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A Survey of Distributed Explicit Rate Schemes in Multipoint-To-Multipoint Network Systems

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Abstract:

Recently, there is a tremendous change in the wired or wireless applications considering the Many to Many (MM) systems in the explicit distributed network environment. In this MM systems two control flow mechanisms are used for correct multicast flow control mechanism they are distributed self- tuning proportional integrative plus derivative (SPID) controller and distributed self-tuning proportional plus integrative (SPI) controller which provides reducing the packet loss and increase in stability but it requires more computation time, utilization of CPU resource and it cannot applicable for more corrupted data, maintaining the buffer when its exceeds capacity, sending the acknowledgements serially. With the ever-increasing wireless/wired data applications recently, considerable efforts have focused on the design of distributed explicit rate flow control schemes for multipoint-to-multipoint service. This paper describes two novel wireless/wired multipoint-to-multipoint multicast flow control schemes, which are based on the distributed self-tuning proportional integrative plus derivative (SPID) controller and distributed self-tuning proportional plus integrative (SPI) controller, respectively. The control parameters can be designed to ensure the stability of the control loop in terms of source rate.

Index Terms:
Explicit rate, flow control, multipoint-to-multipoint system, stability.

General Terms:
Algorithms, Design, Experimentation, Performance.

INTRODUCTION:

Networking is the way for data transfer between two or more systems; By using this networking we can achieve the concept of distributed architecture application like multi input and multi output systems.

A network will become distributed if and only if it is allowing its users to share their views from over a distance without being face to face. In this paper we are using networking as a medium and then showing the communication among the nodes without loss of data and in an efficient manner. Networking is the process of communication among systems which share data. Networking can be achieved with the help of two protocols i.e. TCP and UDP. Both these protocols are basically used for the data transfer. The advantages of multipoint-to-multipoint(MPMP) systems and networking technologies introduced a reformation recently, which assurance significant impact in our lives. Mainly more increasingly multicast data applications, wireless/ wired multicast (multipoint-to-multipoint) transmission has a reasonable effect on many applications such as teleconferencing and information dissemination services. MPMP improves the performance of multipoint data disseminate from several senders to a number of receivers. MPMP transport protocol, which is layered on top of IP multicast, can cause clogging or even clogging collapse if adequate flow control is not provided.

In the traffic management of multicast communication flow control plays a major role. Without an adequate flow control scheme developing in a multicast tree, the incoming traffic to a congestion link might be much more than the outgoing link capacity, it causes many problems. Several multicast flow approaches have been introduced recently. One class of them espouse the simple hop-by-hop feedback mechanism, in which the feedback, i.e., backward control packets (BCPs), from downstream nodes are originally gathered at branch points, and then are transmitted upward by a single hop upon receipt of a forward control packet (FCP). Its manipulation can be carried out on the basis of the tree structure in a multicast transmission. The main advantage of these methods lies in the simplicity of the hop-by-hop mechanism. However, at the same time, they often lead to consolidation noise problem due to incomplete feedback information.

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To overcome this problem, we proposed a method, called feedback synchronization at each branch point, by accumulating feedback from all downstream branches. These schemes then generate another problem of slow transient response due to the feedback from "long" paths. Such delayed congestion feedback can cause excessive queue buildup/packet loss at congestion links. A lot of approaches use queue schemes to solve congestion control problems. Queue schemes in routers make sure that the buffer occupancy stabilizes and never overflows the buffer capacity. Second, the known flow control methods usually do not have explicit control over link buffer occupancy; as a consequence, the allocated rate can wander considerably before converging, and the link flow can temporarily exceed the capacity. To attack this problem, we will concentrate on the stability of our rate control scheme. Third, no explicit rate (ER) allocation has been given in the known approaches.

We will consider ER based rate control with an ER feedback (ER value). Such an ER-based scheme is responsive to network congestion and can serve WAN environments quite well where the bandwidth-delay product is usually large. In the case of a bottleneck link appearing in a multicast tree. Simulation results demonstrate the efficiency of the proposed scheme in terms it will give system stability and fast response to the buffer tenancy, as well as controlled sending rates, low packet loss, and high scalability. Furthermore, the results also give that SPID scheme has better performance than SPI scheme, though the SPID scheme requires more computing time and CPU resources. The major difficulty in designing multicast flow control protocols arises from the long and heterogeneous RTTs involved in the closed-loop control. In-depth research remains in the following three aspects. First, the existing algorithms usually lack scalability, since they require each router to keep maintaining the saturation status of every session,1 and as virtual sessions (VSs) travel through it, this yields a major computational bottleneck. To this end, we are going to present an algorithm that is scalable. Second, the known flow control methods usually do not have explicit control over link buffer occupancy; as a consequence, the allocated rate can wander considerably before converging, and the link flow can temporarily exceed the capacity. To attack this problem, we will focus on the stability of our rate control scheme. Third, no explicit rate (ER) allocation has been given in the known approaches. This paper will consider ER-based rate control with an ER feedback (ER value).

Such an ER-based scheme is responsive to network congestion and can serve WAN environments quite well where the bandwidth-delay product is usually large. In this paper, we develop a distributed ER allocation algorithm to overcome the vulnerability due to the heterogeneous multicast receivers. In our scheme, flow controllers regulate the source rate at a multicast tree, which accounts for the buffer occupancies of all destination nodes. The proposed control scheme uses a distributed self-tuning proportional integrative plus derivative (SPID) controller or uses a distributed self-tuning proportional plus integrative (SPI) controller. The control parameters can be designed to ensure the stability of the control loop in terms of source rate. We further show how the control mechanism can be used to design a controller to support multipoint-to-multipoint multicast transmission based on ER feedback. System stability criterion is derived in the presence of destination nodes with heterogeneous RTTs. We analyze the theoretical aspects of the proposed algorithm and verify its agreement with the simulations in the case of a bottleneck link appearing in a multicast tree. Simulation results demonstrate the efficiency of the proposed scheme in terms of system stability and fast response to the buffer occupancy, as well as controlled sending rates, low packet loss, and high scalability. Furthermore, the results also show that SPID scheme has better performance than SPI scheme, though the SPID scheme requires more computing time and CPU resources.

LITERATURE SURVEY:

Bottle neck Flow control:

Multiple users sharing the links of the network each attempt to adjust their message rates to achieve an ideal network operating point .Each user has a fixed path or virtual circuit. This definition concentrates on a fair allocation of network resources at network bottlenecks. All shares constrained by the same bottleneck are treated fairly by being assigned equal throughputs. With this definition, the network may accommodate users with different types of message traffic.

Virtual-channel flow control:

Network throughput can be increased by dividing the buffer storage associated with each network channel into several virtual channels. Each physical channel is associated with several small queues, virtual channels, rather than a single deep queue.

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The virtual channels associated with one physical channel are allocated independently but compete with each other for physical bandwidth. Virtual channels decouple buffer resources from transmission resources. This decoupling allows active messages to pass blocked messages using network bandwidth that would otherwise be left idle.

A novel explicit rate flow control mechanism in ATM Networks:

The explicit rate flow control mechanisms for ABR service are used to control congestion in ATM. In this paper, a control theoretic approach that uses a deadbeat-response (DR) controller to the design of an explicit rate flow control mechanism is present, and the mechanism has a very simple structure. The rate-based flow control algorithm for ABR service in ATM networks operates as follows: the source periodically sends a “Forward” Resource Management (FRM) cell to the destination every Norm data cells. This FRM cell contains several fields, mainly including the Current Cell Rate (CCR) field that is set by the source to its current Allowed Cell Rate (ACR) when it generates a FRM cell, the Congestion Indication (CI) field that is used to have a source increase or decrease its rate by some predefined amount, and the Explicit Rate (ER) field that carries a 15-bit floating point number representing the explicit rate. Upon receipt of the FRM cell, the destination returns it to the source with the latest network information, and this FRM becomes a “Backward” RM (BRM) cell. The network information is contained in either one or both of its CI and ER fields depending on the mode of operation of the switch.

Explicit Rate Flow Control in Metro Ethernet Networks:

On-off flow control is not able to quickly react to the network bandwidth fluctuation and may result in buffer overflow and packet drop. Moreover, the flow control performance deteriorates with the larger transmission delay, which is typical in the Metro Ethernet that has long transmission distance. To overcome above problems, we proposed an Explicit Ethernet Rate Control (EERC) algorithm based on control theory. EERC scheme utilizes the concept of control theory, which has fast rate control under system with large transmission delay like in Metro Ethernet networks. Such method shows its great advantage than the existing 802.3x. Low control schemes in Ethernet, especially in the situation where available individual output rate fluctuates with time and there is long transmission delay.

A simple, scalable, and stable explicit rate allocation algorithm for max-min flow control with minimum rate:

The proposed ER algorithm is simple in that the number of operations required to compute it at a switch is minimized the user transmission rates and the network queues are asymptotically stabilized at a unique equilibrium point at which max-min fairness with minimum rate guarantee and target queue lengths are achieved, respectively.

Static Information Flow Analysis with Handling of Implicit Flows and a Study on Effects of Implicit Flows vs Explicit Flows:

Implicit flow has significant impact on all these applications. In security violation detection, implicit flow detects more security violations than explicit flow. In type inference, implicit flow infers more un-trusted type variables. In the study of the effect of thread-shared variables, implicit flow detects more affected variables than explicit flow. In the implicit flow sender will overflows the receiver but in the case of explicit flow according to receiver requirement sender will send the packets.

PROBLEM SYSTEM:

The distributed explicit rate SPID and SPI controllers are located at the wireless/wired multipoint to- multipoint multicast source to regulate the transmission rate. We further analyze the theoretical aspects of the proposed algorithm, and show how the control mechanism can be used to design a controller to support wireless/wired multipoint-to-multipoint multicast Transmissions. Simulation results demonstrate the efficiency of the proposed scheme in terms of system stability, fast response, low packet loss, and high scalability, and the results also show SPID scheme has better performance than SPI scheme, however, SPID scheme requires more computing time and CPU resource.

PROBLEM DEFINITION:

We Proposed Especially with ever-increasing multicast data applications, wireless and wired multicast (multipoint-to-multipoint) transmission has considerable effect on many applications such as teleconferencing and information dissemination services. Multicast improves the efficiency of multipoint data distribution from multiple senders to a set of receivers .

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Unfortunately, the widely used multicast transport protocols, which are layered on top of IP multicast, can cause congestion or even congestion collapse if adequate flow control is not provided. Flow control thus plays an important role in the traffic management of multicast communications.

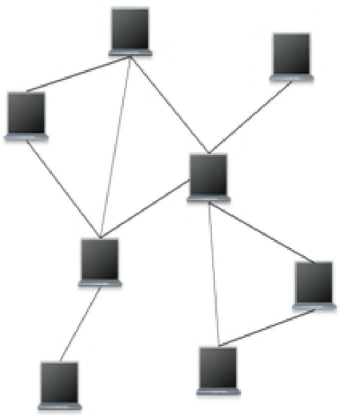

Fig:- Multipoint-to-Multipoint

Several multicast flow approaches have been proposed recently. One class of them adopts a simple hop-by-hop feedback mechanism, in which the feedback, i.e., backward control packets (BCPs), from downstream nodes are initially gathered at branch points, and then are transmitted upward by a single hop upon receipt of a forward control packet (FCP). This kind of manipulation can be carried out on the basis of the tree structure in a multicast transmission. These schemes then introduce another problem of slow transient response due to the feedback from "long" paths. Such delayed congestion feedback can cause excessive queue buildup/packet loss at bottleneck links.

Merits :

1. Data transfer rate is adjusted at the source
2. Group node makes sure that the buffer occupancy stabilizes and never overflows the buffer capacity.
3. These are active and effective methods to adjust the sending rates, and reduce the packets loss.
4. a lot of approaches use queue schemes to solve congestion control problems
5.The main proposed scheme in terms of system stability and fast response to the buffer occupancy, as well as controlled sending rates, low packet loss, and high scalability.

IMPLEMENTATION:
Packet Sequence Numbers:

A packet sequence number is a 32 bit number in the range from 1 through 2^32 û 1, which is used to specify the sequential order of a Data packet in a Data Stream. A sender node assigns consecutive sequence numbers to the Data packets provided by the Sender application. Zero is reserved to indicate that the data session has not yet started.

Data Queue:

A Data Queue is a buffer, maintained by a Sender or a Repair Head, for transmission and retransmission of the Data packets provided by the Sender application. New Data packets are added to the data queue as they arrive from the sending application, up to a specified buffer limit. The admission rate of packets to the network is controlled by flow and congestion control algorithms. Once a packet has been received by the Receivers of a Data Stream, it may be deleted from the buffer.

Multicast Network Configuration Module:

The multicast network is a connection-oriented one, which is composed of sources and destination nodes. multicast connection and every sampling period, the multicast source issues and transmits a FCP to the downstream nodes (the branch node and destination nodes), and a BCP is constructed by each downstream node and sent back to the source. After the multicast source receives the BCPs from the downstream nodes, it will take appropriate action to adjust its transmitting rates of multicast traffic based on the computed value of the SPID controller. After receiving the data packets coming from the branch point, the receivers construct BCPs and send them back to the branch point.

Multi-rate–multicast control (MR-MCC) tree Module:

we process the nodes that have small differences of time delay and sending rate together. Then we unify the time delay and sending rate. Since the situation of every node in each group (about 20 receivers) is similar, we only choose one node from each group as a representative. We assume that the link delay is dominant compared to the other delays, such as processing delays and queuing delay.

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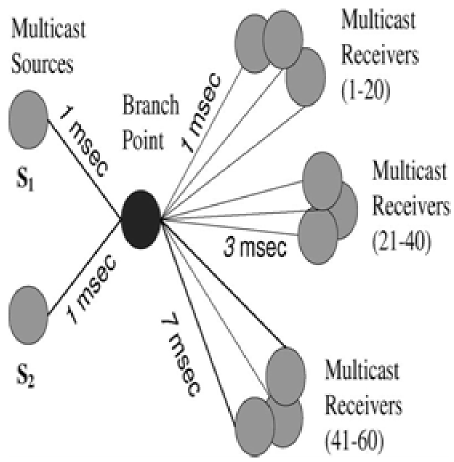
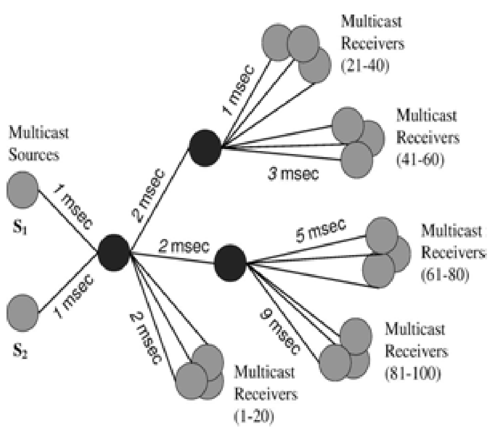
the multicast source S1 sends data packets at 0 ms and the multicast source S2 starts to send data packets at 1000 ms in the simulation time; then the joining of S2 enhances the network dynamic behavior, and also demonstrates the efficiency of the SPID and SPI schemes. In simulation 2 (see Fig), there are more receivers and longer delay than in model 1, and we set appropriate parameters to enable system stability.



SPID and SPI controllers Module:

The control parameters of the SPID and SPI controllers can be designed to ensure the stability of the control loop in terms of buffer occupancy and adjust automatically, depending on the network load. This subsequently means that the schemes provide the least packet loss in steady state. Relevant pseudo codes for implementation have been developed, and the paper shows how the two controllers could be designed to adjust the rates of data service. Simulations have been carried out with wireless and wired multipoint-to-multipoint multicast models.



Forward control packet (FCP) Module:

Forward control packet (FCP). This kind of manipulation can be carried out on the basis of the tree structure in a multicast transmission. The main merit of these methods lies in the simplicity of the hop-by-hop mechanism. First-in first-out (FIFO) queue to multiplex all flows traveling through the outgoing link. Assume that congestion never happens at the router connected with the sources; hence, these two can be consolidated into one node, which is true in most cases in real networks.

Performance Evaluation:

To evaluate the performance of the studied multicast congestion control scheme, we focus on the following two simulation models, and are mostly interested in analyzing the transient behaviors of the network. In the performance analysis, the duration of response time, receiving rate of receivers, and steady state of buffer occupancy are the main concerns. From the view of control theory, a control scheme with short response time has the following advantages: when the buffer of receiver nodes is close to the threshold, one may tell the sending node to reduce the sending rate and prevent the loss of packets as soon as possible; while when the available bandwidth increases, the sending node increases the sending rate as soon as possible and enhances the utilization rate of the bandwidth.

Algorithm Used:
Distributed ER allocation algorithm:

In this algorithm, flow controllers regulate the source rate at a multicast tree, which accounts for the buffer occupancies of all destination nodes. The proposed control scheme uses a distributed self-tuning proportional integrative plus derivative (SPID) controller or uses a distributed self-tuning proportional plus integrative (SPI) controller. The control parameters can be designed to ensure the stability of the control loop in terms of source rate.We further show how the control mechanism can be used to design a controller to support multipoint-to-multipoint multicast transmission based on ER feedback. System stability criterion is derived in the presence of destination nodes with heterogeneous RTTs.

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SPID and SPI Algorithms:

Each branch point of the multicast tree replicates each data packet and FCP from its upstream node to all its downstream branches. The downstream nodes return their congestion information via BCPs to the parents through the backward direction once they receive FCPs. Assume that congestion never happens at the router connected with the sources; hence, these two can be consolidated into one node, which is true in most cases in real networks.

CONCLUSION:

The advances in MPMP systems and networking technologies introduced a revolution in recent times, which promises significant impact throughout our lives, especially in wireless and wired multicast (multipoint-to-multipoint) transmission field. In this paper, we presented two novel wireless and wired multicast schemes, called SPID and SPI schemes, using an explicit rate feedback mechanism to design a controller for regulating the source rates in wireless and wired multipoint-to-multipoint multicast networks. The control parameters of the SPID and SPI controllers can be designed to ensure the stability of the control loop in terms of buffer occupancy and adjust automatically, depending on the network load. This subsequently means that the schemes provide the least packet loss in steady state. Relevant pseudo codes for implementation have been developed, and the paper shows how the two controllers could be designed to adjust the rates of data service. Simulations have been carried out with wireless and wired multipoint-to-multipoint multicast models to evaluate the performance of the SPID and SPI controllers. The simulation results clearly demonstrate the efficiency of our scheme in terms of system stability and fast response of the buffer occupancy, as well as controlled sending rates, low packet loss, and high scalability. The simulation results also show that SPID scheme has better performance than SPI scheme; however, SPID scheme requires more computing time and CPU resources. As evident from the analyses and simulation results, the proposed multicast scheme is simple and also can support uni-cast. We believe that our study is a valuable foundation for a unified flow control scheme capable of being deployed in real multicast networks. A limitation of the explicit rate schemes is that if the network has a larger transfer delay, then the effect of the control schemes becomes weak. A possible reason is that a larger delay makes the response time too long, which is not good for an applicable network.

FURTHER WORK:

Our further research along this line of study would investigate TCP-friendly related issues in multicast congestion control. we can enhance this project by using various algorithms to reduce packet loss, congestion control and improve the system scalability. Various combinations of algorithms may be used for achieving better result. So in this way there is scope to the future enhancements.

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