China Mobile Zhejiang and Partners Build a 5G-A + AI Smart Cultural Tourism System for Hangzhou

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中国移动 China Mobile

HUAWEI

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CASE STUDY LEAD: CHINA MOBILE, HUAWEI

CHALLENGE

As a renowned tourist destination and historic cultural city, Hangzhou attracts visitors who seek in-depth cultural immersion, culinary exploration, and livestream sharing. However, the city faces some pain points: a shortage of high-caliber tour guides (especially those fluent in less-common languages or skilled in detailed storytelling) and a lack of personalised recommendations of restaurants. At the same time, although Zhejiang's 5G networks offer strong downlink performance, the uplink capability falls short, limiting large-scale deployment of AI services such as HD livestreaming and cultural tourism AI agents. This constrains the intelligent upgrade of tourism services.

SOLUTION

To break through these bottlenecks, China Mobile Zhejiang and its partners adopted a "network + application" dual-engine strategy. On the network side, they deployed F/A SUL 5G-A Super Uplink, optimizing base station layouts for Hangzhou's complex tourist attraction environments to significantly enhance uplink speeds and coverage stability. On the application side, they integrated an AI agent app into smart glasses. The AI app's customised cultural-tourism knowledge base provides explanatory commentaries, culinary recommendations, and other services, while the AI glasses enable immersive guided tours onsite. Together, these innovations elevate AI user experience and accelerate the rollout of smart cultural tourism.

BENEFITS

After implementation, the 5G-A network in key tourist attractions in Hangzhou achieved single-user uplink peak speeds exceeding 1 Gbps, with a 20 Mbps uplink speed even in weak-coverage zones—ample to support HD livestreaming and smooth AI agent operation. Visitor satisfaction with the AI app's cultural information and dining recommendations reached 92%, and the AI glasses assisted in more than 100,000 visits during the trial phase. The initiative substantially alleviated the shortage of premium guides, advancing Hangzhou's cultural tourism toward intelligent, personalised services and laying the groundwork for large-scale replication.

Background

Hangzhou, long celebrated as “Heaven on Earth”, is among China’s first nationally designated historical and cultural cities and a premier tourist destination. It is home to world-class cultural and tourism assets such as West Lake, Lingyin Temple, Song Dynasty Town, and the Archaeological Ruins of Liangzhu City. In 2024, the city attracted more than 260 million visits, making the cultural tourism industry a core pillar of its economy. In recent years, the Zhejiang provincial government has placed strong emphasis on high-quality development of the cultural tourism sector, issuing the “14th Five-Year Smart Cultural Tourism Development Plan of Zhejiang Province”, which explicitly calls for empowering tourism services with new technologies such as 5G and AI to build a smart cultural tourism ecosystem featuring intelligent convenience and premium experiences.

Nowadays, tourist preferences are shifting from “checkbox tourism” to “in-depth experiential travel”. On one hand, tourists are eager to share scenic views and historical stories through livestreaming and to receive professional interpretations of cultural heritage. On the other hand, while Hangzhou offers abundant culinary resources (such as West Lake vinegar fish, and Longjing shrimp), tourists often struggle with overwhelming choices and fear of disappointing experiences, making personalised recommendations an urgent need. However, traditional cultural tourism services have clear limitations: the supply of high-caliber tour guides, especially those fluent in less-common languages or capable of interpreting niche cultural topics, is insufficient, and manual recommendations lack data support, making it difficult to meet the personalised demands of massive visitor flows.

Meanwhile, the growing maturity of 5G + AI presents an opportunity for transformation. Yet Zhejiang’s existing 5G network has been optimized mainly for downlink performance. Its uplink bandwidth and stability fall short of supporting scenarios such as HD livestreaming (which requires a stable uplink speed of at least 20 Mbps) and real-time interaction with AI agents, posing a critical barrier to the rollout of smart cultural tourism. Against this backdrop, China Mobile Zhejiang launched the 5G-A + AI Smart Cultural Tourism initiative to address both network and service pain points, thereby driving the upgrade of Hangzhou’s cultural tourism industry.

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Challenges

Service Challenges:

1. **Insufficient supply of high-quality tour guides:** Hangzhou's core tourist attractions receive over 10 million visitors annually, yet guides capable of in-depth cultural interpretation and less-common-language services account for only 15% of the total. During peak seasons, one guide is hard to find, leaving visitors without professional commentary on historical sites or cultural background information.

2. **Lack of precise culinary recommendations:** Hangzhou hosts more than 100,000 dining establishments, but tourists, especially those from out of town, struggle to assess a restaurant's reputation or whether its offerings suit their tastes. The widespread difficulties in finding the right place and ordering the right dishes diminish the overall food experience.

3. **Unmet demand for livestreaming**: Over 60% of visitors want to livestream from tourist attractions and upload HD photos in real time, yet uplink speeds are unstable (peaking at only 80 Mbps and dropping below 20 Mbps during off-peak hours). Such instability causes lagging livestreams and failed uploads, undermining the sharing experience.

4. **Insufficient personalisation in cultural tourism services:** Traditional packages mainly offer standard services, which cannot deliver customized itineraries or information based on visitor age or interests (such as family trips, cultural study tours, or culinary explorations). As a result, diverse touring needs remain unmet.

Technical challenges:

5. **Shortfalls in 5G uplink capacity:** Zhejiang's 5G network can reach downlink peak speeds of up to 3 Gbps, but uplink speeds generally remain below 100 Mbps. Scenic areas like those around West Lake and Lingyin Temple suffer from signal blockage and reflection, further undermining uplink stability and making it difficult to support high-uplink services like AI agent real-time interactions and HD livestreaming.

6. **Complex environments hinder network coverage:** Many tourist attractions in Hangzhou are a mixture of mountain, water, and architecture (for example, the densely wooded areas around West Lake or the undulating terrain of Archaeological Ruins of Liangzhu City). Traditional base stations lack sufficient signal penetration, creating coverage holes in certain areas and resulting in unstable network experiences.

7. **Insufficient network support for AI applications:** Cultural tourism AI agents must continuously access massive datasets (historical records and merchant information) in real time, imposing strict requirements on network latency (below 50 ms) and uplink bandwidth stability. The current network infrastructure struggles to sustain their ongoing operations.

Solution

China Mobile Zhejiang, together with Huawei, AI application providers, and AI glasses vendors, has built an integrated "network + applications" solution to comprehensively address the pain points hindering the development of smart cultural tourism in Hangzhou.

Network Foundation: F/A SUL 5G-A Deployment

Core technology: The solution adopts F/A SUL (supplementary uplink) 5G-A technology. By coordinating TDD and SUL for all-timeslot uplink transmission and optimizing base station scheduling algorithms, it reduces latency fluctuations in signal-blocked areas, improving both the uplink speed and stability.

F/A SUL is a next-generation 5G-A uplink technology that flexibly co-schedules uplink resources across high- and low-frequency bands, significantly enhancing wireless uplink performance. SUL leverages F/A bands to receive uplink data while the 4.9 GHz band is transmitting downlink, enabling uplink reception 100% of the time. The solution can be further extended to support additional SUL bands, greatly improving the uplink user experience. Moreover, as the 5G traffic share increases and 4G traffic declines year by year, F/A bands can be refarmed. Legacy equipment also consumes more energy. By evolving to 5G-A through this deployment, energy consumption and other O&M costs are greatly reduced.

Application Enablement: Integrating AI Agents and Glasses

1. **AI agents:** trained using extensive local cultural and tourism data, including historical and cultural archives, scenic spot description, customer reviews, and special cuisine to support three custom functions:
    1. **Smart guide:** interactive narrations for historical sites, like the enchanting legend of the Broken Bridge at the West Lake and the fascinating tales of Liangzhu Jade Culture, together with real-time route planning like parent-child routes around the West Lake and cultural study tours at the Liangzhu site)
    2. **Food recommendation:** based on preferences (like spicy/mild and meat/vegetarian) and budget with a relevance exceeding 90%, alongside reservation and navigation services
    3. **Livestreaming boost:** built-in bandwidth optimisation based on network conditions to ensure smoothness
2. **AI glasses:** digital content overlaid onto real-life views over 5G-A at the West Lake, Songcheng, and in other areas:
    1. **AI reconstructions:** digital restorations of famous historical sites, including the West Lake at the time of Southern Song and the Liangzhu Ancient City
    2. **Real-time information:** scenic commentary, nearby food, and queuing time without manual operations
    3. **Multilingual switching:** real-time translation of 12 languages for tourists

Deployment

The project is implemented in phases, including earlier pilots and later promotion.

Pilot in 2025: Together with China Mobile Design Institute and China Mobile Research Institute, China Mobile Zhejiang was the first mobile operator to verify F/A Supplementary Uplink (SUL) at scale in outdoor areas in Hangzhou, with the single-user uplink speed peaking over 1 Gbps on commercial devices. This has made it possible to ensure 1 Gbps 5G-A uplink transmission for consistent human-machine interactions in the context of mobile AI.

This verification used the industry's first AAU base stations with F/A SUL extremely large antenna arrays (provided by Huawei) together with legacy 4.9 GHz devices, to ensure continuous coverage. The setup supports F/A turbo uplink multi-channel reception and SUL complementarity between 4.9 GHz and F/A bands. On Huawei's commercial Mate X6, the speed was 52% to 115% faster than with 4.9 GHz alone and the uplink cell-edge speed reached 20 Mbps. This shows the end-to-end performance of F/A SUL, providing reference for commercial deployment. Drive tests and interference tests will be further conducted.

Promotion from 2026 to 2027: This solution will be expanded to other major cultural and tourism cities across Zhejiang from 2026 onwards, including Ningbo, Wenzhou, and Jiaxing. 500 5G-A SUL base stations will be deployed to cover all 5A scenic spots in the province. AI agents and AI glasses will be brought to rural areas as well.

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Achievements

Higher Service Quality and Better Tourist Experience

1. **Polished cultural experience:** The broader access to cultural commentary through AI agents and glasses enables tourists to obtain better historical and cultural narration, with the accuracy topping 95% for historical information. Less-common language services saw an increase in satisfaction from 15% to 88%, while the peak-season shortage in tour guides dropped by 60% and tourist satisfaction with cultural tours soared to 92%.

2. **Accurate food recommendations:** The match rate exceeded 90% with AI agents, reducing the chances of disappointment from 35% to 8%, while increasing the repurchase rate by 22% for merchants.

3. **Smooth livestreaming:** The stuttering rate was reduced from 45% to 5% and the success rate for uploading HD photos in real time jumped from 60% to an impressive 98%, leading to an overall 90% satisfaction of sharing among tourists.

Supercharge the Cultural and Tourism Sectors to Fuel Economic Growth

1. **Improved scenic operations:** AI supports 30% of basic tour services, translating to an 18% labor cost saving. Precise recommendation with AI agents drives the consumption of creative cultural products and intangible cultural heritage services by 25%.

2. **Merchant revenue growth:** The merchants connected to AI agent recommendations saw a 30% increase in customer traffic on average, yielding a 15% to 40% monthly revenue growth. The AI glasses rental, priced at CNY198 a day, has brought in over CNY5 million in revenue, with an annual estimate of CNY12 million.

3. **Replicable implementation:** The project has produced 5G-A SUL specifications for the cultural and tourism sector, providing a sample for other cities in Zhejiang, like Ningbo, Wenzhou, and Jiaxing. The project has been listed as a “2025 Smart Cultural and Tourism Demo” by the Zhejiang Provincial Department of Culture and Tourism.

> Through innovative network and application synergy, the project improves tourist services and propels the digital transformation in the cultural and tourism industry, creating an estimated over CNY200 million in revenue increase for the cultural and tourism industries in Hangzhou in a year

Manager - China Mobile Zhejiang’s smart cultural tourism project

Prospects

China Mobile Zhejiang will expand the integrated use of 5G-A and AI to smart culture and tourism, prioritizing three areas:

1. **Application:** With joint AI agent model optimisation, new modules will be supported for the interactions of intangible cultural heritage and live shopping of cultural and tourism products. Through joint development, smart food scan will be added, allowing tourists to get the stories and nutrition facts of local foods through AI glasses.

2. **Ecosystem:** This includes forming an alliance with scenic spots, catering merchants, and technology firms to formulate the standards for smart culture and tourism and exploring new business models that tap into 5G-A and AI for cultural tourism. For example, an annual pass will be launched, covering network services, AI tour guide, and glasses use. By developing a sustainable ecosystem through innovation, China Mobile Zhejiang aims to make Hangzhou a global benchmark for smart cultural tourism and promote the sustainable growth of cultural tourism in Zhejiang.

3. **Device support:** China Mobile Zhejiang sees SUL innovation as a key to 5G-A×AI networks, believing it will meet the uplink speeds for not only current AI applications but also new-generation intelligent terminals like connected vehicles and AI phones, computers, robots, and manufacturing equipment, which are highlighted in the 2025 Government Work Report. Connected vehicles require instant uploads of extensive road data. AI phones rely on real-time HD image transfer for seamless multimodal calls. Robots frequently send data to the cloud to synchronize motion policies. All of these intelligent terminals would be impossible without stronger uplink performance.

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About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

For more information, please visit the GSMA corporate website at gsma.com

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About the GSMA Foundry

The GSMA Foundry is the go-to place for cross-industry collaboration and making positive change happen, supported by leading technology organisations and companies. By bringing together members and key industry players, engaging, and unifying the end-to-end connectivity ecosystem, the GSMA is solving real-world industry challenges.

Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. This enables the mobile industry's mission: to connect everyone and everything to a better future.

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China Telecom

China Mobile (CMCC) is one of the world's largest mobile network operators, serving hundreds of millions of mobile and broadband customers globally. The company is advancing its strategy around 5G-Advanced (5G-A) and green development to support smart city innovation and sustainable digital transformation.

For more information, visit: www.chinamobileltd.com

Huawei

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