White Paper on the Application of Internet Technology in Judicial Practice

2019

BEIJING INTERNET COURT

August 17, 2019

Table of Contents

Preface

Since its establishment on September 9, 2018, under the strong leadership of the Supreme People's Court and the Beijing Committee of the Communist Party of China, and under the correct guidance of the Beijing Higher People's Court, Beijing Internet Court has adhered to the guiding ideology of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era by remaining true to our original aspiration and keeping our mission firmly in mind. To achieve the goal of "making people feel fairness and justice in every judicial case," the court has followed the principle of high positioning, high standards and high starting point, given full play to the advantages in integration and upgrading of sci-tech applications, and upheld integrity, innovation and integrated development. With these efforts, the court has provided judicial wisdom and Beijing experience for exploring and innovating in the Internet-based trial mechanism and ensuring the implementation of the strategy of building China into a country with strong cyber technology.

I. Creating an Online Platform for the Whole Judicial Process Based on the Principles of Neutrality and Sharing

Relying on the unified trial information resources from the three-level courts in Beijing, Beijing Internet Court follows the construction concept of "openness and inclusiveness, neutrality and sharing, innovation and upgrading, security and control" to create an "multi-functional, all-process,

integrated" electronic litigation platform to promote the legalization and standardization of Internet space governance.

(I) Adhering to the neutrality of the platform and being fully connected with the most advanced information technology.

Based on an open environment, the Electronic Litigation Platform of Beijing Internet Court remains committed to transparent rules and relies on a unified data fusion platform to achieve data and technology compatibility. By setting unified code of conduct for Internet technology and rules for information construction, the court has made available open data interfaces and attracted multi-party participation, with 25 Internet technology companies joining in. The court has absorbed advanced technologies such as big data, artificial intelligence andblockchains on the basis of pursuing trial mechanism innovation, litigation process reengineering and lawsuit service optimization. The court will continue to extend the integration of technology and judicial practice and share the most benefits with all involving parties. Currently, Beijing Internet Court Electronic Litigation Platform has achieved the deep application of mature technologies such as voice and facial recognition and integrated multiple service platforms of diversified mediation, trial and enforcement, electronic evidence storage and electronic summons delivery. The court has moved online the whole legal process from prosecution, mediation, filing and summons delivery to court trial, judgment, enforcement, appeal, etc.

(II) Breaking time and space barriers and providing 24-hour legal service

Beijing Internet Court actively adapts to the needs of Internet trial in

the new era, breaks the barriers of time and space with science and technology, and builds a court "without fence." Unlike traditional courts, which can only accept cases during working hours, Beijing Internet Court has made the following legal practice available on the Internet anytime and anywhere: filing cases, automatically generating indictments, submitting evidence, mediating, holding hearings via remote video, going on trials, delivering electronic documents, settling enforcement cases, and transferring appeals files. Currently, parties can file all of their legal applications online in Beijing Internet Court, and thus do not have to go to the court in person. Of the filing applications, 30% are submitted on non-working days or at non-working hours on working days. Cases involved 23 provinces, 4 municipalities directly under the Central Government, 5 autonomous regions and nearly 200 cities. The cases in Beijing accounted for only 28.5% of the total number. A total of 7,217 cross-regional cases were filed, with a total number of 41,318 persons involved. According to rough statistics, the online trial mode launched by Beijing Internet Court has saved travel mileage up to 29,872,464.2 km, and reduced carbon emissions by 161 tons. The average cost per person for each case has been cut by nearly RMB800, and travel time by 16 hours.

(III) Breaking data barriers and achieving co-construction, co-governance and sharing.

Following the principle of maintaining the neutral judgment, Beijing Internet Court integrates multiple data centers into unified management through cloud computing platform, establishes unified virtual data centers and cloud resource pools, and provides unified data exchange services. First,

the court has built an internal and external network data exchange platform, which joins the electronic litigation platform seamlessly with the existing online mediation system, case filing system, trial system, and summons delivery integration system. The effort aims to achieve rapid synchronization of business data, and thus effectively solve the problem with the internal and external network interaction. Second, the court has opened standard data interfaces, and broken the data barriers existing between the legal electronic litigation platform and e-commerce enterprise network operators and related administrative agencies. On top of that, identity verification, evidence extraction, information flow can be directly completed online, and cross-regional information sharing and coordination can be actually achieved. This effort has laid a solid foundation for building a network-based, three-dimensional and intelligent Internet trial model.

Since the establishment, the electronic litigation platform has received a total of 41.8 million visits, an average of 208,000 visits per day, and a cumulative number of registered users up to 18,941. It has dealt with 15,748 online payments, which amounted to RMB 9,863,812.55; it has delivered 68,575 electronic summons, of which 16,749 were judgment documents, representing a delivery rate of 96.05%. Court hearings have been definitely held online if the parties agree to do so. The rate of online court hearings reached 99.19% with a total of 5,942 online hearings. The average cost per person for each case has been cut by nearly RMB800, and travel time by 16 hours. The electronic litigation platform won the 2018 Government Featured Website Award and was rated “2019 National Innovation Case for the Intelligent Construction of Political and Law

System.”

II. Constructing an Intelligent Judicial System Focusing on User Needs

Zhou Qiang, President of the Supreme People’s Court of China, has pointed out that we should continue be oriented towards demands, respond to the requirements of the era of big data, and actively apply Internet thinking in order to assist judges in handling cases and serve the people well. The aim is to achieve the modernization of trial system and trial performance and provide support for people-oriented and impartial judicature. Putting people first, Beijing Internet Court has been consolidating its foundation, strengthening its capabilities, laying emphasis on tech-led advancement, and has gradually built an intelligent judicial system supported technically by “Internet plus” and driven in response to user demands.

(I) Establishing the Internet Technology Judicial Application Center

Adhering to the concept of “uniting the strengths from all sides to create a better future,” the court has established the Internet Technology Judicial Application Center, by drawing on “the external brainpower” from the Supreme People's Court, the Ministry of Public Security, colleges and universities, well-known Internet enterprises and other experts and scholars, and by inviting legal theory experts, judicial experts, chief technical experts and a wide range of personnel. We have built a court-centered,

innovation-driven, application-oriented technical judicial base featuring the combination of production, teaching and research activities. The center aims to carry out further study on the basic theory of the smart court, platform construction, core technology, innovation and development, in order to better serve the people, assist trials and enforcement , and promote economic and social development.

(II) Establishing a system targeting user needs

Actively focusing on the diverse judicial needs of the people, the court has set up a user demand system that is user-centric, connected with the Internet Technology Judicial Application Center (Center), and affiliated to the Technology Development Company (Technology Company), namely abbreviated to UCT. The system is designed to address the problems such as poor demand communication, information transmission distortion, and frustrating user experience in traditional courts, train judges with technical insight, and continue to achieve the innovation in judicial service mode, content and items. Currently, Beijing Internet Court has established a complete management system that can acquire, analyze, sort and change needs, held experience meetings featuring user needs for 4 times, received more than 700 pieces of feedback on the platform from judges, lawyers, clients and other people, and accepted 620 suggestions related to technology implementation. All these have contributed greatly to the improvement of the platform, so as to achieve the good effects of "reducing workload and enhancing efficiency" for the court staff, "ease of use" for the litigation participants, and "comprehensively and timely knowing the results" for the public. As of today, more than 19 million visitors have

attended online court hearings on various platforms.

III. Exploring a New Type of Judicial Model by Improving Its Quality and Effectiveness

Beijing Internet Court spares no efforts to seize the historical opportunity of the scientific and technological revolution, focuses on solving the reform problems by scientific and technological means, and explores new trial patterns in the information age with an emphasis on the key tasks of trial and enforcement, judiciary for the people, judicial openness, judicial reform and judicial management.

(I) Smart trials help improve quality and efficiency.

Relying on the knowledge map, the court has developed the intelligent case push function, to provide judges with guidance on accurate and standard process; starting with the key elements of cases, the court has developed a system that can generate 5 types of case judgment documents generated with one click. So far, a total of 343,645 documents have been automatically generated, including 4,199 for judgments, decrees and mediation. A total of 266,148 fixed-format documents including court summons and notices of responding to appeals have been rolled out, representing an automatic generation rate of 100%. The system has automatically generated 73,298 indictments and other documents for litigants. The court has independently developed an electronic file management system, which can generate electronic files at one click, and transfer files of appeal cases in 30 seconds. The court has also promoted the deep application of electronic files, integrated the dynamic analysis of legal

documents through big data, and implemented the mode of standardized processing of typed cases.

(II) Executing judgments in a smart way by breaking the "last kilometer" barrier.

Based on the actual experience and innate advantages, the court has created an operating mechanism for the coordination of filing, trail, enforcement and technology. The court has developed an enforcement platform to conduct online interview, and explore the use of blockchain, big data, artificial intelligence in the enforcement. This ensures that the following legal practice can be moved online as much as possible: case filing, judgment service, property inspection and control, party interview, court hearings, fees receipt and dispatch, verdict generation and delivery, case archiving, etc. The court also innovates the way of team building. With the form of 1+N+TOP, the executive team has introduced the mediator, who will play the role in mediating organizations during the enforcement stage. The court has made efforts in innovative service, enforcement assistance, joint enforcement and other mechanisms, involved notary offices in carrying out service and on-site investigation, and opened channels such as JD.com, Taobao.com and other e-commerce platforms as well as toutiao.com to assist in enforcement. The court also cooperates with the State Administration for Market Regulation in solving the problem of inquiries into the personal information on self-employed operators from places outside Beijing.

(III) Scientific decision-making empowered by intelligent management

The court brings into full play the advantages in information construction and explores the ways to include the key nodes ranging from case filing to settlement and case archiving, as well as time limit and process standards into information-based case-handling platform. On top of this, the court seeks to build a trial process management mechanism with characteristics of the Internet court, namely, the whole process fully online with trace, stratification, delicacy, quiescence and visualization. **System integration and stratified management.** The court has established four levels of dynamic management. Based on the importance of the trial enforcement process nodes, the court has established four levels of judgment approval including the trial committee, the vice-president, the presiding judge and the judges in order to make clear the approval affairs. Some important matters existing beyond the early warning period will be automatically pushed up by the trial system to start the higher-level management procedures. **Refined node management.** The trial enforcement process nodes are divided into hard nodes with clear specifications and soft nodes that have no specifications but are prone to delay the trial period, such as initial service time, the time from successful service to court hearing, the time for starting identification, etc. Both types of nodes are included in the management process. At the same time, through information disclosure, online supervision, online evaluation, online assessment and other ways, the court has improved the mechanism for feedback on process supervision and management. **Dynamic analysis and overall management.** The court has independently designed a trial management visualization system with the characteristics of Internet courts.

According to the modules of process management, quality management, risk management and standardized management, the court has integrated in an all-round way the data in the whole process of trial and enforcement as well as the data in the whole nodes of technology application, and used big data technology to create the visualization system featuring personnel service, real-time updating and friendly interface. The system is expected to provide further support for investigation, research, statistical analysis and scientific management.

IV. Launching Online and Offline Intelligent Litigation Services with Emphasis on Intensiveness and High Efficiency

In accordance with the requirements of "systematization, informationization, standardization and socialization," the court has innovated in litigation service concept, and promoted the online and offline intelligent litigation service, so as to provide the masses with "widely inclusive, efficient, intensive and customized" litigation services.

(I) Creating the country's first "Online Litigation Experience Area"

In order to make litigants and the public fully aware of online litigation, and effectively enhance the penetration, appeal and influence of legal publicity and education, Beijing Internet Court has innovated in ideas to create the first "Online Litigation Experience Area" in China. With the full display of face recognition, integrated blockchain evidence storage platform, automatic document generation system, mobile phone text messages, electronic signature technology and other cutting-edge technologies,

litigants and the public can have an intuitive feeling about the deep integration of technology and judicature. The court provides visitors with a fully immersive experience through advanced technologies such as touch-screen projection, interactive animation and virtual reality. According to incomplete statistics, tens of thousands of people in nearly 500 batches have come to have on-site experience of Beijing Internet Court. This has contributed to the effective spread to the public of Beijing Internet Court's convenient litigation services, intelligent online trials and normal judicial disclosure.

(II) Creating an "Online Smart Litigation Service Center"

Closely following the principle of "serving the overall situation, the people and trials," the court has created the "Online Smart Litigation Service Center" to launch joint litigation service featuring "one-click submission, one-time processing, one-line connection and one-stop service" The center has made possible "full coverage, one-stop service and data control."

1. PC litigation service platform. With this platform, the court has combined into a whole the original decentralized functions including trial public, litigation tools, judicial identification and other litigation services, and developed intelligent litigation, enforcement of cases and other new service items, covering the entire process of litigation, so as to transform decentralized litigation services into systematic ones. As of August 8, the court has received 6,060 calls via 12368 and other hotlines and dispatched 531 work orders. The court also answered 15,487 calls for technical consultation. The electronic litigation platform has received more than

6,180 messages from relevant parties.

2. AI virtual judges. The court has combined real judge images and virtual technology to synthesize 3D forms, then embedded in the "litigation service platform," the "intelligent prosecution" section and the "intelligent question and answer" Mobile Micro Court service. The parties only need to select or input questions, and the "AI virtual judge" can simultaneously provide voice and text answers, so as to show affinity and realism via online services and promote the intelligent lawsuit with human qualities. Currently, "AI Virtual Judge" can answer 82 consultation questions in four categories.

3. Mobile Micro Court. The "Mobile Micro Court" provides five litigation services including "intelligent litigation, filing cases at hand, online mediation, video trial and online evidence uploading." Only by using the app embedded in WeChat, the parties can realize online filing, case inquiry, online service, online mediation, online trial and other more than 20 functions, so as to enjoy the indiscriminate one-stop smart litigation self-services on the electronic litigation platform anytime and anywhere. As of August 8, visits to the Mobile Micro Court have exceeded 19,000, with an average of 224 per day. Most of the users are under 40 years old and come from 20 provinces or municipalities. "Mobile Micro Court" successfully mediated a cross-border case, the first one of its kind, so that the parties and judges can fully feel the convenience of "litigation and case handling at a touch of the mobile screen."

4. Content accounts on e-commerce platforms. Based on the characteristics of Internet cases, the court makes full use of large e-commerce platforms with their huge number of users and heavy online

traffic. The court has registered in Taobao.com and JD.com and opened unique content accounts with features similar to “online shopping” in order to provide intelligent litigation guide, online Q&A and selected cases. With this effort, the court is poised to play the role of judicial regulation and guidance in a way that the masses like to see.

V. Sparing No Effort to Prevent Cyberspace Risks by Taking Security and Control as the Underpinning

Beijing Internet Court has always listed cyberspace security, data security and platform security as the priority of the information construction. Through the establishment and improvement of the security protection system, the court can effectively safeguard the security of information data as well as the rights and interests of the people.

(I) Establishing a strict protection system to ensure the safety of information and data. Firstly, according to the three-level protection requirements set in the *Information Security Technology-Baseline for Classified Protection of Information System Security*, the court has followed the basic principles of “unified planning, common standards, clear focus and reasonable construction.” On top of this, the protection design has been based on the graded protection standard requirements at the beginning of the platform construction and combined with the actual situations of the court. The court has carried out security planning and construction in physical security, cyberspace security, host security, application security, data security and backup recovery as well as security management system so as to ensure” network construction is compliant with regulations and

security protection is fully in place." Secondly, the court has taken the most stringent intranet firewall strategy. The control granularity for point-to-point port access rules has been set at the port level and 33 intranet boundary firewall security policies have been established, covering 13 systems including case filing, trial, enforcement and electronic archives. 156 source and destination addresses as well as 232 service ports have been designed. In strengthening cyberspace security, the court also guarantees the efficient development of judicial work and gives consideration to account safety and efficiency. So far, the electronic litigation platform has effectively blocked 233,000 malicious attacks.

(II) Building judicial blockchain to promote the construction of a credibility ecosystem. In order to promote the construction of the online credibility ecosystem, the court takes the lead in cooperating with domestic leading blockchain enterprises in building a "trial-centered and prevention-oriented" Tianping Chain electronic evidence platform that provides electronic evidence preservation, intellectual property rights confirmation, traceability and anti-counterfeiting, as well as other services. The court has formulated the *Standards for Access to and Management of Tianping Chain* and the *Standards for Assessment of Access to Tianping Chain*, and specified the qualification requirements for parties allowed to access "Tianping Chain," the rules for the storage of electronic data, the mechanism for the management of access platform and the way of using electronic data, so as to ensure the security of the data on "Tianping Chain" and the effective protection of the privacy of the parties concerned. This can endow electronic data with "traceability in the whole process, credibility in

the whole chain, and visibility in all nodes." All these measures have greatly improved the reliability and validity of electronic evidence, and significantly reduced the cost for parties to safeguard their legal rights. On March 30, 2019, "Tianping Chain" became the first batch of block chain information service projects reported to the National Internet Information Office for record. At present, the "Tianping Chain" has been cross-linked into 18 blockchain nodes and connected with data at 25 application nodes in 9 categories including copyright, right of authorship and Internet finance. The electronic data uploaded into the chain has reached more than 6.4 million pieces, and cross-chain data has amounted to tens of millions. In the course of case trials in the court, 1,312 preserved cross-chain data involving 218 cases have been verified. Among them, 43 cases were successfully mediated or withdrawn, and 10 cases settled through verdict, while the parties had no dispute about the authenticity of evidence.

VI. Enhancing the Ability of Comprehensive Cyberspace Governance with Support from Extended Functions

In a key speech at the National Conference on Cybersecurity and Information Technology, General Secretary Xi Jinping pointed out that the comprehensive cyberspace management capacity should be improved, and a comprehensive cyberspace management pattern should be formed by involving the Party Committee's leadership, government management, corporate responsibility, social supervision and netizens' self-discipline, and by using a combination of economic, legal and technological means.

Beijing Internet Court firmly follows the correct political direction, public opinions and social values. In the cyberspace management and control, the court strives to shoulder responsibilities, address tough issues and serve as good guidance, hence providing a solid safeguard for the construction of a sound Internet ecosystem.

(I) Effective business environment. The court pays regular visits to Internet enterprises and industry associations to gain knowledge of the new business patterns, new technologies, new patterns in the Internet field, and to grasp the new ways and characteristics of internet intellectual property infringement. In this way, the court can provide more targeted Internet justice "service packages." The court has cooperated with more than 10 trade associations and autonomous organizations including Internet Society of China, All-China Federation of Industry and Commerce, and the Quality Brand Protection Committee of the China Association of Enterprises with Foreign Investment, and visited more than 20 Internet companies such as Baidu, Alibaba, Tencent, Huawei, Byte Dance and Sogou. In May this year, at the World Bank Consultation on Business Environment Assessment Policy, Beijing Internet Court demonstrated the whole process of online trial mode and random case division, which was highly appraised by the Bank's Business Environment Assessment Team.

(II) Leading the Internet Ideology. Based on the strategic positioning of the "four centers" of Beijing as the capital, the court has kept enhancing political acumen and discernment, and further exerting the important role of Internet justice in safeguarding political security, promoting innovation and development of the cyberspace economy, and

supporting the strategy of invigorating the country with the Internet. Through the trial of typical cases including "Douyin IP rights case,""artificial intelligence IP rights case" and "illegally increasing cyberspace traffic," the court has cracked down on online intellectual property infringement and counterfeiting, safeguarded the public interests. Through the construction of the "Internet plus" intellectual property protection mechanism, the court has promoted the coordinated improvement of online intellectual property rights law enforcement, further enhance the influence of mainstream social values, and raise the awareness of the rule of law in Internet space.

(III) Strengthening exchanges and cooperation at home and abroad. The court lays emphasis on exchanges and cooperation at home and abroad and has established the communication mechanism for the exchanges of external information on the construction of smart courts and judicial protection of intellectual property rights. In view of the new situations and problems arising in the deep integration of technology and laws, the court has held or attended by request more than 40 seminars including "Digital Certification and Judicial Innovation,""Legal Challenges of and Judicial Response to Artificial Intelligence" and "The Application and Prospects of Blockchain in Judicial Practice." This effort aims to further promote the development of information construction and provide practical exploration and theoretical support for the development of more standardized online trial procedures and substantive rules. During the Sino-US Dialogue on the Rule of Law and Human Rights, the court held 34 sessions involving 535foreign guests, including guests from the American

delegation, President of the International Court of Justice, Deputy Prime Minister of Luxembourg, President of the Supreme Court of the Republic of Panama, President of the International Association for the Protection of Intellectual Property Rights and other guests from 18 countries and regions. Among them, Abdulqawi A. Yusuf, President of the International Court of Justice, said with deep feelings when attending the seminar, "China's achievements in the field of Internet justice are at the forefront of the world, and all the legal professionals in the world will benefit from your experience." Other foreign guests expressed their hope of transplanting to their countries excellent practices of Beijing Internet Court regarding information construction, online trial mode, block chain technology, and online intellectual property rights protection. Judges from Beijing Internet Court have also been invited to attend the World Intellectual Property Congress in London in 2019 and in Hangzhou in 2020. Through the combination of "bringing in" and "going abroad," Beijing Internet Court has further promoted its position and influence in the judicial arena at home and abroad and contributed the Beijing solutions to global cyberspace governance.

Conclusions

As an ancient Chinese saying goes, when changes happen, we shall seize opportunities and make choices that are suitable for the needs of the times. Beijing Internet Court will follow the guiding ideology of Xi Jinping

Thought on Socialism with Chinese Characteristics for a New Era, continue to pursue the people-centered development idea, and promote the innovation of ideas, technologies and mechanisms, so as to further play the positive role of modern science and technology in promoting fair justice and improving the quality and effectiveness of justice. Through all these efforts, the court will make due contributions to the rule of law in the cyberspace governance.

Appendix: 10 Typical Technical Applications

Appendix: 10 Typical Technical Applications

I. Legal Knowledge Graph

The legal knowledge graph technology is designed for two-way deconstruction of the structure of legal provisions and documents, creating the basic logic of legal knowledge graph and document generation. The contents of electronic legal archives are processed to extract elements that are used to build the conceptual knowledge graph of semantic elements for generation of a legal document. The element information nodes are configured on a document generation template based on the case information obtained by intelligent evidence review. Then the natural language processing (NLP) technology is used to automatically synthesize the corresponding language text, from which a legal document can be generated automatically.

The legal knowledge graph technology supports online automatic generation of documents. This allows judges of Beijing Internet Court to write standard legal documents more efficiently and accurately.

(1) Technical Features

Legal knowledge graph construction for individual cases. The paragraphs of legal documents are marked by type through rule matching. According to the paragraph type marks, part of the text of "facts ascertained by the court" is taken as the facts text of a case. The information extraction method based on deep learning is used to extract relational triplets from the unstructured text of the case, and then the triplets and the basic information of the case are subject to entity alignment and disambiguation. Finally, the processed results are stored in the database.

Document assembly building. The document template and assembly service involves defining the elements, labels or rules that need to be used in the assembly of the documents and writing them in JSON format. The values of assembled labels are taken in the preset document or structured data. After the corresponding content is extracted, the final text is generated according to the predefined assembly rules.

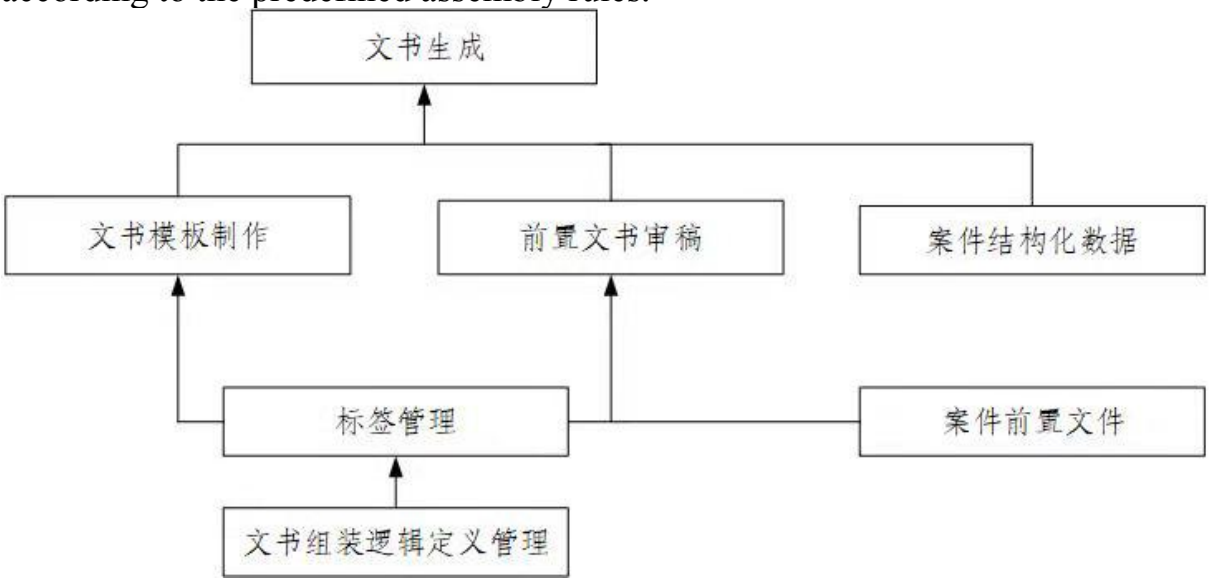


Figure 1 Flowchart of the generation of legal documents with legal knowledge graph

文书生成	Document generation
文书模板制作	Document template making
前置文书审稿	Preset document review
案件结构化数据	Structured case data
标签管理	Label management
案件前置文件	Preset case document
文书组装逻辑定义管理	Definition and management of

	document assembly logic

(2) Main Applications

1. Automatic generation of documents for judges. The legal documents for judges can be generated automatically by using a combination of legal knowledge graph, NPL technology, and document assembly building technology. The generation of rules and template libraries helps standardize documents on the Internet-based litigation platform, and a standard document can be more authoritative. The structured contents and provisions of legal documents are generated quickly, enabling legal documents to be prepared efficiently.

2. Automatic generation of documents for the parties The facts of a case can be organized with the help of big data and artificial intelligence analysis, legal knowledge graph and cognition engine technology. These technologies also support automatic generation of an appeal petition, a letter of confirmation of the address of a defendant to be served, a defendant's answer, a jurisdiction objection application, and a counterclaim, allowing users to prepare legal documents efficiently.

(3) Benefits of Automatic Generation of Legal Documents

Internet-related cases under the jurisdiction of Beijing Internet Court involve the use of electronic documents, which can be automatically generated. Traditionally, it takes no less than one hour to write and proofread legal documents. With the help of the automatic document generation system, no more than half an hour is required, from the generation of the first draft of a document to the completion of its review and revision by a judge. This fully shows the advantages of the IT-based solution. The system sets judges free from repetitive work and allows them to devote more energy to case research. In addition, the system helps minimize the possibility of judging identical or similar cases differently and further alleviate the shortage of court officials. As of August 8, 2019, the electronic litigation platform of Beijing Internet Court's has provided a total of 117,729 legal documents by using the automatic document generation service, which considerably accelerated case handling.

II. Blockchain

The blockchain technology is a new distributed infrastructure and computing paradigm that uses block-chained data structure to validate and store data, uses distributed node consensus algorithm to generate and update data, uses cryptography to ensure the security of data transmission and access, and uses intelligent contract composed of automated script code to program and manipulate data.

The Internet-based litigation platform of Beijing Internet Court features "Tianping Chain," a judicial blockchain system used to store digital evidence. The Tianping Chain enables digital evidence to be stored credibly and validated efficiently. This reduces the costs of the parties for seeking justice and makes it easy for judges to accept electronic data.

(1) Technical Features

The Tianping Chain provides excellent processing performance by combining multi-chain three-dimensional network architecture and intra-blockchain parallel computing technology.

The Tianping Chain has multiple privacy protection mechanisms. The upper chain stores the hash value of electronic data to ensure the data is true and complete and also kept private. In addition, data transmission can be restricted to a specific authorized node, and user permissions can be controlled by using encryption and decryption methods.

The Tianping Chain supports the national secret algorithm and can be used in domestic popular hardware cryptographic devices. The Tianping Chain features national secret CA system, where node permissions are controlled by using the national secret signature certificate. The communication can be secured with the national secret TLS certificate. The blocks are generated by using the national secret algorithm, allowing hardware devices to save private keys and sign, encrypt, and decrypt data. This way, data are more secure and controllable.

The Tianping Chain boasts proven cross-chain technology, supports block anchoring to achieve cross-chain mutual trust, defines standard cross-chain operation APIs, and supports management and authorization mechanism for external link access.

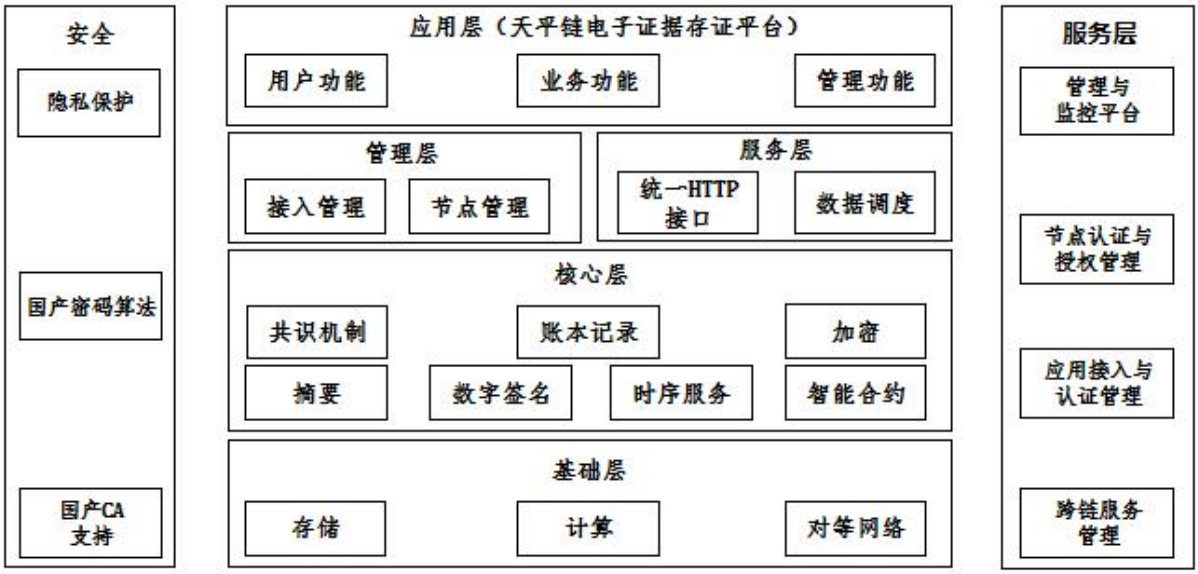


Fig. 2 Technology architecture of the Tianping Chain

安全	Security
隐私保护	Privacy protection
国产密码算法	Domestic cryptographic algorithm
国产 CA 支持	Domestic CA support
应用层（天平链电子证据存证平台）	Application layer (Tianping chain electronic evidence storage and verification platform)
用户功能	User function
业务功能	Service function
管理功能	Management function
管理层	Management layer
接入管理	Access management
节点管理	Node management
服务层	Service layer
统一 HTTP 接口	Uniform HTTP interface
数据调度	Data scheduling
核心层	Core layer
共识机制	Consensus mechanism
摘要	Digest
账本记录	Ledger record

加密	Encryption
数字签名	Digital signature
时序服务	Timing service
智能合约	Smart contract
基础层	Infrastructure layer
存储	Storage
计算	Computing
对等网络	Peer-to-peer network
服务层	Service layer
管理与监控平台	Management and monitoring platform
节点认证与授权管理	Node authentication and authorization management
应用接入与认证管理	Application access and authentication management
跨链服务管理	Cross-chain service management

(2) Main Applications

1. The Tianping Chain is basically used to store and validate electronic data from various Internet applications based on the rules of Beijing Internet Court regarding digital evidence. Once a piece of electronic data is generated, its hash value is written into the Tianping Chain, and the user obtains the storage number of the data in the Tianping Chain. When the electronic data relates to a case under the jurisdiction of Beijing Internet Court, the user can submit the storage number and the original electronic data. The integrity and storage time of the electronic data are verified automatically at the Tianping Chain background. This greatly cuts the time required for judges to accept electronic data.

2. Beijing Internet Court has improved the reliability of data in the upper chain by presetting rules and actively participating in governance. The blockchain technology can only keep data non-tamperable and non-deletable after being stored in the upper chain. To ensure that data are true before the storage, Beijing Internet Court has successively issued the *Standards for Access to and Management of Tianping Chain* and the *Standards for Assessment of Applications' Access to Tianping Chain*. These standards aim at strengthening the management of the compliance of electronic data and platform in the judicial industry and adequately ensuring

secure and steady operation of the Tianping Chain.

(3) Benefits of the Tianping Chain

The Tianping Chain makes the judicial process more efficient, helps judges make impartial judgments, facilitates the protection of rights, and promotes the building of Internet-based credit system in China.

Since its launch on September 9, 2018, the Tianping Chain has 18 blockchain nodes connected cross the chain, and gained access to data from 25 applications related to intellectual property, electronic contracts, and banks. As of August 8, 2019, the Tianping Chain has collected more than 6.4 million pieces of online evidence and stored tens of millions of pieces of evidence. In case trials, 1,312 pieces of cross-chain evidence involving 218 cases were validated. The Tianping Chain has been used to try 10 cases and has helped mediate or withdraw 43 cases. On December 15, 2018, Tianping Chain (V2.0) was granted the CCID License Chain Assessment Certificate. On December 22, 2018, the Key Laboratory of Blockchain Technology and Data Security of the Ministry of Industry and Information Technology established the experimental base for application of blockchain technology in judicial practice at Beijing Internet Court. On March 31, 2019, the Tianping Chain was put on the list of the first batch of blockchain information service projects by the State Internet Information Office (Beijing Internet Information Provider Registration No. 11010619282605830010). On April 12, 2019, She Guiqing, Vice President and Senior Engineer of Beijing Internet Court, was appointed as a member of the first academic committee of the Key Laboratory of Blockchain Technology and Data Security of the Ministry of Industry and Information Technology.

III. Instant Messaging

Instant messaging identifies online users and allow them to communicate with each other effectively and diversely by using extensible messaging and presence protocol (XMPP), Flash SMS based on unstructured supplementary service data (USSD) and other technologies.

At Beijing Internet Court, the instant messaging technology supports real-time communication across various platforms, significantly facilitates communication between judges and the parties, and accelerates the service of information by the court.

(1) Technical Features

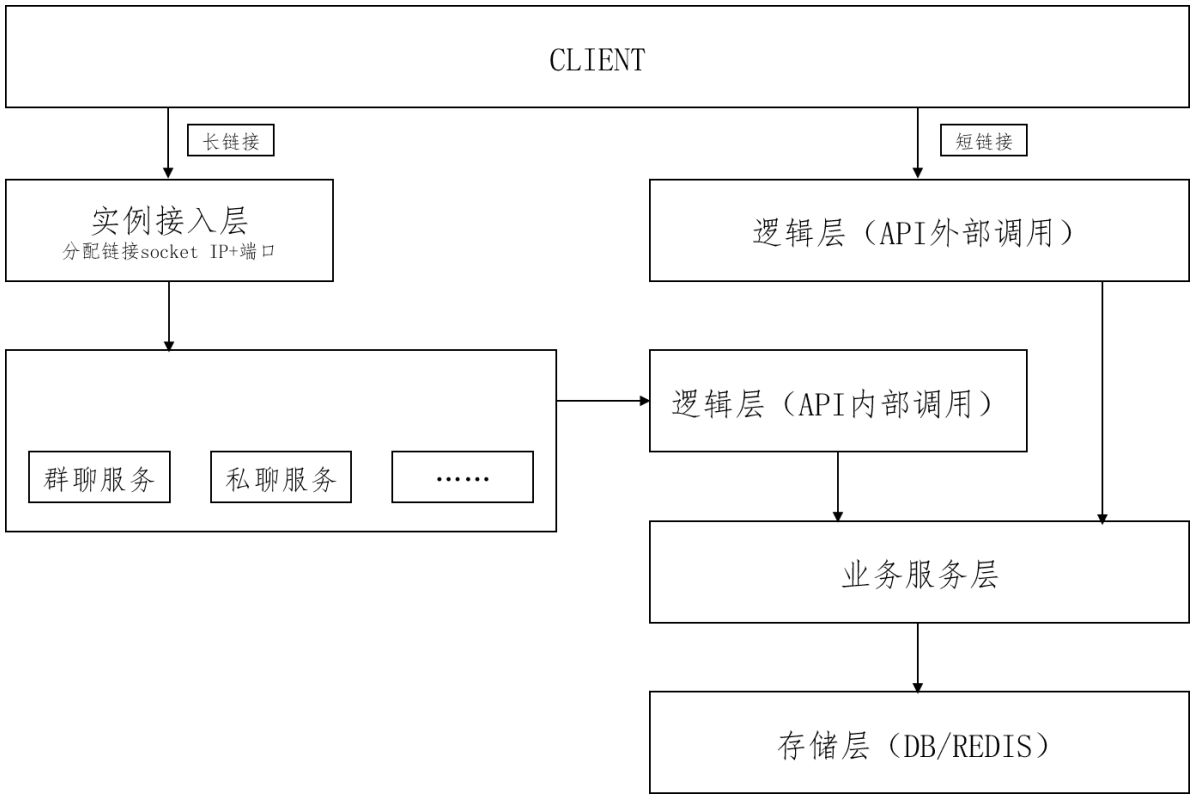


Fig. 3 Instant messaging technology architecture

长链接	Long link
实例接入层 分配链接 socket IP+端口	Instance access layer Assigning an IP address and a port number to connect to a socket
群聊服务	Group chat service
私聊服务	Private chat service
短链接	Short link
逻辑层（API 外部调用）	Logical layer (API for external call)
逻辑层（API 内部调用）	Logical layer (API for internal call)
业务服务层	Service layer
存储层（DB/REDIS）	Storage layer (DB/REDIS)

Beijing Internet Court implements instant messaging in server forwarding mode. The clients communicate with each other with messages forwarded by a server. With WebSocket protocol under the framework of Socket. IO/Swoole, the instant messaging platform of Beijing Internet Court supports scalable and distributed deployment, where short links are

used for business logic and long links for WebSockets.

The USSD-based Flash SMS is a signaling-based interactive data service in a GSM or CDMA mobile network. It does not require high bandwidth and can work with all registered mobile terminals. The Flash SMS service provides pop-up information, which can be directly targeted at users.

(2) Main Applications

1. Mobile Micro Court. This App, which is built using instant messaging technology, enables online filing, trial, evidence presentation and verification, and service on the mobile side. The instant messaging technology allows the parties and judges to send, in real time, location and multiple types of message to each other, including text, emojis, pictures, voice recordings, and files. Moreover, it can send SMS notifications to the parties upon completion of submission of their evidence, and also notifications when they come online. At present, Beijing Internet Court is carrying out system upgrade and adaptation work for high-quality online video trials in a 5G network.

2. Pop-up notification service platform. This platform, built with Flash SMS software, can automatically display a notification served by the court at the top of the mobile phone screen when the screen is locked. The user must read the notification and click “Confirm” before continuing to use his/her phone. The pop-up notifications sent to the mobile phone of a party, regardless of whether the phone is being used or in standby mode, will not be blocked by common security anti-virus software or security settings on the phone. This ensures that notifications are served effectively. The receipt of a notification serves as one of the proofs of successful service of that notification.

(3) Benefits of Instant Messaging

As of August 8, 2019, with the help of instant messaging technology, the Mobile Micro Court App has attracted an aggregate of more than 19,000 users. 8,000 people have watched live trials and the litigation service of more than 5,000 times has been provided through this App. The App has been employed by judges and parties to discuss more than 700 cases. It has been used for remote video mediation and trials for nearly 100 times. The method of pop-up notification service is widely used by Beijing Internet Court to serve case information over the Internet safely, quickly and effectively. The application of instant communication technology makes the contact between the parties and judges more closely, greatly improving user

experience and the efficiency of judges in handling cases.

IV. Facial Recognition

Facial recognition technology is a kind of biometric technology which detects and tracks the face in an image or video stream and then performs identification based on the facial feature information.

In the Internet-based litigation platform of Beijing Internet Court, facial recognition technology enables online registration, effectively solving problems with biometric authentication and ensuring the accuracy of litigant participants' identities. Besides, facial recognition technology supports the digital management of personnel access control of Beijing Internet Court by intelligent access control and passive unconscious face-swiping attendance checking, greatly improving efficiency.

(1) Technical Features

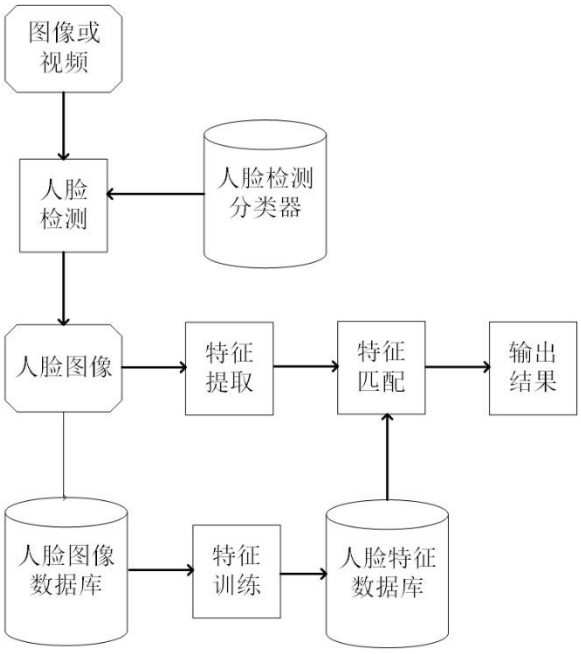


Fig.4 Basic process of facial recognition

图片或视频	Image or video
人脸检测	Face detection
人脸检测分类器	Face detection classifier
人脸图像	Facial image
特征提取	Feature extraction
特征匹配	Feature matching
输出结果	Data output

人脸图像数据库	Facial images database
特征训练	Feature training
人脸特征数据库	Facial features database

Facial recognition, compared with other biometric technologies, has various advantages such as visualization, concealment, simplicity and concurrency. A complete facial recognition system consists of two modules: face detection and facial recognition. The biological features of human faces have overall structural similarity and individual local differences. Therefore, it is necessary to extract the structural features of human faces through face detection to separate human faces from background images. Common face detection methods include geometric feature-based method, skin color model-based method and statistical theory-based method. Facial recognition of the separated faces is a process of feature extraction and matching recognition of normalized face images, aiming to determine the identity of people whose face is in the image.

(2) Main Applications

1. Identity authentication. Identity authentication based on facial recognition technology is applied in many scenarios such as platform registration, online court hearing, online mediation and security protection, effectively reducing the time spent in identity verification. In the registration process on the PC-end electronic litigation platform, users need to authenticate their real names and pass facial recognition to avoid registration with false account information. When litigants handle related litigation through the mobile client, the Mobile Micro Court App provides convenient authentication for litigants, agents and other litigation participants. The authentication can be completed in various forms such as face matching and liveness detection. The whole process takes less than 20 seconds, providing considerable simplicity and ease for mobile phone users.

2. Intelligent access control for the office building of Beijing Internet Court, and passive unconscious face-swiping attendance recording. For the purpose of partitioned management, facial recognition technology is used for intelligent access control to intelligently identify the different identities of litigants and lawyers and to carry out intelligent access management for different areas. This effectively improves the efficiency of security management. It also real-time collects data such as face images and feature

attributes and record particulars of visits. Once an illegal entry is found, an alarm will be sent promptly. With passive unconscious face-swiping attendance recording, police officers do not have to stop at the attendance machine. The system automatically captures the facial information when police officers walk into or out of a door, and quickly performs identification and matching in millisecond level to complete attendance recording, thus remarkably improving work efficiency.

(III) Benefits of Face Recognition

The use of facial recognition technology can eliminate the tedious formalities of document examination and registration, as well as repeated input of information. In this way, the litigation process is simplified and the process of litigation information collection is standardized. The facial recognition system can remotely confirm the identity information of litigants. This allows litigants to participate in the court trial without appearing before the court, making litigation procedures convenient. As of August 8, 2019, the facial recognition system of Beijing Internet Court had provided remote identity authentication for various platforms for more than 200,000 times; the intelligent access control and intelligent attendance system have provided stable and convenient services, which greatly reduced the workload of litigants and court officers.

V. Image Recognition

Image recognition is the technology that combines image angle recognition, text line detection, text line recognition, and detection of single-character coordinates to identify targets and objects in different modes in an image.

On the Internet-based litigation platform of Beijing Internet Court, image recognition supports online identification and extraction of the content of electronic files and assists judges in reading and writing documents daily. The technology enables judges to handling cases efficiently.

(1) Technical Features

The image recognition technology which Beijing Internet Court adopts features high recognition accuracy, fast modeling and fast recognition. It provides higher accuracy levels in recognition of objects in blurred images and images with indeterminate directions. The technology can be used in various complex scenarios and hardware devices.

Lightweight angle recognition. As the direction of pictures uploaded by litigants on the litigation platform is uncertain, the system needs to identify their directions. For this reason, a lightweight image classification network is implemented for image recognition. Its recognition speed is up to 200 frames per second, with an accuracy of 99%. The reliability of the recognition result is judged according to the confidence degree of the result, and unreliable results are verified again to ensure accurate recognition.

Automatic image quality optimization. The accuracy of image recognition is improved by black edge removal, deviation correction, sharpness detection, and noise optimization.

High-precision text recognition. A text detection network based on scene text recognition and multi-scale feature map detection is implemented for text line detection. With weight sharing, it can ensure a recognition speed of 8 frames per second and an accuracy of over 95%. A single-character detection branch is added to the text recognition algorithm for regressing single-character coordinates. Meanwhile, the backbone network is improved to speed up recognition while ensuring accuracy. In the data set of this algorithm, the accuracy of text line recognition can reach 98%. A language model based on LSTM (long- and short-term memory network) is used to correct the recognized characters with low confidence to improve OCR accuracy.

Language model supporting high levels of matching. By using open data and judgment document data for training, a language model for case file images with high levels of matching is obtained.

(2) Main Applications

First, image recognition, which can automatically identify litigation materials and documents, is applied to electronic case files and archives. With the help of the technology, the electronic litigation platform automatically identifies and categorizes the materials submitted by litigants and the documents prepared by judges in the process of handling a case. After the case is closed, the court clerk can archive electronic case files with one click, and replace paper files with electronic files for appeal transfer.

Second, image recognition is used to help judges read files. To enable judges to quickly search for and locate files in a large volume of files, intelligent file reading supports functions of full-text search, page number locating and catalog locating. After judges enter keywords in the search box, such as litigation status, name of the litigant or name of evidence, etc., the system will perform automatic retrieval. The contents of case files are

directly displayed in the area of search results on the reading interface. The page number can be input in the page number locating box, and the system automatically locates the page number in the image. The catalog of electronic case files clearly displays material names and their page numbers. By clicking on the material in the catalog tree, the system will automatically locate the material.

(3) Benefits of Image Recognition

Image recognition allows for identification and extraction of picture information. This makes it easy for litigants to fill in required information and also improves the court's litigation service level. Meanwhile, electronic case files are documented, digitized and structured, enabling judges to reuse the text of case files to generate legal documents intelligently. In this way, the deskwork of court officers is considerably reduced, and the service level and efficiency of judges is improved. Through the circulation and application of electronic case files, the whole process of case hearing can be recorded and managed scientifically. This provides the entry point and basis for the judicial management of the people's court and helps make further progress in building institutionalized, IT-based, and scientific judicial management system. As of August 8, 2019, Beijing Internet Court had produced 47,626 electronic files for cases, and the litigation platform has identified nearly 100 million Chinese characters.

VI. Speech Recognition

Speech recognition utilizes super-large scale language pattern recognition and independent learning technology to predict the context of conversations, conduct centralized analysis and processing of speech signals generated in various services, and finally provide efficient speech-to-text service.

On the Internet-based litigation platform of Beijing Internet Court, speech recognition supports intelligent generation of trial records and documents and mediation records and meeting minutes. Its features such as multi-service application, multi-role differentiation, intelligent sentence segmentation and automatic generation of hot words significantly reduce the workload of court clerks by effectively improving the efficiency of input of trail records.

(1) Technical Features

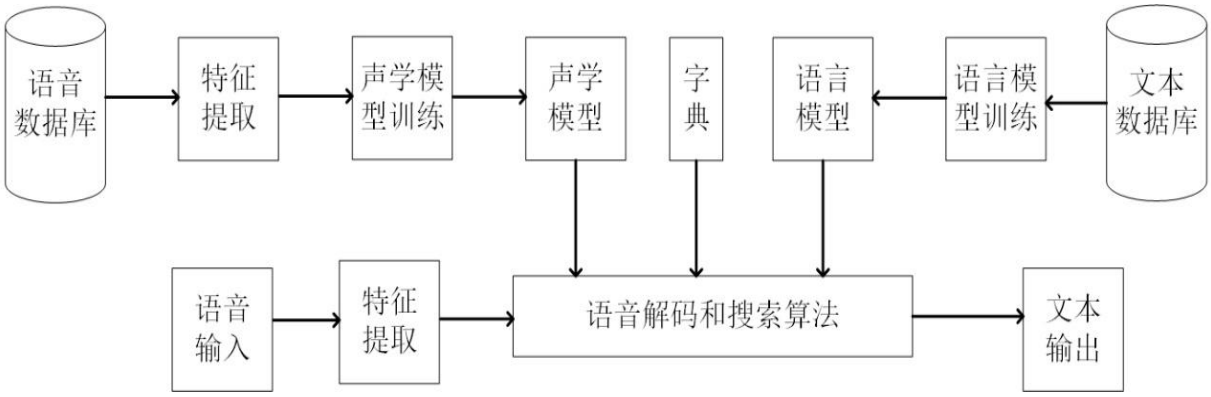


Fig. 5 Framework of speech recognition system

语音数据库	Speech database
特征提取	Feature extraction
声学模型训练	Acoustic model training
声学模型	Acoustic model
字典	Dictionary
语音模型	Language model
语音模型训练	Language model training
文本数据库	Text database
语音输入	Speech input
特征提取	Feature extraction
语音解码和搜索算法	Phonetic decoding and search algorithms
文本输出	Text output

Speech recognition consists of three basic parts: feature extraction, pattern matching and reference model library; and it comprises two stages: learning and training. Firstly, the characteristic parameters of the recognized content are trained to obtain a reference template. Then, the test template is compared with the existing reference templates for degree of match through recognition decision. The best matched existing reference template is considered as the result of speech recognition. Template matching involves selecting and building appropriate recognition models and algorithms based on the characteristics of speech signals. It plays a core role in speech recognition.

(2) Main Applications

1. Intelligent generation of trial records and documents. During a court

trial, by using the intelligent speech recognition system, the court clerk can automatically import case information and insert, locate, and proofread trial records in an intelligent way based on the court role. Moreover, the combination with legal terms in the documents to improve the accuracy of speech recognition helps makes court trials smooth. The speech to text transcription enabled by the document making tool allows judges to prepare documents quickly.

2. Intelligent generation of mediation records. The use of a mediation application system enables mediation speech to text transcription. It supports differentiation of the roles of litigation participants, and improves the accuracy of speech recognition with the help of legal terms and hot words. The trial records generated are automatically returned to the trial system through the secure data exchange system.

3. Intelligent generation of meeting minutes. The seamless connection with the meeting system allows meeting minutes to be automatically generated. It supports intelligent insertion of text according to roles, meeting agendas and topics, which helps meeting recorders take meeting minutes throughout a meeting.

(3) Benefits of Speech Recognition

The speed of the speech recognition system can reach 300-350 characters/minute, and the speech recognition accuracy has reached over 98% for clear speech. In terms of the efficiency of overall improvement of intelligent document preparation and meeting recording, the accuracy of oral input of the whole law provisions reaches 100%. Therefore, judges can use the system to produce the first draft of a document, and then complete the final version following simple revision. As of August 8, 2019, the speech recognition platform of Beijing Internet Court had completed 5,870 trial records in an intelligent way, more than 4,300 documents and 400 meeting minutes. The platform has significantly reduced the workload of judges and judge assistants, and improved the efficiency of input of trial records.

VII. Cloud Video

Cloud video features flexible video coding architecture of the H.264/H265 scalable video coding (SVC) standard and can provide super-large scale concurrent access.

On the Internet-based litigation platform of Beijing Internet Court, cloud video supports online trial and mediation, enabling judges to hold

trials and mediation through video conference with litigants. It is compatible with different networks and access methods and can meet the needs of different roles. The technology facilitates court trials and mediation.

(1) Technical Features

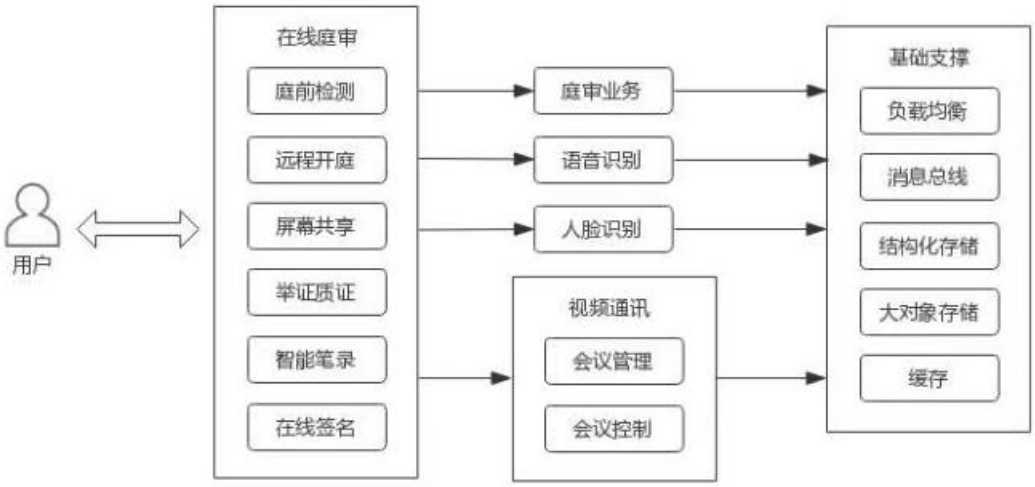


Fig. 6 Cloud video architecture

用户	User
在线庭审	Online trial
庭前检测	Pretrial check
远程开庭	Remote court session
屏幕共享	Screen sharing
举证质证	Cross-examination
智能笔录	Intelligent recording
在线签名	Online signature
庭审业务	Court trial
语音识别	Speech recognition
人脸识别	Facial recognition
视频通讯	Video communication
会议管理	Conference management
会议控制	Conference control
基础支撑	Infrastructure support
负载均衡	Load balancing
消息总线	Message bus
结构化存储	Structured storage
大对象存储	Large object storage
缓存	Cache

Cloud video utilizes flexible video coding architecture of the H.264/H265 SVC standard. With automatic detection of adaptive call rate from 64K to 8Mbps bandwidth, it adapts to all kinds of network access, and can adjust video SVC layer division dynamically and in real time according to bandwidth changes to ensure an optimal video experience. The audio is encoded with Opus, supporting ultra-wide band (24 kHz sampling rate) and full band (48 kHz sampling rate) speech. Moreover, the audio combines functions of complete echo cancellation, noise suppression, reverberation suppression, automatic gain control, directional sound, and beam forming. These functions create better sound effects and an optimal auditory experience.

When packet loss, delay or jitter occurs on the Internet, special forward error correction and packet retransmission algorithm and intelligent adjustment mechanism are adopted to ensure that there is no video lag and blurred screen when the network loses 30% of the packets; video can be transmitted and sound is clear and smooth when 50% of the packets are lost; sound can be identified when 80% of the packets are lost. It has ultra-strong network adaptability and can reduce the impact of network problems on audio and video quality.

(2) Main Applications

1. Online trial. Online court trials support PCs and mobile phones. Prior to a court trial, litigants and lawyers can perform an intelligent pre-trial check to ensure that local computers meet the requirements of access to the court trial video. After the litigants and lawyers log in successfully, image and voice are detected on the computer to ensure that the screen images can be clearly seen and the speech of all litigants can be clearly heard during the court session. At the same time, the system automatically displays the court discipline to the litigants. According to the number of participants, the images of litigants are dynamically distributed to display aesthetically appealing layout on the screen. By clicking the screen sharing button, the judges can share the scene on the middle screen to all the litigants involved in the court trial. The public can watch a court trial involving multiple parties by watching the live broadcast of the case on the same screen. In the case of poor network, the intelligent adjustment mechanism of cloud video technology can still ensure the smooth progress of the online court trial, and the public can clearly view the trial scene when watching the trial. The litigants do not need to apply for a digital certificate

and electronic signature medium in advance. After the trial, they can confirm the trial records electronically by scanning the QR code on the screen and signing by hand on the pop-up signature page on the phone. In the whole process of litigation, the combination of secure and effective electronic signature confirmation of various documents, reliable CA digital authentication, facial recognition authentication and other technologies makes online trials secure and convenient for all litigants.

2. Online mediation. Online mediation supports PCs and mobile phones. In the process of mediation, a mediator can quickly generate a mediation code, which is then automatically sent to the parties of the mediation via SMS. The parties can relate themselves to the case through the mediation code, participate in each mediation stage after authentication, and confirm the mediation agreement and records.

(3) Benefits of Cloud Video

Litigants can participate in online court trial and mediation through their computer, Mobile Micro Court App, and browser, breaking the limits of time and space. They can participate in court trial and mediation anytime and anywhere. Cloud video effectively reduces the time and money required for litigants. As of August 8, 2019, Beijing Internet Court has tried 4,582 cases online through its electronic litigation platform. Litigants made 4,536 accesses to the video mediation room, accessed case details through the mediation code for 17,545 times, and participated in mediation through the App for 14 times. The number of audience members attending a case through the electronic litigation platform had reached 1.96 million. By watching live broadcasts of court trials on the Internet and attending court trials, the public is jointly concerned with the hot cases on the Internet.

VIII. Microservices Architecture

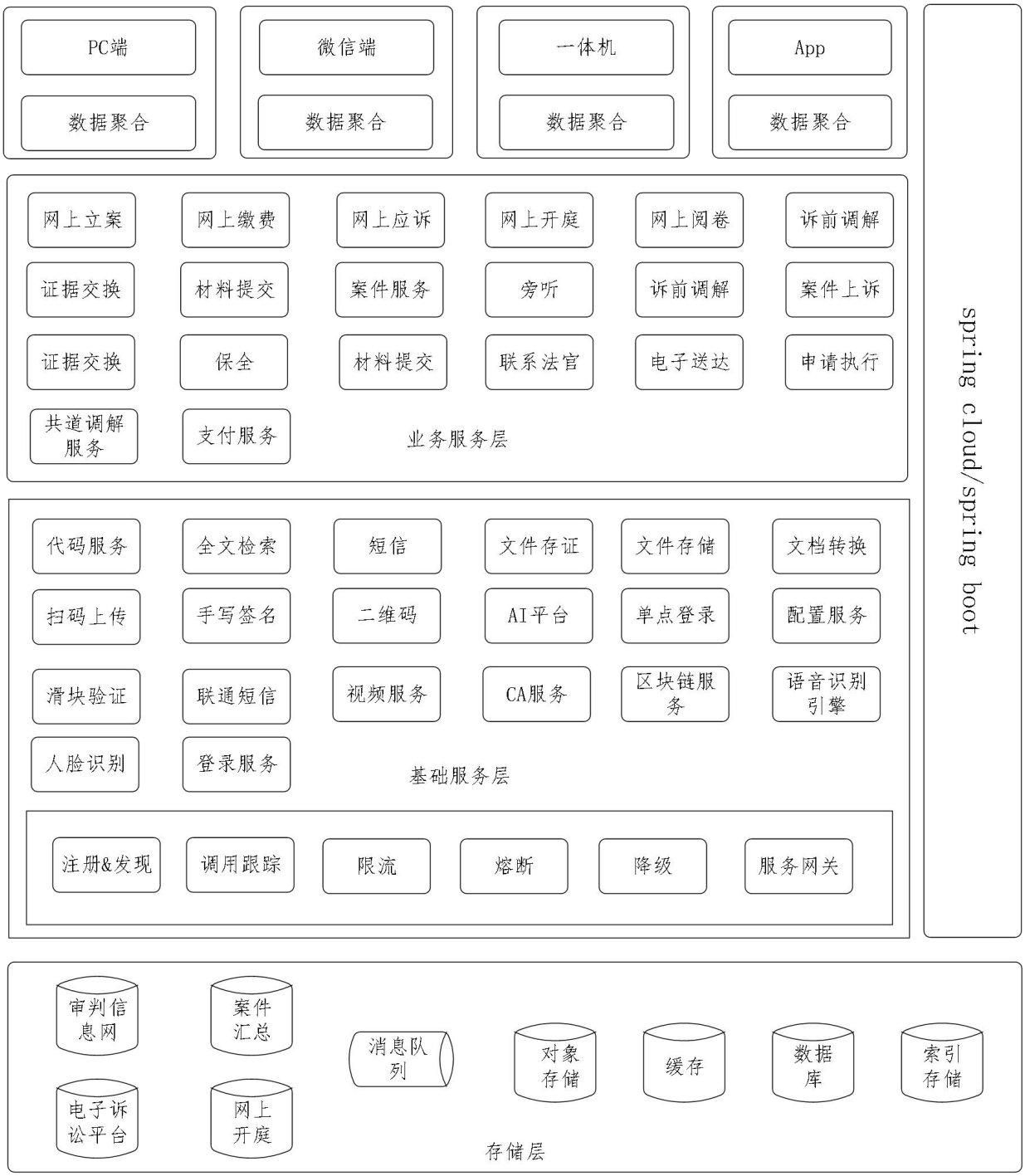
Microservices architecture is a technology to deploy applications and services on the cloud platform. It can realize independent evolution and rapid iterative update of services.

On the Internet-based litigation platform of Beijing Internet Court, it supports the whole process litigation service platform, and realizes rapid response to demands and rapid product iteration, conducive to the improvement of overall expansibility, availability and fast delivery capacity.

(1) Technical Features

The microservices architecture is designed with the mainstream Spring Cloud technology as the back-end technology, and the Vue and JQuery

technologies as the front-end technology to achieve the overall separation of front and back ends. Spring Cloud is deployed in multiple environments such as out-of-the-box, bare machine, virtual machine, and container, and provides various built-in components and many three-party components, making it ideal for rapid integration and efficient system development. In the back-end technology, the design concept of DDD (domain driven design) is adopted to split the business requirements, and to place responsibilities and functions on each micro service; with Spring Cloud technology, micro services are realized. Supported by the cloud computing platform of Beijing Internet Court, Docker and K8s (Kubernates) are adopted to complete the encapsulation, dependency, programming, application deployment, scheduling, isolation and automatic expansion and contraction of each micro service, so as to achieve the single responsibility and independent deployment of services and the loose coupling between services, so as to achieve the results of serving single responsibility, independent deployment, loose coupling between services, independent evolution and iterative updating of services, and meanwhile improve the rapid response to demand.



PC terminal WeChat terminal All-in-one machine App
Data aggregation Data aggregation Dataaggregation Data aggregation

Online case filing Online payment Online responding Online court session Online case reading Pretrial mediation Evidence exchange Case

service Attend trials Pretrial mediation Appeal Evidence exchange Preservation Materials submitting Contact judges Electronic service Apply for enforcement Fair mediation service Payment service

Service layer

Code service Full text retrieval SMS File evidence recording File storage Document converting Code scanning and uploading Handwriting signatures QR code AI platform Single sign-on Configuration service Slider validation Access SMS Video service CA service Blockchain service Speech recognition engine Facial recognition Login service

Infrastructure layer

Registration & finding Calling trace Current limiting Circuit breaking Downgrading Service gateway

Trial information network Case summary Message queue Object storage Cache Database Indexed Storage Electronic litigation platform Online court session

Storage layer

Fig. 7 Microservices architecture technology

(2) Main Applications

1. Electronic litigation platform. The platform can realize the whole process of online litigation functions, such as case acceptance, service, mediation, evidence exchange, pretrial preparation, court trial, and pronouncement of judgment. Therefore litigants can complete the case without leaving home through the computer or mobile phone operation.

2. Mobile Micro Court App. The platform can provide "one-stop" mobile litigation services, which can meet the needs of multiple users, such as judges, judicial assistants, litigants and their agents, and third-party mediators.

3. Diversified mediation platform. This platform can realize the connection between litigation and mediation online, and promote the informatization development of diversified dispute settlement mechanism.

(3) Benefits of Microservices Architecture

Based on the latest development of Internet technology and the basic features of electronic litigation, Beijing Internet Court has realized the deep integration of the trial mode, litigation rules and Internet technology, and

deeply practiced the development idea of advanced Internet products. Subsystems such as online case filing, online mediation and Mobile Micro Court App are developed with advanced microservices architecture. With the support of cloud computing platforms, rapid development and rapid iterative update of the system can be achieved. As of August 8, 2019, Beijing Internet Court had completed more than 180 iterations of the system. Through the improvement of the user demand system, 620 pieces of feedback from judges, lawyers and litigants are implemented, aiming to promote the continuous iterative update of the platform.

IX. Secure Data Exchange

Secure data exchange relies on a data exchange platform to synchronize data between two different security domains or two different networks while keeping data secure during the synchronization through various security measures on the data exchange platform.

On the Internet-based litigation platform of Beijing Internet Court, secure data exchange supports safe and fast data exchange between the Internet and the internal network of the court. This effectively facilitates exchange between the information submitted by litigants over the Internet and the information on trials provided the court over the internal network. The technology enables a truly integrated full-service and full-process litigation platform.

(1) Technical Features

Secure data exchange features a data exchange platform at its core. Such a platform is deployed between internal and external networks, and consists of data exchange devices and cyberspace security devices that meet the national-level security and protection requirements. It allows users to synchronize various types of files and data across databases on internal and external networks in real time, at a fixed time, or in batches.

Fig.8 Features of secure data exchange

内网	Internal network
文件	Files
数据库	Database
数据交换平台	Data exchange platform
访问控制	Access control
病毒检测	Virus detection
格式检查	Format detection
身份认证	Identity authentication
安全审计	Security audit
关键字过滤	Keyword filtering
外网	External network
文件	Files
数据库	Database

The data exchange platform of Beijing Internet Court of supports multiple file synchronization protocols, including FTP, SAMBA, and CIFS. It also supports HTTP, TCP, UDP, FTP, SOCKS, POP3, and SMTP. It allows users to create blacklists and whitelists and can work with common databases at home and abroad. The platform meets China's level-3 cyberspace security protection requirement.

When a file or database server needs to be synchronized between the internal network and the Internet, the data exchange platform will perform a series of security checks such as access control, identity authentication, format, and virus before data transmission, and comprehensive security

audit measures will be taken throughout the synchronization process.

(2) Main Applications

1. Secure data exchange system between internal and external networks. As an infrastructure, the system provides secure, real-time data exchange between internal and external networks for each application.

2. Online filing system. It is mainly used to exchange information on complaint application and litigants and their agents and evidence.

3. Online trial system. It is mainly used to exchange materials and trial records uploaded at court.

4. Tianping chain system. It is mainly used to exchange stored and verified evidence materials.

(3) Benefits of secure data exchange

The secure data exchange platform makes it possible to synchronize data between internal and external networks in real time and quickly. Moreover, the platform provides a variety of security measures to ensure data security during synchronization. It offers technical support for Beijing Internet Court to provide convenient, safe and efficient service on the Internet-based litigation platform. Data are made interoperable and services are coordinated across systems and processes.

Since its application, the secure data exchange platform has synchronized over 700,000 pieces of case information, 4.9TB of case data, and 700GB of trial data for the Internet-based trial system.

X. Cloud Computing

Cloud computing is a model for enabling on-demand access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released. The technology is the product of the convergence of multiple technologies, including server virtualization, distributed storage, and software-defined networking.

On the Internet-based litigation platform of Beijing Internet Court, cloud technology effectively supports the infrastructure required for 24-hour litigation service, enabling the electronic litigation platform to operate safely, stably and reliably.

(1) Technical Features

Server virtualization. Server virtualization uses virtualization technology to partition a single physical server into multiple logical virtual servers, each running its own operating system. Moreover, applications can

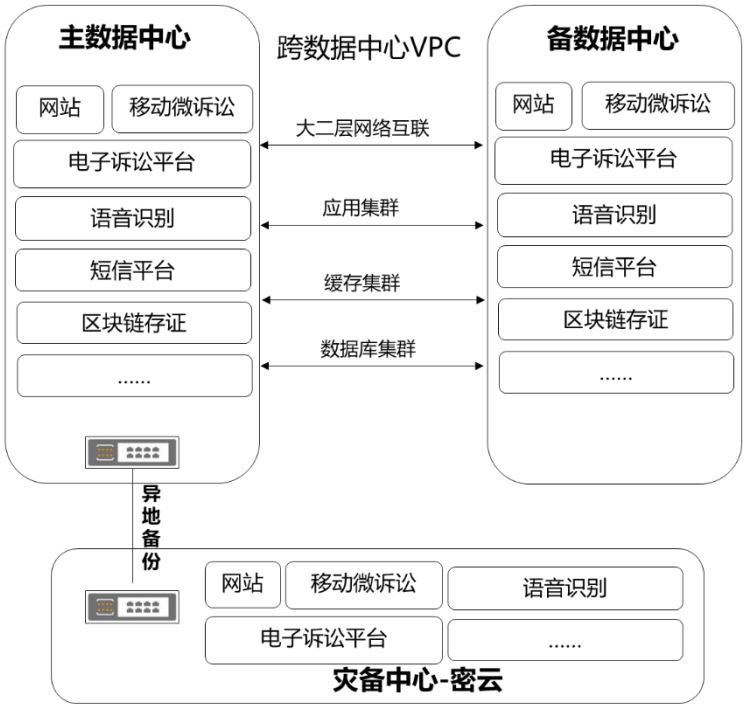
run in separate spaces without affecting each other, significantly increasing server productivity.

Distributed storage. Traditional centralized storage servers are prone to become the bottleneck of system performance. With distributed system structure, a distributed network storage system uses multiple storage servers to share the storage load and uses location servers to locate the storage information. This improves the reliability, availability and access speed of the system.

In the large-scale deployment of a cloud computing cluster, the distributed storage system utilizes a scalable system architecture, which allows for rapid horizontal scaling of computing nodes to implement fast cloud scaling.

Software-defined networking. In the cloud computing environment, different services have different network requirements. Software-defined networking works mainly by separating control and data planes of a network device and flexibly controlling network traffic through software programming. It provides a good platform for innovation in core networks and applications.

(2) Main Applications



主数据中心	Primary data center
跨数据中心 VPC	Cross-data center VPC

备数据中心	Standby data center
网站	Website
移动微诉讼	Mobile micro court
电子诉讼平台	Electronic litigation platform
语音识别	Speech recognition
短信平台	SMS platform
区块链存证	Blockchain-based evidence storage and verification
大二层网络互连	Large Layer-2 network interconnection
应用集群	Application cluster
缓存集群	Cache cluster
数据库集群	Database cluster
异地备份	Remote backup
灾备中心-密云	Disaster recovery and backup center in Miyun District

Fig. 9 Cloud computing platform deployment architecture of Beijing Internet Court

First, the cloud computing platform of Beijing Internet Court integrates cloud computing resources from multiple data centers into a unified management system to establish a unified virtual data center and cloud resource pool. Clustered deployment with a single data center has been implemented. However, to ensure the high availability of the core service system, more than two data centers are planned to be built to simultaneously support the core service system of the electronic litigation platform, and data-level and application-level disaster recovery centers are also planned in Miyun District. These efforts aim to ensure that electronic litigation and trial services are not affected by extreme events and major failures and that electronic file data are not lost.

Second, the cloud computing platform of Beijing Internet Court provides container-based PaaS components, including microservice engine, middleware service, big data service, and DevOps platform. Besides, face recognition, speech recognition, and data visualization applications have been built, available for each trial procedure. The cloud computing platform provides microservice development framework and communication framework to implement application lifecycle management based on the

microservice architecture. The platform supports continuous integration and deployment and rapid iteration of application systems.

Third, Beijing Internet Court has built a cloud security system for its cloud computing platform based on the Information Security Technology - Baseline for Cybersecurity Classified Protection. The platform features a three-level cybersecurity protection system: cloud security CDN protection, cloud network auditing and protection, and key host auditing and protection. Moreover, a security posture monitoring and management center is available for knowing security posture in real time, identifying security risks in a timely manner, and responding to security emergencies at short notice. A unified O&M monitoring and management platform has been established. The O&M service is performed according to the criteria of "five clears": clear assets, clear state, clear process, and clear division of responsibilities, aiming to offer standard, digital, and visual O&M service

(3) Benefits of Cloud Computing

At present, the cloud computing platform of Beijing Internet Court has a total of 346 virtual machines, 8TB of memory, 189TB of data storage and 51TB of disaster recovery and backup storage, available for 35 service systems. The court's electronic litigation platform saw a total of 41.8 million visits and successfully prevented 233,000 security attacks of various kinds. It provides 24-hour services without suffering service interruptions and security incidents.