LAMP EXTENDED APPLICATIONS OVER INTERNATIONAL NETWORK MULTIPROTOCOL TECHNOLOGY

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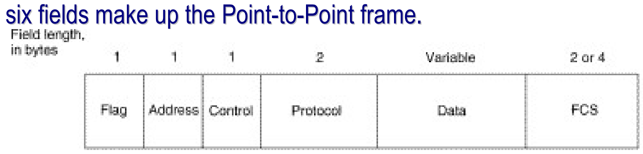
ABSTRACT

Describes how to perform an Internetwork with OSPF single area routing protocol and static routing. Defines what LAMP extended applications are. It shows how LAMP Software Technology is used to Perform information systems over an Internetwork. It combines LAMP Software Technology and Internetwork Technology to propose a way to refer how it works all Technologies together.

INTRODUCTION

Internetwork [1]. An Internetwork is an arbitrary collection of physical networks interconnected to provide a host-to-host packet delivery service and different routing protocols. Point-to-Point Protocol [1]. Originally emerged as an encapsulation protocol for transporting IP traffic over point-to-point links. PPP also established a standard for the assignment and management of IP addresses, asynchronous (start/stop) and bit-oriented synchronous encapsulation, network protocol multiplexing, link configuration, link quality testing, error detection, and option negotiation for such capabilities as network-layer address negotiation and data-compression negotiation. Point-to-Point Protocol supports these functions by providing an extensible Link Control Protocol (LCP) and a family of Network Control Protocols (NCPs) to negotiate optional configuration parameters and facilities. In addition to IP, Point-to-Point Protocol supports other protocols, including Novell's Internetwork Packet Exchange (IPX) and DECnet. This chapter provides a summary of PPP's basic protocol elements and operations. Point-to-Point Protocol Components. Point-to-Point Protocol provides a method for transmitting datagrams over serial point-to-point links. Point-to-Point Protocol contains three main components: A method for encapsulating datagrams over serial links Point-to-Point Protocol uses the High-Level Data Link Control (HDLC) protocol as a basis for encapsulating datagrams over point-to-point links. An extensible LCP to establish, configure, and test the data-link connection. A family of NCPs for establishing and configuring different network-layer protocols PPP is designed to allow the simultaneous use of multiple network-layer protocols.

To establish communications over a point-to-point link, the originating Point-to-Point Protocol first sends LCP frames to configure and (optionally) test the data-link. After the link has been established and optional facilities have been negotiated as needed by the LCP, the originating Point-to-Point Protocol sends NCP frames to choose and configure one or more network-layer protocols. When each of the chosen network-layer protocols has been configured, packets from each network-layer protocol can be sent over the link. The link will remain configured for communications until explicit LCP or NCP frames close the link, or until some external event occurs (for example, an inactivity timer expires or a user intervenes). Physical-Layer Requirements. Point-to-Point Protocol is capable of operating across any DTE/DCE interface. Examples include EIA/TIA-232-C (formerly RS-232-C), EIA/TIA-422 (formerly RS-422), EIA/TIA-423 (formerly RS-423),) and International Telecommunication Union Telecommunication Standardization Sector (ITU-T) (formerly CCITT). The requirement imposed by Point-to-Point Protocol is the provision of a duplex circuit, either dedicated or switched, that can operate in either an asynchronous or synchronous bit-serial mode, transparent to PPP link-layer frames. PPP does not impose any restrictions regarding transmission rate other than those imposed by the particular DTE/DCE interface in use. Point-to-Point Protocol Link Layer. Point-to-Point Protocol uses the principles, terminology, and frame structure of the International Organization for Standardization (ISO) HDLC procedures (ISO 3309-1979), as modified by ISO 3309:1984/PDAD1 "Addendum 1: start/stop transmission." ISO 3309-1979 specifies the HDLC frame structure for use in synchronous environments. ISO 3309:1984/PDAD1 specifies proposed modifications to ISO 3309-1979 to allow its use in asynchronous environments. The Point-to-Point Protocol control procedures use the definitions and control field encodings standardized in ISO 4335-1979/Addendum 1-1979. The Point-to-Point Protocol frame format appears in next figure, where is showed six fields make up the Point-to-Point frame.



The sum of the Point-to-Point Protocol frame fields are: Flag. A single byte that indicates the beginning or end of a frame. The flag field consists of the binary sequence 01111110. Address. A single byte that contains the binary sequence 11111111, the standard broadcast address. Point-to-Point Protocol does not assign individual station addresses. Control. A single byte that contains the binary sequence 00000011, which calls for transmission of user data in an unsequenced frame. A connectionless link service similar to that of Logical Link Control (LLC) Type 1 is provided. Protocol. Two bytes that identify the protocol encapsulated in the information field of the frame. The most up-to-date values of the protocol field are specified in the most recent Assigned Numbers Request for Comments (RFC). Data. Zero or more bytes that contain the datagram for the protocol specified in the protocol field. The end of the information field is found by locating the closing flag sequence and allowing 2 bytes for the FCS field.

By prior agreement, consenting Point-to-Point Protocol implementations can use other values for the maximum information field length. Frame Check Sequence (FCS). Normally 16 bits (2 bytes). By prior agreement, consenting Point-to-Point Protocol implementations can use a 32-bit (4-byte) FCS for improved error detection. The LCP can negotiate modifications to the standard Point-to-Point Protocol frame structure. Modified frames, however, always will be clearly distinguishable from standard frames. Point-to-Point Protocol Link-Control Protocol. The Point-to-Point Protocol LCP provides a method of establishing, configuring, maintaining, and terminating the point-to-point connection. LCP goes through four distinct phases: First, link establishment and configuration negotiation occurs. Before any network-layer datagrams (for example, IP) can be exchanged, LCP first must open the connection and negotiate configuration parameters. This phase is complete when a configuration-acknowledgment frame has been both sent and received. This is followed by link-quality determination. LCP allows an optional link-quality determination phase following the link-establishment and configuration-negotiation phase. In this phase, the link is tested to determine whether the link quality is sufficient to bring up network-layer protocols. This phase is optional. LCP can delay transmission of network-layer protocol information until this phase is complete. At this point, network-layer protocol configuration negotiation occurs. After LCP has finished the link-quality determination phase, network-layer protocols can be configured separately by the appropriate NCP and can be brought up and taken down at any time. If LCP closes the link, it informs the network-layer protocols so that they can take appropriate action. Finally, link termination occurs. LCP can terminate the link at any time. This usually will be done at the request of a user but can happen because of a physical event, such as the loss of carrier or the expiration of an idle-period timer. Three classes of LCP frames exist. Link-establishment frames are used to establish and configure a link. Link-termination frames are used to terminate a link, while link-maintenance frames are used to manage and debug a link. These frames are used to accomplish the work of each of the LCP phases.

Static Routing [1]. Routing is the process that a router uses to forward packets toward the destination network. A router makes decisions based upon the destination IP address of a packet. All devices along the way use the destination IP address to send the packet in the right direction to reach its destination. To make the correct decisions, routers must learn how to reach remote networks. Since static routes are configured manually, network administrators must add and delete static routes to reflect any network topology changes. In a large network, the manual maintenance of routing tables could require a lot of administrative time. On small networks with few possible changes, static routes require very little maintenance. Static routing is not as scalable as dynamic routing because of the extra administrative requirements. Even in large networks, static routes that are intended to accomplish a specific purpose are often configured in conjunction with a dynamic routing protocol.

Open Shortest Path First (OSPF) [1]. Is a routing protocol developed for Internet Protocol (IP) networks by the interior gateway protocol (IGP) working group of the Internet Engineering Task Force (IETF). Group was formed in 1988 to design an IGP based on the shortest path first (SPF) algorithm for use in the Internet. Similar to the Interior Gateway Routing Protocol (IGRP), OSPF was created because in the mid-1980s, the Routing Information Protocol (RIP) was increasingly unable to serve large. OSPF was derived from several research efforts, including Bolt, Beranek, Newman's (BBN's) SPF algorithm developed in 1978 for the ARPANET (a landmark packet-switching network developed in the early 1970s by BBN), Dr. Radia Perlman's research on fault-tolerant broadcasting of routing information (1988), BBN's work on area routing (1986), and an early version of OSI's Intermediate System-to-Intermediate System (IS-IS) routing protocol. OSPF has two primary characteristics. The first is that the protocol is open, which means that its specification is in the public domain. The OSPF specification is published as Request For Comments (RFC) 1247. The second characteristic is that OSPF is based on the SPF algorithm, which sometimes is referred to as the Dijkstra algorithm, named for the person credited with its creation. OSPF is a link-state routing protocol that calls for the sending of link-state advertisements (LSAs) to all other routers within the same hierarchical area. Information on attached interfaces, metrics used, and other variables is included in OSPF LSAs. As OSPF routers accumulate link-state information, they use the SPF algorithm to calculate the shortest path to each node. As a link-state routing protocol, OSPF contrasts with RIP and IGRP, which are distance-vector routing protocols. Routers running the distance-vector algorithm send all or a portion of their routing tables in routing-update messages to their neighbors. Unlike RIP, OSPF can operate within a hierarchy. The largest entity within the hierarchy is the autonomous system (AS), which is a collection of networks under a common administration that share a common routing strategy. OSPF is an intra-AS (interior gateway) routing protocol, although it is capable of receiving routes from and sending routes to other ASs. An AS can be divided into a number of areas, which are groups of contiguous networks and attached hosts. Routers with multiple interfaces can participate in multiple areas. These routers, which are called area border routers, maintain separate topological databases for each area. A topological database is essentially an overall picture of networks in relationship to routers. The topological database contains the collection of LSAs received from all routers in the same area. Routers within the same area share the same information, they have identical topological databases. The term domain sometimes is used to describe a portion of the network in which all routers have identical topological databases. Domain is frequently used interchangeably with AS. An area's topology is invisible to entities outside the area. By keeping area topologies separate, OSPF passes less routing traffic than it would if the AS were not partitioned. Area partitioning creates two different types of OSPF routing, depending on whether the source and destination are in the same or different areas. Intra-area routing occurs when the source and destination are in the same area; interarea routing occurs when they are in different areas. An OSPF backbone is responsible for distributing routing information between areas. It consists of all area border routers, networks not wholly contained in any area, and their attached routers.

Redistribution [1]. To support multiple routing protocols within the same internetwork efficiently, routing information must be shared among the different routing protocols. This process of exchanging routing information between routing protocols is called route redistribution, this can be one-way, it consists on routes are where one protocol receives the route from another; or two-way, that consists on routes are where both protocols receive routes from each other. Routers that perform redistribution are called boundary routers because they border two or more autonomous systems or routing domains.

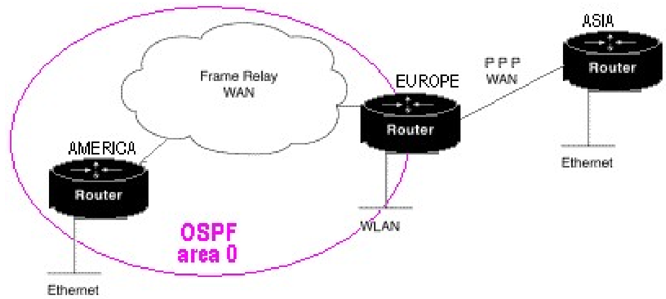
Using multiple routing protocols typically results in increased administrative complexity and overhead. Actually, there are several scenarios in which using multiple routing protocols solves more problems than it creates, especially in medium and large sized networks. Route redistribution can be complicated and have several disadvantages as shown in the following: Routing loops. Depending on how redistribution is used, routes can send routing information received from one Autonomous Systems (AS) back into the AS. The feedback is similar to the split horizon problem that occurs in distance vector technologies. Incompatible routing information. Each routing protocol uses different metrics. Because these metrics cannot be translated exactly into a different protocol, path selection using the redistributed route information may not be optimal. Inconsistent convergence time. Different routing protocols converge at different rates. As RIP converges, slower than EIGRP, so if a link goes down, the EIGRP network will learn about it before the RIP network. This means that it must be used following important guidelines when configuring route redistribution: Be familiar with the network. There are many ways to implement redistribution and being familiar with the network helps to make the best decisions. Do not overlap routing protocols. Do not run two different protocols in the same Internetwork. Instead, have distinct boundaries between networks that use different routing protocols. Use one-way redistribution with multiple boundary routers. If more than one router serves as a redistribution point, use one-way redistribution to avoid routing loops and convergence problems. Consider using default routes in the domains that do not import external routes. Use two-way redistribution with a single boundary router. Two-way redistribution works smoothly when redistribution is configured on a single boundary router in the Internetwork. If there are multiple redistribution points, do not use two-way redistribution unless a mechanism to reduce the chances of routing loops is enabled. A combination of default routes, route filters, and distance modifications can be used to combat routing loops. It must be used the default-information originate router configuration command to generate a default route into an OSPF routing domain. For OSPF causes the communication server to generate a default external route into an OSPF domain if the communication server already has a default route and you want to propagate to other communication servers. Always must be used the redistribute or the default-information router configuration commands to redistribute routes into an OSPF routing domain, the communication server automatically becomes an AS boundary communication server. So, an AS boundary communication server does not, by default, generate a default route into the OSPF routing domain. The communication server still needs to have a default route for itself before it generates one, except when you have specified the always keyword. This command for the OSPF process, the default network must reside in the routing table and you must satisfy the route-map map-name keyword. Using the default-information originate always route-map map-name form of the command when you do not want the dependency on the default network in the routing table.

LAMP Extended Applications [2]. These are the applications formed by LAMP Applications where whatever device browser let surf full Web application using Small-Screen Rendering technology accessing any site on the Internet as every computer. It delivers any portable media players on environment for JavaScript and CCS3, Web applications and dynamic user interfaces. Based on any core engine of any browser accelerating the development of devices and ensures the quality Internet performance.

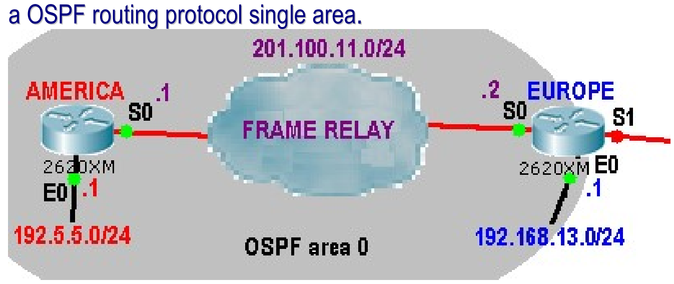
Most sites are written for, and tested exclusively on desktop computers with large color monitors. Mobile wireless devices typically have much smaller screens, and until today, it has been a challenge to present Web pages on these. LAMP Extended Applications reformats Web sites to fit inside the screen width, thereby eliminating the need for horizontal scrolling, enabling access to all the content available on the LAMP applications. Even before this, it was of course possible to browse the Web with any browser. The problem is that most sites are designed with fixed widths that make them hard to navigate on small handheld devices. So, the page is reformatted to fit inside the screen width and eliminate the need for horizontal scrolling, all the content and functionality is still available, it is only the layout of the page that is changed. This is the key enabler for surfing on a mobile device. Most news sites have a center column where the main article text is located. This column is usually 468 pixels wide (due to the standard ad-banner sizes) and the text is set to fill this width. This means that to read an article, it would have to scroll back and forth for every line of text.

DEVELOPMENT

1. Let us consider 3 routers performing an Internetwork between the first and the second a Frame Relay cloud available for attachment and testing of the configuration changes made to the routers, describing an OSPF single area. Between the second and the third a Point-to-Point link.

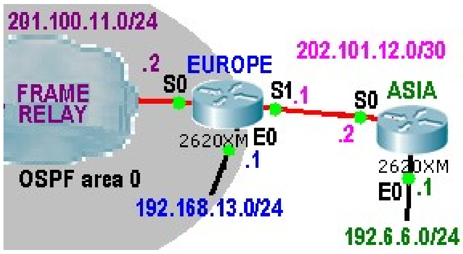


The purpose of this model is to practice the process of configuring the routers to connect to an internet network and performance the LAMP Applications and LAMP Extended Applications. The first router is called AMERICA, configured as [3]. Consider this, select 3 routers which have WAN serial links between them. The middle router is a router border called EUROPE all routers will simulate geographically separate sites connected with two WAN technologies, Frame Relay and Point-to-Point Protocol. This model showed uses routers AMERICA, EUROPE and ASIA. The two first routers (AMERICA and EUROPE) are into Autonomous System with a OSPF routing protocol single area.



2. AMERICA and EUROPE are connected and configured already [3], the way to connect EUROPE and ASIA is the purpose of this paper, before already it has been configured and the way to configure the Point-to-Point Protocol between EUROPE router and ASIA router is very easy, only it does not forget the external route and OSPF single area.

EUROPE and AMERICA routers are showed at the next figure



It has created an Internetwork where a router EUROPE and a router called ASIA are connected by serial link using Point-to-Point.

```
!
version 12.2
!
hostname EUROPE
!
enable secret 5 $1$rAbT$QcjsfrezlqcBh4F.DU7c4/
!
interface FastEthernet0/0
 description EUROPE WIRELESS LAN
 ip address 192.168.13.1 255.255.255.0
 duplex auto
 speed auto
!
interface Serial0/0
 description FRAME-RELAY NETWORK LINK
 ip address 201.100.11.2 255.255.255.0
 ip ospf priority 0
 encapsulation frame-relay
!
interface Serial0/1
 description ASIA PPP LINK
 ip address 202.101.12.1 255.255.255.252
 encapsulation ppp
!
router ospf 1
 network 201.100.11.0 0.0.0.255 area 0
 network 192.168.13.0 0.0.0.255 area 0
 default-information originate
 auto-summary
!
ip route 0.0.0.0 0.0.0.0 202.101.12.2
!
!
ip classless
!
!
!
!
line con 0
!
end
```

Protocol, these are connected and communicated by themselves using in both routers *encapsulation PPP* command in interface configuration mode, using serial 1 to EUROPE router and serial 0 to ASIA router. The primary key is EUROPE router on internetwork, this is because links a Frame Relay WAN through serial 0 and a Point-to-Point Protocol WAN through serial 1, this means that it must be configured **`encapsulation frame-relay`** command at serial interface level. At the same time the Frame Relay WAN works with OSPF

```
!
version 12.2
!
hostname ASIA
!
!
interface Serial0/0
 description PPP EUROPE LINK
 ip address 202.101.12.2 255.255.255.252
 encapsulation ppp
!
ip route 192.5.5.0 0.0.0.255 202.101.12.1
ip route 201.100.11.0 0.0.0.255 202.101.12.1
!
!
```

routing protocol single area, this is written at the configuration on EUROPE router. To make possible the communication between the devices at LAN ASIA and LAN AMERICA at ASIA router it must be configured a static route using ip route 192.5.5.0 255.255.255.0 202.101.12.1 command. But this is not enough, because LAN AMERICA is trying to reach a LAN in other Autonomous System as LAN ASIA, then at EUROPE router, called border router, To generate a default external route into an OSPF routing domain, it must be configured default-information originate command in router configuration mode. All this to any external devices network can be integrated to this Autonomous System Domain at the same time any external devices network can reach the destination into Autonomous System.

3. Any device at Wireless LAN at EUROPE can freely reach to any device at Fast Ethernet LAN at AMERICA, but not any at LAN ASIA, must be configured ip route 0.0.0.0 0.0.0.0 202.101.12.2 command at EUROPE router making with this a default route to reach any destination out OSPF single area Autonomous System. The real top notch in this model is that all devices in this Internetwork has connectivity on every device at the same Internetwork. 4. An LAMP Extended application on this Internetwork must be considered as a WAN application of layer 7. It can perform audio, video and data applications, and this model supports large bandwidth through different WAN technologies at the same time. It can use LAMP servers in order to host applications as discussed in "A LAMP Application Developed On A Noncompatible Platform" [4]. And "IEEE 802.11N Standard Implementation to LAMP Applications" [5].

LAMP Applications have dynamic scripting capability that works in tandem with HTML and PHP code, separating the page logic from the static elements (the actual design and display of the page) to help make the HTML more functional (g.e. dynamic database queries). Due to its open-source nature, if there is something it cannot currently be done in PHP itself there is possible to write a PHP [6] module. This was tested at our university on May 2006 by a set of students from TIC career at Network Lab [6]. This is made possible through the well-documented API which is available to all. The team is using a free open source SCRUM, which substitutes old Rational Rose dependencies and a new tool called Bizagui.

CONCLUSIONS

This model offers how LAMP Applications work over any WAN Technology worked in this paper. Broad manufacturer acceptance and certifiable interoperability means users can expect to see affordable, large bandwidth throughout the Internetworks. LAMP Extended Software Technology is a free Internet Systems technology that can be used over any WAN Technology. SRUM was added to LAMP Software Technology tool stack. LAMP Extended Applications can also be applied to mobile devices without reformatting the pages.

It was showed how to LAMP applications approach on WAN Technology maintaining high-level standard. The main contribution is to show how to operate any application Layer 7 at any Infrastructure Network to make students understand the complete model including hardware and software. With this paper the LAMP technology still alive.

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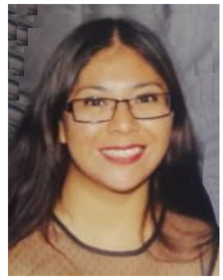

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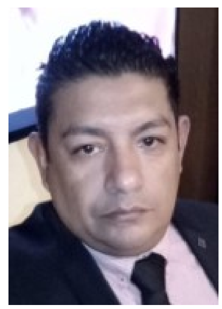

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