Postprint: Recommendations for the Collaborative Development of Communication Technology and Media Technology Industries

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Abstract

The peak of communication technology has arrived, leading to a misalignment with the development cycle of the media technology industry. Leveraging native edge computing capabilities, 5G is evolving from technical governance to industrial consensus, and from technical connectivity to value connectivity. To promote the collaborative development of the media industry and communication technology, and to gradually resolve the contradiction between horizontal communication technology and the industrial demands of media, this paper proposes recommendations from the dimensions of 5G edge computing technical capabilities and market demands for media communications, providing references for subsequent technical research on 5G edge computing and the development of the media technology industry.

Full Text

Preamble

Title: Suggestions for the Coordinated Development of Communication Technology and Media Technology Industry

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Abstract: The peak of communication technology has arrived, creating a misalignment with the development cycle of the media technology industry. 5G, leveraging native edge computing capabilities, is transitioning from technical

governance to industry consensus and from technical connectivity to value connectivity. To promote coordinated development between the media industry and communication technology and gradually resolve the contradiction between horizontal communication technology and vertical industry demands, this paper offers recommendations from the dimensions of 5G edge computing technical capabilities and media communication market demands, providing references for subsequent technical research and industrial development.

Keywords: 5G; communication technology; media technology; coordinated development; market demand

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The global scale development of telecom operators has largely depended on communication standards formulation, with the most important organization being 3GPP (3rd Generation Partnership Project), previously including 3GPP2. Communication technology standards are established to maximally resolve technical barriers between industries and construction costs. When MEC (multi-access edge computing) was proposed, the 4G LTE network standards had already been completed. Consequently, most MEC deployments under current 4G networks adopt proprietary vendor standards, leading to certain issues in regulation, security, and billing. This has also resulted in the lack of large-scale commercial deployment of MEC in the 4G era, both domestically and internationally. The emergence of 5G communication technology has once again significantly reduced communication costs, enabling complex new tasks to be executed remotely and forming the edge computing paradigm.

The matching between communication technology development and media industry digestion may follow two sinusoidal curves. It now appears that the peak of communication technology has arrived, but the media industry has not synchronized or matched this pace. From a standards perspective, IMT-2020 (5G) achieved global unification, yet it is difficult to standardize when facing industry applications. How can we identify demands within the vertical markets of media technology enterprises and provide optimal target solutions? How can we extract common network capabilities from the fundamentals to boost digital transformation in the media industry? The answer to this question from a technical dimension is likely 5G edge computing. In the era of big data and the Internet of Things, the characteristics of edge computing can effectively supplement and complement cloud computing functions to overcome bandwidth pressure, latency issues, and wasted computing power costs [1].

1. Overview of 5G Edge Computing Characteristics

Multi-access Edge Computing (MEC) provides an IT service environment and cloud computing capabilities for mobile network edges. By executing partial caching, data transmission, and computation at the mobile network edge to offset backhaul latency, it ultimately achieves millisecond-level applications. Deploying rich applications at the network edge enhances user experience and

better satisfies end-user demands.

2. Current Status of the 5G Edge Computing Industry

ETSI founding members include HP, Vodafone, Huawei, Nokia, Intel, and others. MEC provides an IT service environment and cloud computing capabilities for mobile network edges. By executing partial caching, data transmission, and computation at the mobile network edge to offset backhaul latency, it ultimately achieves millisecond-level applications.

In the 4G era, RGW (Remote Gateway) was used for edge deployment, initially experiencing the value MEC brought to users. After gateway equipment CU separation, the separated U-plane equipment (DGW, Distributed Gateway) was deployed at the edge or region to provide users with ultimate business experiences. When evolving to 5G, native CU separation allows U-plane UPF and MEC platforms to be co-deployed at the edge or region. Combined with 5G' s powerful network capabilities, more MEC businesses can be developed and innovated.

Overall, the edge computing industry has transitioned from technical governance to industry consensus. The most frightening aspect of industrial development is not capital expenditure and resource investment but misleading industrial guidance. China Mobile, China Telecom, and China Unicom, representing operators, have deployed massive 5G MEC base station resources, including network capabilities and computing resources, gradually forming an "L-shaped" development pattern. The three major operators build and provide cloud-network integrated 5G private network services on demand. While vertical network resource construction has already reached its climax, horizontal development has yet to find its direction. The centripetal force between industries far exceeds technology itself, making the steps of positioning, focusing, and enabling indispensable.

2.1 Industry Positioning of 5G Edge Computing From a positioning perspective, the ultimate goal of edge computing definition is commercial practice. Telecom operators possess advantages in edge infrastructure and irreplaceable network capabilities, which are associated with core network 下沉的 UPF (User Port Function) and wireless-side gNB (next generation node B, 5G base stations). Internet enterprises dominate in edge computing components, IoT platforms and applications, and customer resources.

2.2 Technology Integration of 5G Edge Computing From a technical perspective, the primary purpose is to reduce latency. Currently, many companies integrate IT into OT, with basic forms of IT entering edge computing mainly being N3 UPF and 5G small stations, initially aiming to decouple the existing network architecture. Currently, operators mainly promote 5G private networks, with edge computing serving only as one capability platform.

2.3 Main Forms of 5G Edge Computing From a development perspective, the edge network appears for the first time in the wireless network system, serving both as a resource computing platform and a wireless network capability platform. From the perspective of cloud-edge collaboration, private clouds will integrate with edge computing development. Despite facing many issues, this industry continues to explore. In the long term, edge computing will manage applications in private clouds, public clouds, and hybrid clouds—this is the trend. Technology development is inherently a process of resource collaborative optimization. Edge computing development involves three major components: cloud-edge, cloud-network, and edge-edge.

3. Development Strategy for 5G Edge Computing and the Media Industry

The emergence of any new technology requires two essential conditions: first, strong demand from economic and social development for such technology, and second, sufficient development of a series of foundational technologies related to that technology.

3.1 Demands of the Media Technology Industry

The video edge computing capability framework in the media technology industry has five major technical characteristics: it can provide basic common video processing functions such as video acquisition and codec adaptation for video edge computing application requirements, suitable for multiple scenarios; it sinks video intelligent computing to the edge, supporting AI model edge inference and distributed training to achieve federated learning; it adopts virtualization and container technologies to manage various types of video edge devices; it supports unified platform management of edge devices to reduce management overhead; and it is compatible with general processors and various video intelligent chip-implemented edge devices to reduce equipment and development costs. It achieves access to all Sub-6GHz frequency bands (super uplink), supports access over fixed and mobile networks, optimizes the shortest MEC access network, and provides the shortest path for N3 interface service flows from gNB to MEC UPF. In on-site MEC mode, N3 interface service flows need to be forwarded directly to MEC through mobile bearer routers in media technology parks. This not only ensures low latency and saves bandwidth on operator networks but also ensures that critical service data of media technology enterprises does not leave the park.

3.2 Commercial Development of 5G Edge Computing Technology

From a commercial practice dimension, moving from cost reduction to efficiency improvement, the fundamentals lie in cost reduction, which actually satisfies simple supply-demand relationships. One can also choose to create and satisfy supply-demand relationships, continuously optimizing until reaching a supply-

demand balance. The shift from consumer Internet to industrial Internet is an inevitable trend. From the perspective of telecom operators and the media technology industry, how can they effectively intervene in industrial transformation to achieve factor-driven growth? Currently, REITs (Real Estate Investment Trust) new infrastructure policies promote IDC development, allowing IDC traffic and industrial integration, with 5G MEC serving as a capital factor driver. Guided by digitally-driven business strategies, the technical capabilities of traditional media technology industries gradually extend upstream in the industrial value chain. Organizational structure transformation becomes extremely important, as it will drive the integration of professional capabilities across various lines, upgrade media technology capabilities, and break value chain technical barriers.

4. Recommendations for 5G Edge Computing and Media Industry Development

4.1 Selecting Reasonable Technical Routes

According to current development, the most crucial and primary aspect of MEC is the development of industry applications, which is also what is most lacking at present. Analogous to the paradigm of 2C business development—the App Store—it is recommended to develop and choose from two directions: the South Slope and North Slope approaches. The South Slope refers to a high-quality connectivity model, which uses 5G high-quality connectivity as the core lever, integrating services as a substitute for existing fiber or Wi-Fi networks. The North Slope refers to utilizing operation-savvy platforms, enriching the cooperation ecosystem, reducing total industry chain costs, and changing existing business models.

4.2 Focusing on Scenarios to Complete Verification

By the end of 2019, a certain operator participated in constructing a total of 70 5G edge computing pilot projects covering 10 vertical industries. Based on coverage scope, they can be divided into pan-park businesses and universal service businesses, with all vertical industry projects involved. Eighty-two percent of businesses are pan-park businesses. Industries such as manufacturing, media technology, and parks have urgent demands, accounting for 70% of pilot projects and representing key vertical industries for edge computing development. Among these, it is recommended to prioritize utilizing MEP capabilities to complete verification in media technology industrial park deployments.

4.3 Industry Planning Should Be Moderately Ahead

Later, given the sharp increase in MEC Apps related to the media technology industry, the trust mechanism between developers and traders needs to be timely improved and established. Therefore, distributed ledger technology should be

adopted to create secure, transparent, and trustworthy mobile network edge infrastructure, building a brand-new ecosystem belonging to the media technology industry.

4.4 Focus on Data Security Protection

The overall edge computing security protection solution leverages existing network capabilities to provide basic network security capabilities and on-demand security services for media technology vertical industry customers. For UPF and core network security protection: UPF, as the user plane network element of the core network, is deployed at edge nodes with lower physical security levels and should have physical protection; UPF should be securely isolated from core network equipment to prevent attacks from edge to core and core to edge; SMF and UPF require mutual authentication to avoid forged SMF/UPF issuing policies. On the media plane, UPF connects to the core network through the transport network, requiring protection of the transmission link security between UPF and the core network; UPF-level forged packet attacks require DDoS resistance to avoid forwarding large amounts of malicious traffic to low-capacity MEC Apps. Edge applications require two types of security services: basic security functions and security capability openness. Basic security functions refer to providing security assurance functions possessed by traditional security equipment and tools, requiring customized exclusive functions for specific applications, including vWF, vIPS/IDS, transmission channel encryption, virtual patching, etc., as well as conventional security services such as Anti-DDoS, Anti-Virus, vulnerability scanning, and security baseline checking.

Edge computing is one of the most exciting new concepts in the digital world. It breaks traditional cloud computing boundaries and represents the next competitive highland after cloud computing, allowing access to more efficient and powerful network architectures. Gartner predicts that by 2022, edge computing will become a necessary requirement for all digital businesses. Forty percent of large enterprises incorporated edge computing into their 2021 projects, compared to less than 1% in 2017. According to research firm Stratistics MRC analysis, the edge computing market was approximately $8 billion in 2017 and is expected to reach approximately $20.5 billion by 2026.

From cultural thresholds to technical thresholds, opening them too wide leads to confusion and opportunism, while opening them too narrow makes it impossible to sustain the ecosystem. Who defines the technical threshold becomes crucial. The most frightening aspect of industrial development is not technical investment and capital expenditure but misleading industrial guidance. From an independent perspective, partial understanding and cognition exist, and biases gradually form and solidify. Standards come from demand, and technology moves toward the market. Whether edge computing or 5G, they are essentially technical means and implementation methods, but they are expected to resolve the main contradictions between communication technology and industrial demands. 5G moves from technical connectivity to value connectivity, alleviating

and gradually resolving the main contradictions between communication technology and media industry demands, creating new opportunities in segmented media technology markets and promoting new revenue growth for edge computing [1].

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Note: Figure translations are in progress. See original paper for figures.