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OSPF integration with Energy Saving IP Routing (ESIR) strategy with Green Traffic Engineering

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Abstract

Unnecessary energy consumption reduction is important factor for industries in economic, environmental and marketing point of view. We know that data centres and networking infrastructure require high performance and high availability machines for this devices more energy require. This problem can be solving by proposed system by minimizing the energy consumption. The proposed solution works on IP Network which provides energy saving solution for Internet Service Provider (ISP). The Proposed solution is known as Energy Saving IP Routing (ESIR) this strategy integrated OSPF protocol. ESIR perform SPT Exportation mechanism, in this mechanism shortest path find by using Dijkstra algorithm and Move Mechanism. ESIR is based on Maximum Set Compatible Move(MSCM), this problem in two step 1st step is called basic MSCM problem which is called Basic MSCM problem and 2nd step is full version of problem QoS-aware MSCM problem. This solution gives near about 40% links to be switched off in daily traffic load to save maximum energy.

1. Introduction

There is lots of challenges arises in network community, about 15% power of information communication technology is consumed by networking. According to the survey about 13 times more routers, times more server and 16 times more PCs are required in 2020 than in 2007. This is because of growth of internet traffic and subscriber which leads to increase of number of network element and their capacity also increases. Now a day global communication requires more network element which must provide high performance with providing reduced power consumption. There is question is that at what extent energy consumption of network rises? And it is also important to determine which processes provide circumstances to increase energy efficiency at a network level.

To increase efficiency of network there is lots of work carried out. Along with minimizing power consumption one should preserve Quality of Services. There is basically two type of solution available for energy consumption one is component level and another is network level. While providing energy solution we must reduce traffic overload and should reduce delay of packet transmission switching off the network equipment is one of the method which pass on the network flow to another route which reduces the energy consumption by network.

In this work, we find out the way to minimize energy consumption for this purpose we calculate the shortest path by using dijkstra algorithm. To save the energy this approach offers strategy is

called as Energy saving IP routing. This approach provides energy saving solution for internet service provider for backbone network. ISP network provide overprovisioned link and it handle traffic changes because of failure or user request growth. We can save maximum energy during off-peak period. This energy saving strategy provides QoS-aware ESIR, which can re-route IP traffic minimizing traffic consumption

2. Related Work

Christoph Lange, Dirk Kosiankowski, Rainer Weidmann, and Andreas Gladisch define energy consumed by telecommunication (TC) network. According survey taken by them, the energy is consumed in fixed and mobile network as well as in data centers and in backbone network is highest. Different methods are recommended and metrics for energy related assessment of networks is compared. They suggested that when we combine different energy reducing methods such as load adaptive networking energy aware system design there can possibility of maximum energy saving. The proposed system based on predicated traffic number and subscriber number [2].

Edoardo Amaldi, Antonio Capone, Luca G. Gianoli and Luca Mascetti proposed an approach which is offline traffic engineering. Aim of this approach is minimize energy consumption and traffic congestion. In this work they defined two heuristic algorithm GA-ES (Greedy Algorithm for Energy Saving) and TA-ES (Two-stage algorithm for Energy Saving) [4].

Kin-Hon Ho defines distributed routing protocol which can help to achieve automatic sleep mode in routes. Aim of this routing protocol is to coordinate routers which enter in sleep mode as well as maintain quality of service. It enable automatic sleep mode in routers [5].

Mingui Zhang, Cheng Yi, Bin Liu and Beichuan Zhang discover energy saving approach at network level. In this workload on router or link is adjusted by routing the traffic through different paths. This approach defines intra domain traffic engineering [6].

3. Problem definition

Energy saving solution is defines for Internet Service Provider (ISP) backbone network. Basically when traffic decreases with esteem to peak hours, resources are underloaded during peak period. We can save energy in between off peak period, but for this purpose it requires extension in routing protocol. So this problem can be overcome by ESIR strategy.

Depend on network layer this strategy can be classified on two classes one is

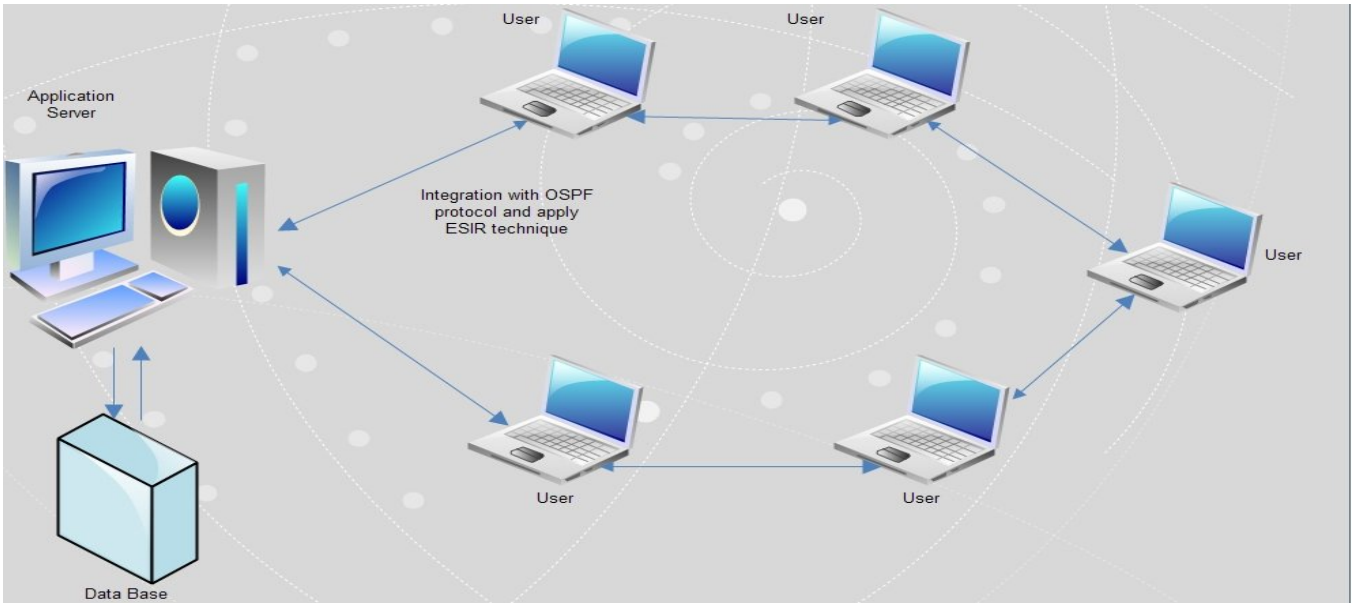

Figure 1 System Arhitecture

WDM layer and second one is IP level. This approach used overlay strategy because both energy saving algorithm and routing protocol worktogether try to find maximum nodes to be switch off so that minimum energy can be utilized for communication.

This strategy is integrated with OSPF protocol and to find shortest path it uses Dijkstra algorithm. ESIR strategy use exportation mechanism for energy saving. Here the concept of maximum clique problem used. In this approach the shortest path finds after this it finds the node to be switch off for this purpose sleep awake concept used exportation mechanism basically two nodes are used:

Exporter node: - Exporter node is a node which can be connected to maximum node in network, which acts as root node in the computation of shortest path.

Importer node: - It is node which compute shortest path tree of its exporter node.

The active node can be finding out by following formula:

$A_n = U_{v \varepsilon V} SPT\ (v)$

Where,

A_n= set of active node

V= set of nodes

SPT (v) = shortest path tree with v as source node.

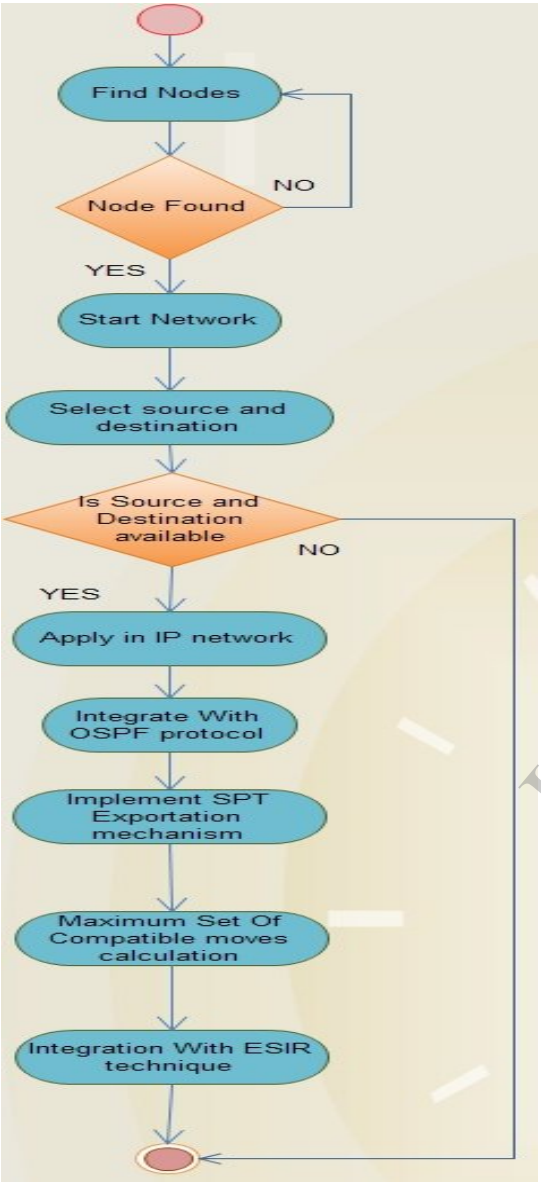

Figure 2 Activity diagram

Fig 2 defines activity carried out by this approach in this approach first it find out whether there is any node is present for communication or not after checking this it build network topology. Then it integrates this network with OSPF protocol, then it uses dijkstra algorithm to find shortest path tree which can be used in exportation mechanism. Then it apply maximum set compatible move problem which can find maximum set of moves so that maximum inactive link to be select to switch off.

3.1 Mathematical model

1] U is main set of users like u1, u2, u3….

U = {u1, u2, u3…….}

2] A is main set of Administrators like a1, a2, a3….

A = {a1, a2, a3…….}

3] P is main set of participating paths like p1, p2, p3…

P = {p1, p2, p3…….}

5] Identify the processes as P.

P = {Set of processes}

P = {e1, e2, e3, e4, e5, e6}

Where

{e1=Find the nodes in the network}

In this process we will fire net view command in the command prompt then we will check that the node is active or not. If it is active then we are adding that node into the network.

{e2=Select the data which has to be send}

{e3=Formation of IP network}

{e4=Implementation of OSPF protocol}

{e5= Plotting tree's using SPT exportation mechanism}

e5:- EA = $U_{v\varepsilon V}$ SPT (v)

Each router vεV computes its own Shortest Path Tree.

SPT (v) composed of the links belonging to at least one shortest path having *v* as source node. EA of active links (those used for packet routing)

{e6=Implementation of MSCM problem}

e6:

1) max $\sum_{i=1}^{L} wi\, xi$

2) $x_i + x_j \leq 1$, where (I, j) $\varepsilon \bar{F}$

3) $x_i \varepsilon \{0, 1\}$,where I ε M

This is for basic MSCM problem

1) $r_k + \sum_{i \varepsilon M} xi \Delta tik \leq pk, \max Ck$

Where k ε E

This is formulated for QOS aware mscm problem. Where Ck is the capacity of link *k* and ρk, max is the maximum link load on link *k*.

4. Conclusion

In this ESIR, to save energy in an IP network during low traffic hours has been proposed. ESIR strategy is fully compatible with OSPF and it is based on the the concept of sequence of "moves" aiming at determining the best way to put in low power mode a set of links and to reroute the paths crossing them. ESIR is able to modulate the network performance and allows a QoS strategy to be implemented. Further here the system implement sleep awake concept in which nodes are undergoes sleep condition so that the maximum energy saving carried out.

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