Improving The Performance Of Tcp Flows In Wireless Networks By Using Tcp Aware Backpressure And Aodv Algorithms

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Abstract : Wireless sensor networks (WSN's) are a wireless network consisting of spatially spare out. The wireless sensor network is being deployed in many real-time applications such as environmental monitoring, security, surveillance, industrial automation and control. There are many challenges available in the wireless sensor network. They are Quality of Service (QoS), fault tolerance, scalability and maintainability. Here, choose the Quality of Service to measure the performance of Transmission Control Protocol (TCP) flows. Throughput and fairness are present in the parameter Quality of Service. There are two algorithms are used to measure the throughput and fairness. The first algorithm is TCP aware Backpressure and another one is Ad-hoc On Demand Distance Vector (AODV). Contrast these two algorithms which one is giving a better performance of TCP flows.

Keywords: Wireless sensor networks, Quality of Service, Throughput, fairness, TCP aware Backpressure and Ad-hoc On Demand distance Vector.

1 Introduction

Nowadays the most common way to communicate, the processed information is through a wireless communication. The past few years, the wireless communication has established large and the communication is over a wide range. In the wireless communication, the information is sensed by the sensor called wireless sensor and the networks and protocols are used with those sensors to communicate with the devices are called the wireless sensor networks. A sensor network is composed of a large number of sensor nodes, which are thickly organized very close to it. The sensor network protocols and algorithms must acquire self-organizing capabilities. Some of the purpose areas are health, military and security. One of the most significant constraints on sensor nodes is the low power consumption requirement. Sensor nodes carry limited, generally irreplaceable and power sources. Therefore, while the traditional network aims to achieve Quality of Service and sensor network protocols must focus on power conservation. Quality of Service is defined as a measure the performance of the network (Akyildiz I F et. al, 2002 and Rajan S et.al, 2016). One important practical problem that remains open, and focus of this paper, is the performance of backpressure with Transmission Control Protocol flows. TCP is the dominant transport protocol on the Internet today and is likely to remain so for the foreseeable future. Therefore, it is crucial to exploit throughput improvement potential of backpressure routing for TCP flows has proposed (Hulya Seferoglu & Eytan Modiano 2016). TCP aware Backpressure and AODV algorithms are used to measure the performance of TCP. In that throughput and fairness is calculated by using these two algorithms. Compare these two algorithms which one will give better throughput and fairness.

2 Related Work

2.1 Throughput

A benchmark can be used to compute throughput. The given period of time, the data can be successfully moved from one place to another in data transmission and its unit is measured in bits per second (bps), as in megabits per second (Mbps) or gigabits per second (Gbps). Throughput is a compute of how many units of information a system can process in a given amount of time. It is applied broadly to systems ranging from various aspects of computer and network systems in organizations wae described by (Kavitha K et.al 2017). The specific workload can be completed including the speed and response time, the given amount of time between a single interactive user request and receipt of the response. Answer the throughput by using TCP aware Back pressure and

AODV algorithms. In that, compare these two algorithms which one gives better performance. The throughput formula can be defined as in equation (1).

$$\text{Throughput (TH)} = (MSS / RTT) * (1 / \sqrt{LOSS}) \quad (1)$$

Where, MSS = Maximum Segment Size
RTT = Round Trip Time
LOSS = Probability of loss

This is the formula for calculating the throughput. For example, different loss probability is taken in algorithms and finding the throughput. The Maximum segment size (MSS) is defined as the largest amount of data, specified in bytes, that TCP is eager to receive in a single segment. The IP fragmentation to be kept away because MSS should be small and it provides best performance, which can lead to packet loss and excessive retransmissions. The time taken between sender to the receiver and receiver to sender is called Round Trip Time (RTT).

2.2 Fairness

TCP fairness requires that new protocol receives no larger share of the network than a comparable TCP flow was described by (Neely M J, Modiano E and Li C 2008). This is significant as TCP is the dominant transport protocol on the internet and if new protocols obtain unfair capacity they tend to cause problems such as congestion collapse. To achieve high throughput by making one flow generate enough packets in multiple flows and preventing other flows from sending. All flows receive an equal share of the resources to make another property. Although not very well defined at this point, will describe this property fairness. Consider the following Figure 1.

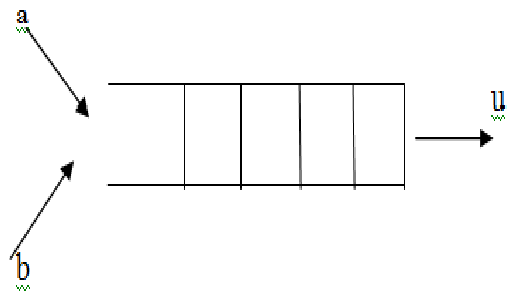

Figure 1 Fairness with two flows

The Figure 1 shows that a+b is close to u. However, fairness means that a is equal to (b. Jain R K 1991 & Huaizhou SHI et.al) have proposed fairness is calculated by using Jain fairness index . The fairness formula is in Equation 2.

$$F = \frac{\left(\sum_{i=1}^{n} X_i\right)^2}{n\sum_{i=1}^{n} X_i^2} \quad (2)$$

Where,
Xi = normalized throughput
n = number of user

3 TCP Aware Backpressure and AODV Algorithms design

3.1 TCP aware Backpressure

Backpressure routing algorithm is a method for directing passage around a queueing network that achieves maximum network throughput and it operates in slotted time was proposed by (Tassiulas L and Ephremides A 1993). In particular, TCP aware Backpressure takes into describing the behavior of TCP flows and gives transmission occasion to flow with short queues. This makes all TCP flows send out their packets, so the TCP clock, which relies on the packet transmission and end to end ACKs and continues to operate. Furthermore, the throughput of TCP flows improves by exploiting the routine of Backpressure routing. Such as out of order delivery, high jitter RTTs and packet losses due to corruption over wireless links these are the challenges are introduced in Backpressure described (Hulya Seferoglu & Eytan Modiano 2016), (Tassiulas L and Ephremides 1992) & (Ryu J et.al). Figure 2 explains the flow diagram of TCP aware Backpressure.

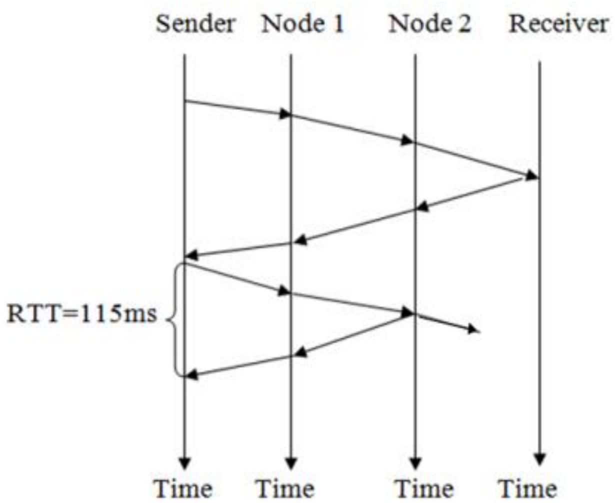

Figure 2 Flow diagram of TCP aware Backpressure

The Figure 2 shows the sender sends the packet to the receiver in between the congestion is occurring and the receiver does not receive the packet. The RTT is measured in flow 2 is 115ms. For example, different loss probability is taken finding the throughput and fairness. The throughput in TCP aware Backpressure is where MSS=1460 bytes and RTT=115m.

For the loss probability =0.1,

Throughput (TH) =(1460*8/115m) * (1/√0. 1)

TH =321 kbps

The fairness in TCP aware Backpressure is

For the loss probability =0.1,

Fairness, $$F = \frac{\left(\sum_{i=1}^{n} 321\right)^2}{6\sum_{i=1}^{n} 321^2} = 0.16$$

3.2 Ad-hoc On Demand distance vector (AODV)

An Ad Hoc On-Demand Distance Vector (AODV) is a routing protocol considered for wireless and mobile ad hoc networks described by Perkins C et.al 2003. This protocol establishes routes to destinations on demand and chains, both unicast and multicast routing. The AODV protocol builds routes between nodes only if they are requested by foundation nodes. AODV is consequently considered an on-demand algorithm and does not create any additional traffic for communication along links described (Tamizarasu K and Rajaram M 2012).

Figure 3 Flow diagram of AODV

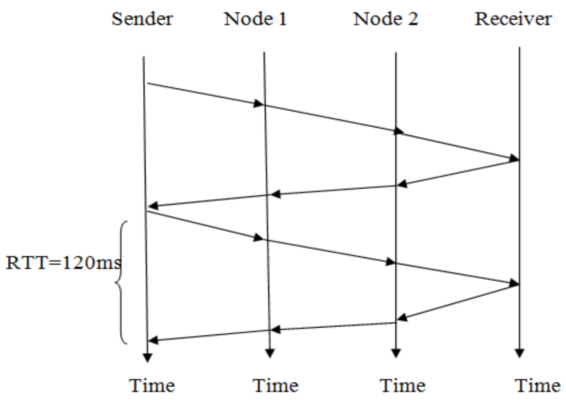

Figure 3 explains the sender sends the packets to the receiver and the receiver receive the packet and send ACKs to the sender. The measured RTT in AODV is 120ms. The throughput in AODV is where MSS=1460 bytes and RTT=120m.

For the loss probability =0.1,

Throughput (TH) = (1460*8/120m) * (1/√0. 1)

TH =307 kbps

The fairness in AODV is

For the loss probability =0.1,

Fairness $$F = \frac{\left(\sum_{i=1}^{n} 307\right)^2}{6\sum_{i=1}^{n} 307^2} = 0.14$$

4 Results and Discussion

In result, discuss the throughput and fairness in TCP aware Backpressure and AODV algorithms.

Table 1. Summarizes throughput in TCP aware Backpressure and AODV

Test case	Loss Probability	Throughput (kbps)	
		AODV	TCP aware Backpressure
1	0.1	307	321
2	0.2	217	227
3	0.3	177	185
4	0.4	153	160
5	0.5	137	143
6	0.6	125	131

Consider the Table 1 and draw the graph for the relevant values in TCP aware Backpressure and AODV as in Fig. 4. In Table 1 throughput is analyzed in TCP aware Backpressure and AODV.

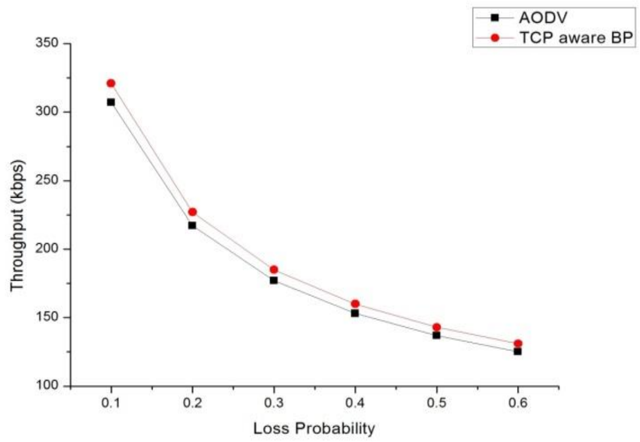

Figure 4 Throughput in TCP aware Backpressure and AODV

Figure 4 shows that different loss probability are taken and finding the throughput in TCP aware Backpressure and AODV. In particular, TCP aware Backpressure improves throughput as compared to AODV by %10 for TCP flows. These results confirm the compatibility of TCP and TCP aware Backpressure.

In Table 2 finding the fairness for different loss probability in TCP aware Backpressure and AODV.

Table 2 Summarizes the fairness in TCP aware Backpressure and AODV.

Test case	Loss probability	Fairness	
		TCP aware Back Pressure	AODV
1	0.1	0.16	0.14
2	0.2	0.32	0.34
3	0.3	0.47	0.40
4	0.4	0.61	0.56
5	0.5	0.76	0.68
6	0.6	0.90	0.85

Consider the Table 2 and draw the graph for the relevant values in TCP aware Backpressure and AODV as in Figure 5. In Table 2 fairness is analyzed in TCP aware Backpressure and AODV.

Figure 5 Fairness in TCP aware Backpressure and AODV

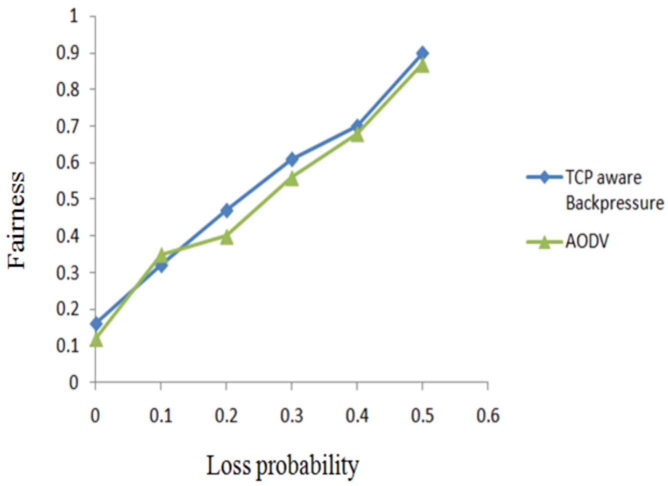

Figure 5 shows that the fairness index is close to 1 when TCP aware Backpressure is employed. This means that both TCP flows are able to survive in TCP aware Backpressure. Note that the fairness index of TCP aware Backpressure is 0.90 while the fairness index of AODV is 0.85 when the packet loss probability is 0.6.

5 Conclusions

The proposed TCP aware Backpressure routing to deal with the incompatibility of TCP and Backpressure even as exploiting the performance of Backpressure routing over wireless networks. TCP aware Backpressure improves the throughput of TCP flows considerably and also improves the fairness across challenging TCP flows. TCP aware Backpressure provides the similar stability and utility-optimal operation.

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