It's Time to Give Online Games Serious Consideration

By Jose Saldana and Mirko Suznjevic

I attended my first IETF meeting in Paris (IETF 83) in order to present the preliminary idea for a traffic optimization proposal in the Transport Area. The idea emerged when I tried to adapt a VoIP (voice-over-Internet protocol) optimization technique to online game traffic. One of my research interests is the characterization of online game traffic so when several people mentioned that it might be interesting to have an informal session about the topic, we requested a room and organized an online games session on the fly (see *The IETF Journal* June 2012, Vol. 8, Issue 1).

After the informal session in Paris, Wes Eddy suggested that I organize a more-formal tutorial and announce it in advance to get more people interested. Although online games have become increasingly popular, we wondered if the IETF community was interested in learning more about them. I enlisted the help of Mirko Suznjevic of the University of Zagreb, who'd just received a fellowship for attending the IETF meeting in Berlin. We'd previously collaborated on some research articles, mainly about the traffic of massively multiplayer online role-playing games (MMORPGs), one of today's most popular game genres.

We talked with the Transport Area directors, and they encouraged us to prepare the tutorial. They also granted us a slot in the Transport Area Open Meeting at IETF 87. The main objectives of the presentation, after a succinct overview of the online games market, were to inform the IETF crowd about the traffic characteristics of online games and to play a variety of game genres to illustrate in real time the impact of network impairments on a player's quality of experience (QoE). Since many IETF members were interested in experiencing first-hand the effect of network impairments (i.e., delay and packet loss) on game playability, we decided to have volunteers play instead of demonstrating the games ourselves.

At the onset of our overview, we shared global data that illustrate the size of the gaming industry. Those who think gaming is only for a minority of the population are mistaken. The current number of players worldwide is estimated to be 1.2 billion, with a very high percentage of gamers in Asia and the Pacific region. In recent years, the gaming industry as a whole has shifted towards online gaming. Facebook has confirmed that it has more than 250 million unique players a month. League of Legends, the online game with the record for most concurrent players, has more than 3 million concurrent players at peak times. In addition, every next-generation game console now includes a network interface. It's safe to assume that the amount of game traffic on the network will continue to increase.

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Most session attendees were surprised to learn that:

- The average age of a game player in the United States is 30 years old.
- Adult women in the United States represent a greater portion of gamers (30 percent) than do boys age 17 or younger (18 percent).

We also summarized different game architectures. Today, there is a strong predominance of client-server schemes. The biggest reason is that they permit better control of the server, which translates into good synchronization between players. Other reasons include the deterrence of cheating (some players modify the packets in order to gain an advantage over others) and easier billing.

In recent years, a trend has arisen in gaming business models: pay-to-play models (e.g., game client purchase, subscription-based games) are being replaced by free-to-play models in which the game is free, but additional content or cosmetic and usability improvements are offered for microtransactions. In this model, a player can either spend a week trying to get a new item (e.g., a sword, a car, camouflage paint) or buy it immediately for a small sum.

The Internet is the part of the problem that the gaming company does not control—upon installation of the application, all 3D information about the game's virtual world is stored in the user's hard disk. We showed a World of Warcraft folder that comprised 25GB of data as an example. This model enables games to function with very low bandwidth requirements: they need only send information containing the

Jose Saldana copresents an online game tutorial during the Transport Area Open Meeting

player's commands and inputs, in addition to chat and built-in voice systems. All textures, characters, and landscape meshes reside on the hard disk—they need not be transmitted during play.

As a result, the main characteristic of gaming traffic is very small packets (a few tens of bytes) sent at a fast pace. Similar to VoIP, interactivity is critical. The bandwidth sent is low—in some cases tens of kilobits-per-second, and a player's actions are transmitted to the server in milliseconds. This ensures that the competition between players is realistic and not a case of the gamer with the highest delay being penalized.

We also presented an approach used by cloud-based games in which clients are "thin," and servers calculate the virtual-world state and send a high-quality video stream to the player's client. The client then sends the player's commands to the server. This results in different traffic characteristics, including significantly higher bandwidth usage.

The effect of network delay and packet loss on playability is a critical concern of online game developers, network operators, and Internet service providers. Players are difficult customers to deal with—if a game does not work properly, they may leave the game and never return. For this reason, gaming companies tend to simplify the problem with a goal of 24/7 workability and very low network delay.

In order to show the audience the effect of network impairments on playability, we had two volunteers play three rounds of a first-person shooter (FPS) game on a dedicated server. They played the first round as normal. During the second round, we added 300ms (round trip) of latency to one of the players via a network emulator. During the third round, we added 10 percent packet loss.

Although the FPS game was resilient to our imposed impairments, particularly the loss, some negative impact was observed: the video was not continuous and it went back in moments. Since manageability was reduced, the player with the impairments had a higher probability of being shot. Even so, the impairments did not significantly affect performance and both players reported that their quality of experience (QoE) was not significantly degraded.

Mirko Suznjevic copresents an online game tutorial during the Transport Area Open Meeting

In another demonstration, we had two different volunteers play three duels on the public server of a MMORPG. The same scenarios were executed: normal network conditions, 300ms of latency, and 10 percent of loss. Due to the MMORPG using TCP (transmission control protocol), a much more significant impairment was reported by the player with the high loss rate.

In summary, our tutorial presented some important high-level information about the game industry, gaming traffic characteristics, and game QoE issues. As online games become an increasingly significant market, we believe that the IETF should consider game characteristics and requirements during the standardization process.

A NEWCOMER'S EXPERIENCE

I attended IETF 87 primarily to participate in the birds-of-a-feather (BoF) for Tunneling Compressed Multiplexed Traffic Flows—a mailing list on which I'm active. I was nervous prior to the meeting. It was both my first IETF meeting and I was giving two presentations: one at the BoF and another on online gaming traffic.

The Internet Society's morning meetings eased my nervousness by breaking the ice with other fellows and Fellowship program staff. That first contact was very warm and helped calm me. I specifically thank Steve Conte for his advice and guidance. I didn't expect the people in the IETF to be so approachable, but everyone—from students to highly ranked members from corporations like Cisco—is polite, kind, and willing spare a few moments to answer questions. I talked with a lot of people and received a lot of very good advice regarding my current research and further activities in the IETF. Conversations and the ability to meet with a variety of people were probably the greatest benefits of attending the meeting.

I'm very pleased with the meeting's outcome: the tutorial was very well received. Although the BoF did not result in creation of a working group, we received a lot of constructive criticism, and we were able to identify issues that need to be addressed in order to advance our work. I also realized what a great opportunity IETF meetings are to meet and talk with people from different parts of the world. Gaining these vastly different perspectives is valuable for researchers like myself and I'm grateful to ISOC's Fellowship program for enabling my attendance.

— Mirko Suznjevic