

# The Research in Streaming Media On-Demand Technology based on IP Multicast

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**Abstract.** Based on the use of IP multicast technology in Streaming media system, the paper proposes a streaming media on-demand technology solutions which is combined of IP multicast. It is not only reasonable distribution of traffic share in each node share, reduce the load of streaming media server and backbone network, improve the scalability and availability of system, but also effectively improve the system quality of video streaming and voice streams in streaming media on-demand system to improve the network efficiency and security.

**Keywords:** Multicasting; PIM-S; streaming media on-demand; VOD; OPNET

## 1. Introduction

In recent years, rapid development and popularization of the Internet as streaming media business provides a powerful market force, streaming on-demand business is becoming increasingly popular. Streaming media on-demand, commonly known as the Video On-Demand VOD is the abbreviation. It is a user needs on-demand programs can be interactive video system, or, more general point about, it can provide users with all kinds of interactive information services. Currently streaming media network consists of C / S (Client / server), B / S (Web / server), CDN (distribution network), P2P (peer to peer) the four main ways. And because high-bandwidth streaming media service needs with continuous service for a long time on-demand video network with highly dynamic and so on. And each demand node may terminate service at any time, even out of the system, and the physical network congestion may occur at any time and failure; Moreover, the logic in the network nodes may be adjacent geographically far apart, resulting in increased system delay, which are difficult to make on-demand networks to provide reliable service quality assurance.

On account of the problem, this paper, a combination of IP multicast streaming media on demand of the technology, which not only take full advantage of the user nodes of source bandwidth, reduce the streaming media server and the backbone network of load and improve the system scalability and availability, but also effectively improve the system of streaming media video streaming quality of service.

## 2. The overview of IP Multicasting Technology

Multicasting is the process of sending data to a group of receivers. It might be argued that unicasting and broadcasting are subsets of multicasting. In the case of unicasting, there is only a single member of the group; in the case of broadcasting, all possible receivers are members of the group. This chapter demonstrates why such an argument is valid only on a conceptual level; in networking, at least, distinct differences exist between multicasting, unicasting, and broadcasting.

### 2.1 Protocol-independent multicast, sparse mode analysis

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PIM is the only IP multicast routing protocol fully supported by Cisco IOS. (DVMRP is supported only to the degree that PIM can connect to a DVMRP network.) Like CBT, and as its name asserts, PIM is protocol-independent. That is, it uses the unicast routing table to locate unicast addresses, without regard for how the table learned the addresses. There is a standard list of PIM message formats. Some messages are used only by PIM-DM, some are used only by PIM-SM, and some are shared. All message formats, including those used only by PIM-DM, are described at the end of the section "Protocol Independent Multicast, Sparse Mode (PIM-SM).

PIM-SM uses seven PIMv2 messages: Hello, Bootstrap, Candidate-RP-Advertisement, Join/Prune, Assert, Register, and Register-Stop. Notice that three of the messages (Hello, Join/Prune, and Assert) also are used by PIM-DM. There are four messages unique to PIM-SM, just as there are two messages (Graft and Graft-Ack) used only by PIM-DM. Several functions are common to PIM-SM and PIM-DM: Neighbor discovery through exchange of Hello messages, Recalculation of the RPF interface when the unicast routing table changes, Election of a designated router on multi-access networks, the use of Prune Overrides on multi-access networks. Use of Assert messages to elect a designated forwarder on multi-access networks, Unlike PIM-DM, PIM-SM uses explicit joins, making the creation of both shared and source-based multicast trees more efficient.

### **3. Principles of Streaming Media on Demand System**

#### **3.1 Overview of streaming media on demand**

Streaming media on demand there are many forms Current P2P technology to achieve large-scale video services provide the most economic and effective solution, but in some enterprise networks and campus network, IP multicast applications on-demand video services will have more benefits. VOD is short for video On Demand means in accordance with the requirements of the user to play video. VOD has a broad meaning, includes entertainment, education, business and other fields of various applications such as Movie on Demand, Hot-News on Demand, Interactive Video Games Long Distance Learning [2].

VOD is a video by the user to control the distribution business, which allows users to interactively access remote storage server rich program source.” It is essentially the information needs of users based on their initiative to obtain multimedia information. VOD is essentially different from traditional television, mainly in the following two aspects: first, video-on-demand interactive, user can select the video programming based on individual needs, and specify the program's start time. From this point, can also be referred to as interactive video-on-demand video on demand; Secondly, VOD system, the signal is digital, but the traditional television signal is analog.

As high-bandwidth streaming media service needs with continuous service for a long time on-demand video network with highly dynamic and so on. And each demand node may terminate service at any time, even out of the system, and in the physical network congestion may occur at any time and failure, other logic in the network nodes may be adjacent geographically far apart, resulting in increased system delay These are difficult to make on-demand network to provide reliable quality of service[3].

#### **3.2 Use of multicast-related solutions**

To solve the above problem, in streaming media network, the DVMRP protocol used to build application-level multicast tree to transmit streaming data. Is more an early approach DVMRP shares the characteristic of unicast distance vector protocols of being very simple to implement—little more is required than to just turn it on. But this simplicity comes at the expense of high overhead, creating serious scaling problems in anything other than small, high-bandwidth networks densely populated with group members. That has created another technology.

MOSPF brings its link-state advantages to the table, but at the cost of increased design complexity. Its use of explicit joins eliminates DVMRP's topsy-turvy rule that routers not forwarding for a particular group must remember (hold state) that they are not forwarding packets for that group. The result is a reduced impact on network resources. Yet MOSPF's source-based trees still make the protocol unsuitable for topologies sparsely populated with group members. Given the limited increase in scalability, many, if not most, network designers are unwilling to pay the cost of MOSPF's more-complex topological requirements.

Despite the above-mentioned technologies do not resolved when demand streaming media problems. The most important thing is tor the multicast source network access client server excessive, the load is too high. Delay too long, and so on.

Because of the above problems, now part of the streaming media on demand system through the application layer multicast P2P technology to replace the Internet has not been deployed IP multicast, and did not consider how to increase effective use of IP multicast.

However, in some network environments, particularly the deployment of IP multicast technology can network to PIM agreement constitutes the main element. Reduce the network load, and on the multicast source end to high availability and high stability.

#### 4. Streaming Media On-Demand Network Environment and Test Structures

Next, this article will actually build a real network environment and the associated configuration to reflect the actual environment in the streaming media on-demand multicast technology advantage.

##### 4.1 Real network structures

After you have enabled IP multicast routing on a Cisco router, you can very simply enable PIM-SM by adding the command `ip pim sparse-mode` to all the router's interfaces. Figure 1 shows a simple PIM-SM topology.

This much of the configuration of PIM-SM is uninteresting and requires no standalone examples. The unique requirement of PIM-SM, and the more interesting aspect of its configuration, is the identification of the rendezvous points (RPs). We learned that RPs can be statically configured, or they can be dynamically discovered using either Cisco's Auto-RP or the open-standard bootstrap protocol. The following case studies statically RP methods.

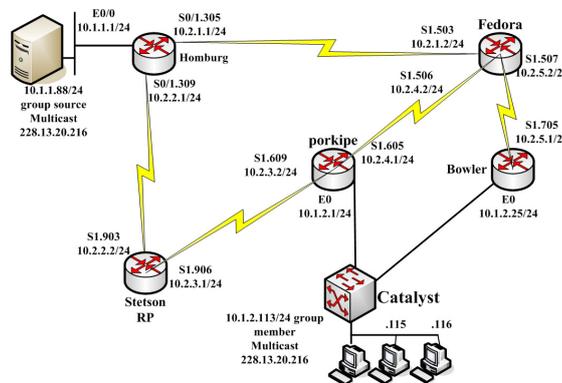


Figure.1. Multicast Protocol of the network topology

Following Figure 1 now the routers are configured to run PIM-SM. Stetson has been chosen as the RP, and all routers are statically configured with that information. The illustration shows that Stetson's RP address is 10.224.1.1. This address can exist on any interface, as long as it is advertised by the unicast routing protocol so that the other routers know how to reach it. In practice, you should use the loopback interface. A minor reason for this is so that the RP address can be more easily managed, but the major reason is so that the RP address is not linked to any physical interface that might fail. This is the same reason that the loopback interface is recommended for IBGP peering endpoints [1].

The other point of interest in the command `ip pim rp-address 10.224.1.1`, which tells the router where to find the RP. When statically configuring the RP, all routers with attached group sources or members must have such a statement, in order for them to know where the RP is. Note that Stetson's loop back interface does not itself have to have PIM running on it, as indicated in Example of configuration. No PIM functionality is required of the interface, other than providing the RP address. That address is advertised to the internet work by OSPF. However, the `ip pim rp-address 10.224.1.1` statement is present in the configuration, even though

there are no attached sources or group members. The reason for this statement on this router, of course, is so that the router knows that it is the RP .In practice, it is wise to statically configure the RP address on all routers in the internet work. It won't hurt if it isn't needed, and it prevents an accidentally missing statement where it is needed [1].

Part of the configuration as follows:

```
hostname stetson
!
ip multicast-routing
!
interface Loopback0
ip address 10.224.1.1 255.255.255.255
!
interface Serial1
no ip address
encapsulation frame-relay
!
interface Serial1.903 point-to-point
ip address 10.2.2.2 255.255.255.0
ip pim sparse-mode
frame-relay interface-dlci 903
!
interface Serial1.906 point-to-point
description PVC to 906
ip address 10.2.3.1 255.255.255.0
ip pim sparse-mode
frame-relay interface-dlci 906
!
router ospf 1
network 10.0.0.0 0.255.255.255 area 0
!
ip pim rp-address 10.224.1.1
```

## 4.2 Real environment test result

In according with the above configuration you use the debug command to see all products in the multicast routing operation.

You also can use debugging to see how the multicast packets are being forwarded. The Figure2 shows that Bowler is receiving the multicast packets for group 228.13.20.216 from source 10.1.1.88, via Fedora on interface S1.705.The packets are being forwarded out interface E0 to the connected group member. We can use IP pim rp Command Displays the Groups Active on a Router and the RP to Which They Are Mapped Figure3.

```
Bowler#debug ip mpacket 228.13.20.216
IP multicast packets debugging is on for group 228.13.20.216
Bowler#
IP: s=10.1.1.88 (Serial1.705) d=228.13.20.216 (Ethernet0) len 573, mforward
```

Figure.2. Using Debugging to Capture IP Multicast Packets (mpackets), You Can Observe That Bowler Is Receiving Packets for (10.1.1.88, 228.13.20.216) on Interface S1.705 and Forwarding Them Out Interface E0

```

Bowler#show ip pim rp
Group: 239.255.255.254, RP: 10.224.1.2, v2, uptime 01:20:13, expires 00:02:08
Group: 228.13.20.216, RP: 10.224.1.2, v2, uptime 01:19:30, expires never
Group: 224.2.127.254, RP: 10.224.1.1, v2, uptime 01:20:05, expires never
Group: 230.253.84.168, RP: 10.224.1.1, v2, uptime 01:20:06, expires 00:01:48
Bowler#

```

Figure.3. The show ip pim rp Command Displays the Groups Active on a Router and the RP to Which They Are Mapped

## 5. Simulation and Data Analysis

### 5.1 OPNET Simulation mechanism

OPNET is using VC++ language as a striking feature of the simulation to meet the special needs of simulation. VC++ is a relatively rapid speed of but slows to change the language, the execution time is very short, but change for a long time, more suitable for the specific protocol.

Customer in the use of OPNET simulation work before, First need to analyze the simulation design level. Model is divided into three, Such as process layer, node layer and network layer. Depending on the different layers, OPNET models are mainly used in the process model, node model, network model, link model, probe model .Simulation model designed to focus on the process model and the node model. OPNET hierarchical modeling features that greatly enhance code reuse reduce duplication of work the designers. OPNET is based on VC++ language extensions. If the OPNET simulation does not have the required agreement or network entity, the user can modify and upgrade the kernel OPNET.

### 5.2 Base on protocol model simulation

The real topology of the experiment has been introduced by previous. Now it is to do a computer simulation. Simulation experiment platform is Windows XP +VC++6.0 OPNET. The focus of observation of the simulation section multicast source to send multicast traffic to nodes in the network nodes of the network load and delay. Topology (Figure 1). Multicast source node is 0, which passes through A, B, C, D, E, respectively,1,2,3,4,5 a few routers, group members is node 6.0.0 seconds simulation started. From 0.10 to 0.20 seconds to send the recipient to join the RP message, set up shared tree; 0.40 seconds multicast source starts sending multicast data, then 30 seconds for the units on the topology, the network load of the display and application rate of comparison, there are 6 nodes in the network node delay to 0.

Simulation process, the link bandwidth are 1.5MB,link delay 10ms, queue packet loss type is Drop Tail, the data packet size do 1000,the data transfer rate is 1024Kb,and has divided into two kinds of simulation tests, one is not multicast enabled network. The other is multicast enabled, the two kinds of simulation after contrast.

### 5.3 Simulation results

The simulation results are the following two diagrams that are figure4 and figure5.The network delay graph, the network load graph.

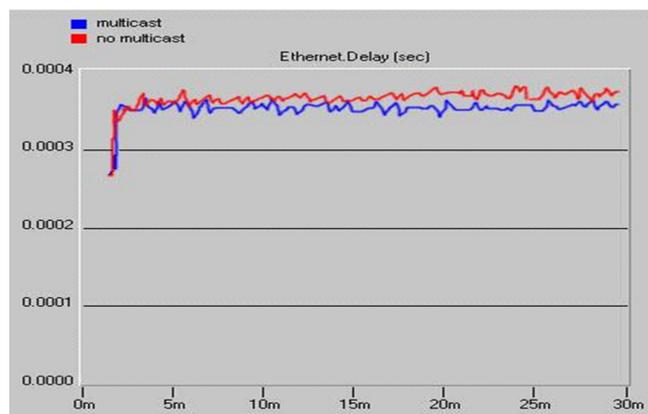


Figure.4. the chart of Network delay comparison

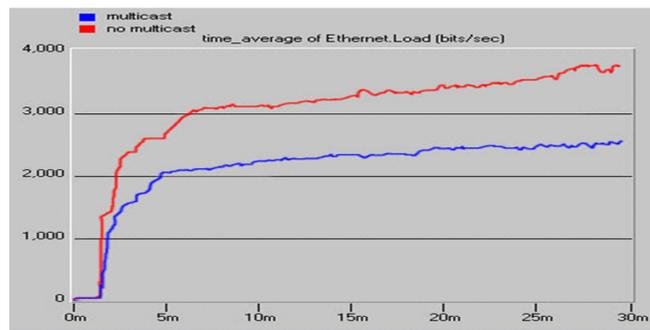


Figure.5. Comparison of the average network load

## 6. Concluding Remark

Multicast technology has tremendous advantages compared to unicast and broadcast technology. With multicast technology more and more widely, the multicast technology has been the one of the indispensable network technology in people's work and live, the research value is more and more important. In the streaming media podcasting technology, multicast technologies ease the load of the network and ease the pressure of the server of the source. It enables distribution of traffic at all points on average, so improve the network's high availability and security. As essential part of the multicast, network simulation technology with its unique method of network planning and design to provide objective and reliable quantitative basis, reduce the network construction period, provide the scientific decision-making and reduce the investment risk in network construction. This paper simulates some problems on the multicast technology by the OPNET which is the well-known network simulation software, and it is proved the initial expected has achieved the purpose of the simulation.

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