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Research Article

UDP Traffic Behaviors Over eXplicit Multicast

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Abstract

Recently the rapid use of the internet, a huge number of applications involve the transmission of packets from one sender to a group of receivers. Group communication became important because number of users needed to communicate and collaborate with each other. Several technologies have proposed to support group communication service. Explicit Multicast (Xcast) is a one of the proposed multicast scheme to support small group multicast. Since the UDP (User Datagram Protocol) is most common transport protocol used for multicast, since UDP is not reliable protocol, so packet might be lost or delivered out of order. This paper has tested the UDP traffic behaviors flow in Xcast technology and compare it with normal UDP traffic behavior. The test was carrying out using NS2 (Network Simulation 2). The results of simulation reflect a better QoS performance parameters compared with UDP traffic in Xcast and normal UDP traffic

Keywords: *UDP, Multicast, Xcast, Ns2, QoS performance evaluation.*

1. Introduction

This document is a template. An electronic copy can be Internet's application divided into three categories: one-to-one, one-to-many, and many-to-many. Multicast (Paul, P., & Raghavan, S, 2002) is technology deals with data delivery from one-to-many likes (live video distribution) or many-to-many likes (video conferencing, network games). Currently multicast used to support large multicast groups number; due to large groups number the multicast suffers from scalability problems. Multicast scheme divided to five categories according to how the packets are routed: IP multicast, the single source multicast, the explicit multicast, the recursive multicast, and Sender Initiated Multicast.

Multicast inefficient to support large number of small multicast groups and unicast technique used to support one to one communication and that overwhelm the channel. Multicast is considered effective for various applications that must deliver information to multiple places in the network at once. GSM (Small Group Multicast) (Boivie, R., Feldman, N., & Metz, C,2000) have been proposed to support small grouping. GSM also known as eXplicit multicast Xcast (Boivie, *et al*. 2003) is new multicast scheme to support very large number of small multicast groups.

Xcast (Boivie, *et al*. 2003), used explicit list of destinations instead of logical multicast address. As well, Xcast has been proposed to Combine and handle the problem of Multicast and Unicast. The Xcast idea has come to defeat scalability problems of the multicast routing protocols. Xcast sender adds a list of IP addresses to header and sends it with data in one packet to router, the router partition the destination base in the next hop. fig.1 illustrates the difference between the three delivery models.

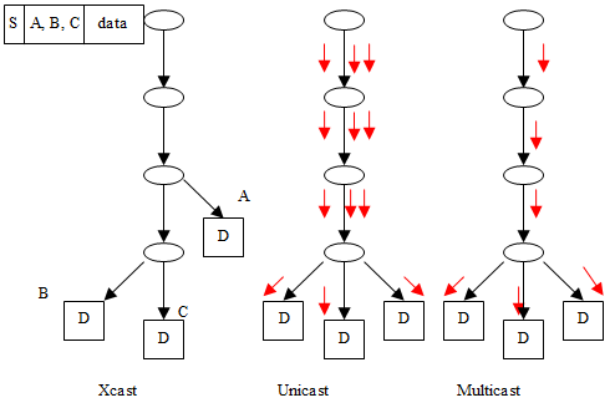

Fig 1 Three Delivery models

A. Multicast

Multicast is the delivery of data to a group of destinations. In multicast model the sender sends special multicast address to router, any receivers wish to get this data should subscribe to router to router data sent to address., multicast address range from 224.0.0.0 to 239.255.255.255, class D for IPv4, for IPv6 is defined by RFC-2375. Multicast good for Asynchronous transmission.

B. Unicast

Unicast is connection between one sender and one receiver. In unicast model the sender sends data to each

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receiver individual, this cause redundant data over a link. Unicast good for synchronous transmission.

C. Xcast

Xcast is new data delivery system, use to support small group multicast. In Xcast model the sender sends single packet contains multi-receivers addresses and data. The sender encode all destination address and data in one packet then pass it to router, the router process Xcast packet, if there is only one destination, the packet sent as Unicast packet. If there are more then one destinations, the router sent packet to next router with list of remaining address. When R1 received a packet from source will forward the C to destination using Unicast. R1 will forward the packet contains A, B to R2, R2 will process the packet and forward A, B to its destination using Unicast. Xcast in the final step convert to Unicast.

The remainder of this paper is organized as follows. Section II provides an overview of related work for XCAST, Section III. Describes Simulation experiment, Section V summarizes the results and section VI concludes this paper.

2. Related work

Multicast have scalability and deployment problem (Asaeda, H., & Dabbous, W,2004). Xcast (Boivie, *et al*. 2003) Boivie, R., Feldman, N., & Metz, C,2000)have been developed to solve these problems. Xcast sender encodes all destinations IP address and Data in one packet, this increase processing overhead in the router. Xcast+ (Shin, *et al* 2001). is extension of Xcast by adding the IGMP(S,G) join at receiver's side to reduce the packet overhead. Linkcast (Bag-Mohammadi, *et al*,2004) is eliminates processing overhead of Xcast protocols Bcast (Bag-Mohammadi, *et al*,2005) remove inefficient part in Xcast and Xcast+ forwarding mechanism. SEM (Boudani, A., & Cousin, B.,2003) (Simple Explicit Multicast) is efficient way to construct multicast tree and deliver packet. GXcast is new version of Xcast that can support Xcast packet fragmentation and increase the number if members in one group.

The majority of xcast research focuses to solve the packet header problems like fragmentation problem (Boudani, A., Guitton, A., & Cousin, B,2004) overhead problem (Bag-Mohammadi, *et al*,2005) (Mozafar, B. M., & Yazdani, N.,2005) and management problem (Shin, *et al* 2001),(Shin, *et al*,2003). Here we discuss some of xcast studies had been done by researcher to solve these problems. Xcast packet doesn't support fragmentation mechanism, According to (Boudani *et al*,2004). they proposed GXcast protocol to solve the Xcast packet fragmentation problems, basic idea of GXcast to avoid the fragmentation problem by divide the destination list into sub-lists, each list correspond to xcast packet destination list, the only difference between Xcast and GXcast is the process at source.

Xcast packet contains: sender address, all destination addresses, and data (payload), this increase the packet processes in the router. According to Mohammadi *et al*.2005 they modified the ERM (Bion,*et al*,2000) in order to reduce the Xcast packet overhead in router, and they come out with Bcast (Branch cast), and they compare the explicit multicast. In Bcast the sender generates the tree code; Bcast assigns number to BP (Branch Point) instead of assigns ID (1byte) in ERM.

According Myung-Ki *et al*. they proposed a new multicast scheme to provide efficient data delivery by adding IGMP (Cain, *et al* ,2002) at receiver's side, and encode DR (Designate router) in the list instead of destination address.

3. Performance Evaluation

We have evaluated the UDP traffic behaviors in comparison with UDP traffic over Xcast using NS-2 .We performed two sets of experiments, one for normal UDP without XCAST traffic and second are UDP traffic over Xcast fig .2 shows our simulation topology.

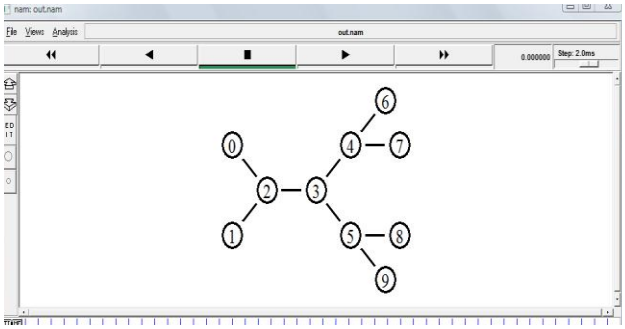

Fig.2 Simulation Topology

Where is the node 0 and 1 generated node, node 2 and 3 Xcast Router, 4 and 7 normal routers performed Unicast look up and 5, 6, 8 and 9 receiving nodes. Table shows the Simulation Parameters.

Table 1 Simulation Parameters

Parameters	Value
Simulation length in seconds	100
Bottleneck bandwidth	1.5 Mb
Bottleneck delay	20 ms
Link bandwidth	2Mb
Link delay	10ms
Queue management policy	DropTail

The efficiency of the UDP traffic with XCAST compare with normal UDP traffic without Xcast is evaluated through the following QoS performance metrics:

- **Throughput**: Throughput is the rate at which a network sends and receives data. It is a good channel capacity of network connections and rated in terms of bits per second (bit/s). To calculate the throughput, we used the formula.

$$Throughput = \frac{Pa}{Pf} \quad (1)$$

where Pa is the packets received and Pf is the amount of forwarded packets over a certain time interval.

- **Bandwidth:** Bandwidth is the amount of data that can be carried from one point to another in a given time period (seconds). This kind of bandwidth is usually expressed in bits (of data) per second (bps). So, to calculate the bandwidth, we used the next formula
- $$bandwidth = \frac{Rp*pS*8}{OT} \quad (2)$$

where Rp is received packet, pS is packet size, and OT is observed time.

- **End-to-End Delay:** End-to-End (E2E) delay refers to the time taken for a packet to be transmitted across a network from the source to the destination. To calculate the E2E delay, we used the following formula.

$$End2End\ Delay = \text{Td} - \text{Ts} \quad (3)$$

Where Td is the packet receive time at the destination and Ts is the packet send time at the source node.

- **Packet Loss:** Packet loss is the failure of one or more transmitted packets to arrive at their destination. This event can cause noticeable effects in all types of digital communications. To calculate the packet loss, we used the formula.

$$Packet\ loss\ = Ps - Pa \quad (4)$$

where Ps is the amount of packets sent and Pa the amount of packets received

Next section discusses the simulation result.

4. Simulation Results

A. Packet Loss

In this case the QoS metrics were studied by investigating the effect of using Xcast in number of loss packets. As it is noted from fig 3. The result show that there is effect of using Xcast, while it decreased number of packet loss, Any packet loss can affect the quality of applications, So using Xcast can improve the quality of applications.

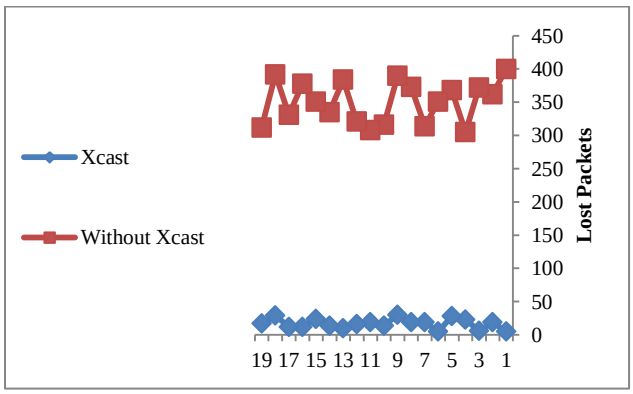

Fig.3 Pakcet Loss

B. Throughput

In this case the QoS metrics were studied by investigating the effect of using Xcast in throughput. As it is noted from fig 4. The result show that there is effect of using Xcast, while it maximizes the throughput, So using Xcast can improve the quality of applications.

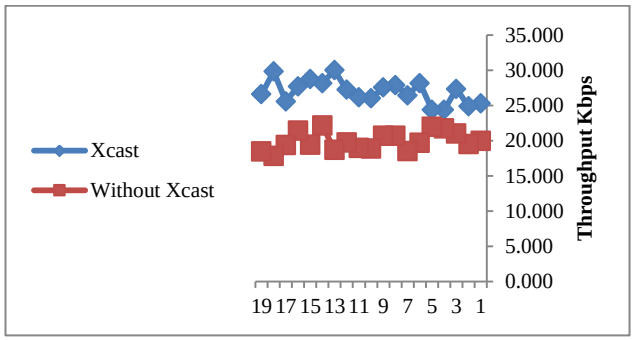

Fig.4 Throughput (3.3)

C. End-to-end delay

In this case the QoS metrics were studied by investigating the effect of using Xcast in End-to-end delay. As it is noted from fig 5. The result show that there is effect of using Xcast, while it decreased end-to-end delay, So using Xcast can improve the quality of applications since it required less delay.

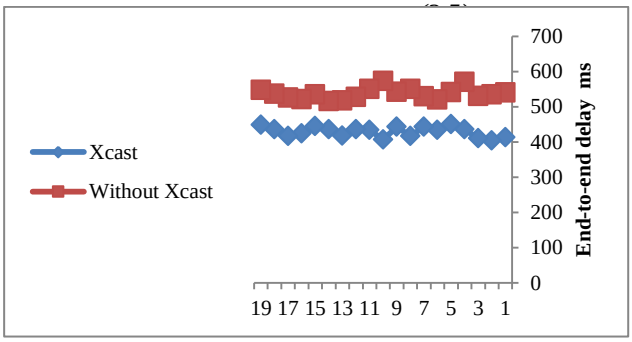

Fig.5 End-to-end delay

D. Bandwidth

In this case the QoS metrics were studied by investigating the effect of using Xcast in bandwidth. As it is noted from fig 6.

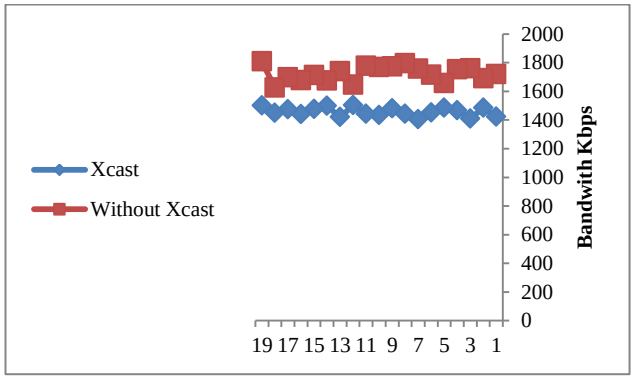

Fig.6 Bandwidth

The result show that there is effect of using Xcast, while it decreased utilisation of bandwidth, So using Xcast can consumed bandwidth.

Conclusions

In this paper, I have studied UDP traffic over Xcast and compared with traffic without Xcast using NS2 simulator. The results showed that the using XCAST with UDP Traffic is efficient in reducing network bandwidth and improving QoS performance.

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