J.Thi-Qar Sci. Vol. 4 (1) Sept./2013

ISSN 1991- 8690 الترقيم الدولي 8690 - 1991

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Using the redistribution between routing protocols to find best route

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Abstract

Routers can forward packets through an internetwork by maintaining routing information in a database called a routing table. The routing table typically contains the address of all known networks and routing information about that network such as: Interface, Routing Path, Next Hop, Route Metric (Cost) and Route Timeout Routers build and maintain their routing database by periodically sharing information with other routers. The exact format of these exchanges is based on the routing protocol.
The output of this study is Compare between routing protocols (Routing Information Protocol v2 and Enhanced Interior Gateway Routing Protocol
).Design and implementation by using (GNS3) Graphical Network Simulator and we also Configuring the exchange of routing information between routing protocols is called route redistribution. Redistribution can be done between various Interior Gateway Routing Protocol routing protocols.

Keywords: RIP, EIGRP, Redistribution

المستخلص

يستطيع الراوتر ايصال البيانات الى الهدف المطلوب بالاعتماد على جدول الطرق وهذا الجدول يحتوي عناوين كل الاجهزة المرتبطة في الشبكة ومن خلال جدول الطرق يستطيع الراوتر تحديد وجهته وفي هذا البحث تم دراسة البروتوكول RIPv2 والبروتوكول EIGRP ثم تمت عملية حقن معاير كل بروتوكول الى البروتوكول الاخر وهذا يساعدنا في استخدام عدة بروتوكولات في شبكة واحدة وايجاد افضل الطرق .
ان هذه الدراسة تقدم مقارنة بين بروتوكول RIPv2 وبروتوكولEIGRP بواسطة استخدام برنامج (GNS 3) وتوضح كيف تتم عملية يبادل المعلومات بين البروتوكولات عن طريق الحقن.

1.Introduction

Networks rely on routing protocols to keep the routing tables updated. Routing is used in networks to control and forward data. For a router to be efficient and effective, the critical factor is the choice of the routing protocol. Routing protocols find a path between network nodes; if multiple paths exist for a given node then the shortest path is selected by protocol. Each protocol has a cost metric that it applies to each path. The path with lowest metric is selected by protocol. Metrics to compare one routing protocol with another are based on convergence time to adapt to topology changes, optimality is to choose the best path, not necessarily at minimum cost but to ensure a minimum delay or to minimize overhead and space requirements to store the routing table [1][3][5].

2-Routing Protocols

There are two types of routing protocols: static or dynamic routing protocols. Dynamic routing protocols are superior over static routing protocols because of its scalability and adaptability features. Dynamic routes are learned by communicating each router with another, when a new router is added or an old router is removed, the router learns about changes, updates its routing tables, and informs the other router about the modification. The classification of a routing protocol is either as an interior or exterior gateway protocol. The interior gateway protocol runs an algorithm within an Autonomous System (AS) and the exterior gateway protocol runs an algorithm outside an AS. The interior gateway protocol is classified into two groups: either distance vector (DV) or link state (LS). The distance vector selects the best routing path based on a distance metric, while link state selects the best routing path by calculating the state of each link in a path and finding the path that has the lowest total metric to reach the destination [1][3].

The parameters used in order to evaluate the algorithm's performance are: [5][8]

- Instantaneous Packet Delay: This is the average delay of all data packets routed successfully from source to destination for a given period during an algorithm simulation.
- Instantaneous Throughput: This is the number of packets successfully routed for a given time during an algorithm simulation.
- Packet Loss: This refers to the number of packets that are lost.

Different features of LS and DV protocols are presented in [1][2][4]. In [9] they enhance the RIP to provide stability and reduce overhead of message updates.

3-Routing Information Protocol (Rip)

RIP is an interior routing protocol that is based on DV routing. RIP uses hop count to calculate the best route. It is simple but has many drawbacks. RIP uses hop count as a cost metric for each link, and each link has a cost of 1. The maximum path cost is 15 so RIP is limited to use in ASs that are not larger than 15 hops. Every 30 seconds the router sends copy of the routing table to its neighbors. The routing table is updated whenever the network topology is changed; each router informs its adjacent neighbors about the updating in the routing table. When the router receives an update, first it compares the new route with the current routing table, then adds a new path to the routing table and informs its adjacent neighbors about the updating in the routing table [3][7].

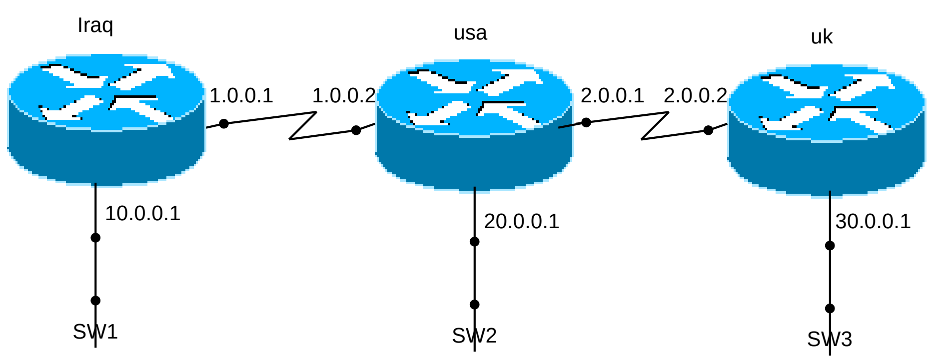
The following table summarizes the advantages and disadvantages of RIP [6] [7]:

Table 1: Advantages and Disadvantages of RIP

Advantages of RIP	**Disadvantages of RIP**
Simple	In heterogeneous networks RIP is not scalable and is inefficient to use in networks with more than one LAN protocol because RIP is based on number of hops to reach destination
Easy to configure	The periodic updating of routing table consumes bandwidth because RIP propagates entire routing table to neighbor routers
	The convergence is slow. (RIP is slow to adjust the link failure)
	RIP is not suitable for large networks because the number is limited to 15

In [9] RIP is enhanced by using Fast Self-healing Distance Vector Protocol (FS-DVP), FS-DVP suppresses its failure notification to provide better stability and reduce the overhead of message updates. In FS-DVP, each node generates a backup node set, for each destination, pre-computes the backup next hop and stores them. If the link has failed, the packet selects the next hop from the backup set. FS-DVP thus eliminates the delay due to re-computation and reroutes packets without any interruption in the presence of link failures. To save bandwidth resources and balance the load in the network, FS-DVP uses a suppression-failure technique to handle link failure, so when a link fails, an adjacent node suppresses the update message and sets a timer for a suppression interval, but other nodes are not explicitly notified of the failure. When router R1 detects that router R2 is unreachable, R1 starts a timer, the timer must be less than 60 seconds, if R1 receives a route from R2 before the timer expires, the link recovers so that the suppression is successful and no notification is propagated for this failure, otherwise a failure is propagated at the end of suppression interval and new routing tables are computed. FS-DVP is applied on RIP and called FS-RIP.

4-Using RIP2 find best route




```
iraq>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route
Gateway of last resort
C    1.0.0.0/8 is directly connected, Serial0/0
R    2.0.0.0/8 [120/1] via 1.0.0.2, 00:00:00, Serial0/0
R    20.0.0.0/8 [120/1] via 1.0.0.2, 00:00:00, Serial0/0
C    10.0.0.0/8 is directly connected, FastEthernet1/0
R    30.0.0.0/8 [120/2] via 1.0.0.2, 00:00:00, Serial0/0
```

5-Over View Of Eigrp

It's a Cisco proprietary .EIGRP's link (neighbor) discovery and recovery is the mechanism that routers use to dynamically learn of other routers on their directly attached networks. Routers must also discover when their neighbors become un reachable or in operative. This is achieved with low overhead by having each router send small Hello packets periodically. As long as Hello packets are received, a router can determine that a neighbor is alive and functioning. Once this is determined, the neighboring routers exchange routing information. The reliable transport mechanism of EIGRP is responsible for guaranteed, ordered delivery of packets to all neighbors. It supp orts inter-mixed transmission of multicast or unicast packets. Some packets must be transmitted reliably and others need not. For efciency, reliability is provided only when necessary. For example, on a multi-access network that has multicast capabilities, such as Ethernet, it is not necessary to send Hello reliably to all neighbors individually. So a single multicast Hello is sent with an indication in the packet informing the receivers that the packet need not be acknowledged. Other types of packets, such as Updates, require acknowledgment and this is indicated in the packet. The reliable transport has a provision to send multicast packets quickly when there are unacknowledged packets pending. This helps insure that convergence time remains low in the presence of varying speed links.

The Diffusing Update Algorithm (DUAL) implements the decision process for all route computations. It tracks all routes advertised by all neighbors. The distance information, known as a metric, is used by DUAL to select minimum cost loop free paths. DUAL selects routes to be inserted into a routing table based on feasible successors. A successor is a neighboring router used for packet forwarding that has a least cost path to a destination that is guaranteed not to be part of a routing loop. When there are no feasible successors but there are neighbors advertising the destination, a recomputation must occur. This is the process where a new successor is determined. The amount of time it takes to recompute the route affects the convergence time. Even though the recomputation is not processor intensive, it is advantageous to avoid recomputation if it is not necessary. When a topology change occurs, DUAL will test for feasible successors. If there are feasible successors, it will use any it finds in order to avoid any unnecessary recomputation. From router i's standpoint, a feasible successor toward destination j is a neighbor router k that satisfes a feasibility condition that is function of the router's own distance and its neighbor's distance to the destination.

The protocol dependent modules are responsible for network layer protocol specifc requirements. For example, the IP module is responsible for sending and receiving DUAL packets that are encapsulated in IP. The parsing packets and informing DUAL of the new information received. IP module asks DUAL to make routing decisions and the results which are stored in the IP routing table. It is also responsible for leaking destinations learned by other IP routing protocols, as well as filtering and summarization.

6-Link Discovery

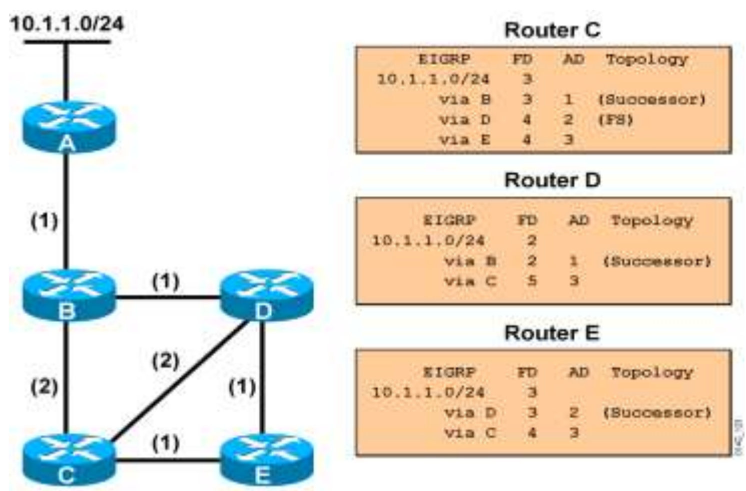
Link (neighbor) discovery and dead detection is used in determining when links appear and disappear. The transport mechanism uses the link discovery and dead detection, while dual only uses the dead detection case.

Small Hello packets are sent periodically. They contain the hold time for the link and factors used in the metric computation. The latter is used only as verification of consistency. When a router receives a hello, it sets a timer to expire after the advertised hold time interval. Each time a hello is received, the timer is reset.A link is discovered when the first hello packet is received. The state of this link (up) is recorded and a request made of DUAL to send a full update to the link. When the transport is requested to send multicasts, it uses the link information to determine from whom to expect acknowledgements.When the hold timer expires, the link is declared down, and dual is informed with a link-down event. Other link-down events are triggered by interfaces going down, a maximum packet retransmission threshold exceeded, and various configuration changes that would disable routing of one or several links.DUAL's treatment of a link-down event is described below.

7-Dual

Each router maintains a vector with its distance to every known destination in the routing table.Routing information is exchanged only between neighbors by means of update messages; this is done after routers detect changes in the cost or status of links. Each update message contains a distance vector of one or more entries, and each entry specifies the length of the selected path to a given destination, as well as an indication of whether the constitutes an update, a query, or a reply to a previous query. A router also maintains a topology table containing the distance reported by selected neighbor routers to each known destination. Information for the routing table is taken from the top ology table. In addition, a link-state table is maintained that contains a list of all neighbors heard.This is used by the transport as well as DUAL. There are two other tables that are used. They are the query-origin table, and the reply-status table. These described below. For a given destination, a router updates its routing table differently depending on whether it is passive or active for that destination. A router that is passive for a given destination can update the routing-table entry destination independently of any other routers, and simply chooses as its new distance to the destination to be the shortest distance to that destination among all neighbors, and as its new successor to that destination to be any neighbor through whom the shortest distance is achieved. In contrast, a router is or becomes active for a given destination must synchronize the updating of its routing-table entry with other routers. A router is active if it is waiting for at least one neighbor to send a reply to a query already sent by the router, and is passive otherwise. Furthermore, a router is initialized in passive state for all known destinations with a 0 distance to itself and a finite distance to other destinations that are directly attached to an adjacent link. Passive destinations with infinite distances are removed from the topology table.

DUAL Example

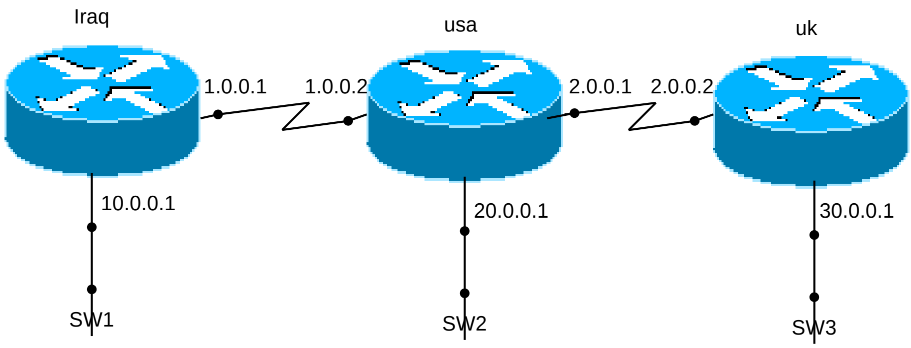


- Selects lowest-cost, loop-free paths to each destination.
- AD = cost between the next-hop router and the destination.
- FD = cost from local router = AD of next-hop router + cost between the local router and the next-hop router
- Lowest-cost = lowest FD

(current) successor = next-hop router with lowest-cost , lop free path.

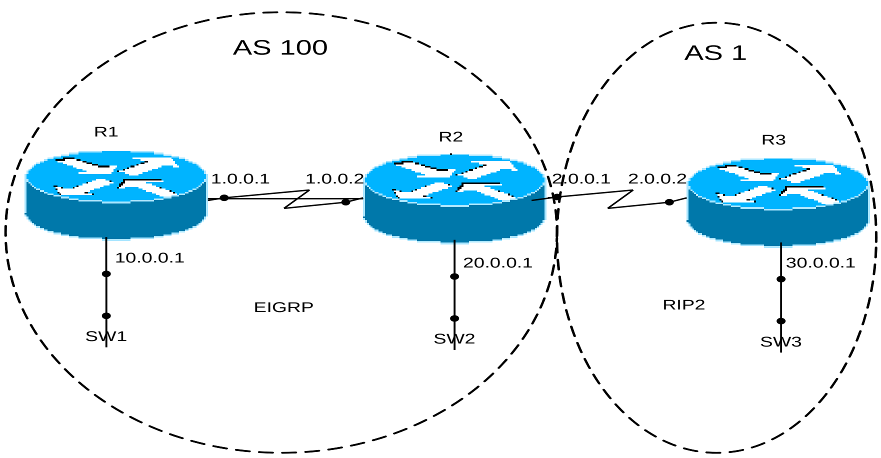
- Feasible successor = backup router with loop-free path (AD of feasible successor must be less than FD of current successor route)

8-using EIGRP to find best route



iraq#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route
Gateway of last resort is not set
C 1.0.0.0/8 is directly connected, Serial0/0
D 2.0.0.0/8 [90/2681856] via 1.0.0.2, 00:01:17, Serial0/0
D 20.0.0.0/8 [90/2172416] via 1.0.0.2, 00:01:17, Serial0/0
C 10.0.0.0/8 is directly connected, FastEthernet1/0
D 30.0.0.0/8 [90/2684416] via 1.0.0.2, 00:01:14, Serial0/0

9-Using the redistribution between RIPv2 and EIGRP



R1
interface Serial0/0
ip address 1.0.0.1 255.0.0.0
interface FastEthernet1/0
ip address 10.0.0.1 255.0.0.0
router eigrp 100
network 1.0.0.0
network 10.0.0.0
no auto-summary

R2
interface Serial0/0
ip address 1.0.0.2 255.0.0.0
interface Serial0/1
ip address 2.0.0.1 255.0.0.0
interface FastEthernet1/0
ip address 20.0.0.1 255.0.0.0
router eigrp 100
redistribute rip metric 10 10 10 10 10

```
 network 1.0.0.0
 network 20.0.0.0
 no auto-summary
```

R3

```
interface Serial0/0
 ip address 2.0.0.2 255.0.0.0
interface FastEthernet1/0
ip address 30.0.0.1 255.0.0.0
router rip
version 2
network 2.0.0.0
network 30.0.0.0
no auto-summary
```

10-Result

When we use redistribution between RIPv2 and EIGRP we will find EIGRP external route as show following:

R1#SH IP ROUTE
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
Gateway of last resort
C 1.0.0.0/8 is directly connected, Serial0/0
D EX 2.0.0.0/8 [170/256514560] via 1.0.0.2, 00:00:42, Serial0/0
D 20.0.0.0/8 [90/2172416] via 1.0.0.2, 00:00:42, Serial0/0
C 10.0.0.0/8 is directly connected, FastEthernet1/0
D EX 30.0.0.0/8 [170/256514560] via 1.0.0.2, 00:00:42, Serial0/0

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