



# The Chinese Information Superhighway, a Holistic View

## Introduction

Initially developed in the 1960s, the Internet consists of a global mesh of interconnected networks, commonly referred to as the Information superhighway. This fundamentally open system now functions as a vast commercial platform for ecommerce and online service delivery. The Internet within Mainland China, uses the same core standards as those used to connect within other countries, with additional local policies and governance also being applied.

Traffic between different geographic locations is delivered via large scale network equipment, consisting of servers, switches, and routers, which together enable the delivery of data from endpoint to endpoint. Strategies that can be employed to minimize latency from impacting service delivery will be discussed in this paper. Services delivered between remote points, such as from the United States into China, are dependent upon reliability being maintained throughout long distances networks, and are therefore more susceptible to potential outages, due to increased exposure to a more complex network environment, as compared to purely local delivery.

Beliefs and opinions relating to how the Internet functions within China, vary considerably amongst those reporting from outside, with sometimes grossly inaccurate information being presented as fact.

Determining the key concepts for review is helpful in covering the basic facts. First, though, some information about what makes China unique in its implementation of the Internet.

***“Leveraging a Content Delivery Network (CDN) with endpoints physically located within China, is one sure way to directly improve service quality and reliability, especially within such a diverse telecommunications landscape that is China.”***

## Provider and Infrastructure Overview

The Internet infrastructure in China has three primary delivery systems: fixed-line, mobile and education. Education is in a special category due to the introduction of the China Education and Research Network (CERNET), a special backbone which delivers content to educational institutions within China. China Unicom, a company formed from the merger of China Unicom and China Netcom, is one of the two largest fixed-line infrastructure companies within China. The other major firm is China Telecom. In the mobile space, China Mobile is the largest firm. All of these firms are state-operated, with China Unicom based in Hong Kong.

In terms of communications, the majority of countries employ one or more Border Gateway Protocol (BGP) devices. A BGP device is much like a boundary of a particular network, and is the point at which traffic flowing into and out of that network is managed. Internet Data Centers (IDCs) in China will often connect to the BGPs owned by the major companies. At a minimum, the IDCs will generally have a connection to a single BGP. In some cases, an IDC may connect to two BGPs, which is called dual-line. And a full access IDC will connect to all the major BGPs.

The advantage of full access to all the major BGPs is the ability to accept direct requests from each network, rather than going through an intermediate connection. This will affect both bandwidth and reliability. Full access IDCs have to pay more, but they have better service.

Potential bandwidth is different in China than it is in countries like the United States. Metropolitan areas of the United States commonly offer speeds on average of 10 Megabits per Second (Mbit/s). Metropolitan areas of China average roughly one to two Mbit/s. There are carrier nodes that support higher rates for video, such as eight Mbit/s. There is so much congestion in the system that it reduces bandwidth. The population density is high and the infrastructure is often legacy and requires retransmission of information.



***“Bandwidth in China can cost in the tens of dollars per megabyte. There are a small number of providers and thus the prices tend to remain high. There are extraordinary expenses associated with high-density infrastructure. Thus, the costs tend to run higher in China than in many other countries.”***

Interconnectivity among the major providers is not as robust as within the major providers’ networks. These peering issues are a product of the major providers not wishing to invest in their competitors’ networks. A company purchasing services from both companies will tend to transmit data separately through each network. Free peering, meaning the connection between major providers, is virtually non-existent. In practical terms, a user trying to access a site hosted on a competitor’s network will experience a much slower load of content than if the site were hosted on their provider’s network. At certain times, no site will load if on a competitor’s network.

A Content Delivery Network (CDN), in the context of interconnectivity, caches content much closer to destinations and also ensures content is located on multiple providers, and thus reduces the impact of this issue. As will be discussed later, this is a very strong reason to use one for reliable content delivery to end users.

China Tietong Telecommunications Company (CTT), formerly known as China Railcom, is another important provider with infrastructure located near physical railroad networks in China. Much like CERNET, it offers specialized coverage over a pre-defined geographic region. Each major provider thus has separate considerations for ensuring reliable content delivery.

Major providers first and foremost provide infrastructure. As a result of China’s high population density and large population, there are unique challenges. These challenges result in certain features being common and also uncommon within China’s use of the Internet.

## Common and Uncommon Features

One of the most common practices for companies is to place content on a website and allow that website to be viewed by anyone who types in the proper Uniform Resource Locator (URL) address. This is not quite the same process in China. In China, if you place content on a server within national boundaries, it is assumed that you are only sharing that content within China. This is the opposite of the United States, where content uploaded usually means global distribution.

The ICP registration is administered by private companies within China who self-censor content for any violations of Chinese law. If content is delivered without an ICP, it will likely be shut down.

Carriers within China often will effectively ban competing content. That includes advertisements for competitors. This means that ad placement is a bit more sensitive in China. If a company offer advertising placement to competitors of the carrier on which their traffic flows, they may find that content is not delivered and the purpose of the advertising is thwarted.

***“Any provider of content within China must register as an Internet Content Provider (ICP). This includes foreign companies that wish to transmit content into China.”***

DNS hijacking is also an issue in China. DNS hijacking refers to a user seeking out content on a server, but where they typed in an address, that address is “hijacked” and the content from a different site is delivered back. It is somewhat like going to an address using a GPS and having the GPS route the driver to the neighboring address at the last minute. DNS hijacking normally does not occur with the large DCs. Mid-tier and less expensive DCs do encounter this challenge with some frequency. Therefore, a strong recommendation is to avoid hosting any important content on cheaper providers, where this issue will likely occur.

There are a finite number of Internet addresses. With Internet Protocol v4 (IPv4), the finite number of addresses has theoretically been consumed many times over. Many servers use Network Address Translation (NAT) to circumvent this restriction, reusing many addresses by mapping them to a single public address that is used on the Internet.

Internet Protocol version 6 (IPv6) is meant to allow for many more addresses and is in limited use. China does not support it, though. This only means that any IPv6 traffic will not flow through China and instead traffic must use IPv4.



The competition between large-scale carriers is important in the basic consequence of not allowing free peering. Having a single provider will reduce the scale and scope of traffic that will flow through China. Other providers will not allow this content through very easily. Choosing a method which leverages multiple carriers is thus a very sound strategy.

China's large population and high population density, along with ICP and regulatory requirements, makes for interesting challenges in terms of connectivity. There are issues with connections, challenges with congestion, and difficulties that can arise from technical outages.

## Connections, Congestion and Cuts

***“Similar to the Great Wall of China, there is a Great Firewall of China. The concept behind it is to prevent Chinese citizens from viewing content considered objectionable by the government.”***

The content in question revolves around concepts like terrorism, crime, political protest and like material.

Most countries have no control over content. Content that is placed on servers can be taken down through legal process in many cases, but often may still be viewed if put up on foreign servers. China, however, has controls that allow the content to be removed. There are content filters and IP filters. There are IP addresses that can be blocked entirely.

In the initial stages of China's growth, there were foreign entities that could have more effectively competed with domestic services. China blocked these foreign entities in order to nurture domestic industries. Skype, for example, was not allowed in China. Facebook is another example. The strategy is to protect domestic industries during their initial growth.

China has a philosophy of “Harmonious Society”. Content that conforms with a harmonious society will generally be allowed, while disruptive content will not. For example, learning how to build a house will most likely be fine, while learning how to commit adultery will not be allowed. These decisions are made by private DCs in line with official policy.

Anonymous social blogging is not condoned. All social forms of networking require identification. This is to promote harmony and mitigate the number of spam comments and negative comments. Google Plus, for example, follows this policy. The Great Firewall of China enforces these policies. This also includes keywords that reflect negatively on the Chinese government.

The Internet does experience congestion with just the proliferation of video and video-related technologies alone. It is an additional burden to deliver content from outside of China which is non-quantifiable, but significant.

What about Hong Kong? Hong Kong is connected to China, but any DCs in Hong Kong go through some of the same filtering as foreign content. The island is some distance from the mainland and this will sometimes result in congestion issues. Content within Beijing may take two milliseconds while travel from Hong Kong could be 10 to 20 milliseconds. Any content in Hong Kong must travel through the Great Firewall of China.

***“Hosting content outside of China means that any content being accessed within China must pass through the Great Firewall of China. At peak times, the government might cut off this traffic just due to congestion.”***

Amazon Web Services (AWS) and similar cloud services that offer content to China must also go through the Great Firewall. There are additional risks in this case because if content on AWS violates regulations and becomes blocked, there are risks that other AWS content will be blocked by association. Sometimes content will not be allowed into China not by any domestic rule, but by foreign entities not wishing to risk any blacklisting within China.



The primary Internet link between China and the rest of the world is through undersea cabling. If a cable is cut, that will impact traffic. Roughly 90 percent of all traffic passes through these cables. If multiple cables are cut, this will severely curtail traffic. At least once in the past a submarine has cut one or more cables. If you have domestic content in China which is cached, this is a non-issue. Lacking any domestic caching will mean a greatly reduced user experience or potentially no user experience available at all.

The risk of traffic reduction is real. While cable damage has actually occurred, there are perceptions of reality about the Chinese Internet which are false. Understanding fact vs. fiction is a method to aid in proper investment in delivering content to China.

## Fact vs. Fiction

Registering for ICP does not mean that content will not be blocked. It is an information tool which has the function of encouraging self-censorship. The extent of its value is in providing information which aids in regulating content. The Great Firewall will block content regardless of registration. Lacking registration will raise the odds considerably of being shut down by private DCs.

The Internet first and foremost a tool for providing information.

***“There is a general perception that some types of content will be completely safe for passing through the Great Firewall or residing within China. This is simply not the case. Even the most potentially harmless content has cases where it will be objectionable.”***

For example, you might have a site which features a forum that allows for discussion of products or services offered by a company. As part of that discussion, a company might allow for comments to be posted by buyers or by the public. Someone posting to that discussion forum might present material unfavorable to Chinese politicians, such as that materials are inferior in Chinese manufacturing because a minister for the region does not provide sufficient oversight. This single post could result in IP blacklisting for the company on the whole, even though the remaining content is unobjectionable. Any type of site which allows for the addition of third-party content may result in the presentation and banning of objectionable material, regardless of context.

The conception of what is acceptable changes. Content over time may become objectionable or it may become unobjectionable. There are methods to understanding what content is emerging in either direction, which require domestic support from users who are knowledgeable about emerging trends in this area.

There is a perception that the Internet is slow in China. This is not the case. For video that is hosted in China, it is high-speed. It is foreign content that traverses the Great Firewall that might encounter issues with latency and jitter.

Another perception is that China does not offer modern features for mobile and site-based applications. China often protects domestic industries in their infancy, and this means that some foreign-developed features are not immediately available. However, where there is a vacuum, Chinese domestic companies often fill it with innovation. There are many cutting-edge Chinese applications. They are simply not as well known as their foreign competitors.

There are applications, such as the previously-mentioned Facebook, which are not available through the Great Firewall. However, that does not mean that Facebook is not available in China at all. Mobile phones sometimes offer access and for foreigners in China using mobile roaming they can customarily gain access. Utilizing a VPN is another method of gaining access to Facebook. The origin of the content and the delivery method are both essential to understanding what will be available and under what circumstances.

Social networking is perceived as being content neutral. Sites like Twitter allow anyone to post their views on any issue. It would be better stated that social networking sites allow all perspectives, but that many of these perspectives are not content neutral. The Chinese government has many concerns about the types of content that is posted on foreign-based social networking sites. Social networking is subject to opinions across all spectrums, which is why most foreign-based social networking sites are banned within China.



High-availability is important. Sometimes sites do not load properly.

***“In China, high-availability is present but there are times when sites will encounter challenges and these challenges sometimes result in a perception that China does not have high-availability.”***

In fact, it does. If an enterprise want maximum availability, it has to understand and follow the guidelines for China which will enable the highest probability of success.

Knowing something about the Chinese Internet landscape is a step toward exposing content for profit or for promotion. Knowledge is a factor, but without implementation it is worthless. Partnering can enable maximizing the usefulness of this knowledge.

## Key Advantages in Partnering

Doing business in China on the Internet means understanding the landscape in terms of infrastructure, competition, and regulation. On all three counts there are principles to follow that will maximize the potential for success. Each count lends itself well to partnering.

A Content Delivery Network (CDN) provider is important regardless of country. Move your content closer to where it is needed and have a place it can be cached that can assist in times of high latency. It allows one to leverage the advantages of content aggregation in terms of relationships with providers and increases the odds of a DC with full access BGP.

A CDN registered in China addresses the Great Firewall issues and also ensures sensitivity to local regulations. A CDN within China will be aware of emerging content trends and follow them to the benefit of its clients. It will also have domestic assistance in times of trouble, such as cables being cut or issues affecting overall transmission country-wide.

A CDN partner that supports high-availability, has domestic support staff and knowledge of the domestic market will assist a company in flourishing within China. The reality is that there are many cases where local presence near the delivery target will be critical. A partner also will ensure that its own content does not result in an adverse impact on its customers.

## Conclusion

China has a few primary providers of Internet backbone services which are divided by role. CTT, for example, brings the Internet to rail services. China Mobile primarily services mobile devices. China Unicom and China Telecom support fixed lines. CERNET provides the educational and research backbone. These are the major players and they are competitive and do not support free peering in and among themselves.

China ascribes to a “Harmonious Society” which means that some content is controlled and disabled at the IP level. A company not in compliance with regulations, including registration, will simply not have its content viewable within China. Some mid-level DCs will allow DNS hijacking, also resulting in content not being available to end users. These challenges are acute with foreign companies which either attempt to go it alone or select cheap providers for displaying their content within China.

Within China, there are many innovative companies which are protected by the government and which are innovative. If content such as Facebook is not readily available, there are likely domestic alternatives. Learning about these domestic alternatives will enable companies to offer cutting-edge user experience within China while being based abroad.

ChinaCache began in 1998 in Beijing as a CDN. Over the past 16 years, it has built a network that now includes maintaining more than 400 service nodes in 120 cities across China with a global point of presence spanning five continents. It has network capacity of over 1000 Gbit/s with interconnections to major Chinese ISPs.

If you need assistance in growing your business in the world’s largest Internet market, look to ChinaCache for help. ChinaCache has the experience, the focus and the knowledge to enable you. Our goal is to educate and support our growing client-base.

*For more information and to take a look at ChinaCache as your gateway to content delivery in China, please visit [www.chinacache.com](http://www.chinacache.com).*

