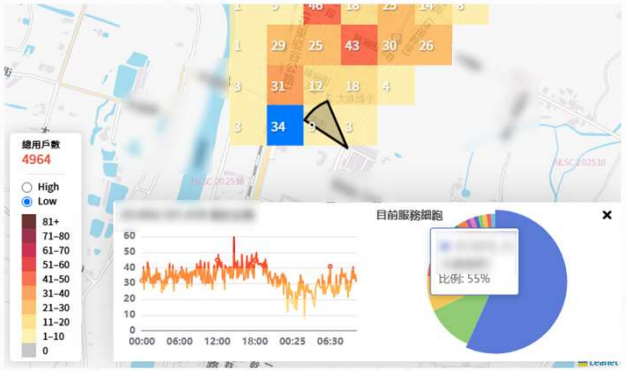
Vendor	BaseID	Predict_Time	Reboot_Time	Ticket_ID	Restarted_Status	Restarted_Time	Alarm_FM_Content	Alarm_FM_Content	InsertTime
		2025-09-29 14:00:01.020	2025-09-30 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-30 16:20:07.657
		2025-09-29 14:00:01.020	2025-09-30 03:00:00.000	NULL	Y	2025-09-30 03:03:53.353	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-30 16:20:06.107
		2025-09-29 14:00:01.020	2025-09-30 03:00:00.000	NULL	Y	2025-09-30 03:04:00.153	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-30 16:20:06.107
		2025-09-29 14:00:01.020	2025-09-30 03:00:00.000	NULL	Y	2025-09-30 03:04:30.460	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-30 16:20:06.107
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-29 16:20:05.833
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	Y	2025-09-29 03:04:28.987	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-29 16:20:05.833
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	Y	2025-09-29 03:04:31.833	NULL	4G細胞服務異常_4G UL RSSI (Ericsson) 異常	2025-09-29 16:20:05.833
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	Y	2025-09-29 03:04:31.487	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-29 16:20:05.833
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-29 16:20:05.833
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-29 16:20:08.053
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常	2025-09-29 16:20:08.053
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常	2025-09-29 16:20:08.053
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-29 16:20:08.053
		2025-09-28 14:00:00.830	2025-09-29 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常	2025-09-29 16:20:08.053
		2025-09-27 14:00:01.643	2025-09-28 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常	2025-09-28 16:20:07.570
		2025-09-27 14:00:01.643	2025-09-28 03:00:00.000	NULL	N	NULL	NULL	4G細胞服務異常_4G UL RSSI (Nokia) 異常	2025-09-28 16:20:07.570
		2025-09-26 14:00:01.867	2025-09-27 03:00:00.000	NULL	N	NULL	VSWR Over Threshold	4G細胞服務異常_4G RRC Conn Fail異常	2025-09-27 16:20:05.443

Software Fault Prediction and Auto Recovery Records

Solution implementation

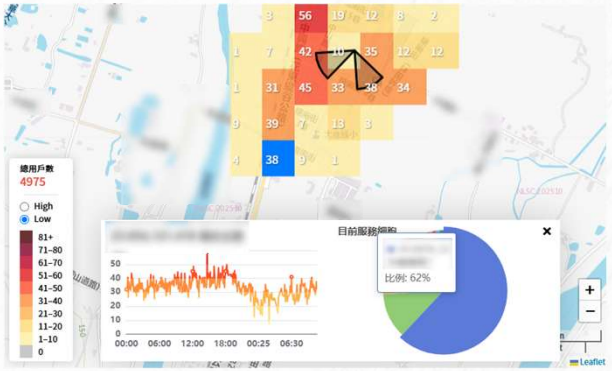
Evidence：

- Regionalized Fault Execution Strategy
  - ✓ The diagram marks different network service grids with numbered areas (such as 19, 20, 3, 5). The system has identified base station alarm hotspots and activated a regionalized solution execution mechanism. This geographically distributed execution strategy helps improve fault handling efficiency and accuracy, meeting the requirements of “Solution Implementation” in autonomous networks.
- Real-Time Trend Monitoring and Execution Trigger
  - ✓ The line chart at the bottom right shows real-time data for cells, indicating that the system continuously monitors network performance indicators and automatically triggers fault-handling processes based on abnormal trends. This real-time monitoring and automatic execution capability is a key feature of the “Execution” stage in autonomy level.
- Multi-Carrier Automatic Switching Mechanism
  - ✓ In the architecture where base stations support multi-carrier capability, the system automatically evaluates the health status and load conditions of service cells for each carrier when detecting RAN alarms. It dynamically switches to an available service cell with better quality.



Serving Cell: [redacted] 55%)

RAN Alarm Rising



Serving Cell: [redacted] 62%)

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Chunghwa Telecom


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THANK YOU