

ZTE Autonomous Evolving Network

AIVO Digital Operation Solution White Paper



Contents

<i>Industry Development and Challenges</i>	<i>03</i>
Big data and AI are key elements to the value development of 5G networks	03
Requirements for operators to build a 5G value operation system	04
Operators requirements for high-efficiency 5G network construction	04
Operators requirements for intelligent O&M development	05
Operators requirements for ToB service development	05

<i>ZTE AIVO Digital Operation Solution</i>	<i>06</i>
AIVO solution objectives and vision	06
AIVO achieves intelligent insight and value operation	08
AIVO improves the end-to-end digital operation capability by three big integrations	09
The integration of big data and AI	10
The integration of SOC and NOC	11
The integration of network and service	11

<i>Intelligent Hierarchical Evolution</i>	<i>13</i>
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<i>Typical Application Scenarios</i>	<i>16</i>
Scenario 1: Integrated O&M	16
Scenario 2: 4G/5G coordinated planning and construction	19
Scenario 3: Intelligent optimization of the wireless network	21
Scenario 4: Smart maintenance	22
Scenario 5: 5G new operation	24

<i>Conclusion: Next-generation intelligent operation system</i>	<i>25</i>
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<i>Abbreviations and Acronyms</i>	<i>26</i>
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Industry Development and Challenges



Big data and AI are key elements to the value development of 5G networks

At present, the communications industry has witnessed a brand-new decade, with 4G traffic explosion and accelerated 5G deployment. According to the GSMA forecast, the investment of global operators in the 5G network will reach US \$900 billion in the next six years, and the number of 5G network users will reach 1.6 billion, bringing great social and economic value. Disruptive changes will take place in the technologies, networks, terminals, users and services.

For 5G networks, with the advent of ultra-dense networking of wireless networks, the evolution of the core network into full cloud, the expansion of services from ToC to the whole industry, and new forms of terminals, the entire system becomes increasingly huge and complicated. Its network management and service operation difficulty exceeds the manual processing capability, and telecom operators are facing unprecedented challenges in the 5G digital era.

Big data and AI technologies have become key elements to meet challenges and support the development of 5G network values. Against the background of burgeoning traffic and endless services, the big data technology achieves the integrated analysis and sharing of massive data, which becomes the basis of the mining of 5G network value and the integration of network and industry value. The AI technology provides brand-new capabilities for 5G network operation through forward-looking prediction, high-complexity analysis, and optimal exploration, helping operators to match the best resources, improve operation efficiency, and achieve cost saving.

Requirements for operators to build a 5G value operation system

With the development of 5G networks, operators support the services of various department internally and serve the development of various industries externally. However, the traditional chimney-type system splits information, and the processes in each field are managed separately, which cannot meet the requirements of operators for the integrated development of network planning, construction, maintenance, optimization, and operation, and open industrial cooperation. Therefore, operators need to build an open and sharing intelligent big data system, thus end-to-end data connection, flexible service orchestration and capability openness can be achieved, and an intelligent, agile, shared and open 5G network value operation system can be built.

Operators requirements for high-efficiency 5G network construction

High frequency bands are used in 5G networks and the density of base stations is high, which results in a sharp increase in the number of base stations. At the initial stage of 5G network construction, the investment scale will be 2~3 times of that of 4G. Operators will face the challenge of 5G network construction with high quality and low cost. The challenges include:

- There are many application scenarios and different service and experience standards in each scenario, so a single network construction standard cannot be adopted.
- The network construction needs to be planned in different modes oriented to ToC and ToB.
- 4G/5G coordination needs to be made in 5G network construction.
- 5G ultra-dense networking and user-level precise forming bring higher precision requirement to network planning and forecast.

In the face of these challenges, operators need to implement cooperative planning and multi-scenario planning of 4G/5G network based on the big data analysis method, and use AI technology to implement intelligent capacity prediction and MM parameter intelligent planning, so as to achieve on-demand, agile and accurate intelligent planning and construction of 5G network.

Operators requirements for intelligent O&M development

With the introduction of new technologies such as NFV, slicing, micro service and MEC, and the coexistence of the NSA/SA network architecture and the requirements for the coordinated development of the 4G/5G network, network O&M and optimization become more difficult. Therefore, automation and intelligence are indispensable means.

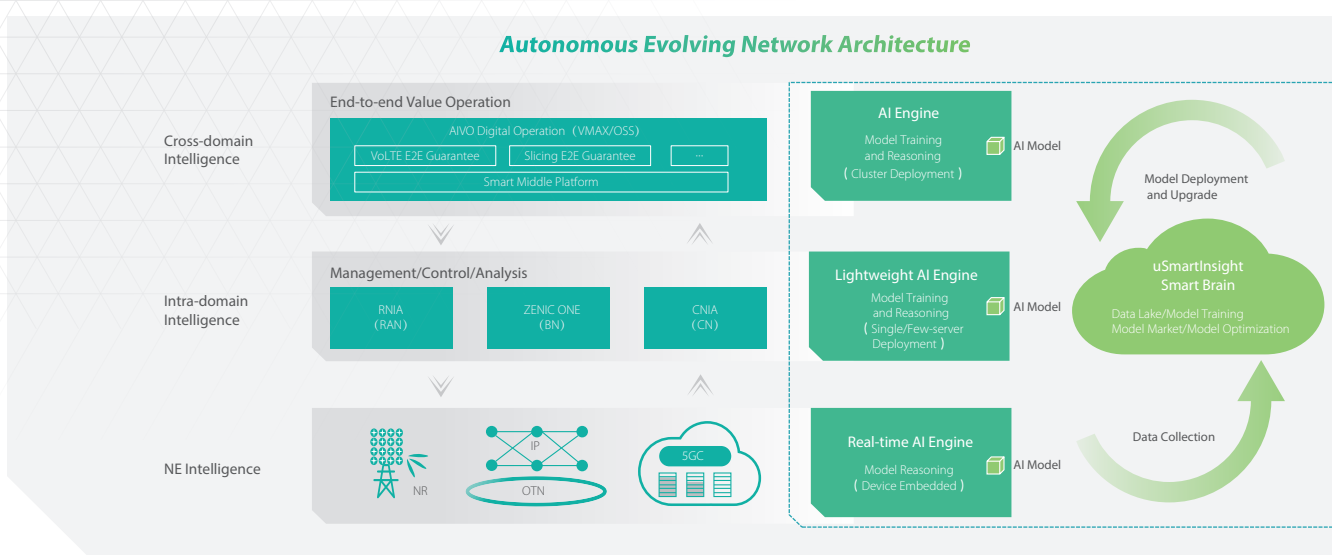
After the 5G core network is virtualized, it has the characteristics of hierarchical decoupling and dramatic increase of device nodes. It is difficult to locate various problems, such as performance, alarms, and perception. It is difficult to meet the SLA requirements of the network through manual operations. Network operation and maintenance requires the end-to-end intelligent analysis capability across horizontal and vertical domains, and provides intelligent fault prediction, root cause analysis, and alarm compression, thus improving the operation and maintenance efficiency. Similarly, 4G/5G collaborative optimization, slice optimization control, and MM optimization also face the challenges of numerous parameters and complex collaboration, which requires dynamic adjustment and automatic optimization of parameters and resources based on intelligent methods

Operators requirements for ToB service development

The 5G network provides the eMBB, URLLC and mMTC scenario capabilities, which provide a better basis for the development of ToB service. Operators are also paying more attention to vertical industries and promoting the transition from ToC service to ToC and ToB service at the same time.

In the ToB scenario, facing the diversified requirements of the Internet of Vehicles, Smart Park, Smart Factory and Smart Healthcare, operators use slicing technology to meet the SLA requirements of different scenarios. For the slicing design, deployment, quality monitoring, assurance and optimization, big data and AI technologies are used to build an automatic slicing management, analysis and assurance system and realize rapid deployment, real-time monitoring, smart analysis and automatic optimization. In this way, the rapid innovative development of ToB services can be guaranteed.

ZTE AIVO Digital Operation Solution



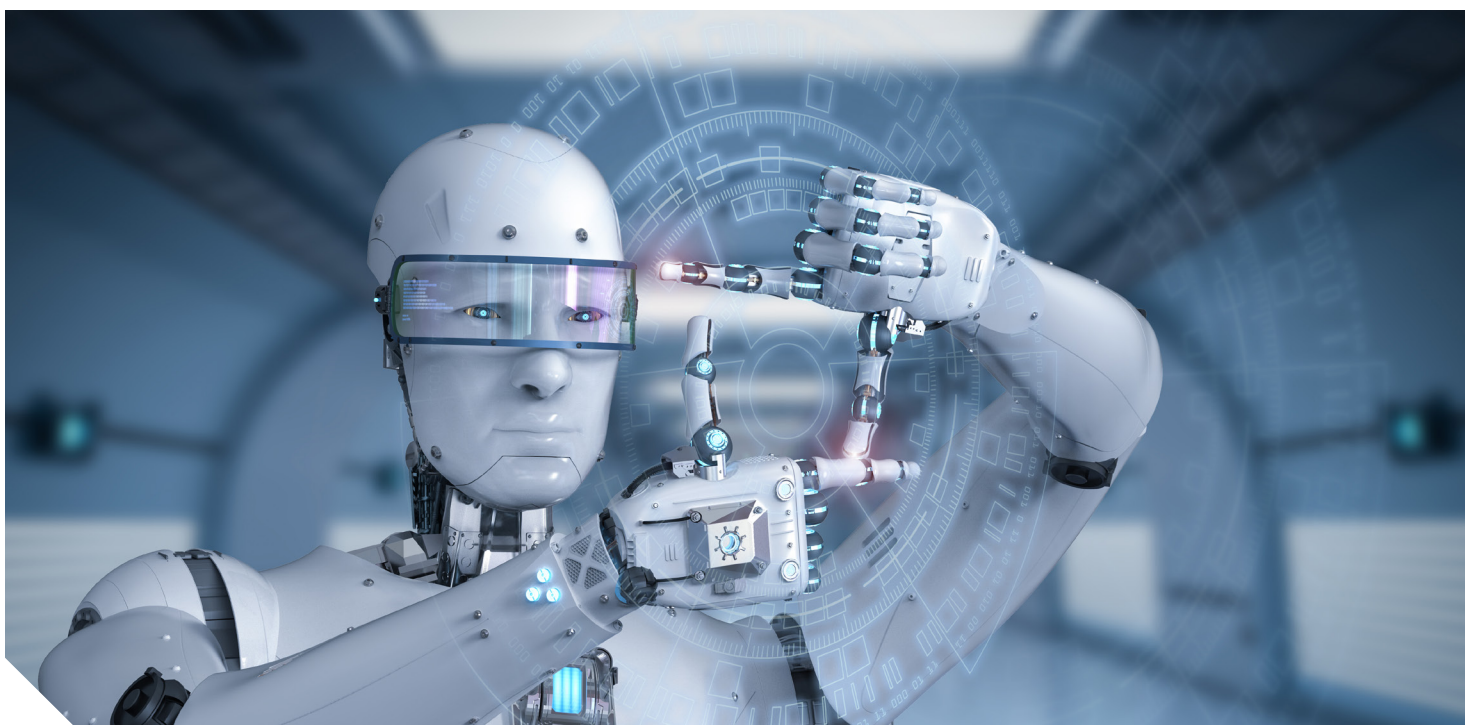
AIVO solution objectives and vision

Facing the above-mentioned industrial development and challenges, ZTE has been making continuous efforts in the field of network intelligence. Based on the white paper "AI Enables Network Intelligence" released in 2017, the white paper of "5G Network Intelligence" was released in 2018, proposing 5G network deployment as a breakthrough point for combining AI and 5G. In 2019, ZTE proposed the "Autonomous Evolving Network" solution for promoting the intelligence of the entire 5G network and empowering networks to evolve in an all-round manner in the ubiquitous AI manner. In 2020, ZTE will enrich the connotation of "Autonomous Evolving Network (uSmartNet)", and implement evolution of uSmartNet in a deep way around ten valuable scenarios.



ZTE's Autonomous Evolving Network solution uses the principle of hierarchical closed loop to build an NE-level, single-domain, and cross-domain intelligent network system. Through a smart brain and three types of smart engines, on-demand AI capabilities are implanted into the NE layer, management and control layer, and operation layer to build autonomous evolving networks with evolved capabilities level by level and continuously overlapped values. AIVO solution is to build an end-to-end value operation system and realize the AI capability of the operation layer to support the cross-domain intelligence. It corresponds to the end-to-end digital operation scenario in the ten major value scenarios of autonomous evolving network. Its goal is to flexibly meet the growing operation requirements of users, maximize the operation value, and support the continuous evolution of intelligent operation. By integrating the big data and AI technologies into the operation system, AIVO makes the originally huge and complex operation system flexible and efficient, thus improving the operation efficiency of the operator's planning, construction, maintenance, optimization and operation fields, and providing customizable and differentiated services as needed.

In the future, with the development of communication networks towards 5G and higher-order networks, AIVO will achieve all-round coordination and on-demand investment in network planning, AI decision-making and automatic closed-loop for network optimization and maintenance, and open sharing and integration into various industries of network operation. In this way, digital operation will be fully integrated, open, intelligent and self-governing.

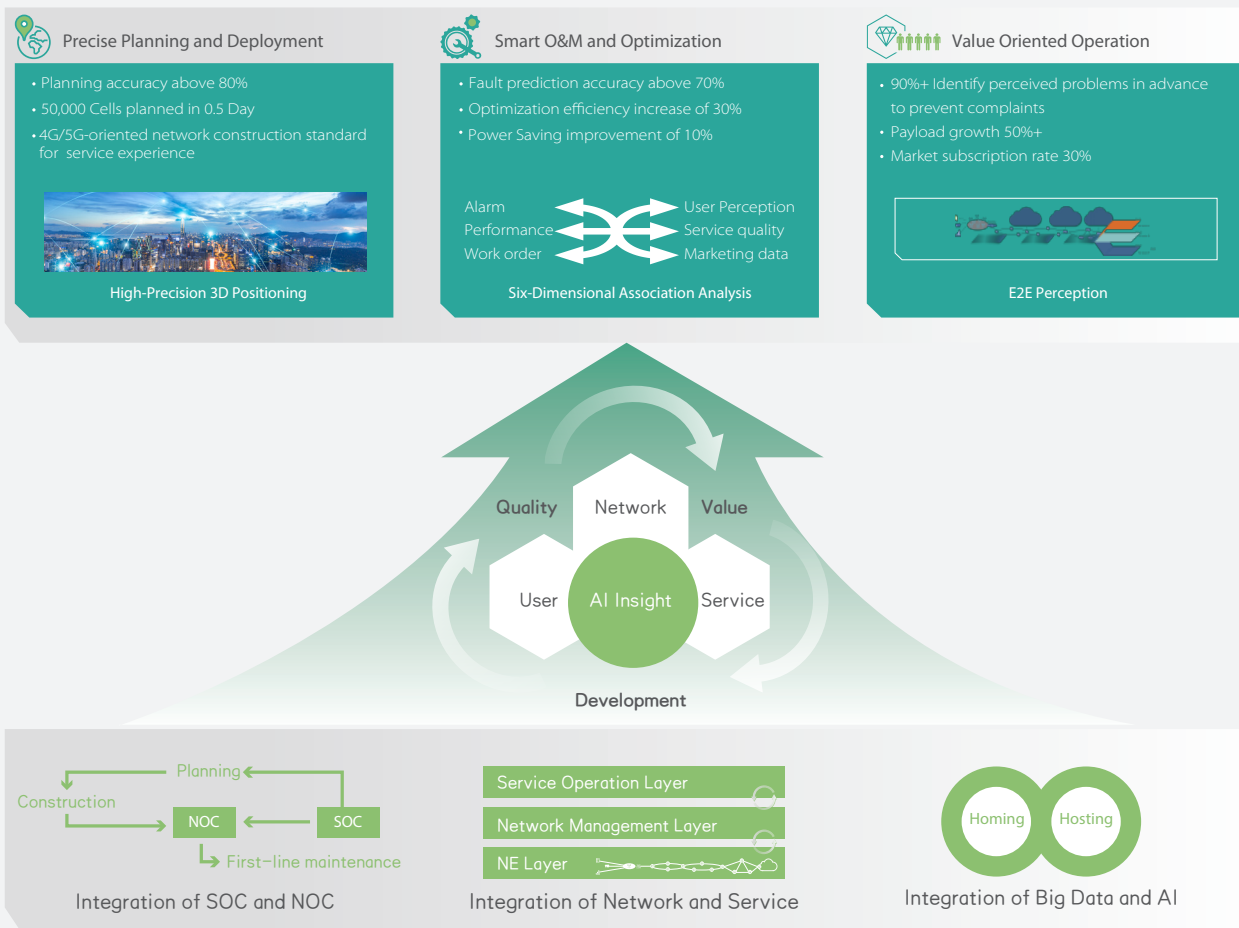


AIVO achieves intelligent insight and value operation

AIVO means intelligent insight and value operation. Intelligent insight makes a three-dimensional insight into the network, service and users, in terms of quality, value, and development. At the network level, AIVO can automatically perceive poor quality NEs, cells with poor quality and valuable areas, and intelligently predict the network capacity and performance. At the service level, AIVO can report the status of 2G/3G/4G/5G voice service and various data services in real time, and implement quality insight into voice and video services through second-level slicing. At the user level, AIVO builds an intelligent perception evaluation system for each service per user to implement accurate evaluation of user experience and perceive high-value customers' behaviors and preferences based on user profiles.

Value operation is to realize full-service support and integrated management of operators' network planning, construction, optimization, maintenance and operation, and continuously create value for operators in precise planning/construction, intelligent O&M, and value operation applications.

Panorama of AIVO Solution



Precise planning and construction

The 4G/5G collaborative precise planning can provide capacity expansion and construction solutions through intelligent network prediction, scenario-based site selection and value sorting making full use of existing network and environment information. In addition, different services and user experience under the scenarios of large traffic, low latency and large connections are considered, and different planning and network construction standards are adopted.

Intelligent O&M

Intelligent and automatic O&M is provided to improve the O&M efficiency under complicated networking conditions. It includes automatic coverage and capacity optimization, 4G/5G coordination performance optimization, intelligent fault prediction and troubleshooting efficiency improvement, and intelligent power saving optimization.

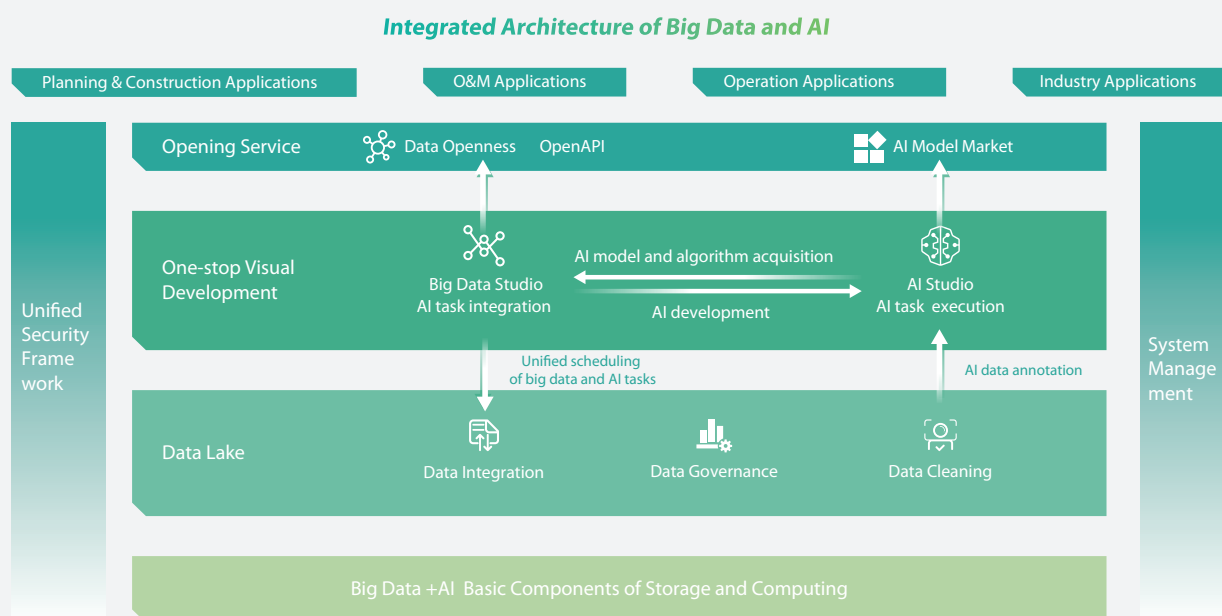
Value operation

In terms of ToC operation, AIVO guarantees the whole domain voice, HD video, VR/AR and other new services for valuable users, and implements precise commissioning of 5G services. Precise positioning and big data profile technology are used for precise marketing to support traffic improvement and user development. In terms of ToB operation, the MEC and slicing technologies are used to provide each customer with a dedicated visual solution, satisfying the vertical service SLA guarantee in different scenarios. By establishing the corresponding KPI system and service SLA for different slices, and performing end-to-end analysis for the slices, it provides self-service platform and guarantee capability for the O&M of the industry slice, and supports the development of the ToB service.

AIVO improves the end-to-end digital operation capability by three big integrations

Based on the integration architecture of the big data platform and AI platform, AIVO can improve the automation, intelligence and end-to-end capability, support the full service process between the NOC and the SOC, which achieves the cross-layer connection of network and service, the opening of data and capability, and really builds an end-to-end digital operation support system of "integration and opening, act on demand". It has the features of architecture integration, the whole process integration covering planning, construction, maintenance, optimization and operation, and network and service integration.

The integration of Big Data and AI



AIVO builds an integrated system based on a unified platform of big data and AI to form a unified data interface and AI exploration interface. The integration of big data and AI is reflected in the following aspects:

Visual development integration: It provides one-stop visual services of big data development and AI development including visual data development, visual interface development, interactive report analysis, interactive report development and AI model training, etc.

Data processing integration: The data lake provides data standards and data set service capabilities for AI scenarios. Based on the data governance and management capability of the data lake, high-quality data can be obtained and automatic AI data annotation can be implemented to seamlessly interconnect with the AI scenario for data preparation.

Task scheduling integration: Implement unified scheduling and resource management for AI reasoning tasks and general big data tasks to fully support various application scenarios.

Therefore, the AIVO solution has the unified data lake and AI capability, and is open to the outside through the OpenAPI mode. It is capable of rapid customization development and intelligent data service.

The integration of SOC and NOC

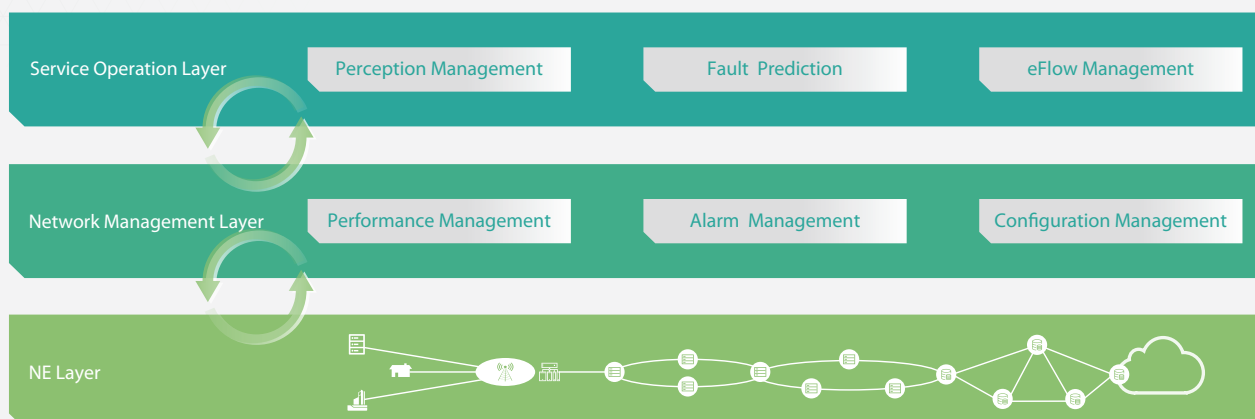
The AIVO solution can help the operator to complete the whole service process, and interconnect SOC with NOC through data sharing and work order and realize the automatic transfer of the whole service, which help the operator move towards higher-order automation level.

We call this automation "two-wheel drivers". On the one hand, our system can be interconnected with the operator's NM and network optimization system, centralized complaint processing platform and B-domain system. The network operation and maintenance is drove by the operator market, network development strategy and complaint optimization requirements, which is called "external driver". On the other hand, through the quasi-real-time insight into network, user and service based on the AIVO operation system, we actively identify problems and requirements, drive fault recovery and network optimization and construction, which is called "internal driver".

The integration of network and service

AIVO also achieves in-depth integration of network and service. By the interconnection between network and service, it achieves interconnection of NE layer, management and control layer and operation layer, bringing benefits to operators in terms of "unified view, active O&M, service closed loop and whole domain perception".

In-depth Integration of Network and Service



Unified view

Provides a unified management view of work orders, perception, alarms, and performance. It allows users to implement visual management by subscribing to large screens.

Active operation and maintenance

By relying on the cross-domain data analysis technology of associated perception data, performance data and internal EMS alarms, fault prediction can be implemented based on big data and AI technology. It can solve the traditional fault prediction bottleneck, manage the work order based on the fault prediction result, and thus dispatches preventive maintenance work orders accurately.

Service closed loop

Innovative SOC alarm and SOC work order can help the operator realize closed loop of service perception and network faults.

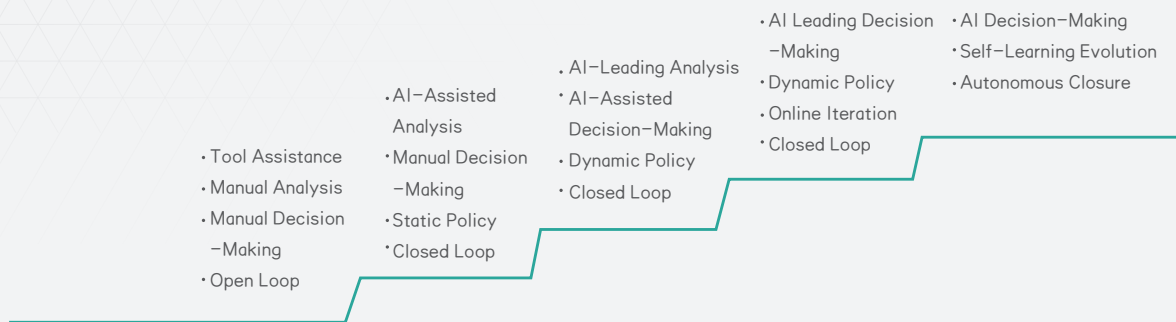
Whole-domain perception

It supports the whole-domain associated delimiting of "user/terminal-wireless network-bearing network-core network-SP". On the basis of end-to-end delimiting of wireless and core network, it implements delimiting of bearing network problems and determines the impact of bearer route connectivity indicators on services. It also supports high-precision problem location, and can associate the alarm, MR and performance data to analyze the root causes of the most complex and fluctuating wireless problems.



Intelligent Hierarchical Evolution

Hierarchical and Staged Evolution of Autonomous Evolving Network and AIVO



	L1 Auxiliary operation	L2 Primary intelligence	L3 Intermediate intelligence	L4 Advanced intelligence	L5 Full intelligence
Implement	 • Automatic implementation of the single-domain tool	 • In single service of planning, construction, O&M, and optimization, EZE tools automatically implement	 • Integration of all services in planning, construction, O&M, and optimization • NOC-SOC automatic transfer closed loop	 • Integration of all services in planning, construction, O&M, and optimization • NOC-SOC automatic transfer closed loop	 • Integration of all services in planning, construction, O&M, and optimization • NOC-SOC automatic transfer closed loop
Data Collection	 • Single-domain data collection of radio and CN	 • In single service of planning, construction, O&M, and optimization, cross-domain data collection of radio and CN	 • Automatic data collection, governance, and modeling in the O, M, and B domains data	 • Automatic data collection, governance, and modeling in the O, M, and B domains data	 • Automatic data collection, governance, and modeling in the O, M, and B domains data
Analysis	 • Radio and CN single-domain Analysis	 • In single service of planning, construction, O&M, and optimization, cross-domain EZE analysis of radio and CN	 • Cross services of planning, construction, O&M, and optimization • AI-assisted analysis	 • Cross services of planning, construction, O&M, and optimization • Online iterative optimization	 • Cross services of planning, construction, O&M, and optimization • Online iterative optimization
Decision	 • Manual decision-making of single service for planning, construction, O&M, and optimization	 • In single service of planning, construction, O&M, and optimization, manual-assisted decision-making	 • Unified operation sand table for planning, construction, O&M, and optimization • AI-assisted dynamic decision-making	 • Intelligent and dynamic decision-making for planning, construction, O&M, and optimization	 • AI decision-making • Autonomous loop closure
Requirement Mapping	 • Manual requirement mapping of single service for planning, construction, O&M, and optimization Preset tool task	 • In single service of planning, construction, O&M, and optimization, manual-assisted requirement mapping	 • Cross services of planning, construction, O&M, and optimization, problem/requirement driving process (external driver)	 • Intelligent insight into network and service requirements/problems, and driving task flow (internal driver)	 • Intention insight, self-planning, self-optimization, self-healing, and automatic service distribution

The intelligent evolution of 5G networks will be a long-term process, which is based on the operator's network status, cloud transformation progress, 5G&IoT technology maturity, and operator network evolution strategies to be implemented step by step. From the perspective of division of responsibilities and coordination between human and artificial intelligence and gradual emancipation of human, the ZTE uSmartNet autonomous evolving network solution divides the network-intelligence process into five stages: L1 auxiliary operation, L2 primary intelligence, L3 intermediate intelligence, L4 advanced intelligence and L5 full intelligence.

The AIVO solution follows the ZTE uSmartNet intelligent strategy and matches the five-phase evolution. It will gradually evolve from the independent deployment of single-domain and single-service tools of L1 to the whole-domain and intelligent operation system of integrated network planning, construction, optimization, maintenance and operation of L5, which ultimately achieves the vision of intelligent self-management and help operators achieve digital operation transformation. L1 is mainly depended on human participation, while L5 is driven by intention insight and independent decision-making, self-planning, self-optimization and self-healing. The intelligent features of each phase are as follows:

- L1** In this phase, manual assistance is required for requirement mapping, identifying the requirements for planning, construction, maintenance, operation and optimization, starting the tool task, implementing the network, user, service insight and outputting the planning and construction scheme, maintenance and optimization suggestion, service quality and perception problem's demarcation and locating result and marketing recommendation. The intelligence is mainly reflected in the implementation, single-domain data collection and service intelligent identification. All scenarios of planning, construction, maintenance, optimization and operation are supported by intelligent tools. For example, VMAX-R, which is wireless planning and optimization tool system, and VMAX-S, which is core network signaling monitoring system, are independently deployed for single-domain O&M in the wireless or core network.
- L2** In this phase, primary intelligence is implemented, including intelligent execution and single service flow's data collection, intelligent identification, association, and analysis. Within single service flow of planning, construction, maintenance, optimization and operation, wireless and core network data is automatically collected and associated for analysis to improve the precision of demarcation and locating. For example, automatic complaint processing can be implemented by interconnecting with the operator's centralized complaint processing platform to demarcate root cause of terminal, wireless, bearer, core network and SP. Automatic root cause analysis can be performed for wireless problems to help the operator intelligently dispatch work orders, interconnecting with the OSS - eFlow O&M processing system, and the O&M engineers receive work orders through the mobile APP to improve the work order processing efficiency.

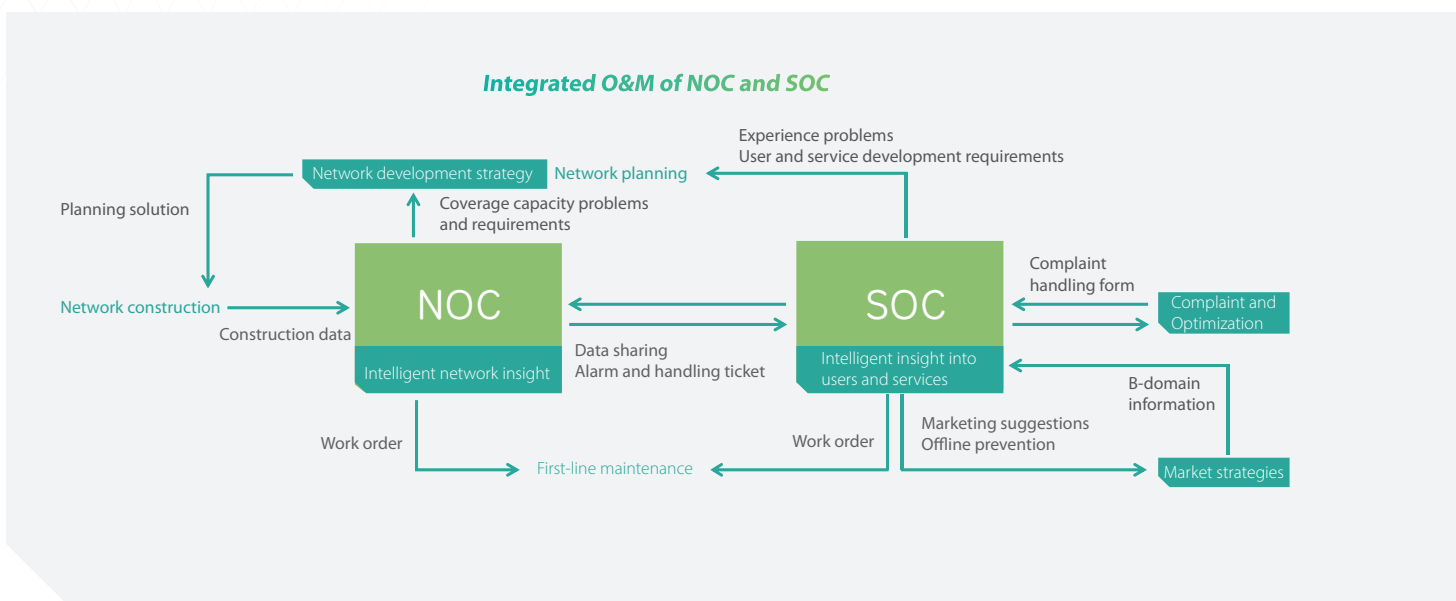
- L3** In this phase, intermediate intelligence is achieved, including end-to-end data collection, intelligent identification, association analysis and execution across service streams. Intelligent decision-making analysis can be assisted by a unified operation sand table integrating planning, construction, maintenance, optimization and operation where problems are solved through O&M or planning, then the best balance between costs and benefits is achieved. At this stage, the NOC, which is network operation center, and SOC, which is service operation center, are interconnected to solve problems and meet requirements in higher automation level according to the demarcation and locating results, cost priorities, and operator policies.
- L4** In this phase, advanced intelligence is achieved. The difference from the previous phase lies in AI-led decision-making, dynamic policy, and closed-loop online iterative optimization. In the previous phase, manual force is required in requirement mapping. External driving events such as planning and construction projects, complaint handling, and operation requirements is manual triggering processes. In this phase, unified all-domain data lakes are implemented, real-time intelligent insight is implemented, problems and requirements are discovered in advance, and planning, construction, maintenance, operation and optimization processes are independently triggered, which is internal driving. In some scenarios, manual participation in requirement mapping and auxiliary decision-making reviews and determines the problems and requirements identified by intelligent insight.
- L5** Fully unmanned data perception, analysis, decision-making, and closed-loop management are achieved in all scenarios. In this phase, AI-based independent learning and decision-making can avoid manual participation in requirement mapping, decision-making assistance, and decision-making confirmation in the previous phase.



Typical Application Scenarios

Scenario 1: Integrated O&M

The AIVO solution can provide SOC and NOC integrated O&M solution to help the operator achieve the integration of planning, construction, maintenance, operation and optimization, high-order automation, and meet the six core requirements of digital transformation through one system:



Unified view

It provides a SOC&NOC O&M sand table, a unified operation entrance, and a CXO overall view. Oriented to management, it brings about the integrated network view and service view, realizing full, multi-dimension and real-time data observation.

User/service/region perception analysis and service problem E2E automatic processing

It provides quality analysis and multi-dimension perception insight of mainstream services and applications such as web page, video and game, and assists operators in VIP guarantee to focus on high-value users. Automatic service problem handling provides four end-to-end capabilities: End-to-end user automatic complaint handling, active identification and end-to-end analysis of poor-perception users, active identification and end-to-end optimization of poor-perception cells, intelligent association analysis of service problems and network problems.

Automatic handling of network problems

Alarm compression and automatic association analysis, automatic generation and distribution of work orders, automatic routing inspection and performance management, automatic work order transfer, rapid and accurate fault location, and monitoring the service impact caused by network faults in real time.

AI-based intelligent O&M

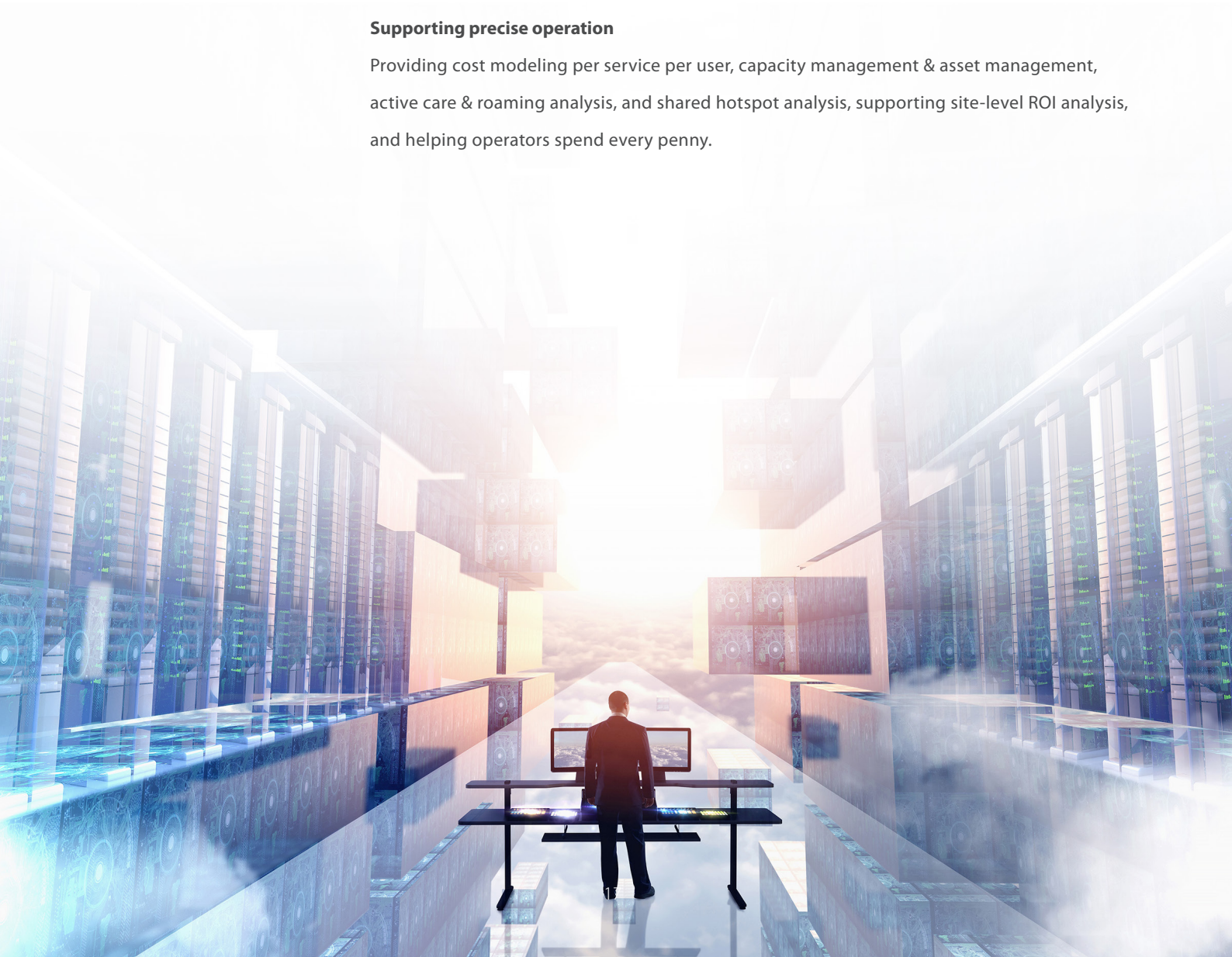
AI-based O&M applications that enable intelligent RCA, potential risk prediction, capacity prediction, intelligent scheduling, and intelligent service management and control.

Precise planning of one case for one network

Based on the capacity management model of multi-source data and AI, the service development can be predicted.

Supporting precise operation

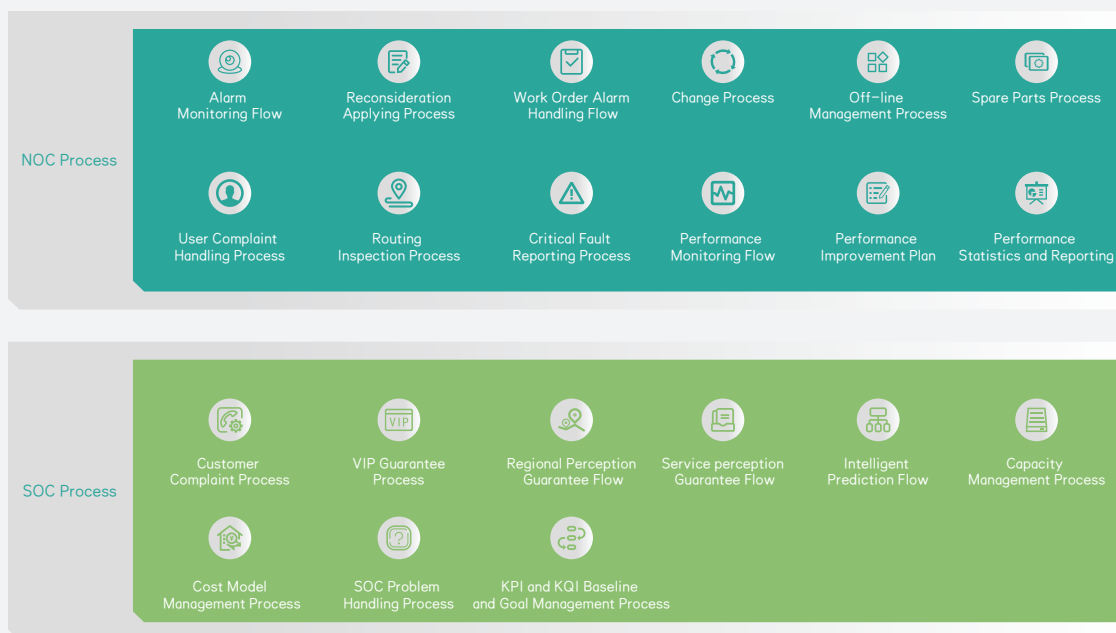
Providing cost modeling per service per user, capacity management & asset management, active care & roaming analysis, and shared hotspot analysis, supporting site-level ROI analysis, and helping operators spend every penny.



In the practice of integrated O&M in overseas cases, 12 NOC processes are interconnected with 9 processes of SOC system, realizing automatic closed loop. This helps operators save a lot of manual cross-process interconnection analysis and supervision manpower, thus improving the closed loop efficiency.

Integrated O&M helps operators achieve digital O&M transformation and automatic & intelligent O&M across domains, networks and vendors, which can obviously improve efficiency and save manpower costs. Take the guarantee of VIP users in the SOC service flow as an example, the deterioration of KPI/KQI indicators of VIP users can be monitored in real time. When the indicator degradation exceeds the threshold, an alarm will be triggered automatically. The alarm compression and dispatch order will be intelligently performed, and the OSS-eFlow O&M processing system will be interconnected. The O&M engineers will take over the order through the mobile APP and automatically supervise the whole processes. In the existing network practice, the AIVO integrated O&M solution efficiently manages hundreds of off-line engineers to implement task assignment, process monitoring and fault closed-loop analysis. Taking the complaint handling in the SOC service process as an example, the user complaint's root causes are manually located by queried according to the user number and complaint content in traditional method and the expert's manpower is required, but the time and locating accuracy can't be guaranteed. The automatic demarcation and locating process shortens the analysis time to 15 minutes and is more accurate.

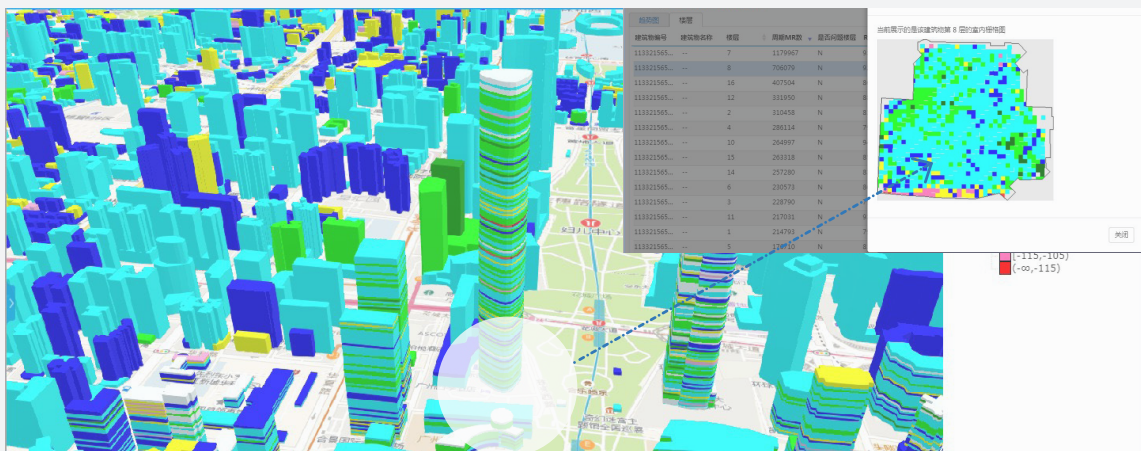
Process Integration of NOC and SOC



Scenario 2: 4G/5G coordinated planning and construction

Operators have invested a large amount of CAPEX and OPEX in 4G network. 5G network will be adopted the mode of collaboration with 4G and hierarchical networking. The AIVO solution helps operators maximize the existing network value according to the value scenarios.

3D Precision Evaluation and Intelligent Planning



In the early stage of 5G network construction, due to lack of reference data, the AIVO precise planning solution can precisely match 5G network planning with service requirements based on 4G network and environment information, so as to ensure optimal investment cost, which is "5G planning based on 4G live data." This solution uses many technical measures to ensure that the planning results comply with the planning principle of "optimal cost and maximum value".

- Automatic value clustering:** Value clustering can be implemented based on traffic, value users, video experience, and other methods. In the 4G era, value scenarios are mainly judged by traffic. In addition to MBB/eMBB large traffic scenarios, 5G value scenarios will be judged by vertical industry distribution and building & road & park types to find new value highlands and focus on investment. For the determined scenarios, set up service requirement modeling and scenario-based network construction standards to help operators balance investment and profits.

- 2 Multi-product coordination:** The costs of different products vary greatly. The macro base station, micro base station, indoor base station and Massive MIMO can be planned together to match the scenario accurately and ensure that the investment and construction meet the scenario requirements and standards.

Take the capacity solution as an example. The low-cost solution is preferentially adopted with coordination planning such as load balancing, sector splitting, carrier addition, site reuse and new construction.

- 3 Intelligent AI prediction:** AI improves the prediction accuracy and supports precise planning. AI is applied in machine learning-based coverage pre-evaluation, intelligent prediction of future hotspots, traffic suppression judgment, and 5G coverage prediction based on 4G MR and the differences in 4G and 5G coverage features.

- 4 Multi-dimension priority:** The planning result can be prioritized based on the problem severity, problem solving rate, costs (reusing or not), scenario value, competition and so on to ensure that the investment priority is the most reasonable. It can also set customized dimensions to match the operator's planning policy.

- 5 Perfect parameter planning scheme:** The optimal weight of Massive MIMO is designed based on 3D building shape and traffic characteristics to maximize the coverage capacity gain at the same construction cost.

- 6 Redundancy check:** topology check and redundant cell filtering shall be performed after planning to avoid coverage problems and ensure that the gain is optimal and no redundancy is wasted.

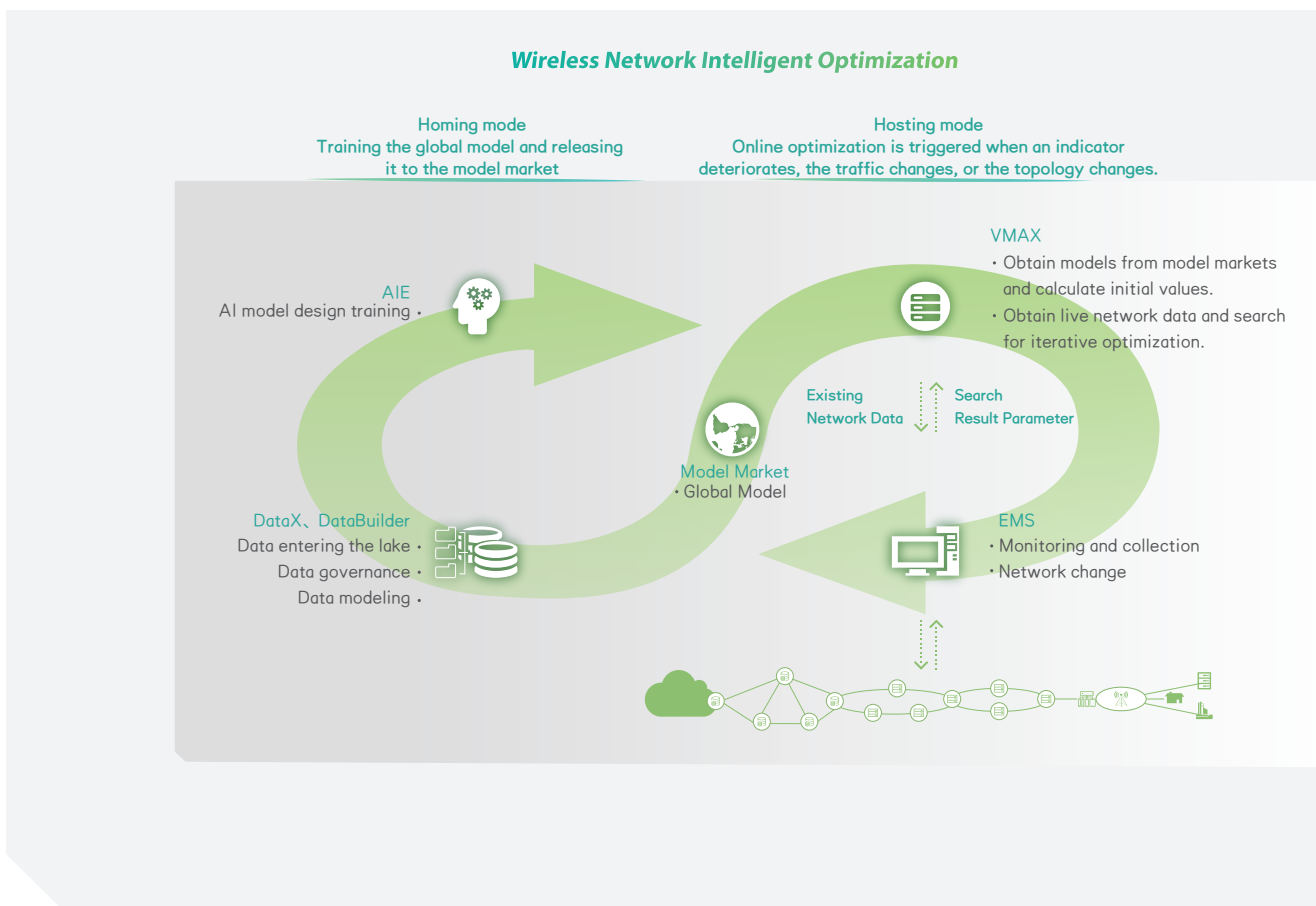
Currently, AIVO planning tool can output a complete solution for the 50 thousand cells' network within half day, including the planning result, weight parameter design result and prediction result. It supports fast adjustment, and can be interconnected with the construction tool to implement agile online delivery.

Scenario 3: Intelligent optimization of the wireless network

The implementation tool of the AIVO solution is the VMAX big data platform and service. At present, VMAX has become an integrated architecture with Network Management System and AIE intelligent platform to form the wireless AI Dev tool chain and unified data lake, which will realize the intelligent maintenance and optimization of the Homing + Hosting mode.

Monitoring and data collection are carried out for the existing network. Intelligent training and global model design are carried out through data collection, unified governance and modeling, and typical models are released to the model market. The on-site VMAX tool obtains models from the model market, and make iterative optimization based on the existing network data. Then parameters are delivered by NMS to change the network and closed loop is achieved.

This makes maintenance and optimization more intelligent, and triggers online optimization of the Hosting mode when network indicators deteriorate, traffic changes and topology changes. At the same time, the training and adjustment of the Homing mode enables the global model with better results to be continuously released to the model market and maximize the shared results. The multiple data lakes bring better data insight and high accuracy in prediction and analysis.



Examples of wireless network optimization applications

- 4G/5G wireless network performance coordination analysis uses intelligent analysis method and neural network machine learning algorithm to analyze the root cause of the cell and end-to-end signaling. 4G/5G configuration and parameters coordination check uses big data and AI to do cell configuration check, antenna feeder integration and RF parameter optimization.
- Massive MIMO weight parameter optimization: AIE releases the 4G/5G MM pattern's global model to the model market. VMAX performs online optimization based on the general model and NMS delivers changed parameters in real time.
- Network perception guarantee: construct an indicator system based on the users' camping rate, camping duration, and throughput to provide visualized key indicators of gird level and camping optimization suggestions to improve network perception.

Scenario 4: Smart Maintenance

Based on big data and AI technologies, this solution improves operators' efficiency, effectiveness, and benefits in terms of Network Elements' operation and maintenance.

Efficiency Improvement

Improve troubleshooting efficiency: 5G&NFV intelligent association of logs

Based on expert experience and big data analysis, the association among same domain & same equipment, same domain & different equipment, and different domain & different equipment is explored to discover and locate the fault events in the log dimension.

Improve fault location efficiency: KPI association

A fault often causes many abnormal KPIs. Based on big data and AI technologies, these related KPIs are associated into a group for detection to improve the location efficiency.

Fault Locating and Efficiency Improvement: Multi-Source Alarm Analysis

Through hop-by-hop route diagnosis, historical path playback, multi-source fault diagnosis, hierarchical cross-vendor fault handling and joint mechanism, the efficiency of fault root cause analysis is improved effectively.

Effectiveness Improvement

AI intelligent power saving, which means power saving strategy round-iteration in real time, can realize energy saving over 10%.

For traditional energy saving technologies, the start time and end time, which are fixed time period, for energy saving are configured in advance. When the load is reduced to a certain extent and lasts for a certain period, the corresponding energy saving technology is triggered. Once the load is relatively high, the corresponding energy saving technology is disabled. The energy saving period is manually set in accordance with most scenarios, and is not set in a personalized manner. In addition, low load can trigger energy saving only after a relatively long period of time, which avoids the ping-pong effect but also reduces the energy saving effect. It can be seen that traditional energy saving technologies are triggered after the event, and the overall strategy tends to be conservative.

By artificial intelligence-based power saving technology, a more accurate shutdown time window is provided to maximize energy saving efficiency without reducing network performance, which collects the NE-side data such as basic configuration information, performance statistics indicators, and cell measurement reports.

Benefit Improvement

Predict service risks and control in advance to reduce the handling costs.

Dynamic management of indicator thresholds

In the 5G era there are a huge number of indicators to be monitored. Based on big data and AI technology, AIVO establishes the corresponding data model according to the historical data, automatically constructs the threshold values, and then generates threshold-crossing events.

Business risk forecast

Based on intelligent association model of performance threshold and abnormal devices and combined with trend analysis, events are triggered before threshold crossing to perform multi-index association prediction and handling.



Scenario 5: 5G New Operation

5G service evolution can be divided into three phases:

Phase 1: Focus on popular 4G services and eMBB emerging services, such as HD video, cloud game and VR/AR.

Phase 2: The service requirements of URLLC and mMTC are increasing gradually, and the differentiated experience and SLA in vertical industries need to be guaranteed, such as smart parks, smart ocean and so on.

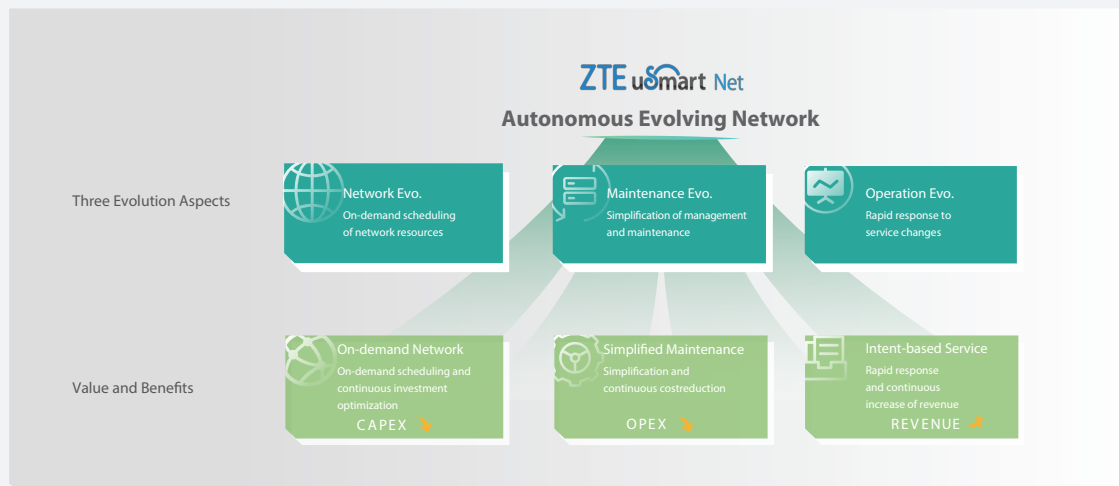
Phase 3: The maturity of URLLC and mMTC services requires the development of autonomous driving, smart home, industrial automation and ultra-large-scale IoT services.

Matching the above three phases, AIVO builds professional capabilities in probe collection, data platform, application analysis and so on, implementing end-to-end monitoring and intelligent slicing optimization to support the network and service operation of ToC/ToB and the expansion of industries such as industry, medicine, ocean, transportation and so on, and gradually integrate into many different kinds of industries.

Conclusion: Next-generation intelligent operation system

We are entering an intelligent era. Network intelligence is the only way of evolution of telecommunications networks. ZTE uSmartNet solution is committed to helping operators evolve from the current man-made mode to the network self-driven autonomous mode, so as to realize the disruptive change in the field of network operation and maintenance and better serve the digital transformation of the whole society. Autonomous evolving network (uSmartNet) is ZTE's solution towards future intelligent autonomous network. By introducing AI in different layers of the network, it promotes the continuous evolution in three aspects: Network, O&M and Operation.

Three Evolution Aspects of Autonomous Evolving Network



The AIVO digital operation solution in the uSmartNet intelligent strategy deeply integrates big data and AI technology with the telecom field, and is committed to providing complete data perception, intention insight and intelligent analysis capability for the telecom network. It helps the telecom operator to adapt to the trend, meet the challenge, construct the next-generation intelligent operation system, and build an intelligent future network to realize the self-governing vision: network self-learning, self-repairing and autonomous evolving to foresee the user and service, act on-demand and make unmanned smart operation.

Abbreviation	Full Spelling
AI	Artificial Intelligence
API	Application Programming Interface
AR	Augmented Reality
CEM	Customer Experience Management
eMBB	Enhanced Mobile Broad Band
EMS	Element Management System
IoT	Internet of Things
KPI	Key Performance Indicator
KQI	Key Quality Indicator
MEC	Mobile Edge Computing
MIMO	Multi-Input Multi-Output
mMTC	Massive Machine Type Communication
MR	Measurement Report
NFV	Network Function Virtualization
NOC	Network Operation Center
NSA	Non-standalone Network
OSS	Operation Support Systems
SA	Standalone Network
SLA	Service-Level Agreement
SOC	Service Operation Center
SP	Service Provider
SQM	Service Quality Management
URLLC	Ultra-Reliable and Low Latency Communication
VR	Virtual Reality

Leading 5G Innovations



The image features a light green grid pattern in the upper left corner. The title 'Leading 5G Innovations' is centered in a green, sans-serif font. Below the title, there are several abstract geometric shapes and lines in various shades of green and blue, including a large blue parallelogram, a green rectangle, and a blue rectangle, all with dashed outlines. To the right of the title, there are several horizontal lines of varying lengths and colors (green, blue) that resemble circuit traces, with small circles at their ends. At the bottom of the page, there are more circuit-like lines and circles in shades of green and blue, creating a sense of connectivity and technology.