

## **The road to the digital resources sharing - cases of the Cultural Information Resources Sharing Project of China**

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**Session:**

**79 — Innovation in resource sharing: new methods, new technologies — Document Delivery and Resource Sharing**

**Abstract:**

*Cultural Information Resources Sharing Project of China (CISP) is a nationwide commonweal culture effort, funded by the Chinese government, jointly led by Ministry of Culture (MOC) and Ministry of Finance (MOF), and implemented by the National Cultural Information Resources Management Center of China (CISP national administration center) and its branches which based on the public culture service facilities such as public libraries, culture stations and community centers. The Project shares and disseminates digital cultural resources to bridge the gap between urban and rural areas, and ensuring the basic cultural rights and interests of people particularly living in remote regions. This paper first introduces that the mission of the CISP is to bridge the digital gap in China, then details the organizational structures of CISP, and the digital resources sharing mechanism and the application of information communication technology (ICT) system, finally gives the summary on the experiences of digital resources sharing of CISP.*

**Keywords:** *Digital Resources Sharing, CISP, Six-hierarchy Service Infrastructure*

### **1. The Mission of CISP - Bridging the Digital Gap**

In recent thirty years, the rapid economic development of China has a significant influence on its social development and the world economy. However, due to its large population and vast territory as well as the uneven development in different regions, China still exist a huge digital gap even today [1].

In order to effectively bridge the huge digital gap in China and guarantee the basic cultural right of the grassroots population, especially the population in the remote rural areas on enjoying the digital culture information services as well as to satisfy people basic needs for enjoying diversified cultural content, the MOC and MOF jointly launched the CISP. As a commonweal cultural effort, with the financial support of the central and local governments, the CISP constructed the information infrastructure based on the public culture service

facilities such as public libraries, culture stations and community centers, and aims to share digital resources by making use of nationwide digital resources collecting and organizing mechanisms, and provides digital resources services to the grassroots population via various transmission network.

By the end of 2011, the central and local governments have invested nearly 6.69 billion Yuan (\$ 1.06 billion), over 3,000 public libraries and more than 600,000 small cultural service stations all over the country have participated in the Project. The CISP have built and integrated over 136.4TB digital resources for sharing, disseminating and servicing, including 70,132 hours of video programs and more than 3,960,000 e-books. Over 960 million audiences have benefited from the project [2]. Today, the CISP has become the No.2 project of the China's grassroots cultural service projects.

## 2. Digital Resources Sharing of the CISP

In the following section, we are going to address how CISP fulfill the goal of the distribution and sharing of digital resources from the aspects, such as the organizational construction and the informational infrastructure, the digital resources sharing mechanism and the ICT system and platform for digital resources sharing.

### 2.1 Six Hierarchies Service Infrastructure

The CISP has formed the six-hierarchy service infrastructure all over the country. They are the national center, provincial branch center, prefecture-level sub-branch center, county-level sub-branch center, township-level service station and village-level service station, which are settled respectively in the CISP national administration center, provincial public library, prefectural-level public library, county-level public library, township cultural station and community center. They form business instruction relations from top to bottom. (In China, there is no public library below the county hierarchy, and its functions are usually undertaken by a cultural station or community center with comprehensive functions).

By the end of 2011, the CISP has built one national center, 33 provincial branch centers (100% covering rate), 333 prefectural-level sub-branch centers (100% covering rate), 2,840 county-level sub-branch centers (99% covering rate), 28,595 township level service stations (83% covering rate), 602,000 village-level service stations (99% covering rate) [3].

They are illustrated in the following table.

**TABLE 1. THE SIX-HIERARCHY SERVICE INFRASTRUCTURE OF CISP**

Hierarchy	Site	Corresponding Public Service Facilities or Sites for settling	Number of Sites
1	National center	National Cultural Information Resources Management Center of China	1
2	Provincial branch center	Provincial public library	33
3	Prefecture-level sub-branch center	Prefectural-Level public library	333
4	County-level sub-branch center	County-level public library	2,840
5	Township-level Service station	Township cultural station	28,595
6	Village-level service station	community center	602,000

Considering the informational infrastructure of public service facilities, especially the public libraries and cultural stations under county-level, are not well equipped, the CISP focus on the construction of the informational infrastructure of all the branch centers and culture stations from 2006 to 2010, which is illustrated in detail in the following table [4]:

**TABLE 2. THE CONSTRUCTION OF INFORMATIONAL INFRASTRUCTURE**

Site	Investment of Per Unit	Use or Equipment
National center	60 million Yuan (\$ 9.52 million) per year (supported by national finance)	To construct application systems and addressing the licensing or copyright of digital resources
Provincial branch center	5 million Yuan (\$ 793,650) for equipment (supported by provincial finance)	more than 120 PC, 15 servers, 50 TB storage devices and professional resource processing equipment, etc
Prefecture-level sub-branch center	1.2 million Yuan (\$ 190,476) for construction (supported by local finance)	60 PC, 5 servers, 8 TB storage devices and professional resource processing equipments, etc
County-level sub-branch center	680, 000 Yuan (\$ 107,936) for equipment (supported by national finance)	30 PC, 4 servers, 4 TB storage devices, etc
Township-level service station	50,000 Yuan (\$ 7,936) for equipment (supported by national finance)	5 PC, 1 TV set, 1 printer, etc
Village-level service station	6,000Yuan (\$ 952) for equipment (supported by national finance)	1 PC or 1 TV set, etc

## 2.2 Digital Resources Sharing Mechanism

The core business of the CISP is the digital resources sharing, including three parts: 1, collecting and organizing applicable digital resources; 2, disseminating and sharing resources; 3, using those shared digital resources.

### (1). Collecting and reorganizing digital resources,

The CISP has formed a digital resources construction system led by the national center with the participant of provincial branch centers, and the funds mainly come from the national finance. In this system, the national center is responsible for the overall planning of the national digital resources construction and the provincial branch centers are responsible for planning the specific construction contents and objects based on the national plan. The specific implementation plans of provincial branch centers are established after their planning is approved by the national center. Then provincial branch centers start to collect, make and organize related digital resources according to their plans. By taking the plan of 2012 as an example, the national center has 30 million Yuan (\$ 4.8 million) for digital resources construction and the 33 provincial branch centers have 120 million Yuan (\$ 19 million) in total. Each provincial branch center has exceeded 3.6 million Yuan (\$ 571,428) on average. Besides, some provincial branch centers with abundant funds can obtain additional special funds from local finance for the construction of their own. By this mechanism, unnecessary repeated resources constructions are avoided and overall purchase cost of digital resources is dramatically reduced.

The collection and organizing of digital resources mainly focus on two aspects: choosing of contents and the scope of using right of digital resources.

In general, the national center mainly focus on commonly used contents nationwide and provincial branch center mainly concern the local contents, the forms of the contents include movies and TV shows, Chinese folks and sketches, theater arts, specialist lectures, dramas and other culture shows related to people's daily life.

As for the using right of digital resources, the resources funded by national finance should have national wide using right and application scope of resources funded by local finance depend on the actual situation. As for the specific using limit, digital resources of the CISP have some basic rights, including replication, broadcasting, Internet transmission, translation, show, exhibitions and so on, which strictly confine the using of digital resources during the sharing process.

## (2). Disseminating and sharing resources

Since the digital resources of the CISP are relatively centralized (mainly in the national center and provincial branch centers), a process of distribution and dissemination of digital resources has been formed.

The distribution approach of the digital resources mainly depends on characteristics of digital resources. Generally, authorizing access to visit the central database rather than direct resource transmission to the usage sites is the major approach for accessing digital resources, such as electronic books, newspapers and periodicals, and the service stations only maintain the relevant network links. The methods of IP restriction, concurrent user sessions limit, VPN authorized access could be used for the access control of these kinds of resources. For the large data files such as digital video resources, they are usually directly transmitted and stored in the local sites. Thus it is necessary for us to study how to transmit and share the large scale digital resources by utilizing ICT system and networks.

As the CISP has a huge amount of digital resources, we also face the problems of which resource should be distributed and which one should be stored by those receiving sites. The managers of the service stations can either directly choose the resources they need, or receive the uniform distribution of resources which are selected according to the results of needs analysis by the CISP. If choosing the former approach, the contents of resources are chosen by receiving stations via network; if choosing the later one, the distributed contents are decided by the distribution plans specified by the CISP. And the digital resources storage of receiving station depends on related strategies according to the demands of its business.

## (3). The usage of digital resources

The usage of the shared digital resources is determined by the methods of distribution and the right of using. For the open access resources on the Internet, users can access them just as regular website services, such as the website of the national center (<http://www.ndcnc.gov.cn>); for resources with limited access, users can only access them within the service stations, and other internet users can not access these resources; for digital resources disseminated to terminal service stations, local area network is the only way to access them. In addition, the CISP also provides culture information services by using digital TV and IPTV.

## **2.3 ICT Application**

In order to efficiently achieve the demands of digital resources sharing, the CISP has constructed a series of ICT applications according to the specific demands, including the Union Catalogue System for sharing resources construction, Media Asset Management System for the storage and management of digital resources, various network transmission systems for digital resources transmission, resource service software for local service and the network service systems for various network applications etc. Among them, the network transmission systems are the most important ICT system of the CISP. It includes satellite transmission system, network transmission system (including the Internet and private network transmission system), as well as conventional mass data transmission method using DVD or HDD. In addition, Push-VOD, a digital resources transmission method using digital TV network, is also used in some areas [5].

## (1). Network transmission systems

- Satellite Transmission

The digital resources transmission of the CISP is a kind of transmission structure with strong broadcast characteristics. Therefore, the early stage of the Project mainly focus on the construction of the national center satellite up-link earth station and about 6,000 satellite receiving stations.

The satellite transmission of the CISP uses the technology of IP package broadcast, with 4Mbps bandwidth, which can transmit IP data package and video stream at the same time. It can send data about 3GB every day [6].

- Network Transmission

Digital resources transmission using network is featured with bidirectional transmission and interaction, which is the best way to provide personalized and customized services. After 2006, as the broadband interconnection popularized fastly in mid-and-small towns and rural areas of China, network has gradually become one of the most important transmission methods of the Project. According to the technical specification of the Project, prefectural-level sub-branch centers should be equipped with network access of no less than 10Mbps, county-level sub-branch centers with network access of above 2Mbps, and township level service station no less than 1Mbps.

In addition, a private network relying on E-government network (a specific VPN for government affairs) is built for the bidirectional transmission and resources sharing between the national center and provincial branch centers and a few sub-branch centers [7].

- Physical Medium Transmission

Physical medium transmission refers to digital resources transmission method in the form of logistics by using DVD or HDD or other storage media. Although it seems very simple, it is broadly used in the Project due to its mass data distribution capability in a short time.

- Push-VOD

Push-VOD is a push resources transmission technology based on the digital TV network. Its basic principle is to equip each receiving station with a digital set top box (STB) with the data storage capability. Because the terminal is only one STB, the cost is very low (about 800 Yuan or \$ 126). However, due to the difficulty to reconstruct the digital TV network, it is hard to apply this technology in a large scale. The application of this technology in China is mainly limited in Liaoning province [8].

Among the four transmission technologies above, only Push-VOD is limited in a few areas and the other three technologies are the technologies for digital resources sharing with strategic significance. These three technologies have different efficiency according to different business demands. For example, satellite technology has a significant advantage for the video live broadcasting, while network transmission is the best choice for trivial file sharing and interactive service. However, for mass data sharing and distribution, an appropriate conclusion can only be reached after careful calculation of the costs and benefits. Now we will analyze the benefits and costs of the three technologies based on the experiences of the CISP. (We will transmit 4TB files, and take the 2,840 county-level sub-branch centers as the receiving stations, to analyze the costs and benefits, and given the depreciation period of electronic equipment for about 3 years):

**TABLE 3. THE COMPARISON OF FOUR METHODS FOR RESOURCES TRANSMISSION**

Technology	Construction Costs	Operation Costs / Year	Average Costs / year	Transmission Capability	Transmission Time
Satellite	85.2 million Yuan (\$ 13.5 million) in total	1.6 million Yuan (\$ 253,968) for satellite broadband charges, 1.31 million Yuan (\$ 207,936) for electric charge in total	31.3 million Yuan (\$ 5 million)	1TB / year	4 years
Network	28.40 million Yuan (\$ 4.5 million) in total	8.5 million Yuan (\$1.35 million) for net charge in total, 1.31 million Yuan (\$ 207,936) for electronic charge	19.3 million Yuan (\$ 3 million)	2.6TB / year	1.5 years
DVD	17 million Yuan (\$ 2.7 million) in total	0	5.67 million Yuan (\$ 900,000)	4TB / time	1 month
HDD	5.68 million Yuan (\$ 901,587) in total	0	1.89 million Yuan (\$ 300,529)	4TB / time	1 month

1. The cost of every satellite receiving system is about 30,000 Yuan (\$ 4,761).
2. Each site needs to receive the data for about 8 hours every day, and the annual cost of the electric charge is about 460 Yuan (\$ 73).
3. It has exceeded the time of depreciation period of electronic equipment.
4. The cost of the private data transmission server and the software is about 10,000 Yuan (\$ 1,587).
5. The cost of the private line is about 10,000 Yuan (\$ 1,587) per year, and the transmission service need to run for about 8 hours every day , so the cost of net charge is about 3,000 Yuan (\$ 476).
6. Every DVD costs 6 Yuan (\$ 1), it includes the costs of data replication, packaging, logistics etc, and 1,000 pieces of DVD are necessary for 4TB resources.
7. It needs to send 1000 pieces of DVD one time. Generally speaking, 40-100 pieces of DVD will be packaged and mailed every time in the actual business.
8. Each piece of hard disk with 2TB capacity costs RMB 1,000 Yuan (\$ 159), it includes the cost of hard disk, data replication and logistics cost. 2 hard disks are required for each center.
9. It includes the time of data replication and the logistics.

From the table above, we can see that the simplest logistics methods using DVD and HDD cost the least and get the highest efficiency during the mass data sharing process. In contrast, advanced and complicated technology such as satellite broadcast has the lowest consumption ratio.

## (2). Unified Resource Management System

In order to meet the business demands of unified planning and distribution collection and organizing of digital resources, the CISP has built a unified resource management system. It includes front-end Union Catalog System, back-end Media Asset Management System and supporting digital resources standard specification etc. The basic idea is that each provincial branch center will collect and organize digital resources based on the standard specification, and then import them into the Union Catalog System of the national center. The digital resources will eventually be managed and maintained by the background Media Asset Management System. Each service center can search various shared digital resources by the Union Catalog System and download or apply for relevant resources by various approaches [9].

### (3). Cloud technology adoption – the next step of ICT system

Through the practice of digital resources sharing and the construction of ICT platform of nearly 10 years, we gradually realize that traditional mass distribution and sharing of digital resources are not the most efficient ways of resources sharing. When they bring immense amount of digital resources to grassroots stations, they also bring great pressure for resources storage and management as well as funds pressure. Therefore, during the "12th Five-year Plan (2011-2016)" period in China, the CISP firstly adjusts methods of resources sharing and dissemination from business view, and propose the cloud platform which based on the cloud computing and cloud storage [10]. On that platform the resources will be relatively concentrated in several cloud centers, the distribution and sharing of digital resources in the CISP will mainly concentrate in several cloud centers. The huge amount of the grassroots service stations of the Project will become the authorized users who have the right to access to the cloud platforms, and the public will also be able to access the resources through the Internet. It is not only the upgrade of an application system, but also the result of the in-depth understanding of the digital resources sharing and the mutually fusion of business of the digital resources sharing and the trend of ICT development. The following figure illustrates the conception of the logical framework of the cloud computing platform.

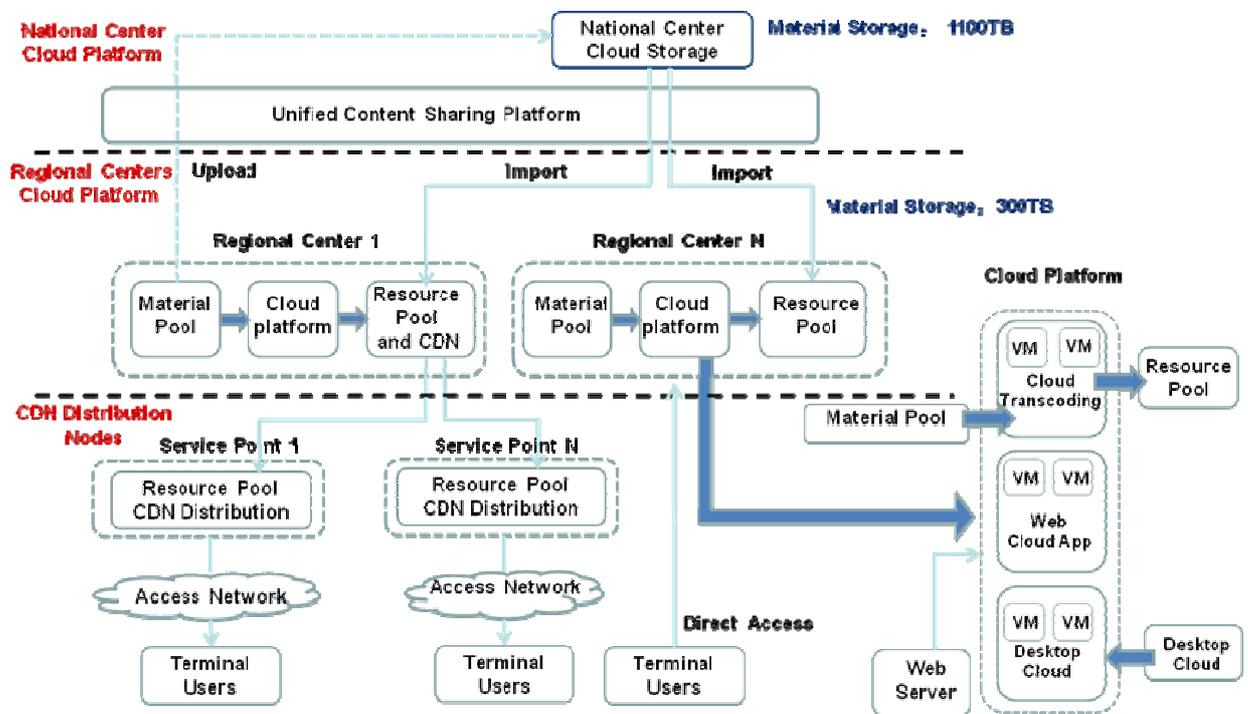


Figure 1. The conception of the logical framework of the cloud computing platform

## 3. The Key Learning of the Digital Resources Sharing of CISP

1. Efficient organization and management is the cornerstone of resources sharing.

The service network based on the public culture service system of China adapts the requirements of the CISP very well. But there are also some problems. The prominent problem is that too many hierarchies of the system have partly restricted the advantage of fastness and flexibility of the ICT system.

From a perspective of informatization, over complicated layered system is unnecessary for information transmission and sharing, it will decrease the efficiency of the information

system. In most cases, a perfect data center can meet most of the business requirements. In a word, the flat structure of ICT system is better.

After 10 years construction of the Project, we gradually realize the above problems.

Therefore, during the 12th five-year plan, the cloud platform will be built in order to turn the original pyramid ICT system into properly flat network system.

## 2. Addressing copyright or licensing jointly is the core of business development.

Digital resources are the core to develop digital resources sharing service. The CISP has made a lot of effort and exploration for many years in this field. From the experiences, we could make a conclusion that the mechanism of the cooperation on the digital resources collecting and organizing is very effective, it could greatly lower the costs and expand the range of usage.

However, the Project, in general, is accumulating digital resources by one-time obtaining using right for many years and has not adopted a more efficient valuation method based on the frequency of use or clicks. This is due to the limits of the use of funds policy of the public finance and restriction of work habit of the CISP of many years. It should be adjusted gradually during later development.

## 3. The solid ICT system is the foundation of reliable business operation

Digital resources can not be shared without the support of ICT system. Mass data sharing and distribution of the CISP has put forward more requirements for the ICT system. Project constructors have also made great efforts and attempts, and achieved much precious experience and harvest, even though made some mistakes.

From many years of practical experiences of the Project, we believe that there are two basic points we should hold during the application of ICT: first, the technology should be applicable; second, the plan should be made moderately in advance. The first point means that we should adopt proper ICT system based on practical business needs instead of blind pursuits of advanced technology. The second means that we should take long-term development needs into consideration while making technical proposals and should not just focus on the current business needs.

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