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Adaptive Routing In Communication Networks by Back Pressure

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Abstract* — In the text we contain considered every packet be running scared down a probably unlike course by using Back Pressure based adaptive routing algorithm. So there is poor delay performance and involve high implementation comply. Soon after than considered Back Pressure algorithm by obviously, we have developed a new adaptive routing algorithm. Here we have designed probabilistic routing table that is used to route packets to per destination queue to decouple the routing and preparation components of the algorithm. In the case of wireless networks the by arrangement decisions are complete counters called shade queues. The cost is also extended to the case of networks that use simple forms of network coding. In that case, our algorithm provides a low-complexity resolution to optimally develop the routing–coding transaction.

Keywords: Back-pressure algorithm, network coding, routing, scheduling.

I. INTRODUCTION

The *n*etworking is a word basically relating to computers and their connectivity. It is very often used in the world of computers and their use in different connections. The term networking implies the link between two or more computers and their devices, with the vital purpose of sharing the data stored in the computers, with each other. The networks between the computing devices are very common these days due to the launch of various hardware and computer software which aid in making the activity much more convenient to build and use.

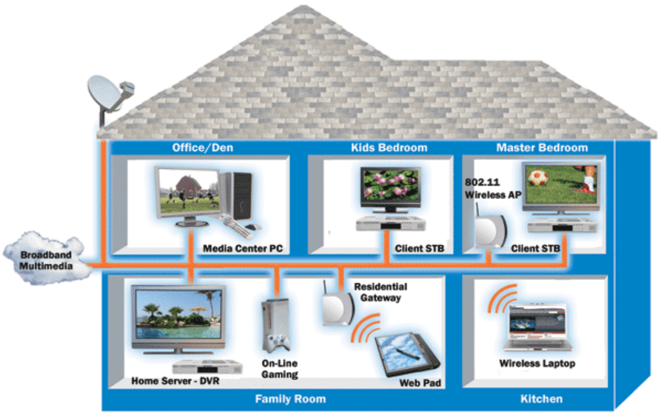

Figure 1.Structure of Networking between the different computers

General Network Techniques - When computers communicate on a network, they send out data packets without knowing if anyone is listening. Computers in a network all have a connection to the network and that is called to be connected to a network bus. What one computer sends out will reach all the other computers on the local network.

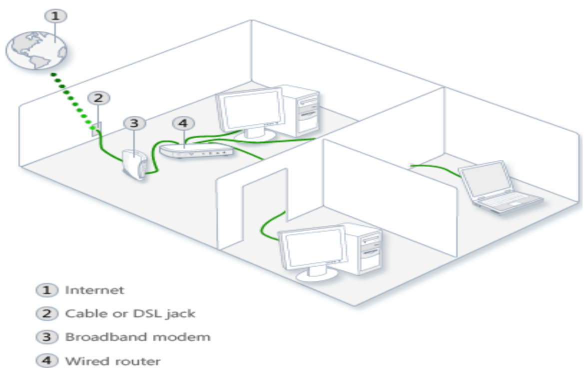

Figure .2: The clear idea about the Networking functions

For the different computers to be able to distinguish between each other, every computer has a unique ID called MAC-address (Media Access Control Address). This address is not only unique on your network but unique for all devices that can be hooked up to a network. The MAC-address is tied to the hardware and has nothing to do with IP-addresses. Since all computers on the network receives everything that is sent out from all other computers the MAC-addresses is primarily used by the computers to filter out incoming network traffic that is addressed to the individual computer .One problem with this network structure is that when you have, let say ten computers on a network and they communicate frequently and due to that they sends out there data packets randomly, collisions occur when two or more computers sends data at the same time. When that happens data gets corrupted and has to be resent. On a network that is heavy loaded even the resent packets collide with other packets and have to be resent again. In reality this soon becomes a bandwidth problem. If several computers communicate with each other at high speed they may not be able to utilize more than 25% of the total network bandwidth since the rest of the bandwidth is used for resending previously corrupted packets. The way to minimize this problem is to use network switches.

II. Throughput-Optimal Back-Pressure Algorithm and its restrictions

It is working on wireless networks. Our back pressure algorithm should be depending on one main procedure [29]. The main procedure is destination queue procedure by using these procedure only we can reducing the poor delay of the time and distance every node at the time of routing file in between the two or more locations predestination queues maintaining the two phases: 1.routing algorithm,2.scheduling algorithm. **I**n existing system says distance is very high and time is very high. So may draw backs will be occurred at the time of working on the routing algorithm that's way we are implementing the new algorithm. Scheduling algorithm along with routing algorithm. Our scheduling algorithm says what to providing the schedule for perpess of the over come to draw backs that's way we are using round robin algorithm and shortest path routing algorithm to overcome through draw backs that's way we are using round robin algorithm algorithm. **I**n our back pressure algorithm providing quality of services to the endusers depending on the service only routing will be decide it is best routing or bad routing .QOS may be depends four phases. Bandwidth, frequency, time, distance. In any network depends on QOS[29]. Bandwidth and frequency is high and time distance is low QOS is very high. At each link the algorithm assigns a weight to each possible destination that is called back pressure. Define the back pressure at link (n,j) for destination d at slot t to be

$$w^{d}_{n,j}(t)=Q_{nd}(t)-Q_{jd}(t) \quad [29]$$

where $Q_{nd}(t)$ denotes the no of packets at node n denoted for node d at the beginning of time-slot t. Under this notation, Qnn (t) =0, $\forall$t. Assign a weight w_{nj} *to* each link (n, j), where w_{nj} is defined to be the maximum back-presure overall possible destinations. i.e.

$$w_{nj}(t)=\max_{d} w^{d}_{nj}(t) \quad [29]$$

III. Implementation information

The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

3.1. Exponential Averaging

In this module, using the concept of shadow queues, we partially decouple routing and scheduling. A shadow network is used to up-date a probabilistic routing table that packets use upon arrival at a node. The same shadow network, with back-pres-sure algorithm, is used to activate transmissions between nodes. However, first, actual transmissions send packets from first-in–first-out (FIFO) per-link queues, and second, potentially more links are activated, in addition to individuals activated by the shadow algorithm. To compute $\hat{\sigma}^{d}_{nj}[t]$ we use the following iterative Exponential averaging algorithm [29].

$$\hat{\sigma}^{d}_{nj}[t] = (1-\beta)\ \hat{\sigma}^{d}_{nj}[t-1]+ \beta\ \hat{\sigma}^{d}_{nj}\ [t]$$

Where $0< \beta<1$.

3.2. Token Bucket Algorithm

In this module, computing the common shadow rate also generating random numbers for routing packets may inflict a computational in the clouds of routers, which should be avoided if possible. Thus, as an option, we suggest the following simple algorithm. At each node, for each next-hop neighbor and every target, uphold a token bucket.

rnjd[t] = maxfrnjd[t 1] njd[t]; 0g: [t 1] [28]

njd[t] < 0, we d say that njd[t] rnjd tokens (associated with bucket rnj) tokens

(associated with bucket rnj) are "wasted" in slot t.

Upon a packet arrival at node n for destination d; find the token bucket rnjd.

which has the smallest number of tokens (the minimization is over next – hop neighbors j),

breaking ties arbitrarily, add the packet to the corresponding real queue

Qnj and add one token to the correspondingbucket:

rnjd [t] = rnjd [t 1] + 1:

To explain how this algorithm works,

Denote by njd the standard value of njd[t] (in stationary regime), and by nd the average rate at which real packets for destination d arrive at node n. Due to the fact that real traffic is injected by each Source at the rate severely less than the shadow traffic, we have nd < X njd: For a single-node network, (12) just income that influx rate is less than available ability. More generally, it is an assumption that needs to be proved. However, here our target is to give an instinct behind the token bucket algorithm, so we simply assume (12). Condition (12) guarantees that the token processes are stable (that is, roughly, they cannot runaway to infinity) as the total influx rate to the token buckets at a node is less than the total service charge and the arrivals employ a join-the-straight-queue regulation. Moreover, since rnjd[t] are rates at the outgoing links of a node should be proportional to the shadow service rates. It is not difficult to see that if "is very small, the proportion will be close to ideal. In general, the token-based algorithm does not guarantee that, that is why it is an approximation[28].

3.3. Extra Link Activation

The shade back-pressure algorithm, only links with back-pressure greater than or equal to Q can be activated. The stability theory ensures that this is sufficient to render the real queues. On the other hand, the delay performance can still be unacceptable[29]. Recall that the parameter Q was introduced to discourage the use of unnecessarily long paths. Under light and moderate traffic loads, the shadow back-pressure at a link may be frequently less than Q, and thus, packets at such links may have to wait a long time before they are processed. One way to remedy the situation is to activate additional links beyond those activated by the shadow back-pressure algorithm.[29]

3.4. Choice of the Parameter

We anticipate the delay at each link to be inversely relative to the mean ability negative amount the arrival rate at the link. In a wireless network, the capacity at a link is determined by the shadow scheduling algorithm. This capacity is guaranteed to be at least equal to the shadow arrival rate. The influx rate of real packets is of course smaller. Thus, the difference between the link capacity and arrival rate could be proportional to epsilon. Thus, epsilon should be satisfactorily large to ensure small delays while it should be satisfactorily small to ensure that the ability region is not diminished considerably[29].

3.5. System Architecture

The Source is possible o send the file it means the source code having some foot range size that is called transmission range. If any one of node having transmission node if node transfer the source code it must have transmission range. source means to send the file and destination means to receive the file. Here some nodes are there these Are called intermediatery nodes. It means if you want to transfer the file one source to destination incially the file forwarding to the router. The file forwarding to the router main nodes only. The router works to establishing the communication between source and destination. That's this is called mediator. The file send to source to outer and router to destination. Here some neighboring nodes are receiving the file at that time transferring the file in between source and destination or source to router or router to destination. In case any attackers are occurred by any one of the neighboring node so that why we can updating the route that's way we have choose another path for direct establishing both communication between source and destination.

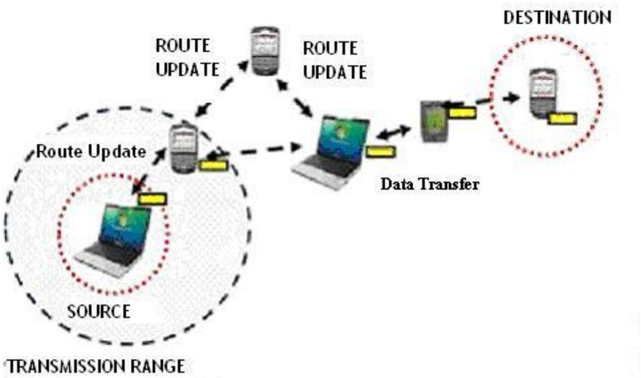

Fig.3. System Architecture

IV. Extension to the Network Coding Case

We expand our move toward to think net-works where network coding is used to advance through put. We think a simple form of network coding. When i and j each have a packet to drive to the other through an middle pass on n, customary broadcast requires the subsequent put of transmissions: drive a pack a from i to n, then n to j, followed by j to n and n to i. in its place, by network coding, one can first drive from i to n, then j to n, XOR the two packets and broadcast the XORed packet from n to both i and j. This form of network coding reduces the number of transmissions from four to three. However, the network coding can simply get better through put only if such coding opportunities are available in the network. Routing plays an significant role in influential whether such opportunities be present. We design an algorithm to automatically find the right tradeoff between using possibly long routes to provide network coding opportunities and the delay incurred by using extended routes[28].

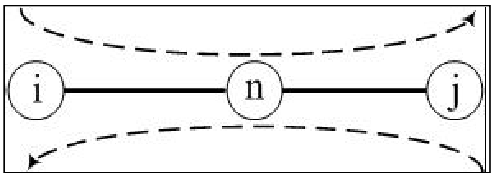

Fig. 4 Network coding case.[28]

V. Simulations

We consider two types of networks in our simulations: wireline and wireless. After that, we explain the topologies and simulation parameters used in our simulations, and then present our simulation results.

5.1. Simulation settings

5.1. a. Wireline settings

The network exposed in Fig. 4 has 31 nodes and represents the GMPLS network topology of North America [27]. Every relation is pretentious to be able to broadcast single small package in every niche. We think that the entrance course is a Poisson procedure by limit, in addition to we think the arrival to approach inside a niche are careful designed for repair at the start of the next niche. Formerly a package arrives beginning an outside run on a lump, the target is determined by probability mass function $p^{\wedge}_{nd}$,d=1,2,……..N, where $p^{\wedge}_{nd}$ is the probability that a packet is received externally a t node n destined for d . Obviously,$\sum_{d:d\neq n} p^{\wedge}_{nd}$ =1and $p^{\wedge}_{nn}$=0. The probability p_{nd} is calculated by

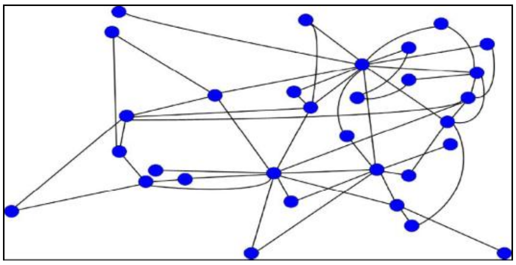

Fig. 5 Sprint GMPLS network topology of North America with 31 nodes.[27].

$$p^{\wedge}_{nd} \quad \frac{J_d+J_n}{\sum_{k,\, k\neq n}(J_k+J_n)} \qquad [28]$$

Where J_n denotes the number of neighbors of node . Thus, we use to split the incoming traffic to each destination based on the degrees of the source and the destination.

5.1. b. Wireless Setting

We generated a random network with30 nodes, which resulted in the topology in Fig. 6. We used the following procedure to generate the random network: 30 nodes are placed uniformly at random in a unit square; then starting with a zero transmission range, the transmission range was increased till the network was connected. We assume that each link can transmit one packet per time-slot. We assume a 2-hop interference model in our simulations. By a -hop interference model, we mean a wireless network where a link activation silences all other links that are hops from the activated connection. The packet influx processes are generated using the same method as in the wireline case. We simulate two cases given the network topology: the no coding case and the network coding case. In both wire- line and wireless simulations, we chose in to be , and we use probabilistic splitting algorithm for simulations[29]

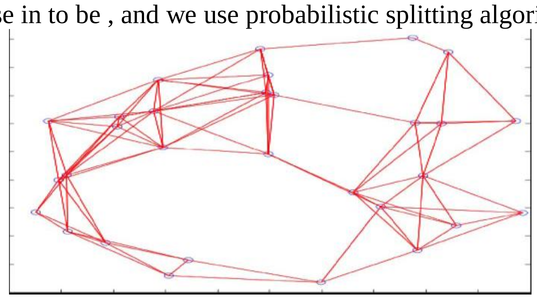

Fig. 6. Wireless network topology with 30 nodes[29].

5.2. Simulation Results

5.2. a .Wireline Networks

First , we compare the performance of three algorithms: the traditional back-pressure algorithm, the basic shadow queue routing/scheduling algorithm without the extra link activation enhancement and PARN. Without extra link commencement, to ensure that the actual arrival charge at each link is less than the link capacity provided by the shadow algorithm

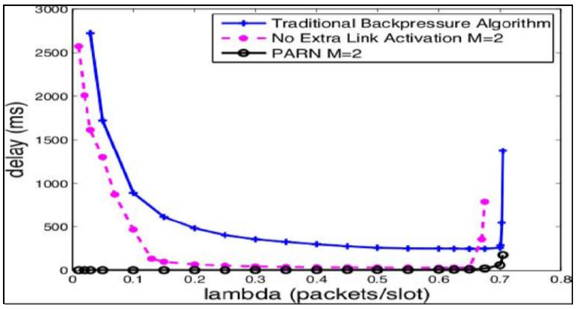

Fig: 7 Impact of the parameter and extra link activation in Sprint GMPLSnetwork topology.[29]

We also compare the delay performance of PARN with that of the shortest path routing in Fig. 8 For each pair of source and destination, we find a shortest path between them by using Dijkstra's algorithm

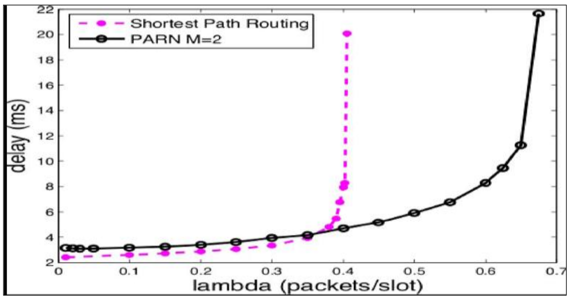

Fig: 8. Delay performance of PARN and shortest path routing.[29]

However, a wireline network does not capture the scheduling aspects inherent to wireless networks, which is studied next. *Wireless Networks:* However, a wireline network does not capture the scheduling aspects inherent to wireless networks, we need. We study wireless networks without network coding. Here the delay performance is relatively insensitive to the choice of as long as it is sufficiently greater than zero. However, does play an important role because it suppresses the search of long paths when the traffic load is not high.

5.2. b. Wireless Networks

In the case of wireless networks, even with extra link activation, to ensure stability even when the arrival charge are within the capacity region, we need €>0. We chose €=0.1 in our simulations owing to motive.

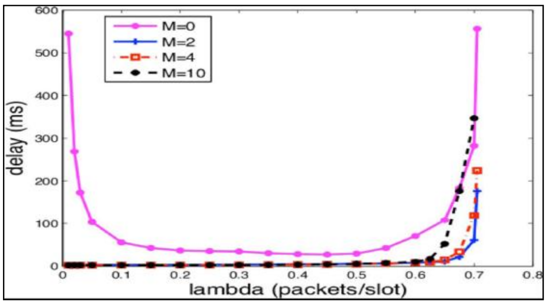

Fig.9. Packet delay as a function of λ under PARN in Sprint GMPLS network topology.[29]

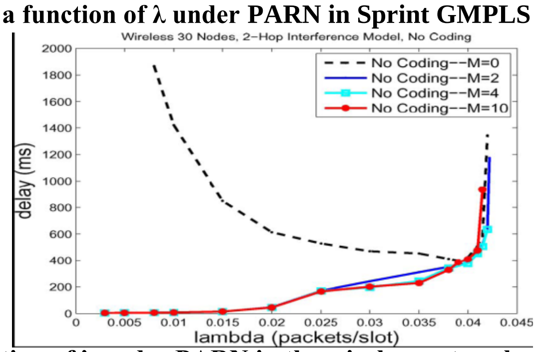

Fig. 10. Packet delay as a function of λ under PARN in the wireless network under 2-hop interference model without network coding.[29]

Fig. 10, we study wireless networks missing network coding. From the figure, we see that the delay performance is relatively unfeeling to the choice of K as long as it is satisfactorily greater than zero. However, K does play an important role because it suppresses the search of long paths when the traffic load is not high. Extra link activation can be used to decrease delays Significantly K>0 for particularly in light traffic area [29].

VI. CONCLUSION

The back-pressure algorithm, while being throughput-optimal, is not useful in practice for adaptive routing since the delay performance can be really bad. In this paper, we have presented an algorithm that routes packets on shortest hops when possible and decouples routing and scheduling using a probabilistic splitting algorithm built on the concept of shadow queues introduced in [3] and [5]. By maintaining a probabilistic routing table that changes slowly over time, existent packets do not have to travel around long paths to improve throughput; this functionality is performed by the shadow "packets." Our algorithm also allows extra link activation to reduce delays. The algorithm has also been shown to reduce the queuing complexity at each node and can be extended to optimally transaction between routing and network coding.

REFERENCES

[1] L. Tassiulas and A. Ephremi des, "Stability properties of constrained queueing systems and scheduling policies for maximum throughput in multihop radio networks," *IEEE Trans. Autom. Control*, vol. 37, no. 12, pp. 1936–1948, Dec. 1992.

[2] M. J. Neely, E. Modiano, and C. E. Rohrs, "Dynamic power allocation and routing for time varying wireless networks," *IEEE J. Sel. Areas Commun.*, vol. 23, no. 1, pp. 89–103, Jan. 2005.

[3] L. Bui, R. Srikant, and A. L. Stolyar, "Novel architectures and algorithms for delay reduction in back-pressure scheduling and routing," in *Proc. IEEE INFOCOM Mini-Conf.*, Apr. 2009, pp. 2936–2940.

[4] L. Bui, R. Srikant, and A. L. Stolyar, "A novel architecture for delay reduction in the back-pressure scheduling algorithm," *IEEE/ACM Trans. Netw.*, vol. 19, no. 6, pp. 1597–1609, Dec. 2011.

[5] L. Bui, R. Srikant, and A. L. Stolyar, "Optimal resource allocation for multicast flows in multihop wireless networks," *Phil. Trans. Roy. Soc., Ser. A*, vol. 366, pp. 2059–2074, 2008.

[6] L. Ying, S. Shakkottai, and A. Reddy, "On combining shortest-path and back-pressure routing over multihop wireless networks," in *Proc. IEEE INFOCOM*, Apr. 2009, pp. 1674–1682.

[7] S. Katti, H. Rahul, W. Hu, D. Katabi, M. Medard, and J. Crowcroft, "XORs in the air: Practical wireless network coding," *Comput. Commun. Rev.*, vol. 36, pp. 243–254, 2006.

[8] M. Effros, T. Ho, and S. Kim, "A tiling approach to network code design for wireless networks," in *Proc. Inf. Theory Workshop*, 2006, pp. 62–66.

[9] H. Seferoglu, A. Markopoulou, and U. Kozat, "Network coding-aware rate control and scheduling in wireless networks," in *Proc. ICME Special Session Netw. Coding Multimedia Streaming*, Cancun, Mexico, Jun. 2009, pp. 1496–1499.

[10] S. B. S. Sengupta and S. Rayanchu, "An analysis of wireless network coding for unicast sessions: The case for coding-aware routing," in *Proc. IEEE INFOCOM*, Anchorage, AK, May 2007, pp. 1028–1036.

[11] T. Ho and H. Viswanathan, "Dynamic algorithms for multicast withintra-session network coding," *IEEE Trans. Inf. Theory*, vol. 55, no. 2,pp. 797–815, Feb. 2009.

[12] A. Eryilmaz, D. S. Lun, and B. T. Swapna, "Control of multi-hop communication networks for inter-session network coding," *IEEE Trans.Inf. Theory*, vol. 57, no. 2, pp. 1092–1110, Feb. 2011.

[13] L. Chen, T. Ho, S. H. Low, M. Chiang, and J. C. Doyle, "Optimization based rate control for multicast with network coding," in *Proc. IEEE INFOCOM*, Anchorage, AK, May 2007, pp. 1163–1171.

[14] B. Awerbuch and T. Leighton, "A simple local-control approximation algorithm formulticommodity flow," in *Proc. 34th Annu. Symp. Found. Comput. Sci.*, 1993, pp. 459–468.

[15] A. Dimakis and J. Walrand, "Sufficient conditions for stability of longest-queue-first scheduling: Second-order properties using fluid limits," *Adv. Appl. Probab.*, vol. 38, no. 2, Jun. 2006.

[16] C. Joo, X. Lin, and N. B. Shroff, "Understanding the capacity region of the greedy maximal scheduling algorithm in multi-hop wireless networks," in *Proc. IEEE INFOCOM*, 2008, pp. 1103–1111.

[17] A. Brzezinski, G. Zussman, and E. Modiano, "Enabling distributed throughput maximization in wireless mesh networks: A partitioning approach," in *Proc. ACM Mobicom*, Sep. 2006, pp. 26–37.

[18] M. Leconte, J. Ni, and R. Srikant, "Improved bounds on the throughput efficiency of greedy maximal scheduling in wireless networks," in *Proc. ACM MobiHoc*, 2009, pp. 165–174.

[19] B. Li, C. Boyaci, and Y. Xia, "A refined performance characterization of longest-queue-first policy in wireless networks," in *Proc. ACM MobiHoc*,2009, pp. 65–74.

[20] X. Lin and N. B. Shroff, "Joint rate control and scheduling in multihop wireless networks," in *Proc. 43rd IEEE Conf. Decision Control*, Dec.14–17, 2004, vol. 2, pp. 1484–1489.

[21] M. J. Neely, E. Modiano, and C. Li, "Fairness and optimal stochastic control for heterogeneous networks," in *Proc. IEEE INFOCOM*, 2005,vol. 3, pp. 1723–1734.

[22] A. L. Stolyar, "Maximizing queueing network utility subject to stability:Greedy primal-dual algorithm," *Queueing Syst.*, vol. 50, no. 4,pp. 401–457, 2005.

[23] A. Eryilmaz and R. Srikant, "Fair resource allocation in wireless networks using queue-length-based scheduling and congestion control,"in *Proc. IEEE INFOCOM*, 2005, vol. 3, pp. 1794–1803.

[24] A. Eryilmaz and R. Srikant, "Joint congestion control, routing and MAC for stability and fairness in wireless networks," *IEEE J. Sel. Areas Commun.*, vol. 24, no. 8, pp. 1514–1524, Aug. 2006.

[25] X. Lin, N. Shroff, and R. Srikant, "A tutorial on cross-layer optimization in wireless networks," *IEEE J. Sel. Areas Commun.*, vol. 24, no. 8, pp. 1452–1463, Aug. 2006.

[26] M. Bramson, "Convergence to equilbria for fluid models of FIFO queueing networks," *Queueing Syst. Theory Appl.*, vol. 22, pp. 5–45,1996.
[27] Sprint, Overland Park, KS, "Sprint IP network performance," 2011[Online].Available:https://www.sprint.net/performance/
[28] Sri Lakshmi, 2G. Krishna Veni "Packet-by-Packet Adaptive Routing in Communication Networks Using Backpressure-based Technique"1D. IJCST Vol. 4, Iss ue Spl - 4, Oct - Dec 2013 ISSN : 0976-8491 (Online) | ISSN : 2229-4333 (Print)
[29] Eleftheria Athanasopoulou, *Member, IEEE*, LocX.Bui, *Associate Member*, "Back-Pressure-Based Packet-by-Packet AdaptiveRouting in Communication Networks" *IEEE*, Tianxiong Ji, *Member, IEEE*,R. Srikant, *Fellow, IEEE*, and Alexander Stolyar IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 21, NO. 1, FEBRUARY 2013.
[30] Mrs. Jayashree, S.Yadannavar,**"** Probabilistic Splitting Table helps in back pressure based packet by packet adoptive routing in communication network" International Journal of Computer Networks and Communications SecurityVOL. 2, NO. 4, APRIL 2014, 137–141 Available online at: www.ijcncs.org ISSN 2308-9830

