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ZTE TECHNOLOGIES

VIP Voices

Izzi Telecom: Tapping into the Broadband Market in Mexico

Expert Views

Video Services are Booming As 5G Applications Surge

Analysis of Key Technologies for 5G Big Video Development

Special Topic: **Big Video**

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Source: Disruptive.Asia

ZTE Brings AI to MEC

28 February 2019, Shenzhen, China — ZTE released its ES600S MEC server at the Mobile World Congress 2019.

With the rise of new technologies and data-driven services, the rapid growth of data requires advanced intelligence closer to the endpoints that generate and consume data. Therefore, the data processing and analytics functions of different applications must be placed closer to the data generating and consuming endpoints, that is, at the "edge."

Compliant with OTII standard, the ZTE ES600S server is built on the Intel Xeon Scalable processor, Intel Core i5 processor and Intel Stratix 10 FPGA for edge AI deep learning applications. It works at the edge to deliver more powerful services, while reducing latency and optimizing TCO by virtue of programmable software and innovative hardware.

The ZTE encode/decode acceleration card, which adopts the Intel Stratix 10 FPGA and Intel Core i5 processor, enables the ZTE ES600S server to implement facial recognition applications at 1200 frames/s on a single AI accelerator card, resulting in a detection rate of over 98%. Furthermore, real-time AI analysis of 100+ HD video streams can be implemented on a single ES600S server.

ZTE will continue to deepen its collaboration with Intel to jointly promote artificial intelligence in the field of multi-access edge computing.

ZTE Showcases Industry's Highest Power Tri-Band UBR and NG Dual-Band FDD Massive MIMO at MWC 2019

26 February 2019, Shenzhen, China — ZTE released the industry's highest power tri-band ultra-broadband radio (UBR) and the new-generation dual-band FDD Massive MIMO at Mobile World Congress (MWC) 2019 in Barcelona, Spain.

ZTE's tri-band UBR is the industry's first RF module that integrates three mainstream frequency bands of 900M, 1800M, and 2100M. The tri-band UBR supports GSM, UMTS, FDD-LTE, and NB-IoT and helps minimize the number of site devices. The product is set to facilitate the industry's smooth evolution to 5G new radio (5G NR).

Dual-band FDD Massive MIMO supports 1800M and 2100M at the same time. In addition to replacing the output of the combination of two RRUs and the directional antennas, it also enables operators to unlock network potential and substantially increase the throughput of 4G stations in highly-loaded cells where the capacity is difficult to be increased.

"With shipment volume currently reaching 150,000 sets to date, the newly released tri-band UBR provides customers with the simplest possible site solution, displaying an unparalleled breakthrough in ultra-wideband technology," said Ms. Tang Xue, Planning Director of FDD Product Division at ZTE.

ZTE Wins the 2018 Global 5G Infrastructure Technology Leadership Award

27 February 2019, Shenzhen, China — ZTE was presented the 2018 Global 5G Infrastructure Technology Leadership Award at Mobile World Congress 2019 by Frost & Sullivan for being a leading provider of 4G, Pre5G, and 5G infrastructure systems, equipment, and devices.

Each year, Frost & Sullivan presents the Technology Leadership Award to companies that demonstrate leadership in developing and leveraging new technologies that offer significant customer value.

ZTE established its leadership in 5G by investing heavily in 5G standardization and product R&D, and subsequently deriving profound insights into 5G technologies. Working in 5G deployment for years, ZTE has launched a series of commercially oriented all-band 5G AAU, 5G transport, 5G core network, 5G devices, and other end-to-end 5G solutions to prepare for large-scale 5G commercialization.

ZTE's full series of 5G base stations can be deployed in various 5G scenarios, helping operators build wide-coverage, high-capacity, rapid-deployment, and cost-effective 5G networks.

ZTE and Ethio Telecom Launch a Joint Innovation Center in Ethiopia

7 March 2019, Shenzhen, China — ZTE announced that it has launched a joint innovation center in partnership with Ethio Telecom in Ethiopia.

The Ethio Telecom-ZTE Joint Innovation Center is expected to facilitate Ethio Telecom to undertake verification on new technologies as well as tests of products and services, and organize seminars, workshops and conferences, aimed to foster an open and inclusive learning environment to conduct research and development in the ICT sector.

Located in the Telecom Excellence Academy (TExA), the joint innovation center, with a lab exhibition hall, is equipped with mobile broadband (MBB), fixed broadband (FBB), core network NFV, IP, BSS/OSS, RCS and IPTV facilities.

As a technological supplier, ZTE donated and deployed various cutting-edge technologies of over USD 3 million to Ethio Telecom to build the joint innovation center.

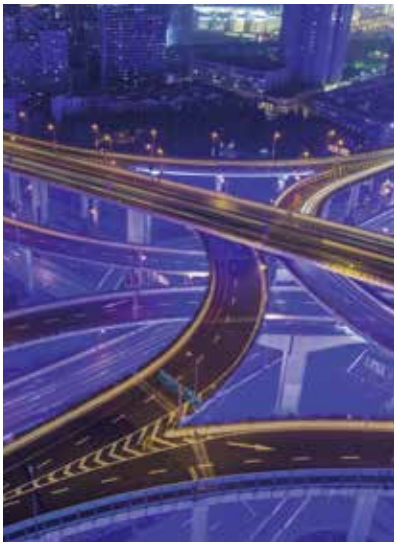
Following the opening ceremony held on March 4, 2019 in TExA, ZTE and Ethio Telecom have also signed a Memorandum of Understanding for future cooperation expecting to make full use of the center and optimize its operation.

ZTE and Ethio Telecom have been collaborating since 2000. The next generation network (NGN) project and telecom expansion project (TEP) are the two major milestones between the two companies.

ZTE and Netgem Sign Strategic Partnership to Address European Fiber Market

13 March 2019, Shenzhen, China — ZTE announced that it has signed strategic partnership with Netgem Group to offer connected home solutions to European fiber operators.

As per the partnership agreement, ZTE will provide device portfolios and innovation roadmap, backed up with its cost-effective production capability and a long-term financing facility, and Netgem will provide European TV multi-service providers with software and contents, by virtue of its 20 years of experience in connected home solutions.



ZTE Unveils Full Range of E2E FTTH Products at FTTH Conference 2019

13 March 2019, Shenzhen, China — ZTE unveiled end-to-end FTTH solution enabled by its full range of FTTH products, and shared its expertise with European partners at FTTH Conference 2019. FTTH Conference is the most influential conference in the optical access field in Europe.

ZTE has showcased the industry's first optical access platform with a high-end router architecture, TITAN. Supporting FMC and virtualization, TITAN enables the integration of access, transport, routing and IT infrastructures. As a 10G-to-50G cross-generational flagship platform, TITAN is also the industry's first to support 16-port 10G-PON and Combo PON cards, thereby allowing the network to deliver ultra broadband, big video, 5G services, and massive connectivity. It supports diverse network slicing and application scenarios.

TITAN features a fully distributed architecture, which is oriented towards SDN and NFV to support edge network re-architecture and evolution, and satisfy the requirements of fixed-mobile convergence and 5G+FTTH access.

In addition to TITAN, ZTE has also launched its ODN product portfolio, which aims at helping operators rapidly build networks while enabling fast deployment, smart acceptance, smart diagnosis, fast troubleshooting and smart O&M of optical networks.

Izzi Telecom: Tapping into the Broadband Market in Mexico

Reporter: Liu Yang

Salvi Folch, CEO of Izzi Telecom

Mexico has a relatively low level of broadband penetration. In an interview with *ZTE Technologies*, Salvi Folch, CEO of Izzi Telecom, talked about the company's fiber-based broadband strategy and highlighted the great prospects that telecommunications will have in Mexico. Izzi is owned by Mexico's largest media company Grupo Televisa. It is a triple play operator that offers television, internet and telephone bundles.

"It's the bundle, the price and OTT."

In the pay TV sector, what differentiates Izzi from the other operators?

First, Izzi is part of Grupo Televisa. Grupo Televisa has been the most important producer of Spanish contents in the world. So we have an integration between a company that originally was producing contents and now is distributing contents. Within Grupo Televisa, there are two companies that distribute contents. One is Sky, the DTH platform that has nationwide coverage; and the other one is Izzi.

The great advantage we have is that we can offer triple play services, offering our customers a very attractive offer at very attractive prices that solves all their needs in terms of pay TV, fixed telephony and broadband connectivity. Our pay TV offer includes a lot of channels that are attractive in terms of prices and some exclusive contents that put us in a competitive position. We offer our customers attractive services. For example, we have an application called izzi go where you can watch the contents when you are away from home. This also includes many on-demand contents. So it's the bundle, the price and OTT. And we are using new technologies to allow the use of new-generation services like being able to stop, to rewind, to go forward and to pause.

OTT video services are growing fast. How is Izzi embracing this trend? What are the challenges?

There are many challenges. Certain OTT players are becoming very strong. They are becoming global brands like Netflix, Amazon and YouTube. They have big budgets for content production. The way that we look at things is that they are a complement to our services. In the Mexican market, the pay TV service is relatively cheap. Our entry price is about 10 dollars a month. For 10 dollars, you get about 60 channels and also a lot of contents on demand. So unlike other markets where pay TV service fees amount to 100 dollars, our pay TV service is more attractive. Also, if you want to use an OTT platform, you need a broadband connection of good quality, a device and you need to pay for the subscription. The competition from OTT in the Mexican market is growing and is very relevant, but we are well positioned to integrate those OTT services within our services. Our strategy, the same as that of the other operators in the world, is to include those relevant contents for our customers. If they want to subscribe to the relevant OTT platforms, they can do it through us. I think we can provide added value by putting everything together in a bundle.

"We have to get ready."

Izzi has been making great efforts to deploy FTTH in Mexico. Could you tell us more about it? What's the driving force behind it? What's your plan to improve customer experience?

Telecommunications is extremely important for any country or any economy. Mexico is lagging behind many other countries in the world in terms of broadband penetration. If you look at the statistics for OECD member countries, we rank the second lowest in terms of penetration and in terms of speed. That's why our government has made a telecommunications reform and amended the constitution, trying to foster competition. We are part of that. Over the last 13 years, starting from

Izzi's website ▶

2006 when we started acquiring cable TV companies and trying to grow our business, Grupo Televisa has invested over 10 billion dollars on deploying infrastructure. As a part of that plan, we are now deploying FTTH to be able to offer a better experience, better speed and more connectivity to our existing and new customers.

It's true that today probably the speeds that people demand are not as high as that in the other countries because if people at home don't have many devices, probably with lower speeds, they are not fighting for the bandwidth, or if they don't use it for video or if 4K is not there yet but will come in the future. So we have to get ready and we have to be very competitive. What we are doing on our FTTH deployment is to look at the best in class in the world, to determine the type of infrastructure, and how to deploy the best network. We have a legacy product because it was the cable company with HFC that was deployed all over the country. But for the new investments and the new areas, and other areas that are relevant, we don't want to go back to that network.

How is ZTE helping you in the project? How do you assess ZTE's team and solutions?

ZTE is in many ways similar to us because it is not the largest player in the industry and is willing to compete in customer services and trying to find solutions for clients. ZTE is a crucial part of our Monterrey project. We have very good communication to try to find solutions together that can solve our business problems.

What's your expectation for the future cooperation between Izzi and ZTE?

ZTE has many customers throughout the world, has a lot of experience, and has a very relevant R&D department, working together for different solutions that we need. It is a fact that ZTE has a lot of experience on FTTH, the new set-top boxes, the Wi-Fi solutions at home, the hotspots for covering the public areas, some of the video solutions, and some of the broadband

solutions (the OLTs and ONTs that we need to deploy). Today, we don't participate in the mobile side of the business. But it's likely that in the future we will somehow participate in the mobile side of the business, and it is very important to be close to different world-class suppliers of equipment and technologies. ZTE is one of those leaders in the world and we have to work together for the benefits of both companies.

"The growth prospects of the company are very encouraging."

What do you see as Izzi's greatest opportunities going forward?

Again, the greatest opportunity in Mexico is broadband penetration. Only about 52 percent of Mexican households have broadband connection. It is very low. I'm not sure how long this may take us, but broadband connection is expected to become as widely used as running water or electricity. Broadband connection will be crucial for libraries, hospitals, households, etc. It's part of the needs that people will have for everything (e.g. financial services, healthcare and education). So the opportunity, the benefit and the knock-on effects it has on the economy are crucial. You can use broadband to improve the quality of life for many communities in the country. I believe that in Mexico there is an opportunity to invest, to connect and to offer better services at very attractive prices.

If you look at the overall industry, we are tiny. We have about 7 percent market share of the overall telecommunications industry. But the growth potential is sizeable. For example in broadband, today we have 23 percent market share of all the broadband connections in the country. But in 2006 when we started, we had zero. Every single quarter we gained market share we had only coverage in only about 43 percent of the households of the country. It's about service, quality, prices and about providing the right solutions for our customers. So the growth prospects of the company are very encouraging. As I pointed out, for Grupo Televisa, the growth of the telecommunications area is very important.

What do you see as Izzi's greatest challenges going forward?

Size in this industry is relevant. So one of the main challenges we have is competition with some of those companies that are much larger than us, and we need to to be very customer-oriented, very responsible from a financial perspective and very conservative, to ensure we are growing in strong grounds.

What's your vision for the future?

Telecommunications need will grow because of the productivity and efficiency that can be achieved with global telecommunications. How the life of people is going to change when everything is connected—going from self-driving cars to virtual reality, more efficient telepresence communications. We need to be ready for those needs. I think that companies such as ZTE that invest a lot in R&D contribute a lot to the global progress because whenever they find a solution, it is not only applicable to one country but applicable to everyone. The pace at which different countries are implementing some of the solutions changes because it depends on where the country is.

I think that fixed networks and mobile networks will converge, and they will be together in terms of providing solutions—everywhere you can watch anything that you want to watch on any device. So it's very encouraging and it generates a lot of passion to see what the future can bring. Our vision is to be the best telecommunications company in Mexico, providing all the different solutions that Mexicans require. We have to work hard every day to be a better company with better technology, better people and better services. ZTE TECHNOLOGIES

"We have a strong R&D resource. We are the leader in the 5G non-standalone (NSA) and standalone (SA) tests and also the first world-class company to provide end-to-end 5G solution with real 5G terminals." *— ZTE CEO Xu Ziyang*

ZTE CEO Highlights 5G Progress

Source: Mobile World Live

At MWC19 Barcelona, ZTE CEO Xu Ziyang updated *Mobile World Live (MWL)* on the company's progress on 5G and outlined what he sees as the biggest challenges for mobile operators.

MWL: For the upcoming 5G era, could you please tell us a bit about ZTE's strategy for 5G?

I strongly believe that ZTE is a 5G pioneer and we are in the tier one of the 5G scenario. Our new vision is to enable connectivity and trust everywhere. So, for the strategy:

- First, we will keep on the end-to-end 5G solution. It's very important to provide the operators with a simplified network. So we insist on that.
- The second is that we still keep focusing on the operator market. There is enough space for us.
- Third, we are much more open for the partner and for the 5G ecosystem.
- At the same time, we will put much more resources on the cybersecurity and the compliance system to make the operators satisfied with that.

MWL: 5G is new. What sort of challenges do operators face in deploying and launching 5G?

I think the biggest challenge for 5G is the business model. We have already tested a lot of scenarios. But the 5G business model is not clear. So, all of our operators and partners should face the challenges together.

And there is also a challenge for the investor to balance the incoming revenue and budget.

The third challenge for 5G is Opex. The higher Opex including, for example, the power consumption, the site fee, and the transport fee. All these are much more expensive. So we cannot use the traditional 4G mode to run in the 5G network. We should provide simplified integration solution for the operators.

These are the challenges we are facing. So we should continually find a suitable solution for 5G with our partners.

MWL: And you mentioned solutions there, tell us a little bit about how ZTE is innovating — some of the technology perhaps that is making you stand out amongst some of your competitors. What are you doing that's innovative?

For ZTE, we have a strong R&D resource. We are the leader in the 5G non-standalone (NSA) and standalone (SA) tests.

And after the 3GPP standard was issued, we were the pioneer to release 5G equipment at the same time.

In addition, ZTE is the first world-class company to provide end-to-end 5G solution with real 5G terminals. So I think this is amazing part of that.

Furthermore, Massive MIMO is the key technology for 5G. In the previous two years, ZTE has already deployed 10K sites of 4G using Massive MIMO. All these key technologies have been embedded in 5G solution to ensure our competitiveness.

An interview

MWL: You have done a lot of trials with operators around the world. Is there anything that you've learned from those trials of 5G that you will take to commercial launch?

I think that the first key thing is that we should move quickly from the lab test to the field test. Because you can try much more complex scenarios in the field test, for example, CBD mode with a higher building, the traffic mode with a large city, and also the coverage mode. So this should be accelerated. And this time, the operator can know how to really run a real 5G system.

Secondly, the vendor should know the operator's previous network from the 2G, 3G, 4G well. Because if you know the details of the operators' network, you can just provide an excellent solution suitable for the operators. This is much more important.

MWL: Do you think 5G will help vertical industries? What sorts of services and applications in the vertical space do you think 5G will enable?

This is the most exciting part of 5G for the vertical enterprises. We have already done a lot of trials with the industry, but I would actually say that the 5G vertical solution is not very clear in the business model. So my suggestion is that we should be involved with the industry together to find a better solution for 5G and integrate our 5G solution into the industry.

The most important thing I would suggest is about the slicing network. Because we can provide a higher-quality and much more flexible solution for the enterprise by using slicing network with virtualization. It can give them a very flexible way to control their private network in 5G.

I wish everybody and partners to join the industry scenario to work together. ZTE TECHNOLOGIES

ZTE Chief Security Officer Sheds Light on Cybersecurity Assurance

Source: ZTE Press Release

Zhong Hong,
Chief Security Officer of ZTE

ZTE puts security value of its customers above commercial interests, and complies with relevant laws and regulations on cybersecurity so as to ensure the end-to-end delivery of secure and trustworthy products and services. Cybersecurity is one of the highest priorities for ZTE's product development and delivery. In an interview, ZTE Chief Security Officer Zhong Hong talked about the company's cybersecurity assurance. ZTE will establish a holistic cybersecurity governance structure based on the company's development strategy plan, with reference to international standards, laws, and regulations, thereby fostering good security awareness for all employees and emphasizing the security of the entire process.

The 5G era has arrived. Cloud computing, IoT, big data and AI are triggering a new round of industrial changes. Under such a background, the greater challenge that the telecom industry is facing is to resist the evolving cybersecurity threat. As a global telecom equipment and solution provider, what position does ZTE take for cybersecurity assurance?

ZTE believes that the security value we provide customers is greater than that of commercial interests, and the security features of products are the first. Cybersecurity threats are a common issue that customers are facing with us. In my opinion, the biggest concern for customers is whether we have sufficient security control measures to ensure the security operation of their equipment and services. ZTE's ongoing cybersecurity governance in the past few years has provided customers with a holistic end-to-end security assurance mechanism that makes products and services be able to withstand cyber-attacks.

ZTE is willing to communicate and cooperate with operators, regulators, business partners, and other stakeholders in an open and transparent manner, comply with relevant laws and regulations, respect the legitimate rights and interests of customers and end users, and continuously improve management and technical practices to provide customers with secure and trustworthy products to create a good cyberspace security environment.

Recently, some governments have raised concerns about cybersecurity. From your point of view, how can ZTE protect the security and confidentiality of information for customers around the world? In other words, how do you help customers achieve the goal of jointly resisting cybersecurity threats, how to dispel customers' concerns about cybersecurity?

This question should be answered from two perspectives. One is of our own, what we should do to guarantee cybersecurity and how to do it; the other is the customer perspective, how our initiatives could gain customer recognition and trust.

First of all, I think security is the intrinsic property of product, so we put security in the top position. Secondly, on the one hand, we should fully understand the security needs of our customers, and on the other hand, we need to let our customers know that our products are secure. ZTE is running a long-term and continuous cybersecurity assurance program, which is called "ZTE Cybersecurity Governance". Our vision is "security in blood and trust through transparency". The ultimate goal is to provide customers with end-to-end trustworthy cybersecurity assurance.

At the strategic level, cybersecurity is one of the highest priorities for product development and delivery. That is to say, in the key decision-making points in the process of R&D and engineering services, when we need to make choices, we will give priority to ensuring the security of the products. For example, in the product development process, we set the release gate. If a product fails the security test, the version will not be allowed to release. In the

engineering services process, the technical and management methods are used to ensure the security operation of the customer network. For example, account management applies the need-to-know and the minimum privilege principles; all operation involving access to customer networks and data must be authorized in advance by the customers.

At the organizational level, ZTE has adopted an industry-recognized three-lines of defense security structure. Based on the principle of separation of duties and responsibilities, ZTE oversees product security from multiple perspectives: The first line of defense achieves cybersecurity self-management and control, the second line of defense implements independent security verification and supervision; and the third line of defense audits the effectiveness of the first and second lines of defense.

In the product development process, the deployment of a multi-layer security verification mechanism ensures that security is reviewed from multiple perspectives. In the field of engineering services, according to regional, national, and project dimensions, the company has established a multi-level product security management team and a cybersecurity monitoring and incident response mechanism; The second and third line conduct on-site inspection and audit on the field of engineering services to ensure the operation and maintenance of on-line products are secure and trustworthy.

At the tactical level, the cybersecurity assurance program adheres to a six-point policy: standardization, strict implementation, traceability, strong supervision, transparency, and trustworthiness.

- Standardization: The developed security policies and process specifications are infiltrated into each product and process. We regularly review the security specifications against the industry's maturity model and ensure that they are enforceable and effective.
- Strict implementation: The daily work of each business department is strictly implemented in accordance with the regulations. The company has issued a "Product Security Red Line" which drew an insurmountable security bottom line for customer network operations and personal data processing, mandatory for both organizations and individuals.
- Traceability: The components of the product, the distribution of the product's location, and the record of the execution process constitute a complete picture of the product, helping us visually manage the product, for example, security incidents can be traced back and reviewed.
- Strong supervision: Check the effectiveness of the implementation of the regulations and specifications through internal and third-party security audits, the audit results are reported to the Audit Committee, rectification and review must be followed up.
- Transparency: Cybersecurity initiatives should be transparent to customers, and we have deployed a series of initiatives to make the process transparent. In 2017, the company has become a CVE Numbering Authority, the relevant parties can be aware of the handling process of vulnerabilities in our products through the formal vulnerability disclosure policy. In the first quarter of 2019, we are expecting to release a new version of the “Cybersecurity White Paper” to let stakeholders understand ZTE’s understanding, attitudes, and initiatives on cybersecurity assurance. In the meantime, the company has begun to

build overseas security labs, which allows customers to review our products online; in addition, we are seeking strategic partnerships with third parties to acquire industry-leading technologies and services for security laboratory preparation, independent evaluation and security audits.

- Trustworthiness: The premise of winning customers' trust is to respect and understand the values of our customers by making the process transparent and regulated. ZTE has passed ISO 27001 certification for the information security management system in 2005 and updated its certificate every year. In 2017, ZTE passed the ISO 28000 (Specification for security management systems for the supply chain) certification. Since 2011, more than ten products have been certified by the Common Criteria (i.e., ISO 15408). In the past two years, ZTE has been working closely with customers, third parties and overseas regulators to conduct activities, such as source code review, security design review and supplier audit.

In terms of personnel training, we believe that the success of the cybersecurity governance program depends largely on personnel and security awareness. We have built security teams and trained security professionals. In the past year, we have added 27 certificates consisting of Certified Information System Security Professional (CISSP), Certified Information Security Auditor (CISA), Certified Information Security Assurance Worker (CISAW) and Certificate of Cloud Security Knowledge (CCSK). We have also organized various levels of learning, training, workshops, hands-on practices, and exams, and have educated security personnel of more than 600 people. But, most importantly, the development of security awareness begins with management. The Cyber Security Committee (CSC) is headed by the CEO, with the CTO as the executive deputy director, and the CSO as the deputy director, the members of the Standing Committee of the CSC is represented by the ultimate responsible persons from the business unit of Supply Chain, System Products, and Engineering Services. The organization of cybersecurity assurance has been deployed throughout the management level.

Could you please introduce more on the preparation and release plan of the security?

The security labs being built will be operated in a "1+N"mode. The center lab will be located in China, and multiple remote access points will be deployed at home and abroad.

The security labs will preset three functions: View and evaluate the source code of ZTE products in a secure environment; provide access to important technical documentation of ZTE products and services; and provide manual and automated security testing of ZTE Products and services.

The construction will come in phases: Two security labs are expected to be built overseas in Belgium and Italy in 2019. Moving forward, ZTE will be considering the establishment of new labs in accordance with the customers' needs and business development.

Recently, there is a concern about national security spreading around the world that the credibility of Chinese telecommunications equipment manufacturers has been questioned by foreign governments and enterprises. Some people believe that Chinese telecom vendors provide cooperation for government intelligence work. What opinion do you hold on the issue?

ZTE has never received any requests from relevant agencies to set up backdoors in our products; the source code of our products can be opened to security audits by customers and professional organizations through our security labs. ZTE TECHNOLOGIES

Video Services are Booming As 5G Applications Surge

Yin Qin
General Manager of Multimedia Video Conferencing Products, ZTE

It is estimated that 5G commercialization and popularization will start in around 2020, accompanied by significant rate, traffic and bandwidth improvement. In addition, due to low latency and mass access features of 5G, the technology upgrade will facilitate innovations in the live video industry and market penetration of 4K/8K high-definition videos. For example, when the AR and VR technologies are combined with live broadcast, the use of AR and VR technologies also brings high bandwidth occupation and more latency, and thus poor user experience. In such cases, the low latency and mass access provided by 5G will make a difference and bring excellent user experience. Predictably, with the support of 5G, live broadcast via drones and VR will be extensively used in such scenarios as concerts, football matches and ultimate experience tours.

Other factors that promote mobile live video include cancellation of domestic mobile roaming charges, increased internet speeds and reduced internet fees in recent years, and further 5G development. At the end of November 2017, China's Ministry of Industry and Information Technology announced that the basic goal of 5G Phase-3 R&D trial would be achieved by the end of 2018 and be commercially launched in 2020. 5G means not only higher transmission speeds but also lower traffic tariffs. China's huge population base and high penetration rate of smartphones have also provided a fertile soil for the development of short videos.

Short Video and Live Broadcast

With the popularity of 4G and predictable 5G applications, short videos and live webcast via mobile terminals are booming and growing rapidly. This has greatly promoted the internet economy. In many emergencies and important activities in recent years, the media used aerial photography and short videos to plan new media content, thereby enhancing the appeal and spread effect of the report.

The trend of all the people to be anchors began in China in 2016. The live broadcast platforms such as YY, Douyu and MP have become hot, and the content industry has exploded. Everyone gets a chance to be a

network star as long as the anchor is good-looking or the content is attractive enough. The fast-rising live broadcast platforms can be found in various areas, such as entertainment, online education, investment and financial management, corporate management and product release. The best-known broadcast platforms include professionals represented by Luo Yonghao and Luo Zhengyu, live broadcast endorsement represented by the actress Gong Li, and live corporate press release represented by Lei Jun.

At the end of 2017, the number of China's online video users reached 579 million, an increase of 6.3% year-on-year, and that of mobile video users reached 549 million, an increase of 9.7% year-on-year. Moreover, the number of instant messaging users in China increased to 720 million, accounting for 93.3% of total internet users, an increase of 8.1% year-on-year. The sharing and forwarding of various social media and instant messaging tools is an important way for short videos and live broadcast in the mobile internet.

As the industry scale in the short video field expands rapidly and the whole peripheral environment gets better and better, investors are investing more in the short video industry and new explorations are being made on the market leading mode. Among the top 100 APPs in China, one or two short video apps are growing at 20 to 30%, and some even as high as 50%. This growth rate is basically unprecedented in other areas. If 80% of online content in the future is video content, the user base of short video will achieve double growth in the next three years.

As unstable and slow network connections are most likely to occur during the live broadcast of a large event, good cellular networks are quite important to network platforms. The survey showed that more than half of anchors are forced to abandon their live broadcast due to poor network connectivity. The number of mobile TV services accessed via mobile networks will increase in the future, especially live events. The audiences expect to upload video clips or live events, causing huge capacity pressure on the mobile network. People are eager for networks with few stutters, good coverage, high video quality, short delay time, short loading time, and high sound quality. In live broadcasting of sports events, 5G can also provide a more intuitive on-site experience. By synchronously transferring data between a large number of smartphones, 5G networks enable fast live multicast. With real-time video streaming and virtually zero-latency transmission at different camera angles, users will be able to enhance and share their true stadium experience.

To meet increasing user needs for mobile video and enhance user experience, it is extremely urgent to develop the next-generation new technologies. The pleasant live video experience is inseparable from 5G.

In China, ZTE and China Mobile jointly set up an integrated CDN system to provide professional content delivery for internet video suppliers such as Tencent, iQiyi and Sohu. The system covers not only traditional fixed networks but also 4G mobile networks. It is fully prepared for 5G popularity and deeply integrates the 5G network, MEC, and CDN service platform to deliver best user experience of video services in the future.

Live Broadcast via Drone

In October 2017, ZTE cooperated with Wind Tre & Open Fiber to build up Europe's first 5G

pre-commercial network in Italy, taking a significant step toward 5G commercialization in Europe. With ZTE's commercial ultra-bandwidth, low-latency 5G mobile system used for network support, drone HD live broadcast and 360-degree panoramic VR live broadcast can be simultaneously performed. The drone and the 360-degree panoramic camera transmit the captured 4K full-view videos to the cloud CDN center through the 5G network, and then deliver them to each end user for real-time viewing through the 5G network and the CDN node. Users can enjoy the view of the drone in the air through the big screen, or 360-degree full-view immersive experience through VR glasses.

Smooth 4K/8K Broadcast

5G can provide a peak rate of 10 Gb/s, supporting HD videos that meet user needs of immersive experience. Japanese mobile communication company DOCOMO cooperated with Nokia to successfully complete the real-time transmission of 8K video test using wireless access technologies of 5G mobile communication system. This test used the H.265/HEVC coding technique and radio tracking technology to transmit millimeter-wavelength (MMW) signals at 70 GHz. In the test, 48 Gb/s 8K video was compressed by the encoder into 145–85 Mb/s, and successfully achieved transmission with no latency.

Thanks to the ultra-fast transmission rate of 5G signals, Samsung demonstrated the scene of 4K ultra HD videos transmitted wirelessly to a mobile vehicle. With the development of driverless car technology, in-car streaming media entertainment will become more and

more popular.

In China, the radio and television service will provide ultra HD broadcast TV based on the 5G/wireless interactive broadcast TV technology for the 2022 Beijing Winter Olympics, enabling backhaul transmission of ultra HD contents as well as broadcasting and mobile receiving of ultra HD TV.

5G TV

The combination of 5G with other network enhancements and technologies will allow operators to support TV services, which may gradually replace the USD 500 billion global TV and video market currently served by cable, satellite, IPTV and terrestrial TV broadcast service providers.

Although data transmission rate is the most important factor, other network technologies will also become the key to the success of 5G TV service. The feasibility of 5G TV service depends on the efficiency of end-to-end network delivery. The cases of operators such as Verizon, Deutsche Telekom, Korea Telecom, AT&T and BT prove that 5G TV will appear in many places around the world in the future.

The number of homes and devices supported by 5G TV will determine the success or failure of 5G TV applications. The enhanced network technologies that can increase this figure include MIMO and beamforming optimized for spectrum utilization, virtualization of cellular base stations, dynamic throughput of backhaul network, as well as the network slicing technology and MEC+CDN that guarantee data rates to the home.

According to the latest report from market research firm Strategy Analytics, TV and video contents may become the core of next-generation 5G wireless communication services. Recent technology demonstrations have proved 5G will be able to support data transfer rates of 1 Gbps. When combined with other network enhancement solution and technologies, 5G is expected to allow operators to support services equivalent to TV broadcast and thus to enter the USD 5 trillion global TV and video markets. They will compete with cable TV operators, satellite TV operators, internet TV operator, and terrestrial TV broadcast service providers.

T-Mobile, the third-largest mobile operator in the United States, announced its "5G First" strategy for TV market development in September 2018. "5G+TV" will be its major TV business (big screen TV) development mode.

After the merger with Sprint, the fourth largest mobile operator in the United States, T-Mobile will provide "5G+TV" services to urban and rural users through the coverage of 5G networks across the whole country. T-Mobile will become the first mobile operator in the United States to deliver bundled "5G+TV+wireless broadband" service, with the goal of developing 9.5 million such 5G home users by 2024.

The operators that proposed the development of "5G+TV" also include Verizon and AT&T, the top two mobile operators in the United States. In August 2018, Verizon officially announced a cooperation agreement with Apple and Google to provide 5G TV services. The rise of 5G represents the combination of multimedia and communication as well as the convergence of wireless and fixed-line services will enter the next stage.

Conclusion

Compared with existing wireless networks, 5G has four significant features, namely high-speed transmission, massive connection, low latency at millisecond level, and large-capacity throughput. Video accounts for more than 70% of internet traffic, and is one of many services that rely heavily on the internet. With the rise of live video broadcast and the pursuit of high-definition 4K/8K experience, 5G will better support the existing video scenarios with poor experience or unachievable and will usher in a new outbreak in the video field. ZTE TECHNOLOGIES

Analysis of Key Technologies for 5G Big Video Development

Wang Jindong
Director of Multimedia Pre-research at ZTE

5G network, featuring large bandwidth, low latency and massive connectivity, will bring users abundant new services and stimulate rapid development of existing services. Video services, with no doubt, will be a highlight of 5G applications. Among a variety of services, the most important video technologies are cloud virtual reality (Cloud VR), ultra high definition (UHD), and multi-access edge computing-content delivery network (MEC-CDN) that acts as the underlying support (Fig. 1).

Cloud VR

The VR technology can be divided into VR headend, cloud VR platform, and VR terminals according to its application locations in the VR service system. The VR headend involves mobile panoramic photography, panoramic sound, VR video stitching, toning (image noise-reduction, image sharpening, contrast enhancement, etc.), audio-video synchronization, content editing (watermark adding and cropping), just-in-time packaging (JITP), audio-video coding, push stream and local recording techniques. VR terminals include VR EPG and VR players. These terminals involve the asynchronous time warp (ATW) and asynchronous space warp (ASW) technologies. The cloud VR platform is the core of VR business operation. With high-bandwidth, low-latency networks and the MEC technology, the platform makes it possible to have VR contents based in the cloud and rendered in the cloud. The cloud contents can aggregate discrete contents and fully protect the interests of content providers, while the cloud rendering can make terminals lightweight, low cost, and easy for users to accept. The cloud VR platform involves the following technologies:

- Computing and rendering: Implement multithreading distributed computing and soft/hard rendering of VR videos and games by using edge-cloud resources such as vCPU and vGPU.
- Projection mapping: Convert three-dimensional spheres into the print media formats. The commonly used formats are cylindrical projection and polyhedral projection.
- Coding: The common traditional video codec formats include H.264, H.265, VP9, AOM's

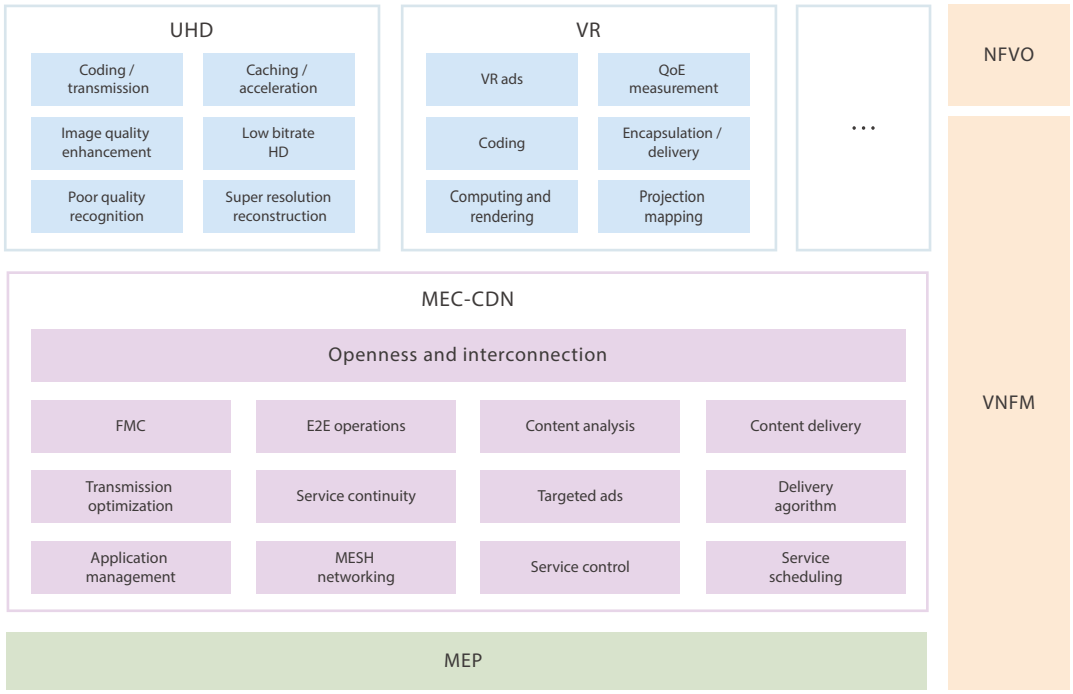


Fig. 1. Hierarchical structure of key 5G video technologies.

latest AV1 format (equivalent to H.265 compression ratio, open source, free of patent fees), ZTE's H.265S (complying with H.265, with 30% increase in compression ratio), and H.266 that may be released in 2020 (about 30% increase in compression ratio compared with H.265). The audio formats include AAC, MPEG-H, and 3D Audio.

- File/encapsulation: There are many container formats for VR contents, such as MP4 and FLV. The DASH format is usually used for encapsulation.
- Delivery: The transmission of VR traffic falls into full view transmission and field of view (FOV) transmission. The former refers to full transfer of VR contents, while the latter only transfers contents in the current field of the user's view to the VR terminal.

  For weak-interactive VR services, full view transmission is usually used at the early stage of VR development. When VR resolution improves and its technologies and standards are mature, FOV transmission will gradually be used to save transmission bandwidth. The current VR transmission usually uses RTMP, RTSP, HLS, DASH, and FLV over HTTP protocols. Based on this, the mainstream protocols are extended for VR contents, such as HLS, DASH, and MMT. Since different terminals support different transmission protocols and DRM solutions, the VR-JITP technology is essential for compatibility with different terminals.
- VR advertisement: Advertisement is essential for commercial operation for video services. Current VR ads are produced in advance during content production. In the future, with the dynamic ads insertion technology at the service side, different VR ads will be presented for different users according to contents.
- QoE measurement: VR QoE measures the immersion quality and interactive quality. Immersion quality is measured through content quality and terminal presentation quality, while interactive quality is measured according to the degree of matching between the interaction and the feedback received by the user's sensory channel. In general, VR QoE measurement involves video quality, audio quality, presentation quality, transmission quality, interactive quality, and experience quality. At present, China Video Experience Alliance, ITU-T SG-12, and VQEG

are specifying VR QoE measurement standards and testing the product quality.

UHD

UHD technology is currently a hot research topic in codec formats, transmission protocols, segment caching, bitrate smoothing, performance enhancement, image quality enhancement, super-resolution reconstruction and poor quality recognition. ZTE has developed a unique low bitrate HD technology that can reduce bitrate by more than 30% compared with H.265 and offer visually lossless performance. The HD technology fully complies with the H.265 specifications, and terminal users have no awareness.

MEC-CDN

As MEC has been widely accepted in the industry, MEC-CDN will undoubtedly become a life-saving medicine for operators to get rid of the fate as pipeline providers and will also be their golden key to open the OTT market. The MEC-CDN technology involves:

- Networking: MEC-CDN implements dynamic self-networking as required. ZTE is the first in the industry to propose the MESH-CDN networking architecture that can effectively help operators address the issues of long uploading and uplink path and slow response time in the traditional CDN tree structure.
- Transmission optimization: The guarantee of video transmission QoS is especially important when a large number of users access the system at the same time. According to the network status feedback by MEC, CDN can combine with PCF, SDN and its own service capability (the slicing technology) to achieve congestion control and bandwidth balance of video transmission.
- Service continuity: Service continuity refers to seamless service migration when handover between fixed and mobile networks or between multiple MECs occurs. There are many solutions for seamless migration in MEC, but a complete solution has not yet been available for video business in the industry. It is easier to think of using the timeout connection reconstruction method that uses the terminal's caching ability. However, this method may cause video stuttering that will affect user experience especially in live broadcast. After in-depth research, ZTE, for the first time in the industry, proposed a complete seamless migration solution for video services, ensuring the service continuity when users move across MEC-CDN.
- Content delivery algorithm optimization: Since MEC-CDN aims at a small number of users, the traditional content delivery algorithm needs to be further optimized. ZTE makes full use of the effective information provided at the MEC side, abandons the policy that delivers only based on content popularity, and takes into full consideration the user identity, trajectory, stay time and preference to build a content delivery prediction model based on user behaviors. This significantly improves the MEC-CDN cache hit ratio and reduces the upstream bandwidth cost.
- Content delivery: In addition to traditional OTT adaptive bitrate and protocol optimization, MEC-CDN needs to focus on the use of OTT multicast and further evolved multimedia broadcast multicast service (FeMBMS). ZTE is working with telecom operators to develop 5G live broadcasting solutions in venue.

With the leading position in the industry and rich technological accumulation, ZTE has rolled out its big video system to lead the development trend. In the upcoming 5G era, ZTE has also developed a full range of video products that can deliver complete and highly competitive solutions for individuals, enterprises and vertical industries, aiming to promote the prosperity of 5G big video industry. ZTE TECHNOLOGIES

Smart Speakers are Quickly Gaining Popularity in AI Era

Wang Weiwei
Chief Planning Director of Home Media Center, ZTE

AI-enabled smart speakers that allow for chatting, shopping and music-playing have been favored by the households, as evidenced by a string of new highs in shipments reached by them.

The latest data from research firm Canalys showed that global smart speaker shipments had surpassed 100 million units by end-2018 compared with just 40 million in 2017. The figure is likely to climb to 225 million in 2022. Such growth already exceeds the rate at which any consumer electronics grows over the past decade.

Smart speakers have been hailed as a phenomenal product. As new brands enter the fray and there are diverse products, competition is heating up. This is a sign that "the battle of speakers" has begun, with products of all price ranges shaping up to carve out their respective market niches. By the end of 2018, Amazon and Google had gained a worldwide market share of around 80%. China has become the second largest smart speaker market behind the U.S. thanks to a fast expansion in the sector, with Alibaba, Baidu and Xiaomi ranked the top three vendors domestically.

It seems that technology titans are falling all over each other to grab a piece of the smart speaker pie. But why?

Reason: Traffic Portal Is a Must-Win for Industry Players

In the PC era, the traffic portal was operating systems, which enabled Microsoft to dominate all computer interfaces. Search engines, the portal of the internet age, turned Google and Baidu into giants among web companies. The mobile internet era sees the role of the portal played by smartphones and the apps running on them. Apple, Facebook, Alibaba and Tencent have since emerged as industry heavyweights of the era.

In the AI era, voice interaction becomes the

preeminent portal. Because the smart speaker can cover various scenarios of home life, it is the ideal carrier of voice interaction in the home and that in turn makes the smart speaker the perfect candidate as the controller of the smart home and as the portal to search, shopping, content and social media (Fig. 1). Sensing the huge potential of smart speakers, almost all big technology giants are throwing their hats into the ring.

Currently a fierce price war is raging in the smart speaker market. That is because vendors are concerned not about the profitability of the smart speaker but about the big pie associated with it, i.e., the smart home (Fig. 2).

Key: Hardware, Technology and Service Are Indispensable

Experience is king. To deliver a superior AI-based user experience and become a must-have for households, smart speakers must be truly:

- Audible. Using far-field voice technologies including speech enhancement, sound source location, beamforming and echo suppression, smart speakers can provide wake-up and identification services that are more accurate, faster and more stable (Fig. 3).
- Understandable. Through deep learning, smart speakers can strengthen their natural language processing (NLP) capability and boost their understanding capacity close to that of humans. Only when the person who speaks is identified can a real conversation between man and machine be achieved.
- Smart. By integrating the industry chain and improving the ecosystem, industry players can make rich content and excellent services available to smart speakers so that they can deliver a really smart experience.

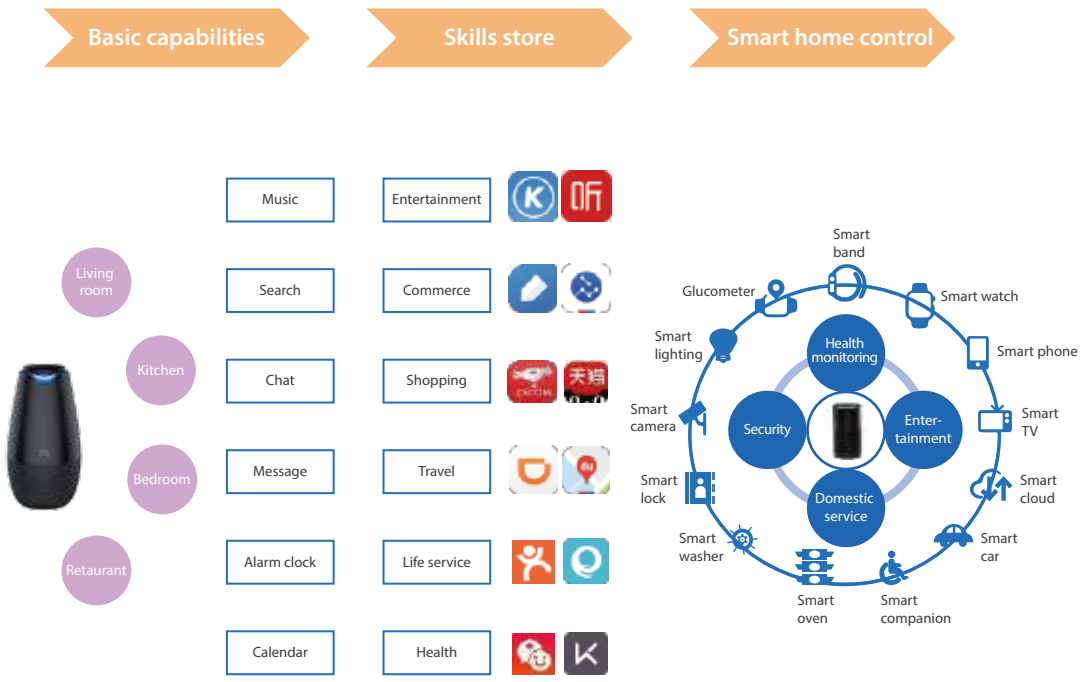


Fig. 1. Traffic portal is a must-win for industry players.

Opportunity: The Entry Point for Operators to Embrace the AI Era

In 2018, home broadband and video services experienced rapid development, while AI began to play an increasingly strategic role in video services. Operators are bundling 100M bandwidth, 4K UHD, and intelligent networking with the smart home. By building a new ecosystem and a new portal in this way, operators hope to explore new revenue sources in new areas.

Smart consumer products, especially smart home offerings, will be the main driver of a consumption upgrade in China in the near term. Undoubtedly, they have a strong attraction for operators. On the one hand, operators face uncertain revenue growth because their data dividend will soon disappear thanks to the rapid adoption of unlimited-data plans, but on the other hand, they have inherent advantages for building a smart speaker ecosystem because they possess pipe and platform resources. By seizing the voice portal of the household, operators can accelerate the deployment of smart home and new services to tap opportunities in the new segment.

At the "Digital Sichuan" meeting held in May 2018 to order pan-smart terminals, the Sichuan branch of China Telecom (Sichuan Telecom) purchased 5.78 million pan-smart terminals, including 2.48 million smart speakers and 2.41 million smart control devices. To gain entry into homes, Sichuan Telecom adopted the "1+1+N" sales model, which was complemented with strong channels and heavy subsidies to achieve quick results. The sales model plus the complementary measures made the smart terminals project of Sichuan Telecom a classic case of "pinpointing the entry point and quickly

Fig.2. Big technology giants, vendors and CPs involved in the smart speaker market.

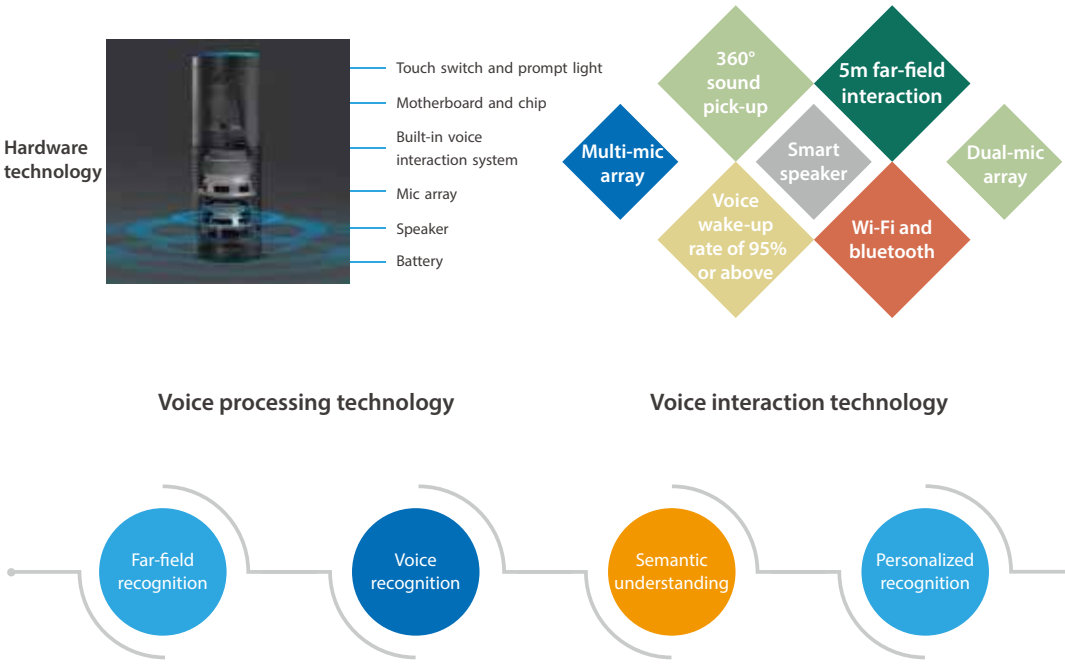


Fig. 3. Hardware, technology and service are indispensable.

scaling up". The first 1 in the sales model refers to the smart speaker, which is the voice portal of the home. The second 1 stands for the smart control device, such as a smart plug or smart infrared gadget, which is used to control traditional household appliances. The N represents other smart home devices, including smart locks, smart curtains and smart routers.

The "1+1+N" model allows operators to first use a smart speaker plus a smart control device to gain entry into the user home and then keep adding other smart gadgets to complete the setup of whole-home intelligence. Among all the products involved, the smart speaker is the portal and therefore has strategic significance. As a long-term partner of telecom operators, ZTE always seeks to continually create value for customers through technological innovations. The series of smart speakers developed by ZTE, including the pure-play speaker, speaker plus STB, and speaker plus phone, can assist operators in strategic planning and intelligence-based home transformation.

Conclusion

Chinese telecom operators have hundreds of millions of home broadband users and an associated sales and service system. The smart speaker is the portal to the smart home and should be the focus of operators before they integrate core services including IPTV, smart home and IMS voice. The eventual win-win smart home ecosystem involving all industry partners should include the smart speaker as the unified portal, the smart home product portfolio as the core carrier, and smart operations as the way of traffic monetization. ZTE TECHNOLOGIES

Key Technologies for STBs in 5G Era

You Hongtao
Chief Planning Engineer of ZTE's DHome Products

Much different from previous generations of wireless standards where applications were driven by technologies, 5G technology has been driven by specific uses and applications. 5G will come with many improvements to meet multiple scenarios, such as continuous wide-area coverage, high capacity hotspots, and low-power massive-connections. Video, an indispensable service to users, will also embrace new opportunities with the arrival of 5G.

As a multimedia terminal device, the set-top box (STB) will undergo a revolutionary transformation along with the new developments in video.

Access Mode

5G with the high bandwidth feature will transform the access mode. Different types of users are supported over the same physical 5G network, which logically includes fixed network users. In 5G, fixed and mobile networks will interwork and collaborate for full-service and integrated-service operation.

Current Home Networking Mode

Home wiring (Fig. 1), expecially connection between rooms, is the biggest obstacle in home service development. It remains a headache for operators since either PLC or wireless connectivity has problems in stability and penetrability.

Home Networking Mode in 5G Era

Through deploying intelligent CPE, using 5G wireless backhaul for upstream and 5G/Wi-Fi dual channels for downstream, the home networking solution in 5G era (Fig. 2) can provide larger coverage and easier

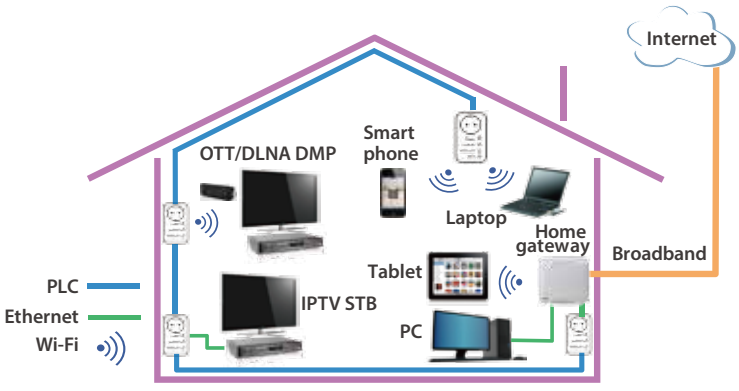


Fig. 1. Current home networking mode.

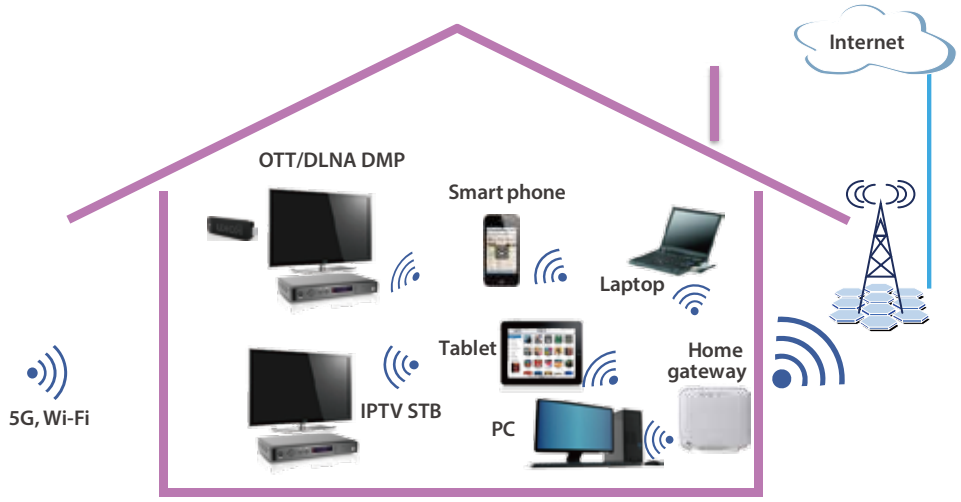


Fig. 2. Home networking solution in 5G era.

access by capitalizing on 5G base stations/small base stations/micro base stations. It has the following features:

- Integrating WLAN management and 5G NE for management
- Higher mobility guaranteed by a 5G cellular network
- Seamless service integration; real-time switch between licensed spectrum (5G) and unlicensed spectrum (WiFi); flexible deployments

Smart Home with IoT

5G can effectively solve network deployment and device access problems to realize the IoT potential. More and more smart home devices will deployed around the home (Fig. 3). For example, the home monitoring device integrated with the home base station function supports wireless upload and makes device placement and management more convenient. Personal devices, like mobile phone, allow users to view and control smart home devices more conveniently. 5G could promote a boom in smart home, and a uniform network architecture allows better management of smart home devices.

Service

With rapid development of ultra HD video, video has entered the 4K era. Here is a brief exploration of how it will evolve in the future.

From 4K to 8K

Japan will broadcast the Tokyo Olympics in 8K in 2020. In September 2018, China Unicom announced its 5G+8K live broadcast solution, which is going to be used in the Beijing 2022 Winter Olympics. Demands for service will bring higher resolution videos. 8K encoding and related transmission standards have gradually matured, and it is expected that 8K video will come into market in next 2-3 years. Video is entering the era of 8K along with the arrival of 5G.

From Single-Screen to Multi-Screen

TV dominates the traditional multimedia landscape. Mobile devices like smartphone allow users to display contents from their phone on a bigger TV screen. With developments in video technology, network access capacity and processing capacity

of terminal devices, new multi-screen services have emerged, such as PIP, multi-screen viewing (four concurrent streams), and nine-screen program guide.

From 2D to 3D

Traditional videos come in two dimensions. However, with the development of VR technology, 3D video services are growing, especially 360-degree omnidirectional video and 120-degree wide angle 3D video. Developments in interactive operations have further transformed the user experience.

From One-Way to Interaction

Traditional video service is one-way broadcasting (for example DVB). Interactivity emerged in the era of IPTV/OTT but it is only limited to program selection. In the future, the multi-screen mode and integration of VR services, when coupled with the high bandwidth of 5G, will enable Director Mode, which allows users to dynamically select video shooting angle, and God Mode which allows users to watch videos shot from different angles of view simultaneously. Such kinds of services will be given full play in live streaming events such as electronic sports, concerts and ball games.

From Non-Intelligent to Intelligent

AI technology has improved greatly in recent years and is increasingly being incorporated into the video industry. Terminal devices integrated with far-field vice recognition have the ability to "listen" and, when connected with the background AI system, also have the ability to "think" and "speak". Terminal devices, which used to be operated by a remote control, now have the ability to communicate with users. With the development of AI technology, multimedia devices will make good companions for children and elderly people at home.

Fig. 3. Solving home wiring problem to create a smart home.

Video and Audio Technology

The move to 5G will transform access technologies and services. Since the demand for 5G technology has been driven by new services, video and audio technologies will also have revolutionary changes.

Encoding/Decoding Technology

Currently, H.265/HEVC is the mainstream codec for 4K video, which contributes greatly to 4K service development. However, HEVC licensing is complex and uncertain. There are now three patent pools, one of which has not published their license, and a significant number of patent holders that have not published their licenses. It is believed there is going to be a huge cost for the whole industry chain.

To avoid above-mentioned risks, several organizations have proposed alternative solutions.

- AVS: AVS is created in China. AVS2.0 is the latest codec standard for 4K video. Tests have shown that AVS2.0 has advantages over H.265/HEVC in terms of encoding rate and efficiency. Many Chinese and overseas operators have included support for AVS2.0 in their bid specifications.
- AV1: The Alliance for Open Media (AOMedia) is backed by leading members like Google. It released the AV1 royalty-free video format in March 2018. The technical disadvantage of AV1 is its optimization algorithm. As a result of avoiding patent issues, AV1 encoding is very slow when compared with H.265/HEVC.
- XVC: The Swedish company Divideon has developed XVC codec based on MPEG/VCEG technology. The codec is available under a single license approach. The latest version of XVC (2.0) was released in July 2018. XVC is said to outperform HEVC by around 20% and AV1 by around 10%. It still takes a long time for this codec to gain industry-wide recognition.
- VVC: The Joint Video Experts Team (JVET) commenced work on a new coding standard known as Versatile Video Coding (VVC) in 2018. It faces great difficulties to compete with other video coding standards developed earlier.

While the 4K video codec battle is in full swing, work on new specifications concerning 8K and full-view video is underway. MPEG's FVC/H.266 is expected to be ready in several years. The AVS 3.0 standard for 8K is being formulated with the first edition to be released in 2019.

Other Technologies

- HDR: HDR is one of the most important aspects of ultra HD video, providing greater brightness levels in low-light scenes. HDR10, HLG and Dolby Vision are three major HDR standards and each has its own supporters. These standards will coexist for a long time and terminal devices have to support all of them.
- WCG: The BT.2020 standard for Wide Color Gamut (WCG) has defined the color space for ultra HD TVs. 10-bit color depth is designated for 4K and 12-bit for 8K.
- New-generation video and audio transmission technologies: New technologies and services in 5G era put higher requirements on traditional transmission technologies. MPEG's Common Media Application Format (CMAF) aims at unifying two leading streaming protocols (HLS and MPEG-DASH) and adding support for new services like VR. In the future, transmission technologies such as QUIC and HTTP/2 will be introduced to further reduce the latency.

Summary

5G will have a drastic impact on the fast-growing multimedia video industry. ZTE will keep a close eye on the latest technology trends, specifications and services, explore new market opportunities, and help operators create more value in the new era. ZTE TECHNOLOGIES

Premium Video Solution to Meet User Expectations for Video Streaming Services

Lu Wei
Chief Multimedia Product Strategy & Innovation Officer, ZTE

Nowadays more and more operators are realizing that video is not just a value-added service on top of traditional telco services but also fundamental to future strategy, especially in the coming 5G era. 5G cellular will enable significantly greater capacity and lower latency, and optimum support for UHD streaming video embedded with advanced applications and services including AR, VR, education, and various IoT enabled applications and services.

Meanwhile, the video industry has benefited greatly from the recent advancements in artificial intelligence (AI), and there are tremendous opportunities to offer captivating user experiences to subscribers and new revenue streams to content and video service providers. To capture these openings, ZTE has launched its premium video solution with a platform evolving toward the future, and helps operators unlock new business models by using innovative AI technologies.

ZTE's Premium Video Solution

ZTE's premium video solution is a convergent platform that allows IPTV, OTT, mobile, and DVB video content to be accessed, managed, operated, and delivered in a unified manner. It helps operators provide rich and quality video content such as 4K/8K, AR and VR with ultimate experience and across multiple network types and terminals.

The premium video solution is mainly composed of the video service platform, the convergent content distribution network (CDN), and core components such as O&M module and STBs. On top of the basic video services, ZTE provides an AI abstraction layer which encapsulates various AI technologies such as object or face recognition, deep learning (DL), and natural language processing (NLP), and helps operators differentiate their video services, improve their customer loyalty and discover more opportunities for their revenue growth.

AI Powered Video Services

In today's connected universe, data is important to the movie and TV experience. The ecosystem of the video industry involves many parties and is expanding from content producers, aggregators, solution vendors, to many AI capability providers having their own data analytics and learning algorithms, trained with massive data. As part of this convergent and innovative video ecosystem, ZTE cooperates with industry's leading AI capability providers by encapsulating their capability including object or face recognition, DL, and NLP into the AI abstraction layer, in order to deliver new consumer experiences through innovations in artificial intelligence with the highest accuracy. Based on open APIs, the AI abstraction layer allows operators to unlock many advanced features in addition to the traditional video services. For example, features using data analytics such as personalized UI, precise recommendation or intelligent search allow operators to re-imagine the TV experience,

change the way viewers connect with, discover, and enjoy their favorite TV shows and movies, and finally attract users and increase revenue with long tail marketing.

Moreover, with the development of network technology and expansion of social platforms, short-form, UGC, mobile-friendly and UHD video may dominate the future of content, and content and service providers more and more consider the value of social as a distribution network. AI based 4K UHD restoration of the classic movies will enrich the UHD content library, and features such as short-form editing and content recognition will facilitate from production to delivery of the massive UGC contents, as well as creation of short clips and trailers of sports event or traditional TV programming. For example, as AI is able to analyze each video frame to figure out all the imageries and mark them up with timestamps, video clips as trailers can be automatically generated. Moreover, object and face recognition technologies have made it possible to automatically tag objects with additional information, and can be used to enrich the content metadata, to generate smart advertisement, or to shorten the content reviewing process before sharing it by social networks.

Smart Advertising

TV advertising is another interesting topic regarding the use of AI technology. TV advertising has been a dominant marketing channel across the world for more than 60 years. Unlike traditional linear or programmatic TV, smart advertising using AI such as addressable technology can completely eliminate wasted reach, when advertisements are viewed by viewers who aren't part of the target market. This precision helps the operator target its audience whatever they are watching, closes the loop on true marketing outcomes and delivers improved audience understanding. Technology is fundamentally changing the way brands connect with audiences through television, helps to maximize advertising effectiveness by delivering the data-driven capabilities for advertisers using any television platform for their campaign, and introduces new revenue opportunities to the operator and Ad inventory owners.

UHD Video Distribution

With the premium video solution, ZTE extends its video platform to network edges to optimize UHD video distribution and transport, as the multi-access edge computing (MEC) platform is impacting the future of the telco ecosystem. By providing vCDN and content processing modules as software-based solutions on the MEC platform, the content can be rapidly ingested, processed and delivered at the very edge of the network, closer to the customers.

The premium video solution also adopts microservice based architecture (MSA) that will not only facilitate O&M or launch of new features but also allow for expansion of video service capabilities to various vertical applications under 5G. As 5G network architecture relies on network slicing to deal with high external demands and network slicing requires a scalable and software-defined infrastructure, MSA will properly support the responsiveness, flexibility, updatability and scalability that 5G demands.

Today, hundreds of millions of users watch TV programming or online videos supported by ZTE video solutions. However, network, AI and video technologies continue to evolve from generation to generation. The 2018 World Cup featured a range of emerging video technologies, and the Winter Olympics in PyeongChang also provided many innovations including some events covered already in 8K. Aiming to be the operator's best partner in the video industry, ZTE accelerates the transition to pervasive next-generation video by connecting people and media across any device with its premium video platform, and continuously removes the barriers of accessibility and watching experience with industry's leading technologies. ZTE TECHNOLOGIES

CloudTV Brings a New Experience for STB Deployment and Operations

Pang Hongyi
Manager of vSTB Project at ZTE

As big video develops more and more mature, users have placed higher requirements on video experience. They hope to enjoy a better UI experience through big video, enjoy richer value-added services, and enrich their daily lives. Also, with fast fixed broadband connection, fiber-to-the-home, 4G prevalence, and the arrival of 5G, the big video service will usher in a period of rapid development and widespread applications. Big video has become a strategic basic business for telecom operators.

However, in the promotion of the big video service, operators are increasingly feeling that set-top box (STB) hardware capabilities have become the bottleneck of service development. Due to the limitation of STB hardware, some services cannot be deployed on the existing network. User experience is inconsistent and the cost of replacing STB is too high. There are many STB vendors on the network, and there are too many models. This results in a particularly long period of service adaptation and activation. STB hardware capabilities include resolution support and service support. The video service has entered the 4K era. 4K resolution will remain dominant for a long period of time because the advantage of 8K resolution is not obvious in a home scene. However, the growth of future services such as Big Video 3.0S, complex services, and large games will pose ever higher requirements for STB hardware, mainly in terms of enhanced CPU/GPU capability and expanded RAM/flash space.

Combining the development trend of big video and STB hardware, ZTE is the first to introduce its CloudTV solution (Fig. 1) in the industry, which can help operators solve the difficulties of business operation and development. The core idea of ZTE CloudTV product planning is to retain the STB core decoding capability and peripheral interface capabilities. The big video UI, services, and games are processed in the cloud, while STB simply provides the presentation function.

Customer Benefits

In addition to lowering the requirements for STB capabilities, the CloudTV solution shields STB vendors and models to deliver a consistent service experience. This helps operators solve

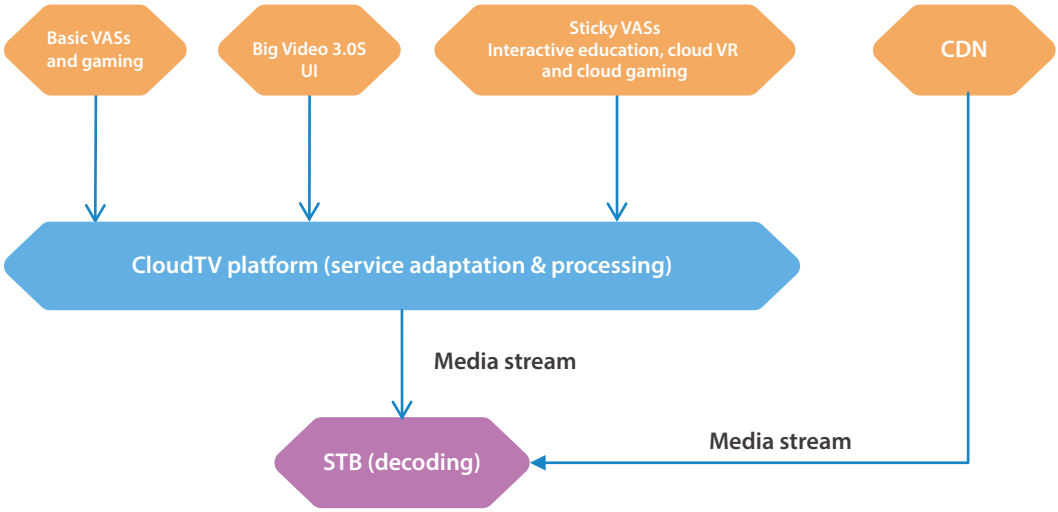


Fig. 1. ZTE's CloudTV solution.

the pain points in their service development and reduce Opex. The CloudTV solution offers the following benefits:

- Fast adaptation: The new service or new UI deployment only needs to be connected to the capability platform in the cloud once and does not need to adapt to various types of STBs on the existing networks. This enables STB to truly implement hardware and software decoupling.
- Fast development: The unified service and UI development environment reduces software development and testing complexity, thus resulting in a shortened development cycle for STB applications.
- Fast upgrade: The upgrade is completed in the cloud and takes effect in real time without waiting for existing STBs to be upgraded. There is also no need to consider whether the software versions of old and new STBs are compatible. All the STBs can be upgraded overnight.
- Less maintenance: Services are processed in the cloud, while STB carries only a light load. This reduces failure rate and Opex.
- High security: Third-party APKs are manageable and controllable. The STB security solution can be fast deployed.
- Numerous services: As services are deployed in the cloud, there is large space for business development.
- Good experience: STB carries light load, allowing for smooth operation, better user experience, and lower latency.
- Long lifecycle: Since its 4K decoding ability remains unchanged, STB does not need to be updated. STB has a long lifecycle.

Mature Conditions for Deployment

Technically, virtual devices and cloud services have become a trend in the industry, and the virtualization technology has matured for commercialization. From the network perspective, optical access has become the mainstream, and home broadband has entered the 100-megabit era, meeting the demand for network bandwidth and quality of CloudTV products. From the architecture perspective, with the advent of 5G, CO and AO re-architecture significantly reduces network latency. The move of edge computing resources

into end users lays a foundation for CloudTV deployment. In summary, ZTE believes that the conditions have matured for CloudTV deployment.

Technical Features

ZTE's CloudTV products based on virtualization technology enable cloud services. Resources are flexibly allocated based on user activity. The CloudTV products have the following technical features:

- Standard interfaces: A big video system has many network elements (NEs). CloudTV products use standard interfaces to connect external NEs such as EPG and CDN. Its element management system (EMS) does not need to be changed.
- Flexible deployment: CloudTV products can be deployed at the CR, BRAS or OLT side according to service and network conditions.
- Fast deployment: CloudTV products can be deployed with a cloud resource pool or purchased general-purpose servers. As the products adopt the NAT mechanism and need only one public network address, they are more convenient to deploy.
- Strong adaptability: CloudTV products support multiple user access modes including bridging, routing and NAT. They can be widely deployed and are adaptable to different networks.
- Secure network platform: The CloudTV solution is designed to run carrier-class applications, with its software and hardware architecture incorporating security policies and mechanisms necessary for smooth system operations. The capability nodes of CloudTV products use the NAT mechanism to improve security and reliability.

In the product development process, ZTE CloudTV team continues to make technological breakthroughs. They have gained rich experience in low latency, image quality enhancement, network adaptation, multi-screen overlay, graphics device call, and efficient coding. The continuous breakthroughs of these key technologies have laid a solid foundation for large-scale commercial use of CloudTV products. As technologies advance, products will continue to evolve. With the maturity of the ecological chain, cloud VR, cloud games, cloud education, cloud video, and AI interaction will become basic services of CloudTV products. "Technology leadership, cost leadership, and product leadership" has always been the core concept of ZTE Cloud TV team.

ZTE's CloudTV products are being trialed for cloud services by Fujian Telecom, with the goal of allowing new and old users to enjoy big video 3.0s services without changing their STBs. Moreover, ZTE has cooperated with Hunan Telecom to jointly build a universal CloudTV capability platform, and has successfully run the CloudTV trial with Anhui Telecom. The CloudTV products are highly recognized by operators and are expected to be fully commercialized in 2019.

ZTE's CloudTV products transform the traditional experience in STB operations, providing a new direction for the deployment of big video services. With the arrival of 5G, the CloudTV products will certainly become basic network elements that play an increasingly important role in the 5G fixed-mobile convergence (FMC) and the development of 5G big video. 5G will make networks accessible everywhere and make service ubiquitous possible. Meeting the technology trend towards mobile edge computing (MEC), ZTE's CloudTV products will have a strong vitality not only to bring users a more extreme sensory experience but also to help users stick to operators, increase ARPU, and bring about growth in both profits and user base. ZTE TECHNOLOGIES

ZTE Big Video 3.0S Boosting Video Service Development

Cheng Shenliang
Chief Engineer of Multimedia Video Solutions at ZTE

After going through the voice era and the data era, the communications industry is entering the video era. Video is the primary carrier for information creation, spread and consumption in the ICT industry. Statistics show that video accounts for 70% of total network traffic. Higher quality video experience, smarter video interaction, and more diversified video application scenarios are key elements in a strategic upgrade of the video industry. Video, especially HD/4K, will become a major service carried by networks. The number of households worldwide which pay for digital video service will reach over 1 billion mark, which means huge market potential of video.

Many operators have upgraded video from a traditional VAS to a basic pillar of their strategy. Video service development has gradually shifted from increasing user base to increasing APRU with good user experience and precision marketing. To help operators address challenges in the new era, ZTE proposes the brand new Big Video 3.0S solution (Fig. 1), aiming to achieve a "New Experience, New Platform, and New Operation". Through a smooth upgrade of operators' existing IPTV platforms, this solution can help operators realize their two strategic goals—network reconstruction and operation reconstruction.

"New Experience" with a focus on one-second improvements means a comprehensively improved user experience. "New Platform" means a new-generation video platform with unified EPG and iCDN as its core. "New Operation" means smart operation and maintenance (O&M), which can greatly improve the profitability of the video service.

New Experience

To make IPTV a significant attraction for users, enabling high-quality user experience is a prerequisite. ZTE Big Video 3.0S solution is user experience-centric. It proposes the concepts of "splendid, special, smart, and speed", which precisely define the criteria for user experience assessments in the video 3.0 era. Its ultimate purpose is to get users engaged at the very beginning and offer them personalized guidance and natural interaction experience.

Splendid Experience

Users will have a immersive viewing experience the moment the TV is turned on. The interface always has some kind of streaming element. When users browse the program guide, channels will run in the background. When they enter the live TV menu, channels in the preview

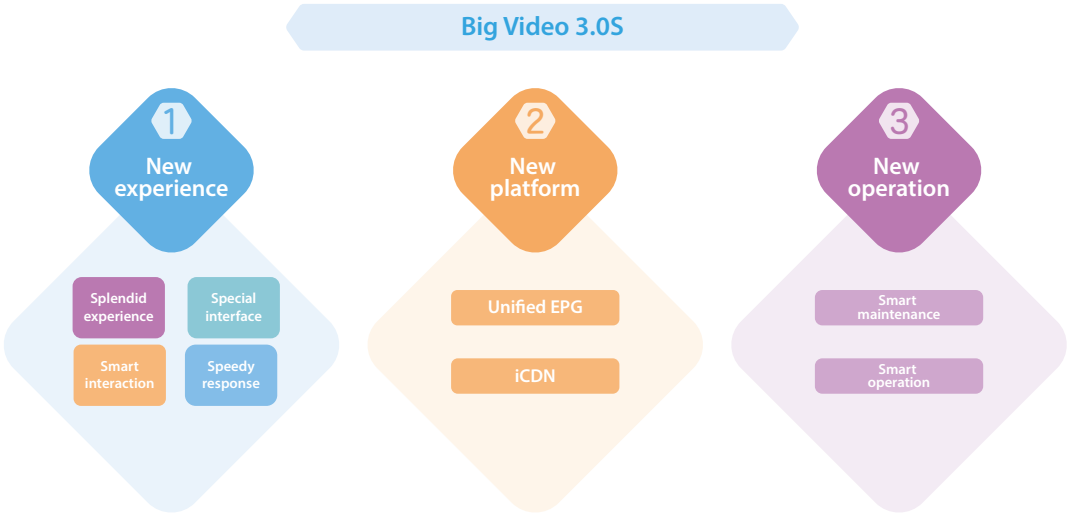


Fig. 1. ZTE Big Video 3.0S solution.

PIP windows will be displayed simultaneously. The PIP preview is changed in real time as the channel is switched. When users open the VOD content pages, instead of dull introduction texts, they can view trailers that are automatically loaded and played.

Big Video 3.0S understands users better with its big data-based analysis. Through CDN frame extraction and smart analysis, it enables fast update of short video posters and replacements of default posters of movies in the viewing history, allowing users to get a content preview directly.

Special Interface

Big Video 3.0S has a brand new interface that offers great visual effects. The EPG interface with a waterfall-style design reduces interface complexity and saves space, making browsing easier for users. Users can browse each module (e.g. latest recommendations, movies and TV series) in one page, and each module is composed of system recommendations, hot columns, hot programs, and recommended stars. Since multi-dimensional contents are displayed, users can easily find their preferred programs.

When users are watching programs, relevant contents with different tags will be intelligently recommended. Based on the users' previous watching habits, contents can be matched precisely with the user preferences.

Navigation is easy. With roller-type cross searching, users can find interesting contents in various aspects effectively and rapidly. The navigation drawer layout allows users user to focus on the main content.

To fulfill different requirements of family members, user interfaces customized for different roles are available. For example, the user interface for children has a child-friendly cartoon look and presents videos appropriate for them; the user interface for the elderly has a large font size.

Smart Interaction

Voice control is becoming a new habit for users. Big Video 3.0S offers powerful voice control capabilities, allowing users to change channels, search for contents and perform operations on VOD programs through intuitive voice commands.

With the CDN frame extraction technology, when a video is released, images with specified resolution will be extracted at an interval of several seconds based on

the frame extraction service configuration. When a user wants to play the preview, a request for thumbnail pictures will be sent to the frame extraction server. Preview thumbnails can be displayed when the progress bar is hovered over. This gives users a visual way to browse content of the video. Markers can be added on the progress bar to indicate the locations of interesting contents in a video.

Speedy Response

Big Video 3.0S creates a "one minute faster" user experience with speedy response and zero latency, differentiating itself from internet videos and improving the user stickiness.

For live channels, the PIP swapping time is reduced from 1-2 seconds to less than 0.5 second. With the cache technology, the EPG poster loading time is reduced from more than 1 second to less than 0.5 second. 4K videos can be played within 1 second.

New Platform

ZTE Big Video 3.0S helps operators build a brand new video service platform, which also helps create a new ecosystem. With unified EPG and service management platform, it completely solves the multi-vendor CDN interconnection problem. Content interconnection, capability scheduling, service development, and terminal management will be unified to greatly improve O&M efficiency. End-to-end security is realized through four aspects: security O&M, WAF firewall, live broadcast anti-tampering, and content anti-tampering. A EPG editing tool is also provided for fast and convenient page editing to ensure the timeliness of EPG information.

ZTE Big Video iCDN solution truly integrates IPTV, OTT and cache services in one CDN platform, and with the added support for interconnection with third-party CDNs and capability leasing, it can significantly reduce operators' expenditure and improve operators' capability in providing unified services. Meanwhile, it uses technologies like smart scheduling, M-ABR, JITP and JITT to greatly reduce network bearing and content storage costs. In 2018, ZTE launched the VS3000H series and VS3000S series CDN devices with the maximum throughput for a single device reaching 60 Gbps and 90 Gbps respectively. In 2019, a single CDN device is going to achieve a throughput of 200 Gbps, providing powerful support for scaled deployments of 4K and 8K services.

New Operation

ZTE Vinsight smart maintenance platform based on video quality evaluation system (V-QoE) can timely detect and diagnose video service problems. Based on its big data analytics capability, it allows operators to utilize various marketing methods (e.g. personalized display, desktop layout, in-depth operation of contents, smart advertising, smart recommendation, smart search) and refined marketing strategies to gain more market share. In December 2017, ZTE launched a pre-commercial trial of Big Video 3.0S on the existing network of China Telecom Fujian Branch, demonstrating that ZTE Big Video 3.0S is capable of full commercial use. On October 30, 2018, at a smart TV press conference held in Anyang, Henan Province, China Unicom Henan Branch, China Broadcasting Network (Henan Branch), and ZTE announced that the new generation IPTV video platform Big Video 3.0S has been put into commercial use.

Big Video 1.0 solves the basic video problems, which helps create the IPTV service. Big Video 2.0 further improves the service. Big Video 3.0S that makes technology upgrades to improve the user experience will improve APRU, increase customer retention, and add new impetus to the industry growth. ZTE TECHNOLOGIES

Telkom and ZTE Develop Win-Win Cooperation in Deploying IPTV/OTT STB in Indonesia

Yang Buan

Manager of Multimedia Digital Home Product line at ZTE

Telkom is the largest fixed-line operator in Indonesia, with approximately 5 million fixed-line subscribers, accounting for about 90% of the country's market share. Since 2010, Telkom has been working with ZTE on an IPTV project. Through years of sincere cooperation, Telkom has attracted more than 2 million IPTV users, and the IPTV project has become one of ZTE's largest overseas sites.

New Products and Solutions to Enhance Competitiveness

Telkom chose ZTE as its cooperative partner because ZTE could continually offer cutting-edge technologies and solutions. Early in 2014, ZTE deployed a converged IPTV/OTT platform solution for Telkom. To improve user viewing experience, Telkom adopted special functions supplied by ZTE such as low bit rates and high definition, and also used DASH-based Multi-DRM for video delivery. Moreover, ZTE continually rolled out latest product solutions ranging from screen management and advertising services to the big video 3.0 smart operations platform that will be commercially used and to the new-generation INK6 template.

The horizontal and vertical scope of the TV industry chain is relatively wide, and only positive integration can be a benign development. In the IPTV/OTT set-top box (STB) project, Telkom and ZTE worked closely to build the IPTV ecosystem including the headend, DRM, third-party value-added services, and multi-ecological terminal operating system. The ecosystem helped Telkom introduce multiple popular Chinese TV channels and mature game platforms, hence enhancing their brand competitiveness.

Telkom has adopted the latest STB models made by ZTE. Since 2017, ZTE has supplied 4Kp60 STBs that are characterized by high security and superior performance, fulfilling Telkom's needs for developing new services. ZTE's Android TV STBs have also been used to

improve Telkom's brand competitiveness.

To build a mature business incubation mechanism, Telkom and ZTE co-founded a Joint Innovation Center (JIC) in 2015. Since then, the two sides have discussed and formulated multiple topics each year, and implemented verification and closure. So far, several JIC innovation projects have been completed. In the Digital Experience Center built by Telkom in 2019, a number of ZTE product solutions have been deployed. Customers are regularly invited to visit ZTE booth and experience new services. ZTE has been committed to providing the best solutions for mainstream operators worldwide.

Active Response to Improve User Satisfaction

To satisfy the user needs, Telkom has to customize its IPTV/OTT STB system and terminals such as tailor-made EPG templates. Assisted by ZTE, Telkom carries out numerous custom development programs every year. For some of the more customized needs, Telkom arranges expert on-site communication and implements tests on-site if necessary. Especially after the commercial use of Android STBs, user demands grow rapidly. Telkom has built an AppStore that introduces three mainstream OTT content providers (iFlix, Catchplay, HooQ) and several APP providers at a time. With the help of ZTE, Telkom has completed customization and commercialization within a short period of time. This has greatly enhanced the ecological dominance and integration capabilities of Telkom in the regional market. Moreover, Telkom and ZTE hold regular meetings, collect user requests and feedback questions, and give solutions in a timely manner.

Since 2016, Telkom has cooperated with ZTE in implementing interoperability tests for the IPTV/OTT STB platform. From the formulation of standard specifications to the final implementation of commercial use, they have invested a lot of manpower to address the issue of openness. The open IPTV/OTT STB platform has been highly recognized by high-level leaders from Telkom.

High-level leaders from Telkom Group visit ZTE booth.

Timely Delivery to Ensure Service Continuity

Telkom needs to purchase IPTV/OTT STB terminals regularly for sustainable development. ZTE is required to comply with Indonesian national regulations and implement localized production of STBs. Every step from market access to import, production, and delivery requires precise control to ensure terminal supply. Because Indonesia is a multi-regional, multi-island country with a complex geographical environment, it poses a higher challenge to local logistics and after-sales services ranging from transportation to delivery and acceptance. In the case of a sharp depreciation of the Indonesian rupiah exchange rate in 2018, ZTE kept stable product supply to Telkom, ensuring that users are uninterrupted in IPTV services.

Telkom and ZTE will continue to adhere to the concept of sincere cooperation and work together for a win-win future. Telkom will continue to roll out new products and services to meet user needs, enhance competitiveness, and strengthen its market position. ZTE TECHNOLOGIES

How AI Can Transform Video Offerings into Big Video

Source: Disruptive.Asia By Weijun Lee

To accurately define the emerging status and trends of the convergent video landscape, ZTE and other players have proposed the concept of big video that covers four aspects: big content, big network, big data, and big ecosystem.

The big video industry has benefited greatly from the recent advancements in artificial intelligence (AI), especially machine learning (ML) and deep learning (DL), which is a specialized and powerful version of ML with many processing layers.

Advancements in AI

Artificial intelligence has two major schools: rule-based expert systems and data-driven machine learning systems.

Rule-based expert systems perform efficiently and deterministically but lack the ability to learn adaptively from the data sets being processed.

Data-driven machine learning systems, especially deep learning systems, are able to solve problems that are hard to define or enumerate by explicit rules, for example, natural language understanding. They can also autonomously learn from the massive big data sets and improve their accuracy over time.

ML and DL require massive computing power that was infeasible until the commercial deployment of cloud computing systems. In recent years, ML/DL are able to recognize and understand objects, faces, voices, and conversations with 95%+ accuracy, equivalent to human classification errors. This is an enabler to unlock many advanced features in big video.

AI for Big Content

Big content denotes the current diversified trends in the digital content business, ranging from audio to video to virtual reality (VR) / augmented reality (AR) / mixed reality (MR), from standard definition (SD) to high definition (HD) to ultra high definition (UHD), from traditional studio-produced long-form movies and dramas to user-generated mobile-friendly portrait-mode short videos.

The content may be professionally generated content (PGC), occupationally-generated content (OGC) like live casting of online games, and user-generated content (UGC).

To facilitate fluent multi-screen experience and sharing by social network services, short clips and trailers of long content are essential. This used to be done by experts manually.

One smart use case of AI for big video is to automatically generate interesting video clips as trailers. AI is able to analyze each video frame to figure out all the imageries (meaning objects) and mark them up with timestamps. For example, for a 90-minutes long soccer game, AI is able to pick up scenes related to goals and misses and audience cheers.

For the audio/speech side of big video, natural language processing (NLP), a branch of AI, has enabled automatic generation of subtitles and close-captions based on a good understanding of the speeches and conversations in a video.

Moreover, object-recognition (including face-recognition) technologies have made it possible to automatically tag objects with additional information. This is especially useful for VR, AR, and MR.

AI for Big Network

Big network captures the facts that modern video contents may be delivered via many types of networks including terrestrial broadcasting, analog/digital cable, analog/digital satellite, managed IPTV and undamaged OTT videos over fixed broadband networks, Wi-Fi networks, and mobile data networks.

IPTV and OTT video systems are notoriously hard to maintain and manage due to their non-deterministic and non-repeatable nature. Unsupervised learning algorithms can be used to automatically detect abnormality of network operations.

AI for Big Data

Big data in the video industry covers multiple dimensions: by each subscriber, by each content/asset, and by each network resource.

Face-recognition to each subscriber by the set-top box (STB) or the soft clients (e.g. smart phones/tablets) provides a smooth user experience with an individualized electronic program guide (EPG).

Content recommendation system is critical to attract users and increase average revenue per user (ARPU). It is based on supervised learning algorithms that remember what a user likes and dislikes and figure out a formula that covers many features/properties of the user and each content.

AI for Big Ecosystem

The big ecosystem of the video industry involves many parties, e.g. content producers, content aggregators, solution vendors, multi-channel video service providers/operators, and advertisers.

An interesting example here is smart AI advertisements based on image recognition and video blending. For example, appropriate advertisements or logos may be added onto open space in the video scene and will appear as naturally embedded objects.

APIs to access the subscriber data and network statistics can be offered to the third-party developers that create advanced features and services. For example, enterprise-oriented online education systems can utilize the content delivery network built for the operator-oriented pay TV services.

Final Thoughts

AI is not a panacea that can solve all the problems in one shot. Nevertheless, with massive data to train the system, AI can become smarter and smarter. For the big video industry, smart AI leads to happier users, more attractive contents, better-managed networks, and more prosperous ecosystems. ZTE TECHNOLOGIES

To enable connectivity and trust everywhere