Performance Measurement Study on Two Video Service Providers in China

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ABSTRACT

This article describes how understanding the potential characteristics of video services is very important, as it can help users or third-party applications to predict performance or to identify service strategies. For this purpose, a measurement system deployed in 11 provinces and cities in China and monitoring two popular Web sites—Youku and Tudou—was designed. Through analyzing the measured records, it is obvious that the performance trend of the two service providers follows diurnal patterns, and it is consistent with users’ accessing behavior. These two service providers share the underlying content delivery network to some extent, especially for the same content. The playing quality can also be guaranteed, typically for low-resolution content. Meanwhile, the user terminal’s ISP is an important impact factor of service quality. In addition, how to predict the service performance online is also discussed, which is useful in some applications (e.g., video source recommendation systems).

KEYWORDS

China, Performance Analysis, Performance Measurement, Video Service Provider

1. INTRODUCTION

With the rapid development of Internet bandwidth, video services such as YouTube, Netflix, and Hulu have become very popular worldwide and attract billions of users. The number of video users is also quickly increasing in China. A report by China Internet Network Information Center (CNNIC, 2015) shows that the number of video users amounted to 433 million at the end of 2014, and the number of popular video content providers in China rose to about 20. However, there presently is no way for end users to have direct quantified knowledge of the different service performance offered by the various content providers. Measuring the performance of multiple content providers in real time is not easy. One key feature experienced by users is the smooth playback of video, which is related to the average and the jitter of data download rate. For users with diverse terminals, such as TV, PC, and mobile phones, network conditions and the desired video resolutions are quite different.

DOI: 10.4018/IJMCMC.2018010104

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The factors that affect the service quality of video Web sites in China and how to measure the related information are not thoroughly discussed in the state-of-the-art work. This motivated us to provide a third-party, measurement-based evaluation of service performance for different content providers, reveal the characteristics of the performance of different video Web sites, and offer some advice about the performance prediction for each user, which can be used to optimize content provider selection on behalf of users and third-party applications.

Video Web sites use content delivery networks (CDNs) to place the service node near the users and to provide high-quality service, which means that the distribution of CDN nodes and service strategies in different Web sites vary. Although measuring and analyzing video service quality is investigated in several works (Adhikari et al., 2015; Adhikari et al., 2012a; Ameigeiras et al., 2012; Artero et al., 2010), none of them is for current Chinese content providers; therefore, the results may not be immediately applicable to the China market due to its large population, different geographic distribution, and different viewing habits of Chinese video users. For Netflix and YouTube, the CDN structure and service strategies are usually discussed; however, the performance changing trends in different time scales, which are critical in designing performance predictors, are not studied in depth. Therefore, the current literature cannot meet our needs.

Although there are some popular video websites in China, their service strategies are different and undisclosed. Thus, analyzing each popular video service provider can help us to understand the potential service performance trend and design the proper performance predictor for different websites. In this work, a thorough measurement and analysis of two major content providers in China—Youku and Tudou—was conducted. According to CNNIC (2013), about 70.4% of video users use Youku and Tudou. For Youku, the amount of paying users and loyal users are larger than other Web sites. For the user-generated content, the loyal users of Tudou are remarkable. In addition, these two companies merged in 2013, but the two Web site brands still exist independently. People are also curious about whether their service performance and the underlying architecture are the same.

Based on our analysis, third-party applications such as service selection and recommendations can offer strategies for different video Web sites and can also be useful for performance predictor design. In general, the contributions of our work include the following:

- A distributed performance measurement system was developed to monitor the service procedure and service quality of two major Chinese video content providers: Youku and Tudou. Based on the captured data, the connection time and available bandwidth of the two service providers in different time scales were analyzed. In general, for the two Web sites, the available bandwidth of different resolutions is not the same, which shows that the higher the resolution is, the higher the available bandwidth is. Moreover, the performance of both exhibits the diurnal pattern. The lowest available bandwidth always occurs between 8:00 p.m. and 9:00 p.m., which aligns with the “prime-time” bursting access. Meanwhile, the performance of the two Web sites presents obvious periodicity;
- The service strategies of the underlying CDN are investigated by reverse engineering. It is highly likely that the content of the two Web sites shares the same CDN architecture, but the Youku and Tudou portals are mostly operated separately. Although the selected CDN nodes are sometimes changed based on the dynamic network condition, the average performance is quite stable. In addition, the average results of measurement nodes from different ISPs show various performance characteristics, which means a user’s hosted ISP is an important factor in the user’s experience;
- Predictability of the performance metric is verified by correlation analysis of measured data, and it implies that the future performance of each node is predictable based on historical information.

The remainder of this chapter is organized as follows: The next section outlines the related work about video service performance measurement and analysis. The third section presents our architecture of the system for measuring Youku and Tudou. The fourth and fifth sections analyze the performance
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