International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 11 (2015) pp. 28845-28851

http://www.ripublication.com

Fast Rerouting Technique on Energy Efficient Routing

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Abstract

The partial energy utilization on the Internet has become a basic issue with its rapid growth, as all network devices operate at full capacity instead of the real traffic load. To develop energy efficient routings by collecting traffic and switching under utilized devices into sleep mode. To present fast rerouting-based energy efficient routing scheme, namely FSR, which influence the technique of fast rerouting to reduce the convergence time. The formalize FRR-based energy efficient routing problem and prove that the problem is NP-hard. In order to solve this problem, the goal is to maximize the number of interfaces set in ZBR (Zigbee Routing) mode in the network routers maintaining the reach ability of all potential destinations and maintaining the high network QoS (Quality of Service).

Key words: Energy efficient routing, Fast rerouting, Zigbee routing

Introduction

The traffic in a given network follows a well known daily and weekly pattern, there is an opportunity to aggregate traffic flows over a subset of the network devices and links, allowing other devices to be temporarily switched off. The results obtained by showing the amount of energy saving that is possible to achieve using our method. The results drove us to the development of such a technique on a real environment.

Energy Efficient Routing

Energy efficient routing is obtained either by centralized or distributed ways. For centralized approaches, a heuristic algorithm to solve a multi-commodity flow problem with the objective to effectively aggregate traffic and switch more network components into sleep mode. The dynamic topologies and network pruning to save energy by topology control. They identifies under utilized router line cards by presenting topological properties of the graph. Then, routing paths are computed after pruning these line cards. An ant colony based self adaptive energy saving routing. An integer linear programming for an multi-topology and link weight problem to save energy with loop-free routing table update. The mixed integer linear programming based algorithm to minimize the energy consumption by adjusting OPSF link weights. The centralized approaches have the problems of poor scalability and single point of failure. To address these issues, the system approach computes in a distributed manner. For distributed approaches, energy-critical and on-demand paths offline packets are delivered online to aggregate traffic and use sleep mode. To enhance OSPF, enabling each router to select adjacent links for sleeping. The fully distributed algorithms the routers select sleeping links in a consistent way.

Fast Rerouting

Fast Re Routing (FRR) provides a potential technique to develop network resilience in intra-domain routing. As mentioned in previous, a router with FRR computes rerouting paths in advance, and switches traffic to these rerouting paths quickly after failures occur. This greatly reduces the interruption period to tens of microseconds compared to traditional IGP such as OSPF(Open Shortest Path Found). By introducing green Internet routing, a power model that quantifies the relationship between traffic volume and power consumption.

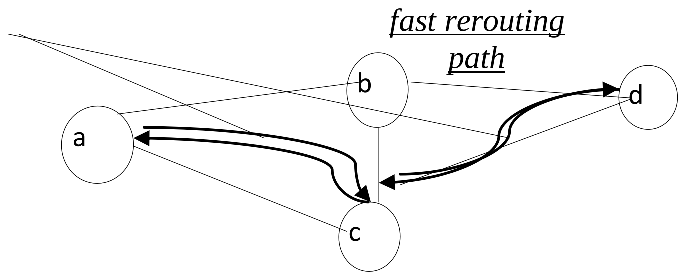

Figure: Example of Greenfrr

Related Work

Distance Vector Algorithm

Distance vector algorithms use the Bellman–Ford algorithm. This approach assigns a cost number to each of the links between each node in the network. Nodes will send information from point A to point B via the path that results in the lowest total cost (i.e. the sum of the costs of the links between the nodes used).

The algorithm operates in a very simple manner. When a node first starts, it only knows of its immediate neighbours, and the direct cost involved in reaching them. (This information list of destinations, the total cost to each, and the next hop to send data to get there makes up the routing table, or distance table.) Each node, on a regular basis, sends to each neighbour node its own current assessment of the total cost to get to all the destinations it knows of. The neighbouring nodes examine this information and compare it to what they already 'know'; anything that represents an improvement on what they already have, they insert in their own routing table. Over time, all the nodes in the network will discover the best next hop for all destinations, and the best total cost.

When one network node goes down, any nodes that used it as their next hop discard the entry, and create new routing-table information. These nodes convey the updated routing information to all adjacent nodes, which in turn repeat the process. Eventually all the nodes in the network receive the updates, and discover new paths to all the destinations they can still "reach".

Link-State Algorithms

When applying link-state algorithms, a graphical map of the network is the fundamental data used for each node. To produce its map, each node floods the entire network with information about the other nodes it can connect to. Each node then independently assembles this information into a map. Using this map, each router independently determines the least-cost path from itself to every other node using a standard shortest paths algorithm such as Dijkstra's algorithm. The result is a tree graph rooted at the current node, such that the path through the tree from the root to any other node is the least-cost path to that node. This tree then serves to construct the routing table, which specifies the best next hop to get from the current node to any other node.

Routing schemes differ in their delivery semantics. They are

Unicast: Delivers a message to a single specific node.

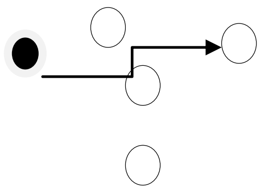

Figure: Unicast

Broadcast: Delivers a message to all nodes in the network.

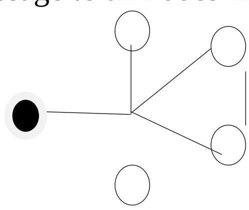

Figure: Broadcast

Multicast: Delivers a message to group of nodes that expressed interest in receiving the message.

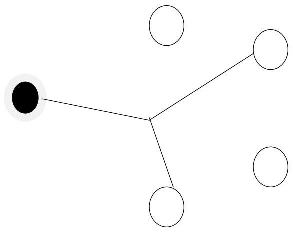

Figure: Multicast

Anycast: Delivers a message to anyone out of group nodes, typically the one nearest to the source.

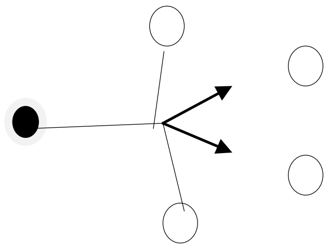

Figure: Anycast

Motivation
Energy efficient routing is obtained either by centralized or distributed ways. For centralized approaches, a heuristic algorithm to solve a multi-commodity flow problem with the objective to effectively aggregate traffic. Fisheye State Routing (FSR) provides a potential technique to develop network resilience in intra-domain routing.

Problem Domain
In Green FRR, LFR-Circles and EA-Circles are computed by Algorithms, respectively. The algorithms can be implemented either in each router, or in a centralized node that announces the results.

In the centralized case, the control traffic consists of the EA-Circles data and the value. There are at most |E| - |V| + 1 EA-Circles, and the largest EA-Circle has at most |V| nodes. Thus, at startup, the amount of control traffic in the worst case. When the topology changes, only the changed data needs to be announced, which is much less. Furthermore, topology changes are considered much less than traffic changes.

In such a way, the last links will not sleep, because they find that they may cause a link overload, so routing oscillations are avoided. Destination can be reached via multiple paths with the same cost, load balancing can be applied to improve the QoS of the communications.

Problem Definition

In this mechanism do not limit our Green FRR to a particular packet forwarding technique. It gives a brief review of four typical algorithms, which can be used to construct rerouting path for sleeping links.

- The loop-Free Altenatives (LFA).
- Improving the Convergence of IP Routing Protocols.
- The Tunnels with Directed Forwarding Approach.

Statement:

In Green FRR, a sleeping link is selected according to the traffic volumes in an EA-Circle.

In an extreme case, sleep mode cannot save power and will not be used. However, system can still apply fast rerouting approaches to achieve a fast routing convergence, without affecting the energy efficiency.

Problem Formulation

The characterized local fast rerouting (LFR-Circles) which give hopeful FRR ways to by pass around resting connections. At that point, formalize the FRR-based vitality productive steering issue. To demonstrate the ideal arrangement can be found in polynomial time under certain conditions, while for the most part, the issue is NP-hard. For amplifying the quantity of dozing connections, while there is a substantial rerouting way interfacing two end hubs of each one resting connection. Besides, exchanging a connection into sleep mode should not induce congestions.

Solution Methodologies

The formula to model the FRR-based energy efficient routing problem

$\text{Max}|S|$………………… (1)

The objective is to maximize the number of sleeping links.This takes after the way the connections consume the larger part of power, and a join's energy changes little with the activity volume.

Show that $\forall l \in S, \exists c^r$ is an LFRcircle, $C^r \cap S = l$……….. (2)

Where S is sleeping nodes.

C^r is LFR-circle.

It guarantees that packets can be delivered in a valid local rerouting path for each sleeping link, so that each end-to-end path can reach the destination without loops or black holes.

$x_l/c_l \leq \lambda, \forall l \in e$……………… (3)

where x_l is traffic volume on link l.

c_l is capacity of link l.

λ is threshold limit.

e is edges

It specifies that the link utilization ratio must less than threshold limit of λ. The link utilization changes within the LFR-circle

$f(v_{i,}v_j)=\eta.\sum_{v\epsilon N(vi)}c(v_{i,}v).\sum_{v\epsilon N(vj)}c(v_,v_j)/(length(P^s_{vi,vj}))^2$........ (4)

$C\leftarrow P^s_{v,vi}+(v_i,v_j)+P^s_{v,vj}$

where v,v_i,v_j are nodes.

η is scale factor.

$c(v_{i,} v_j)$ is capacity of nodes $v_{i,} v_j$.

$N(v_i)$ set of neighbors of $v_{i.}$

$P^s_{vi,vj}$ shortest path from v_i to v_j

The traffic volume from node vi to vj, namely f (vi, vj), is proportional to total output capacity of vi and the total input capacity of vj, and is inversely proportional to the square of the shortest path length from vi to vj, as shown in Eq. (3)

Results

Input	**Output**
channel type	Wireless Channel
propagation model	Two Ray Ground
network interface type	Wireless Interface
MAC type	IEEE802.11
interface queue type	Drop Tail
Message type	packets
antenna model	---------------
number of mobile nodes	50
routing protocol	AODV
x coordinate of topology	200
y coordinate of topology	100
set stop Time	50
Node type	Active and Sleeping

Figure: Experimental results for given inputs.

Comparision of Results

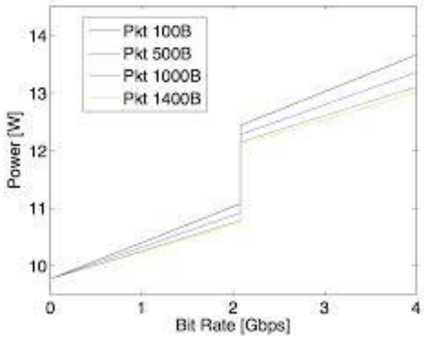

Figure: Power Utilization

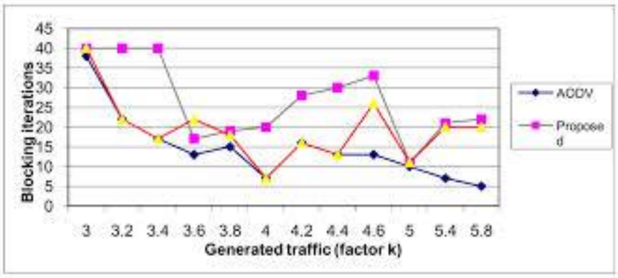

Figure: Traffic generated.

Conclusion

In this we designed ZBR routing algorithm to maximize the number of sleeping links. In particular, we consider link utilization ratio and path stretch in our algorithms. In this scheme of simulations on real and synthetic topologies with real and synthetic traffic traces. The results show that the power consumed by replacing two hop network on behalf of single hop network due to this some instant of time is saved and energy is utilized without any failure.

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