Analysis of Scalable Data Streams for Representations in Networked Virtual Environments

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ABSTRACT
Analyzing the data generated by networked applications is a topic of great interest to a number of parties, such as ISPs and Network Equipment Manufacturers. However, it is becoming an increasingly difficult task to accomplish, mainly due to the use of undisclosed protocols. This is especially true when considering applications that stream content in real-time from central servers. There is a clear need for more detailed knowledge of the network behavior of these techniques. In this poster, we analyze the data streams related to 3D objects that are requested by the clients of our own networked virtual environment framework. We employ several LoD optimizations such as the use of image based representations and reduced complexity geometrical models. Using these optimizations, we try to deliver an acceptable visual representation of the virtual world as quickly as possible to a user in an environment that is in its entirety streamed in real-time from a server. Since these techniques are becoming integrated into commercial applications the conclusions drawn are widely applicable.

Categories and Subject Descriptors
E.2 [Data Storage Representations]: Object representation

General Terms
Measurement, Performance

Keywords
Scalability, Representations, Networked Virtual Environments

1. ANALYZING STREAMS
Modern NVE applications feature a highly dynamic world state, for which a local database is not ideally suited. These applications make extensive use of real-time streaming of representational data from central servers. There are however a number of problems which are apparent when considering real-time streaming of entire worlds to each individual client that is connected to the NVE. Most of these worlds are made up out of hundreds of complex objects that need to be streamed to the user when he/she logs in to the application or moves to a previously unexplored part of the world. Highly detailed geometrical models consume large amounts of bandwidth, due to the high number of polygons they contain. Commercial NVE applications therefore employ techniques such as Level-Of-Detail representations to limit the downstream bandwidth and still present the user with an acceptable view of the virtual environment. It is however a non-trivial task to extract the precise characteristics of these optimizations from captured network traffic of these applications, due to the closed nature of the protocols that are used and the lack of knowledge of the (network) architecture.

Distinguishing data streams from each other is increasingly difficult in commercial applications. We have therefore opted to work top-down on an NVE application that was developed in-house\(^1\) and that features optimizations that are comparable to the ones found in modern commercial NVE applications. The main goal of the framework is to enable the client application to present and render a sufficiently good view of the virtual world as quickly as possible, using low detail representations if available. For this poster we have limited the data streams under consideration to those that are associated with representations in the virtual world. These streams consist of the data necessary to render the graphics of the objects and/or persons in the virtual environment, e.g. avatars and other 3D objects. Our measurements show that the proposed hybrid system decreases network traffic and speeds up rendering, while still presenting a satisfactory view of the NVE. Future work will include extending this idea for mobile access to our NVE.