Application of AI in Network Assurance and O&M

人工智能在網絡保障和運維中的應用

Interviewed by: Mr. Danny Li | 採訪者： 李友忠先生

Mr. Denny Deng
鄧水根先生

Chief Executive Officer
Huawei International Co. Limited

行政總裁
香港華為國際有限公司

The vision and mission of Huawei is to bring digital to every person, home, and organization, and build a fully connected, intelligent world. Building a fully connected, intelligent world is a process of helping various industries to implement digital transformation.

Mr. Denny Deng, CEO of Huawei International Co. & Limited, emphasizes the focus of Huawei's unceasing innovations is directed at the autonomous driving network (ADN), ubiquitous cloud services, pervasive AI, and low-carbon development benefiting from digital technologies.

AI-Native Evolution:
Empowering Autonomous Communication Networks
According to Deng, in the next decade, AI-native will be the core of network architecture. The control closed-loop and knowledge closed-loop based on network digital twins will drive communication networks to achieve full autonomy, thereby fundamentally solving the structural problems caused by a large network scale and high complexity.

Network communication is widely prevalent in our lives. People rely on mobile phones and smart devices almost all the time. As more smart devices such as smart cars and wearables access the network, their influence on people will increase sharply. The substantial transformation of human society depends on increasingly intelligent, reliable, and flexible communication networks. Therefore, communication networks are facing many challenges including large-scale and complex services, O&M, and connections. The best solution to these challenges is to deploy fully intelligent AN in order to simplify network O&M, improve network efficiency, implement network self-configuration, self-healing, and self optimization, and achieve network autonomy.

Navigating AN Evolution:
Disruptive Innovation vs. Iteration Pathways
Fully intelligent AN is an inevitable trend. To smoothly evolve to such an innovative network architecture, especially Level 5, evolution path selection is the key. There are two evolution paths: disruptive innovation and iteration.

Moreover, the evolution of the network architecture not only affects network architecture selection, but also changes the network O&M mode and transforms organizations and processes. The evolution of the network architecture and O&M mode will change O&M personnel's knowledge and work habits and promote the transformation of O&M personnel, organizations, and O&M processes.

Ultimately, Collaboration among industry organizations and alliances, including standards organizations, is critical to the development and large-scale application of AN.

Network Evolution Strategies:
Innovating Self-Development and Collaborative Cores
Disruptive innovation involves self-development with operations support system (OSS) as the core, whereas iteration involves the combination of self-development and collaboration with network applications and network infrastructure as the two cores.

Gradually establishing an intelligent domain O&M system based on architecture evolution. Transforming the O&M mode requires organizational transformation. A new O&M system should be gradually established from four aspects. Making breakthroughs in basic theories and key technologies through cross-disciplinary collaboration is also important. AN is also a new field that spans multiple disciplines, including communication science,

華為的願景和使命是把數字世界帶入每個人，每個家庭，每個組織，構建萬物互聯的智能世界。實現萬物互聯智能世界的過程，也是幫助各行各業實現數字化轉型目標的過程。

香港華為國際有限公司行政總裁鄧水根先生指出，華為不斷創新，讓網絡走向自動駕駛、讓雲服務無所不在、讓人工智能無所不及、以數字技術助力低碳發展是華為持續創新的方向。

智能原生：
未來網絡架構的核心與自治之路
鄧先生表示，未來十年，基於智能原生將是網絡架構的核心，通過基於網絡數字學生的控制閉環和知識閉環，驅動通訊網絡實現完全自治，從而根本上解決當前網絡規模和複雜性所帶來的結構性問題。

當前的網絡通訊已經滲透到人類生活的各個方面，通訊對人們日常生活的重要性和影響是巨大的，人們每天清晨醒來後的幾乎每一分鐘都會受到手機和智能設備的影響，與此同時伴隨著汽車、可穿戴設備等更多種類智能終端機接入網絡，這種影響也會隨之急劇增長。人類社會的這種實質性變革依賴於越來越智能、可靠、靈活的通訊網絡，這使得通訊網絡面臨著規模以及業務複雜、運維複雜、聯結複雜等多種複雜性並存的挑戰。通過建立全面智能的自智網絡，降低網絡的運維運營複雜度，提升網絡自身效能，使得網絡具備包括自配置、自修復、自優化等特性最終實現網絡的自治，是應對這種挑戰的最佳選擇。

引領自智網絡發展：
顛覆式創新和繼承式反覆運算
全面智能的自智網絡是網絡發展的必然趨勢，如何平滑順利地演進到這種創新的網絡架構，特別是 L5 級的自動駕駛網絡架構，演進路線的選擇是關鍵，這其中包括顛覆式創新和繼承式反覆運算兩種演進路線。其次，網絡架構的演進不僅帶來了網絡架構選型的變化，同時也帶來了網絡運維模式的改變，並進一步引起組織和流程的變革。自智網絡架構及運維模式的演進，會改變現有運維人員的知識結構和工作習慣，推動運維人員進行轉型，並促進組織和運維流程的變革。最後，包括標準組織在內的行業組織和聯盟之間的協同、合作，對自智網絡的發展同樣至關重要，也是自智網絡能否規模應用的關鍵。

網絡演進策略：
全新自研及核心合作
顛覆式創新演進路線意味著全新自研的以運營支撐系統（OSS）為核心的網絡架構變革，而繼承反覆運算式演進路線則以自研加合作的方式，逐步反覆運算來實現以網絡應用和網絡基礎設施為雙核心的架構變革。逐步推進智能化專業運維體系建設，運維模式的改變需要組織的變革進行支撐，應當逐步建立新的運維體系。跨學科合作，突破基礎理論和關鍵技術也是至關重要的一環。自智網絡同樣也是一個全新的跨學科領域，跨越通訊科學、計算機科學、控制理論、複雜系統等多個學科，需要學術界和工業界深度合作。

Revolutionizing Operations:
AI-Driven Efficiency and Seamless Integration

The telecom foundation model reshapes the telecommunications industry in four key ways. First, this model provides role-based copilots and scenario-specific agents to the operator. Using the natural language processing capability of the model, copilots create customized digital assistants for different roles and carry out human-machine interactions using natural language, for example, the FME-MBB copilot which assists in the development of the wireless on-site maintenance engineers. The Agent can be implemented to self-closed analyze scenarios such as the transmission failure analysis Agent. Next, the model uses AI to solve complex network issues and enhance the productivity of operations and maintenance for network and teams. Furthermore, the objective is to eliminate interruption points, simplify operational processes, open up cross-domain processes and improve overall operational efficiency. Deng believes that the traditional API integration mode could be discarded in favor of a new model that automatically calls upon relevant tools and network APIs, with the objective of further reducing the TTM required for business transactions to complete.

Networks Fueling AI Development:
Building a Mobile AI Foundation

How to effectively and successfully enable AI-driven communication. The first is Networks for AI, which means using networks to fuel the development of AI in order to lay a solid foundation for the mobile AI era. There will be a wide array of services in the future, which will, in turn, raise higher requirements for network capabilities such as large uplink and downlink bandwidths and low latencies. To meet the growing demand for the Internet of People (IoP) and IoV, we will need to accelerate the evolution of all frequency bands to support 5.5G experience, fully unleash the value of each frequency band, and build a foundation for a superior network experience.

The second area that requires joint effort is AI for Networks, which means using AI to empower networks and enable network productivity surges on all fronts. To fully embrace AI, improving network O&M efficiency is imperative. Copilots improve the productivity of different roles by providing Q&As related to professional knowledge and assisted O&M. Agents, on the other hand, can understand user intent and orchestrate tasks to automatically resolve issues in complex scenarios.

In the mobile AI era, a solid network foundation will provide fertile ground for developing innovative applications and business models. We will need these upgraded business models and boost the value of connectivity in all scenarios. In the consumer market, there will be a continuous stream of new intelligent applications, and consumer demand for experience will continue growing across multiple dimensions. This will drive a shift for carriers from monetizing data traffic to monetizing multiple experience dimensions. In industrial scenarios, intelligent services will continue seeing wider adoption and create new monetization opportunities for carriers to expand from just providing connectivity to providing novel services combined with connectivity.

推動行業價值重塑：
人工智能驅動高效集成

通訊大模型給電信行業帶來四大領域的重塑。第一是運維模式的重塑。通訊大模型為運營商帶來了基於角色的 Copilot 和基於場景的 Agent。Copilot 基於自然語言的人機交互用於對固定角色的數字助理，如輔助無線現場維護工程師的 FME-MBB copilot；Agent 則可以實現場景自閉環，如實現傳輸故障自閉環的傳輸故障分析 Agent。其次是系統能力的重塑，利用 AI 解決疑難網絡問題，提升網絡運維人員效率。此外是業務流程的重塑，透過消除業務中斷點，簡化運營流程，打通跨域流程，提升整體運營效率。鄧先生更指出，通訊大模型也將助力行業重塑集成模式，擺脫傳統 API 集成模式，轉變為通過大模型自動調用相關工具和網路 API 新模式，從而進一步縮短業務 TTM。

構架以網興智：
以智賦網發展底座

如何有效的，成功的使能 AI 驅動通訊，首先是「Networks for AI」，即是以網興智，打造移動 AI 時代的堅實底座。移動 AI 時代的多樣化業務對網絡大下行、大上行、低時延等能力提出更高要求。因此，面向率先到來的人與車的聯接需求升級，我們需要加速推動全頻段走向 5G-A，充分釋放各頻段價值，建立極致網絡體驗基礎。同時面向萬物智聯，5G-A 需逐步走向一網多能，提供泛在的通、感、算、智融合能力。

其次是「AI for Networks」，即以智賦網，全面使能網絡生產力提升。全面擁抱 AI，提升網絡運維效率成為當務之急。通訊大模型加速推動網絡自動化走向 AN L4 高階自智，可以提供兩類應用：「面向角色的 Copilot」，通過專業知識問答和輔助運維能力，提升人員效率；「面向場景的 Agent」，通過理解用戶意圖、自動編排任務，自主閉環複雜場景問題。

同時，在移動 AI 時代，堅實的網絡基礎為創新應用和創新商業模式提供了基礎。我們需要升級商業模式，提升全場景聯接價值。面向消費者（toC）場景，智能化應用不斷創新，消費者體驗需求的維度不斷提升，推動運營商從「流量經營」向「體驗經營」轉變。面向企業或商家（toB）場景，智慧化服務逐步普及，為運營商帶來了從「聯接」擴展到「聯接 + 多維服務」的價值變現新機遇。

AI 產業轉型：
華為助力千行萬業轉型升級三大戰略重點

千行萬業正在積極擁抱人工智能，把行業知識、創新升級與大模型能力相結合，以此改變傳統行業生產作業、組織方式。人工智能的發展與使用將成為全球各個國家行業轉型升級的關鍵一環，助力各個國家在人工智能時代不斷取得發展，華為將聚焦以下三方面，持續助力：

AI Industry Transformation:
Huawei's Three-Fold Strategic Focus

Thousands of industries are actively embracing artificial intelligence, combining industry knowledge, innovation and upgrading with large model capabilities to change the production operations and organization of traditional industries. Deng believes that the development and use of AI will become a key part of the transformation and upgrade of industries in countries around the world, helping countries achieve continuous development in the AI era. Huawei will focus on the following three aspects:

First, innovation leads. Continuously strengthen innovation investment in AI infrastructure, provide flexible intelligent computing power supply modes, and provide an efficient and reliable AI development system to make large models at all levels easier to deploy and faster to apply, promote AI applications, and help industries and enterprises achieve scenario innovation.

Second, ecological openness. Open computing power, supporting hundreds of models and thousands of states; Open perception, smart connection of everything; Open model, matching thousands of industries. We will work with partners in various industries to build an AI ecosystem, explore more AI applications in industry scenarios, and work with enterprises, research institutes, and academic institutions to build a secure and reliable AI ecosystem.

Third, personnel training. Talent is the core force of enterprise development, support various industries, various enterprises to cultivate and attract artificial intelligence talents, to create a high level of artificial intelligence research and development team, to provide a broad space for talent development. Currently, we have comprehensive co-operation with major universities in Hong Kong including basic research and Development field and has established 14 cross-sector AI research laboratories.

創新引領。持續加強人工智能基礎設施的創新投入,提供靈活的智能算力供給模式,高效可信的人工智能開發體系,使各層級大模型更易於部署,應用速度更快,推進 AI 應用走深向實,助力行業、企業實現場景創新。

生態開放。算力開放,支持百模千態;感知開放,實現萬物智聯;模型開放,匹配千行萬業。與各行業的合作夥伴共同構建人工智能生態圈,探索更多的人工智能行業場景應用,攜手企業、研究機構、學術機構等共築安全可信的人工智能生態體系。

人才培養。人才是企業發展的核心力量,支援各個行業、各個企業培養和吸引人工智能人才,打造一支高水準的人工智能研發團隊,為人才提供廣闊的發展空間。目前,我們與香港各大高校進行了包括基礎研究在內的全面合作。香港已建立了 14 個跨行業的 AI 研究實驗室。