Multi-protocol and Multi-platform Traffic Generation and Measurement

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Abstract

D-ITG is a software platform for traffic generation and active measurements which presents several features that make it a robust and flexible tool for networking researchers and developers. In this demo we will show how it is possible to perform several experiments under a variety of network scenarios, which will include usage of novel network protocols and appliances (i.e. Intel network processors [1]*)*

1. Introduction

Networking research needs robust tools to perform realistic experiments and performance measurements. In this demo we will present the capabilities of D-ITG [4]. D-ITG is a traffic generation and active measurement software architecture, able to replicate several network traffic profiles and to perform packet-level measurements. Traffic generation is useful in many scenarios, e.g. to test network equipment, to evaluate (operational and new) network architectures and algorithms, to test anomaly detection and classification systems, to compare protocol performances etc.

In recent years, networks have become incredibly heterogeneous, in terms of applications, protocols, access technologies, and devices. Thus, flexible tools capable to work under different conditions and to replicate complex distributed scenarios can be more effective for research activity. D-ITG was indeed conceived with this in mind, and therefore it supports different platforms (hardware and OS) and protocols, recently tracking cutting edge architectures.

In this demo we will show the functionalities offered by D-ITG which was recently updated to support also new generation protocols as SCTP [2] and DCCP [3] and to run over new network processors architectures. The scope of the demo is to show to developers and researchers how it is possible to make realistic experiments using our platform for performance measurements in different scenarios.

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2. Supporting novel network protocols and appliances

Today we are assisting to the spread of new services related to multimedia content distribution, voice and video communication, real time interaction. Not only the Internet has not been originally designed to support such kind of services, but, the more they become pervasive in our social and business lives, the more the users need to rely on them. Therefore stringent requirements in terms of security, privacy, quality of service, etc. are to be satisfied. Current networks, even when allowing deployment of such services, are not optimized for them, yielding costly or poorly performing implementations. Thus a lot of current efforts are focused on the design of new network protocols and devices. This cannot be possible without the availability of proper measurement tools.

New transport protocols as SCTP and DCCP are being proposed to overcome several limitations of UDP and TCP in the aforementioned scenarios. On one hand, SCTP has been conceived looking at the telephony world. It allows efficient and reliable multi-streaming and supports multihoming devices. On the other hand, DCCP has been designed to face the problem of providing applications access to congestion control functionalities implemented at transport layer, with specific regard to VoIP.

As for new hardware platforms, appliances based on network processors are envisioned and are already approaching the market [5]. Such architectures provide developers a high level of flexibility with high performance and an acceptable time-to-market. Their network processing engines can be programmed to efficiently execute intensive operations tied to new generation services (digital signal processing, on-the-fly encryption tunneling, etc.).

3. The D-ITG platform

Distributed Internet Traffic Generator (D-ITG) is a platform capable to produce IPv4 and IPv6 traffic that accurately adheres to patterns defined by the Inter Departure Time (IDT) between packets and the Packet Size (PS)

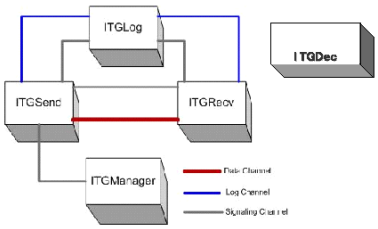

Figure 1. D-ITG Software Architecture

stochastic processes. Such processes are implemented as an i.i.d. sequence of random variables. A rich variety of probability distributions is available. Also, D-ITG embeds some statistical models proposed to replicate source traffic related to various applications: DNS, Telnet, VoIP (G.711, G.723, G.729, Voice Activity Detection, Compressed RTP) and some network games (e.g. Counter Strike). Moreover, we are in the process of adding to D-ITG models which take into account also correlation structures present in network traffic [1].

Measurements of One Way Delay (OWD), Round Trip Time (RTT), packet loss, jitter, and throughput can be performed. For each generation experiment it is possible to set a seed for the random variables involved. This option gives the possibility to repeat many times exactly the same traffic pattern by using the same seed. Also, D-ITG permits the setting of TOS (DS) and TTL packet fields.

Figure 1 shows a high level overview of the distributed multi-component architecture underlining the relationship among the main bricks of the D-ITG platform. The communication between each sender (*ITGSend*) and its corresponding receiver (*ITGRecv*) is done by using a separate signaling channel and ruled by a protocol for the configuration of the experiment.

D-ITG allows to perform measurements at both sender and receiver sides. Additionally, D-ITG enables the sender and the receiver to delegate the logging operation to a remote log server. This option is useful when the sender or the receiver have limited storage capacity (e.g. PDAs, Palmtops, etc.) or when a central point of collection is required.

D-ITG is currently available on Linux, Windows, and Linux Familiar[2] platforms. Source code and pre-compiled binaries are freely available at [4].

4. Demo activity / Scenarios shown during the Demo

In our demo we will show some simple experimental testbeds for traffic generation and measurement. The hardware used will include palmtop devices and two StarEast boards hosting Intel IXP-425 network processors, miniPCI wireless network interfaces, and running the SnapGear OS. These boards are conceived to support rapid development of embedded systems by combining network applications such as: wireless access points, VoIP gateways, ADSL and ATM routers, etc. Moreover, we will show generation experiments of SCTP and DCCP traffic using mobile devices with multiple interfaces. Multiple senders and receivers will be used to show the utility of having a such distributed platform. After each experiment it will be possible to sketch some diagrams generated on-the-fly representing measurement results. This is just to give a simple overview of a thorough measurement analysis which is possible to perform after experiment data has been collected. Thanks to this feature, we will show how it is possible to perform a simple performance comparison of several transport layer protocols (e.g. TCP, UDP, DCCP, SCTP) by considering: (i) wired and wireless scenarios, (ii) different statistical profiles of application-level traffic (see Sec. 3). Finally, it is worth noticing that we will organize our demo according to the audience requests.

5. Conclusion

Through the past years D-ITG has been used by several groups from the industry and the research community. This is also testified by the relevant number of citings present in scientific publications and in research activity reports and web sites. Here we present the upgrade of our distributed measurement and traffic generation platform to support new generation protocols and hardware architectures. It is our opinion that a live demonstration would be useful to explain and to discuss with researchers and developers on how they could take advantage of such software platform. We think also that collecting feedback and requests from the research community would allow us to improve and extend our software in the right directions to better fulfill community needs.

References

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2 A porting of Linux for ARM-based palmtop devices.