Lab 6 Report: Multicast Communication

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Multicast Versus Unicast Remote Communication

Multicasting and unicasting are two different forms a remote communication that
allows a connection between a client and server to be established. While there
are similar characteristics between the two communication approaches, there are
also significant fundamental differences between the two. First, they are both
similar in the since that a connection can be established to transfer data remotely.
In both cases the server must identify where the client in order to transfer data.
They way in which this is done is one of the largest differences between either
approach. In unicasting communication, the connection is established in a point
to point fashion, which means the server identifies where a single client is located
and data is transfered from the server directly to the client. In multicasting
communication, the server connects to a middle component, called the multicast
group, and the multicast group routes the information to any client that is
listening. By using this approach, not only is information able to be sent to
multiple clients concurrently, it is possible to transfer information to clients
whose location was originally unknown. This is possible because the multicast
group sends out a message that any client is capable of listening to if they are in
range. Generally, it is better to use unicasting if there is only one client that
data will be sent to. Alternatively, if the data is likely to be sent to multiple
different clients concurrently and the location of these clients are not known,
multicasting is the optimal approach to utilize.

Types of Multicasting Systems Used in Production

Research was conducted to analyze the different types of multicasting systems
that are used in production today. A report that was published by Cisco on
the deployment fundamentals of IP multicast was analyzed and information
on the different types of multicast systems was found. The report states that
there is three main features that a multicast system can utilize; one to many,
many to one, and many to many. The major differences among each of these
types of systems is related to the number of nodes on both the client and server
sides. One to many is a multicast system that is structured such that there is
one node on the server side and the server transmits information to multiple
clients. Applications for a system such as this include systems that update
database, broadcasts, or any other situation in which a message from a single
point must be sent to several different points. The next type of system is a
one that utilizes a many to one structure. This is a system in which there are
many receivers that are generally sending information back to the single sender,
the report states that this is useful in situations in which there are requests

and responses between clients and servers, but the request for information may come from either the client or the server. Examples of situations in which this would be useful is when there is some form of data collection, such as auctions or polls. The last system structure the report analyze was many to many, in which there may be any number of hosts sending and receiving information from the same multicast group. Example in which a system may utilize a structure like this would be systems that use synchronized resources such as Google drive, group chats, specifically those that use audio and visual data distribution, or multi-player games in which many clients are connecting to one another to simulate a single environment. (Cisco)

Analyzing Multicasting Within the Lab Assignment

Key Components

In order to analyze remote communication using multicasting, two Java classes were analyzed to determine how data is transfered. Some of the key characteristics of the classes included the INET address, the port number, a buffer, and DatagramPacket objects. Similarly to how unicast communication works, the port number simply tells the client and server which port should be listened to in order to send or receive the message. One major difference is the use of an INET address opposed to a host name. In unicast communication, the host name is a means for the client to identify where to look for the server alongside the port number, whereas in multicast communication, this INET address is used to tell the server where to send messages to and tell each of the clients where to look for the servers message. This approach allows more than one client to be listening at the same address for messages. Next an essential art of each class is the buffer which allocates memory space for incoming and outgoing messages. This aspect of each class is very important because incomplete messages may be sent if too little memory is allocated, but also allocating too much memory can have performance trade-offs. Finally the DatagramPacket objects used allow the messages to be sent in a connectionless fashion. The Javadoc page on the DatagramPacket class states that the connectionless packet delivery service sends the messages from remote nodes based only on the information that exists within the packet. for this reason, multiple packets sent from one node to another may be routed differently in such a way that the may arrive in any order. Furthermore, the delivery of a packet is not guaranteed, which is a significant downside to uses DatagramPackets.

INET Addresses Analyzed Further

In order to better understand exactly how multicast communication works, more information was gathered on the use and implementation of the INET address. The Javadoc page on INET address states its purpose is to identify a set of

interfaces that are establishing a connection, such that, a packet sent to that address is delivered to all interfaces identified by the address. This means that any client that establishes a connection to the INET address will receive all messages sent to that address. Therefore, if the client changes this address to a different value, the clients that are requesting message from that server must change the INET address that they are connecting to, to the new value.

Real Life Applications

A report titled "An Internet Multicast System for the Stock Market" written by Shur and Maxemchuk was assigned to read so that the system that is the main focus of the report could be compared with the two classes that were used to complete this lab assignment. The major fundamental difference between the two systems is that the stock market system utilized a many to many structure, because the system consists of both many senders and many receivers. Even more importantly, the largest difference between the two systems is that the stock market system guaranteed the delivery and ordering of messages that were sent. This makes for a much better multicasting system than the one that was used in the lab assignment, because the guarantee of delivery and ordering of messages allows for much greater reliability. Using a system similar to the one in this lab assignment would not be ideal due to this lack of reliability seen with the stock market system. Due to the fact that many people in the stock market are highly dependent on the accuracy of messages and the order in which they are received. Should a message fail or come in the wrong sequence, the result of this could be highly detrimental to its users. (Shur, Maxemchuk)

Challenges Faced

The biggest challenges faced with completing the lab was becoming familiar with the Java packages that were used in the classes given for the assignment, specifically the DatagramPacket and how it worked exactly. Another challenge was becoming more familiar with the concept of a multicast system, and researching how it is applied to real life systems.

Citations

Cisco, "IP Multicast," Deployment Fundamentals , 2016. [Online]. Available at: http://www.cisco.com/en/us/tech/tk828/tech_brief09186a00800e9952.html. [Accessed: 05-Mar-2016].

D. H. Shur and N. F. Maxemchuk, "An Internet Multicast System for the Stock Market," tech., 2001.