IP_TASCM: IP Trace Analysis System based on Code Moving

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Abstract

This paper proposes an IP Trace Analysis System based on Code Moving (IP_TASCM) for sharing Internet measurement, tools and dataset. However, two characteristics differentiate it from other prior similar systems. One of them is that besides the common catalog service, IP_TASCM also stores tools, datasets and measurement results together for researches' download and analysis. The other one is that it provides a shared computing resource for researchers, where they can analyze measurement with tools submitted by themselves or others and wide used ones offered by system. IP_TASCM introduces a simple and convenient means for measurements, avoiding the problems of downloading large-scale dataset and researchers' limited computing resource. We believe that IP_TASCM will attract more researches to share their tools and measurements.

Keywords

Network measurement, Resource sharing, Meta-data, IP Trace

1. Introduction

Traffic measurement is important to network characterization and modeling[1]. Organizations and researchers have developed several systems for sharing Internet measurements, tools and datasets, such as SIMR[2], MOME[3],[4] and IMDC[5]. They provide a way that data can be accumulated from multiple vantage points, tools and measurements be grouped together to share everything that a researcher needs to reproduce a set of results. However, these systems mainly emphasize on the design of specific database item to provide more convenience and correlations for users' searching for certain ones. They work as catalogs and archives, users can find where the tools and datasets stored, but still need to download those from remote sites to local for analysis and store the measurement result themselves.

In this paper, we introduce the IP Trace Analysis System based on Code Moving (IP_TASCM), providing a simple and convenient method for measurements. Besides the common function of tracking the measurements, two characteristics make it totally distinct from other systems.

1) IP_TASCM dose store the three indispensible components of measurement—tool, dataset and analysis result as well as their specific information.
2) IP_TASCM provides a platform with shared computing resources, where researchers can analyze measurement with tools submitted by themselves or others and wide used ones offered by system.

These two characteristics introduce our basic design principle of the system—resource sharing, including dataset resource, tool resource, measurement resource and computing resource. IP_TASCM overcomes the obstacles we must face to before as well as brings about some advantages.

1) The researchers don't have to download traces, whose size usually amount to TB, from remote repository, which consumes considerable bandwidth and time, especially for the packet trace of long duration and international users.
2) The calculation of large scale traffic data always accompanies with significant CPU and memory cost. Shared computing platform of IP_TASCM

benefits the organizations have not the high performance computing resource which meet the calculating demand.

3) Instead of downloading tools and analyze on local server, users can complete these on the shared computing platform, which reduces the possibility of intrusion of malicious tools on their own computers.

2. Architecture

IP_TASCM consists of two separate systems, outer sub system and internal sub system. The outer one provides web-based graphic user interface, test section of dataset and security control mechanism for tools. The internal one is composed of database, shared computing platform and two traffic data collectors.

An alternative to this architecture would be a centralized system, which may work well in other systems implemented before but not IP_TASCM. This two-level architecture is determined by the functions the system provides. The shared computing resource leads to the security problem that users maybe upload malicious tools, and then submit a measurement require to execute them. On the other hand, the storage of dataset, tools and results together means the impossibility of backing up them totally on another server, a huge storage waste. Due to these two reasons, we must pay great attention to the tools security and reliability and ensure that the measurement analysis in the internal systems is under control. So we set a separate server called castle on the boundary between the public and the kernel system. On this sever, we will execute the submitted tools, check the reliability and security, only the tools pass the validation test can be added into tools repository of internal system. Even if in some unfortunate cases, the castle is destroyed totally, it can be rebuilt from backup.

3. Outer Sub-system

In the first place, it provides web-based interface to give users a clear and complete view of the main features and policy of IPTAS_CM. The users can use the functions including register, login, tools submit, measurement apply, database query and so on through the webpage.

Besides, another significant function of the outer sub system is providing security control mechanism on tools. When user submits a tool, he should fill in the information about it. Then the tool will be executed with test data section in the outer server, during this process, security control mechanism will work, for instance, detecting network ports, session establish, memory overflow, protection of system key areas and so on. Administrator will decide the validation of the tool based on its test execution report, and then discard the bad and malicious ones or transport the valid ones into tools repository of internal system. After that, system will inform submit users the details though email.

Moreover, though the system provides detailed information and format of the datasets, users maybe still need data itself to debug the program. However, some traces have large size, so small sections of every trace format are stored in the outer server and users can download them for testing. Moreover, these sections will also work in the test process of tools mentioned above.

4. Internal Sub-system

The internal system is the center of IP_TASCM and provides three main functions, shared computing platform, database storage and traffic collection. This section we will pay more attention to the shared computing platform as its significance than the other two.

4.1 Shared computing platform

One of the most significant components of IP_TASCM is the shared computing platform, which makes the system unique. Users’ measurement with specific tools and datasets will be executed on this platform, afterwards they can download the results when receive measurement completion information through email.

Considering of tool reuse by other researchers, we ask all the tools submitted should obtain the parameters from configuration file instead of set them in programs for single usage, and users must give out the configuration file name and its detailed format. In this case, others can configure parameters as their own demands.

When apply a measurement request through webpage, users need to choose the dataset and tool, as the same time fill in the parameters except dataset input and result output path which will be generated based on database information by system. All these parameters composed the configuration file as the format corresponding to the tool in use. After administrator's validation, the measurement will be added into schedule queue and execute at proper time.

However, shared computing platform leads to some problems, including the system security mainly solved by outer sub system, as well as code portability.

Though we ask users submit executable code and source code, we want to compile source code as less as possible. On the other hand, some program languages depend greatly on operation system and compiler, which need to be compiled again or can't be compiled correctly when moved to other platforms. Fortunately, JAVA has much better portability because of its virtual machine mechanism, driving us to set the policy that all the codes need re-compiled submitted by users must be JAVA. Though JAVA has comparatively low efficient, we must tradeoff between it and the portability. We will also demonstrate complete information of the compiler, link library and operation system on the webpage and strongly encourage users to adapt their codes to that. While users can also apply more demands through email to administrator. We have to mention that supporting JAVA is just the first step, we will improve the system for adapting to more program languages.

Besides, it will be an impossible task for system to run all the measurement users applied at one time. However, first come first service may be fair in daily life but not here. So we introduce the schedule policy based on user classification and priority. The basic rule is that the more contributions to the system, for instance the used time of tools one user submitted, the higher his priority and the more possible his measurement application will be executed early. We believe that this policy could encourage users to submit more valuable tools for share instead of the ones with bad coding, algorithm design, low efficient.

When it comes to security concern, besides the mechanism similar to outer sub system, we also limit the IP address range could connect to the internal system, including the outer system and some reliable administrators.

4.2 Database

The database is divided into four separate databases to track users, tools, measurements and datasets respectively.

The key task of the database is specifying the meta-data required for each database entry so other researchers can use them for their own research. Every separate database should have specific attributes which can be used as the search criteria when querying the database for certain kinds of datasets, tools and measurements, and the details are included in IP_TASCM design handbook due to the limited contents here. We expect to provide as much as query methods to facilitate user and minimize the interaction with database. For instance, tools can be queried by functions, submitted users, submitted date, size and measurements analyzed by them.

4.3 Traffic data collector

The internal server is connected to two Internet traffic "collector", Watch[6] and Gather. Watch is an Internet traffic monitor captures network flows and record information with the advantage that it works very efficiently on high speed networks (very low packet loss ratio) and can generate very compact flow records. While Gather is a separate server designed for downloading datasets from other organization and research sites. With the help of these two servers, we can obtain more dataset to meet measurement demands.

5. Exemplary usage scenarios

We has implemented IP_TASCM and arranged it in CERNET regional center. In this section, we demonstrate one research has been completed based on this system as example usage scenario. Figure I depicts the webpage after user successful login, which shows the functions they can use as their user hierarchy.

Figure I

Through the page in Figure II, we can apply a measurement require by choosing the tool, single or group of datasets and fill in the parameters.

Figure II

The goal of this measurement[7] is to find whether the conclusion that time-triggered techniques did not perform as well as the packet-triggered ones with very small difference in performance is still suitable for nowadays rapidly increasing Internet traffic. We analyze three datasets and give the positive answer to the question above, as well as find that the percent of long large size packet has increased than ever before.

6. Conclusion and Future Work

In this paper we have outlined IP Trace Analysis System based on Code Moving for sharing measurements, tools and datasets. The most important difference between it and prior meta-data repository systems is that IP_TASCM provides a shared computing platform and users can submit tools and analyze measurement with them and other ones in this system. We hope that we have provided a starting point for a community discussion on this topic. And we believe that a great amount of researchers will submit their tools to IP_TASCM because of the shared computing resource.

On the other hand, there are still some aspects need to improve. Firstly, the shared computing can't meet the measurement requirements as the growth of the registered users, so the user management policy should be modified based on some characterization of the system itself after certain duration, such as the number of users and average time of measurement analysis. Moreover, supporting more program languages besides JAVA is also in our plan.

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