

Simulation & Setup of Smart Wireless Wi-Fi Router

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Abstract: The shortest & easy communication is essential in network system, and router is widely used to do so. If we need heavy Internet user with multiple wireless devices competing for Wi-Fi coverage at the same time, then need a Wireless Linksys router. Wireless router is up to 4x faster than normal router and is the most powerful networking technology at this stage. A wireless router is a device that performs the functions of a router and also includes the functions of a wireless access point. It is used to provide access to the Internet or a private computer network. It can function in a wired LAN (local area network), in a wireless-only LAN (WLAN), or in a mixed wired/wireless network, depending on the manufacturer and model. The main objective of this research paper is to introducing smart wireless router with setup and simulation.

Keywords: LAN, DSL router, ISP, Packet Tracer, IEEE 802.11.

I. INTRODUCTION

In today's society, the demand for network applications has grown rapidly. Therefore, high speed routing has become more important in Open Shortest Path First (OSPF), which is the most used intra-autonomous system routing protocol. When a topological change occurs due to an unexpected situation in the OSPF, the network routing algorithms are used to update the routing table. For example, if there is a link failure in a network, then the shortest paths must be recomputed. In this situation, the shortest paths computation is performed using the router. However, when some links have new weights in a network, using the router can create redundancies through performing more computations and unnecessary corrections by repeating the operation for every node regardless of the location of the link weight change [1]. Therefore, this can cause network instability because the overall routing table is frequently updated.

In this paper, a multi-path routing system is presented and it uses the multi-path information to create the shortest path tree when some links have new weights. In order to evaluate the proposed network, it is compared with the well-known Linksys router.

II. INTRODUCTION TO ROUTER (COMPUTING)

A router is a networking device that forwards data packets between computer networks. A router is connected to two or more data lines from different networks. When a data packet comes in on one of the lines, the router reads the address information in the packet to determine its ultimate destination [2]. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey. This creates an overlay internetwork. Routers perform the "traffic directing" functions on the

Internet. A data packet is typically forwarded from one router to another through the networks that constitute the internetwork until it reaches its destination node.

The most familiar type of routers are home and small office routers that simply pass data, such as web pages,

email, IM, and videos between the home computers and the Internet [3]. An example of a router would be the owner's cable or DSL router, which connects to the Internet through an ISP.

More sophisticated routers, such as enterprise routers, connect large business or ISP networks up to the powerful core routers that forward data at high speed along the optical fibres lines of the Internet backbone. Though routers are typically dedicated hardware devices, use of software-based routers has grown increasingly common.

III. FEATURES

Most current wireless routers have the following characteristics:

- One or multiple NICs supporting Fast Ethernet or Gigabit Ethernet integrated into the main SoC
- One or multiple WNICs supporting a part of the IEEE 802.11-standard family also integrated into the main SoC or as separate chips on the printed circuit board. It also can be a distinct card connected over a MiniPCI or MiniPCIe interface. So far the PHY-Chips for the WNICs are generally distinct chips on the PCB [4]. Dependent on the mode the WNIC supports, i.e. 1T1R, 2T2R or 3T3R, one WNIC have up to 3 PHY-Chips connected to it. Each PHY-Chip is connected to a Hirose U.FL-connector on the PCB. A so-called pigtail cable connects the Hirose U.FL either to a RF connector, in which case the antenna can be changed or directly to the antenna, in which case it is integrated into the casing. Common are single-band (i.e. only for 2.4 GHz or only for 5 GHz) and dual-band (i.e. for 2.4 and 5 GHz) antennas.
- Often an Ethernet switch supporting Gigabit Ethernet or Fast Ethernet, with support for IEEE 802.1Q, integrated into the main SoC or as separate Chip on the PCB.
- Some wireless routers come with either XDSL modem, DOCSIS modem, LTE modem, or fibres optic modem integrated.

- IEEE 802.11n compliant or ready.
- Some dual-band wireless routers operate the 2.4 GHz and 5 GHz bands simultaneously.
- Some high end dual-band wireless routers have data transfer rates of at most 300 Mbit/s (For 2.4 GHz band) and 450 Mbit/s (For 5 GHz band) [5].
- The Wi-Fi clone button simplifies Wi-Fi configuration and builds a seamless unified home network, enabling Super Range Extension, which means it can automatically copy the SSID and Password of your router.
- Some wireless routers have 1 or 2 USB port(s). For wireless routers having 1 USB port, it is designated for either printer or desktop/mobile external hard disk drive. For wireless routers having 2 USB ports, one is designated for the printer and the other one is designated for either desktop or mobile external hard disk drive.
- Some wireless routers have a USB port specifically designed for connecting mobile broadband modem, aside from connecting the wireless router to an Ethernet with XDSL or cable modem. So, can be inserted a mobile broadband USB adapter into the router to share the mobile broadband Internet connection through the wireless network.

IV. TABLES & FIGURES

TABLE I

| Network Destination | Net mask | | |
|---------------------|-----------------|---------------|---------------|
| | 0.0.0.0 | 192.168.0.1 | 192.168.0.100 |
| 127.0.0.0 | 255.0.0.0 | 127.0.0.1 | 127.0.0.1 |
| 192.168.0.0 | 255.255.255.0 | 192.168.0.100 | 192.168.0.100 |
| 192.168.0.100 | 255.255.255.255 | 127.0.0.1 | 127.0.0.1 |
| 192.168.0.1 | 255.255.255.255 | 192.168.0.100 | 192.168.0.100 |

The column Network Destination and Net mask together describe the Network id as mentioned earlier. For example, destination 192.168.0.0 and net mask 255.255.255.0 can be written as network id 192.168.0.0/24. The Gateway column contains the same information as the Next hop, i.e. it points to the gateway through which the network can be reached. The Interface indicates what locally available interface is responsible for reaching the gateway [6]. In this example, gateway 192.168.0.1 (the internet router) can be reached through the local network card with address 192.168.0.100. Finally, the Metric indicates the associated cost of using the indicated route [7]. This is useful for determining the efficiency of a certain route from two points in a network. In this example, it is more efficient to communicate with the computer itself through the use of address 127.0.0.1 than it would be through 192.168.0.100.

Routing tables are generally not used directly for packet forwarding in modern router architectures; instead, they are used to generate the information for a smaller forwarding table. A forwarding table contains only the routes which are chosen by the routing algorithm as preferred routes for packet forwarding. It is often in a compressed or pre-compiled format that is optimized for hardware storage and lookup [8]. This router architecture separates the Control Plane function of the routing table from the Forwarding Plane function of the forwarding table. This separation of control and forwarding provides uninterrupted performance.

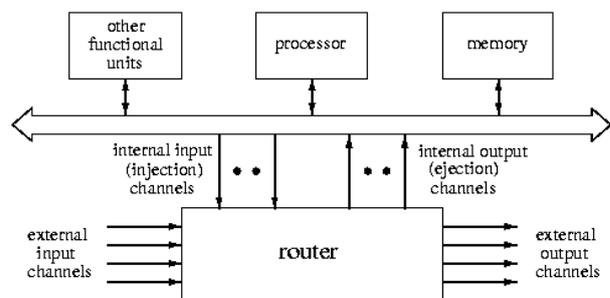


Fig. 1 A sample structure of a Router.

Fig. 1 shows generic structure of a router. Routers are connected through a bus.

Router:

A HW coprocessor implementing lower levels of communication protocol. It comprises of a switch, buffers, and routing and arbitration unit (see Figure 1).

External channels:

Interconnect routers and define the topology of a connected direct interconnection network.

Adjacent nodes: Nodes with directly connected routers.

Internal channels:

Connect the router to the local processing node and implement the physical HW interface between them.

1-port architecture: one injection and one ejection channel

K-port architecture: k injection and k ejection channels,

All-port architecture: # of injection channels = # of external output channels and # of ejection channels = # of external input channels.

Channel:

Consists of buffers, link controllers, and communication medium.

Buffer:

FIFO memory for storing one or several units of communication in transit. They are required for storing transferred data until the next channel is reserved and can overtake them. A router can implement

- Input and output buffering: each input and output external channel is associated with one buffer, as in Figure 2.
- input buffering: buffers are associated with input external channels only,
- Output buffering: buffers are associated with output external channels only.

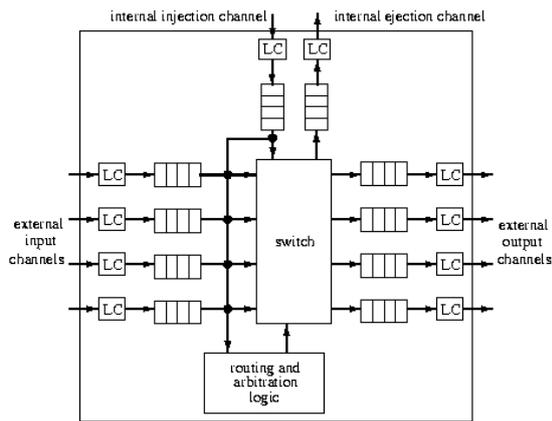


Figure 2: Generic architecture of router with input and output buffering

Message:

The unit of communication from the programmer's perspective. Its size is limited only by the user memory space.

Packet:

Fixed-size smallest unit of communication containing routing information and sequencing information in its header. Its size is of order hundreds or thousands of bytes or words. It consists of header flits and data flits.

V. SIMULATION WITH PACKET TRACER

Cisco Packet Tracer is a network simulation program that allows students to experiment with network behaviour and ask "what if" questions. As an integral part of the Networking Academy comprehensive learning experience, Packet Tracer provides simulation, visualization, authoring, assessment, and collaboration capabilities and facilitates the teaching and learning of complex technology concepts.

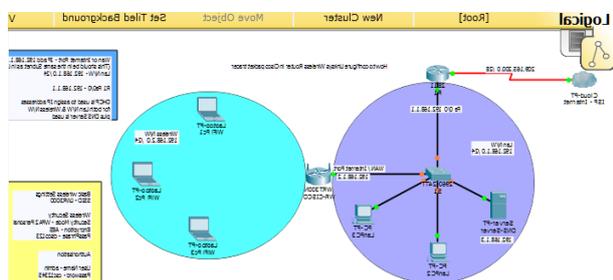


Figure 3: Packet tracer simulation

We have 2 networks (Network 1 and Network 2). Router R1 tied with 2 networks hence it knows two networks 10.0.0.0 and 12.0.0.0 but it doesn't know anything about 11.0.0.0 network.

Similarly R2 knows about 11.0.0.0 and 12.0.0.0 networks, but it has no idea about existence of 10.0.0.0 network. Routing is the process by which we are configuring R1 to communicate with Network 2 (11.0.0.0) and R2 to Network 1 (10.0.0.0). A routing protocol shares this information first among immediate neighbours, and then throughout the network. This way, routers gain awareness of the topology of the network.

VI. CONFIGURATION OF A ROUTER

There are three methods to configure a Cisco router.

1. Console
2. Telnet
3. Auxiliary

Step 1:

Connect console cable at the console port of the router and the other end to your computer or laptop. Now need serial port to do this.

Step 2:

Run Putty Select Serial and click Open

Step 3:

It will give us command line interface for configuring the router.

Configuration Command:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with
CNTL/Z.
Router(config)#hostname R1
R1(config)#
R1# %SYS-5-CONFIG_I: Configured from console by
console
R1#show ip interface brief
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 unassigned YES unset administratively
down down
FastEthernet0/1 unassigned YES unset administratively
down down
R1#configure terminal Enter configuration commands,
one per line. End with CNTL/Z.
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 10.0.0.1 255.0.0.0
R1(config-if)#no shutdown R1(config-if)
# %LINK-5-CHANGED: Interface FastEthernet0/0,
changed state to up R1# %SYS-5-CONFIG_I
```

VII. APPLICATIONS

Routers intended for ISP and major enterprise connectivity usually exchange routing information using the Border Gateway Protocol (BGP).

- Edge router: Also called a Provider Edge router, is placed at the edge of an ISP network. The router uses External BGP to EBG routers in other ISPs, or a large enterprise Autonomous System.
- Subscriber edge router: Also called a Customer Edge router, is located at the edge of the subscriber's network, it also uses EBGP to its provider's Autonomous System. It is typically used in an organization.
- Inter-provider border router: Interconnecting ISPs, is a BGP router that maintains BGP sessions with other BGP routers in ISP Autonomous Systems.
- Core router: A core router resides within an Autonomous System as a back bone to carry traffic between edge routers.
- Within an ISP: In the ISP's Autonomous System, a router uses internal BGP to communicate with other ISP edge routers, other intranet core routers, or the ISP's intranet provider border routers.

- (DFZ). The major ISPs' system routers make up what could be considered to be the current Internet backbone core. ISPs operate all four types of the BGP routers described here. An ISP "core" router is used to interconnect its edge and border routers. Core routers may also have specialized functions in virtual private networks based on a combination of BGP and Multi-Protocol Label Switching protocols.
- Port forwarding: Routers are also used for port forwarding between private Internets connected servers.
- Voice/Data/Fax/Video Processing Routers: Commonly referred to as access servers or gateways, these devices are used to route and process voice, data, video and fax traffic on the Internet. Since 2005, most long-distance phone calls have been processed as IP traffic (VOIP) through a voice gateway. Use of access server type routers expanded with the advent of the Internet, first with dial-up access and another resurgence with voice phone service.

VIII. CONCLUSION

Maximum Performance of wireless router derived from IEEE Standard 802.11 specifications. Actual performance may vary, including lower wireless network capacity, data throughput rate, range and coverage. Performance depends upon many factors, conditions and variables, including products used, interference and other adverse conditions. 802.11ac 1750 Mbps and above (for 5 GHz) is up to 4.3x faster physical data rate when compared to 802.11n 300 Mbps (for 2.4 GHz) Wi-Fi routers using two antennas to transmit and receive data. An 802.11ac adapter may be needed to achieve 11ac data rates. In order to achieve the best performance, router must be used with a compatible 802.11ac wireless device. The standard transmission rates are the physical data rates. Actual data throughput will be lower and may depend on the mix of wireless products used and external factors.

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BIOGRAPHY



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