Comparative Study on CCN and CDN

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Abstract—**With the explosive increase in Internet Contents, the Internet usage is shifting from host-to-host model to content dissemination model, e.g. video content accounts for the majority of Internet traffics. ISPs, content providers and other third parties have already deployed CDNs (content delivery networks) to improve user experience. However, as an ad-hoc solution to the content dissemination problem, CDNs still face big challenges, such as complicated control plane. With a fundamental change in network architecture, CCN (content centric network) incorporates content delivery functions in its network layer, and appears to be a most promising solution to this problem. In this paper, we construct comparable CDN and CCN testbeds separately and systematically compare the content delivery of CDN and CCN.**

Keywords-Content Delivery Networking, Content Centric Networking, Internet Architecture.

I. INTRODUCTION

As content distribution traffic continues growth, existing technology, such as ISP and CDN [1], is unable to satisfy the needs of users, thus, efficient content distribution methods are needed. CCN [2] is one of these methods. In this paper, we evaluate CDN-based and CCN-based file distribution performance [3] with virtual machines, including. What's more, we modify some settings to compare CDN with CCN better. As we know, it is first time to compare these two network schemes systematically. Although this comparison may not very fair, it is helpful to identify the two commons and differences, the advantages and disadvantages, and the merits need to be further exploit for both of architecture.

II. BACKGROUND

A. *Content Delivery Network*

Content delivery network (CDN) overlay tries to solve a fundamental challenge for the Internet: How to distribute and retrieve content effectively, meanwhile reduce the delay time of terminal host. On the technical level, CDN provides content caching and services distributed on the Internet. The kernel of CDN is a method that overlay routing redirects requests and content to achieve load balancing. For example, the CDN method includes DNS rewriting, URL rewriting and HTTP redirecting. To balance requests and downloading content, CDN optimize different criteria, including technical measures (response time and server load) and economic measures (bandwidth costs). As a result, data packets can be cached and redistributed in the network by utilizing CDN caching proxies. With the widely deployed CDN infrastructure, it is a practical method for content distribution.

B. *Content Centric Network*

Content centric network (CCN) (i.e. information centric network or Named Data Networking) is an alternative approach to the current architecture of computer networks. CCN is based on the principle that communication network should allow users to focus on the data, rather than having to reference a specific, physical location where that data is to be retrieved from. CCN will clearly allow automatic and application-neutral caching, which enables a more efficient data delivery system. Its structure appearance is similar to today's TCP/IP network, both are hourglass fashion. The biggest different is in the "thin waist" Content Chunk replaces the IP. From the network view, CCN uses data naming instead of the naming of physical entities. What's more, CCN builds storage capability for the cache passed data, which shortens the response time to access the same data, thus greatly easing the network traffic.

III. COMPARISON IN CONTENT TRANSMISSION

A. *Cloud platform infrastructure*

Saturn-cloud [4], a home-brewed cloud computing platform, is used to conduct experiment and analysis task. Saturn-storage, NFS storage with ZFS file system (openindiana+napp-it) [5], is used to accommodate the virtual machines. It can scale to 16 hard disks, each with 2 TB SATA storage. Cloudstack [6] is used to manage a VMware vSphere 5.0 based computing servers. The whole cloud infrastructure is shown in Fig. 1. In the future, we will use the openvSwitch in network tested.

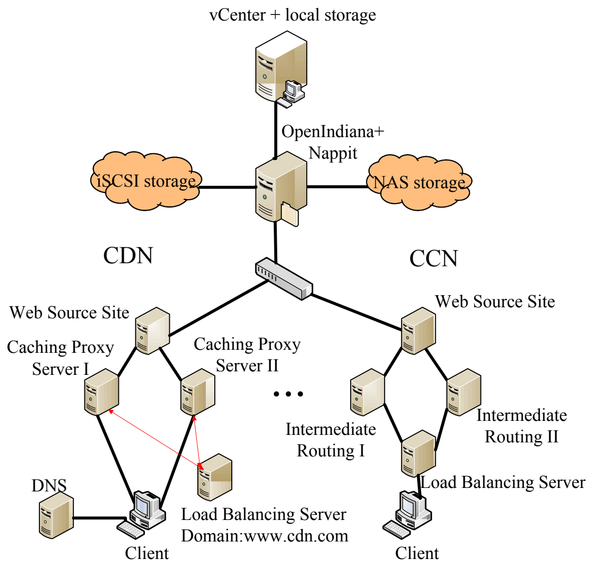

Fig .1. Cloud platform infrastructure and testbeds.

B. *CDN and CCN Settings*

For the comparison purpose, all the hosts used in the testbeds are virtual machines installed on Debian Linux 6.0 (64 bit version).

The CDN testbed has six servers, including a web server (content source), two caching proxy servers (running squid), a load balancing server (running nginx), a DNS name resolve server (running bind) and a client.

We conduct testbed in CCN with the same topology of CDN for the purpose of comparison. CCN test bed also has five hosts, including a content source CCN node, two intermediate routing nodes, a CCN node functioning as load balancing and a client. Fig.1 shows the setup of CDN and CCN testbeds.

CCNx [6], developed by PARC, is the current implementation of CCN. The key component of CCNx is the ccnd daemon, which supports packet forwarding and caching functions. The CCNx implementation used in this paper is the version (0.8.0) released on Aug 12, 2013.

C. Performance Experiments

In CDN case, the client host runs the *wget* program to fetch data file. For the CCNx case, every host only needs to run the *ccnd* daemon and the client run *ccngetfile* application to download the data file. To perform file transfer, a file is stored in the web source in advance, meanwhile the client sends requests to get the file until it is downloaded completely, and the transfer time will be recorded each time.

For the convenience of comparison, we take the logarithm scale of transfer time. We have done three experiments where the CDN load balancing server's strategy is accessing caching proxy in round-robin, while CCN's strategy is that download data from the fastest response router. We set the cache of CDN 2.5GB. The cache of CCN is set 200MB and 2.5GBseparately. What's more, we increase the delay between transmission channels to make the network practical.

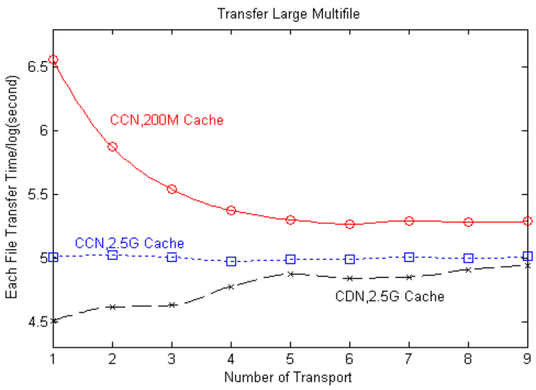

Fig.2. Transfer Large Multifile.

In the first experiment, the client requests multiple files simultaneously, the number of files is varied as 1, 2, … , 9 separately, and the interval time of each request is 1 second. Through the Fig.2, we observe that when transfer large files, CDN's average transmission time of a single file is incremental, CCN 200MB Cache's is diminishing, and CCN 2.5GB Cache's is smooth. And when the number of transport is more than 5, the average time between them is not much difference. This is because that every server is a CCN node in the CCN network, even the client. 2.5GB is enough to store the file, but 200MB is too small. So the data in the local cache could transfer itself quickly. However, CDN doesn't have the local cache.

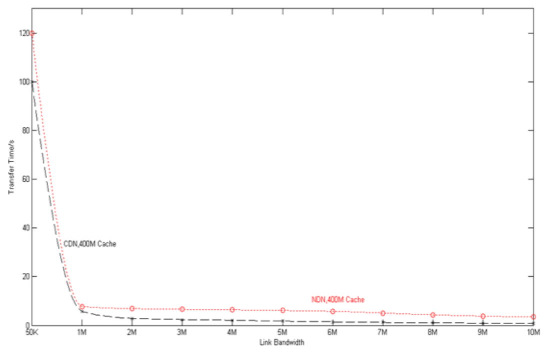

Fig.3. Transfer Performance for Different Bandwidth.

To our surprise, more than 50% of the time is spent on functions related to packet name decoding and data restructuring. In order to evaluate the transfer performance under different network bandwidth conditions, we conduct this experiment. We set different bandwidth and compare the transfer time between CDN and CCN. The size of transferring file is 5.2 MB and Fig.3 records the transfer time.

Fig.3 depicts that in low bandwidth, simple network transmission performance of CCN is approximate with CDN. With the bandwidth increasing, the performance of CDN is more superior than CCN's.

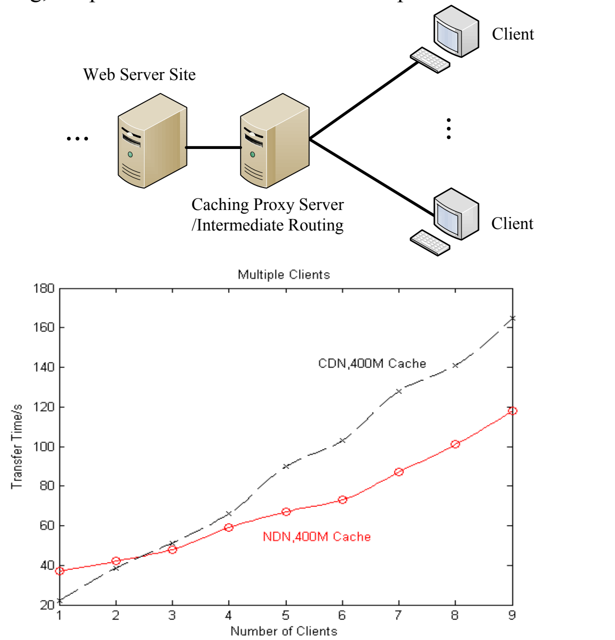

Fig.4. Multi-user Environment and Results.

The last one, we measure corresponding time as multiple users request the same single-file (size: 220MB). The topology and result is shown in Fig. 4, which illustrates that with the clients request increasing the CCN is better than CDN gradually resulting from the difference of cache granularity. Because CDN's cache granularity is file level, there is more pressure on bandwidth when request growing. And CCN has the character of content multi-homing, so in reality the speed is faster.

IV. CONCLUSION

In this work, we set up testbeds on the cloud computing platforms, and systematically compare content delivery capability of CDN and CCN in the metric of performance. Although CCN spends much time on content chunk decoding and restructuring of the contents, in many situations, CCN is comparable to CDN. Whereas, the signature verification enhances the CCN data credibility and safety. As open content network architecture, CCN has many attractive advantages on security and local cache mechanism etc. It should be pointed out that there will be a great challenge to find a more efficient packet encoding/decoding method in current CCNx project. And in routing strategy, and content multi-homing, there is enough research space to ameliorate CCN.

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