Application Note

Before you begin

There are several hardware requirements for this procedure. You must have:

- Two Patton 2884 models

- A PC or a laptop with a serial port

- Two crossover T1\E1 cables

- RJ45 to DB-9 adapter

- Two straight-through Ethernet cables

Introduction

The instructions in this application note explain how to set up a routed multi-link Point-to-Point Protocol connection with two Patton IPLink Model 2884s back to back.

When following the steps in this procedure, it is assumed that you know how to access your device through both the console and the webpage. If you do not know how to do this, please refer to the quick start guide you received with your unit. You can also find this guide on the Patton website at: http://www.patton.com/manuals/288x_qs.pdf.

A TFTP server is used for backing up of configuration files, although this is not needed. If you are in need of a TFTP server, you can download SolarWinds for Windows which is a free TFTP server: http://www.solarwinds.com/downloads/

It is strongly recommended, if you are doing this for the first time, to set up this procedure as an isolated network so that it will not interfere with your network.

Follow these steps to set up the routed multi-link PPP connection:

- Restore to minimal configuration
- Naming the units (optional)
- Removing the default IP addresses
- Setting an IP address
- Setting up system clocking
- Setting up a T1 or an E1 link
- Setting up a T1 link
- Setting up an E1 link
- Configuring the MLPPP
- Setting up an IPCP-PPP
- Checking the link state
- Configure the routing table
- Saving your configuration

Restore to minimal configuration

To begin, make sure that your units do not contain a configuration. To do this you will need to restore to the minimal configuration. It is strongly recommended that you back up the configuration of your unit.

Backup Your Current Configuration

If you have a TFTP server setup you can copy the startup-config to the TFTP server by using the command:

```
(none)#  copy startup-config tftp://<IP Address>/<filename>
```

The filename is what you want the configuration file to be named on your TFTP server.

Or, you can save the startup-config to Non -Volatile Random Access Memory (NV-RAM). NV-RAM is the location that the configuration file is stored in any router. To save the startup config to NVRAM, enter the command below (you can replace original-config with any name you like. It does not have to have the "-config" part) :

```
(none)# copy startup-config original-config
```

Now that you have backed up your configuration, you can restore the unit to the shipping-config or to the minimal-config. If you restore to the shipping-config, the configuration will be as it was when you first received the unit. If you restore to minimal-config, everything will be cleared, and there will only be default settings will be available.

Restore to Minimal Configuration

You should go through the following process with each unit. Enter the following command to restore to minimal-config from the CLI.

```
(none)# copy minimal-config startup-config
```

You will need to restart your unit for the changes to take affect:

```
(none)# reload
```

Naming the units (optional)

It is not necessary to name the units. Naming the unit will change the command prompt from `(none)` to the name you have chosen for the unit. For this document, the units have been named `London` and `Berlin`. This will make it easier for you to tell which commands are run on each unit. Make sure you save the config after renaming the units.

To rename the first unit:

```
(none)# configure system host-name
London
Host Name will take effect on next
boot!
(none)# write
(none)# reload


London login: admin
password:
London#
```

To rename the second unit:

```
(none)# configure system host-name
Berlin
Host Name will take effect on next
boot!
(none)# write
(none)# reload


Berlin login: admin
password:
Berlin#
```

Removing the default IP addresses

Your units will have an IP address of **192.168.200.10** on Ethernet port 0/0 (eth0). However, both of the units have the same IP address.

A PPP or a MLPPP can be configured as a Bridge Control Protocol (BCP) interface. A BCP connection will bridge two networks together to appear as one.

If you want to configure a BCP, select a unit and change the IP address of that unit to **192.168.200.1**.

```
London login: admin
password:
London# configure
London[config]# interface ethernet eth0
London[eth-eth0]# no ip address 192.168.200.10
London[eth-eth0]# no ip address 192.168.1.10
```

The above commands remove the IP addresses that were previously assigned to the interface. It is possible to put more that one IP address on an interface.

You will also need to disable the DHCP client on eth0.

```
London[eth-eth0]# no ip address dhcp
```

Exit the eth0 interface:

```
London[eth-eth0]# exit
```

Below is the configuration for the Berlin Unit:

```
Berlin login: admin
password:
Berlin# configure
Berlin[config]# interface ethernet eth0
Berlin[eth-eth0]# no ip address 192.168.200.10
Berlin[eth-eth0]# no ip address 192.168.1.10
Berlin[eth-eth0]# no ip address dhcp
Berlin[eth-eth0]# exit
London[config]#
```

Setting an IP address

There are two ways to specify the netmask of an IP address. You can enter the IP address as shown below:

```
London[eth-eth0]# ip address 192.168.200.1/24
```

This notation is often referred to as slash notation. It is simply calculated by counting up the Binary bits.

/32 = 255.255.255.255
/24 = 255.255.255.0
/16 = 255.255.0.0
/8 = 255.0.0.0

Alternatively, you can enter the IP address as shown below:

```
London[eth-eth0]# ip address 192.168.200.1 netmask 255.255.255.0
```

Exit the interface:

```
London[eth-eth0]# exit
London[config]#
```

Below is the Berlin configuration:

```
Berlin[eth-eth0]# ip address 172.16.0.1/16
Berlin[eth-eth0]# exit
Berlin[config]#
```

Setting up system clocking

If the clocking on the units is not set up correctly, you will not be able to establish the PPP link. Both units are configured by default for internal clocking. In the commands below, the Berlin unit is set to receive clocking from the London unit:

```
Berlin[config]# controller t1e1-clocking
Berlin[t1e1-clock]# source primary 0
Berlin[t1e1-clock]# source secondary 1
Berlin[t1e1-clock]# mode fallforward
Berlin[t1e1-clock]# exit
Berlin[config]#
```

The options for the **Fallback** setting are:

- **None:** If the primary clock fails, it will wait for the primary clock to come back up.

- **Fallback:** If the primary clock fails it will switch back to the secondary clock, but will not switch back if the primary clock starts to function again.

- **Fallforward:** If the primary clock fails it will switch back to the secondary clock, and when the primary clock comes back it will switch forward to the primary clock.

The commands below show how the London unit is set by default (*you do not need to run these commands*):

```
London[config]# controller t1e1-clocking
London[t1e1-clock]# source primary internal
London[t1e1-clock]# exit
London[config]#
```

Setting up a T1 or an E1 link

The next step is to decide if you want to use T1 or E1. T1 is used primarily in the USA, Canada, and Japan. E1 is primarily used everywhere else in the world. This document contains instructions on how to set up both T1 and E1. They are not compatible with each other and you cannot connect a T1 to an E1.

T1 uses 24 DS0 lines; one DS0 line runs at 64kbps. This means that a T1 runs at 1.544mbps.

An E1 contains 32 timeslots that are at 8 bits each. This means that an E1 runs at 2.048mbps.

Setting up a T1 link

Configure the following settings on both units, London and Berlin:

```
London[config]# controller t1e1 0
London[t1e1-0]# mode t1
London[t1e1-0]# hdlc 4 1-24
London[t1e1-0]# exit
```

```
London[config]# controller t1e1 1
London[t1e1-1]# mode t1
London[t1e1-1]# hdlc 5 1-24
London[t1e1-1]# exit
London[config]# controller t1e1 2
London[t1e1-2]# mode t1
London[t1e1-2]# hdlc 6 1-24
London[t1e1-2]# exit
London[config]# controller t1e1 3
London[t1e1-3]# mode t1
London[t1e1-3]# hdlc 7 1-24
London[t1e1-3]# exit
London[config]#
```

Setting up an E1 link

Configure the following settings on both units, London and Berlin:

```
London[config]# controller t1e1 0
London[t1e1-0]# mode e1
London[t1e1-0]# hdlc 4 1-31
London[t1e1-0]# exit
London[config]# controller t1e1 1
London[t1e1-1]# mode e1
London[t1e1-1]# hdlc 5 1-31
London[t1e1-1]# exit
London[config]# controller t1e1 2
London[t1e1-2]# mode e1
London[t1e1-2]# hdlc 6 1-31
London[t1e1-2]# exit
London[config]# controller t1e1 3
London[t1e1-3]# mode e1
London[t1e1-3]# hdlc 7 1-31
London[t1e1-3]# exit
London[config]#
```

Configuring the MLPPP

Now, you can create and configure the Multi Link Point to Point Protocol connection.

First, you must create the interface using the command below (ppp0 is just a name, it must be named ppp and then a number):

```
London[config]# interface ppp ppp0
```

Enter the following command to define the interface as a multi-link interface:

```
London[ppp-ppp0]# multilink
```

Note If you are only setting up one T1/E1 connection, you should not use the multilink command. The mulitlink command enables you to bind more than one hdlc to the PPP interface.

Bind the HDLC interfaces to the MLPPP:

```
London[ppp-ppp0]# bind hdlc4
London[ppp-ppp0]# bind hdlc5
London[ppp-ppp0]# bind hdlc6
London[ppp-ppp0]# bind hdlc7
```

Make sure that that you enable the PPP interface or it will not work:

```
London[ppp-ppp0]# no shutdown
```

Enter the following commands to configure the Berlin unit:

```
Berlin[config]# interface ppp ppp0
Berlin[ppp-ppp0]# multilink
Berlin[ppp-ppp0]# bind hdlc4
Berlin[ppp-ppp0]# bind hdlc5
Berlin[ppp-ppp0]# bind hdlc6
Berlin[ppp-ppp0]# bind hdlc7
Berlin[ppp-ppp0]# no shutdown
```

Setting up an IPCP-PPP

By default, the PPP is set to IPCP. You do not have to do anything else to the London unit.

```
Berlin[ppp-ppp0]# show
No Shutdown
Multilink: Enabled   Min-Initial-Frag-Size: None
Device(s):
  hdlc4 (establish)
  hdlc5 (establish)
  hdlc6 (establish)
  hdlc7 (establish)
Active
Holdoff:   5 seconds
LCP:
  Echo-Failure:   5  Echo-Interval:  5  Max-Configure: 10  Max-Failure: 10
  Max-Terminate:  3  Restart:        3  MRU:         1540  MTU:         1540
IPCP:
  Local IP:        192.168.254.0
  Actual Local IP:
  Peer IP:         192.168.254.1
  Actual Peer IP:
  Max-Configure: 10  Max-Failure:   10  Max-Terminate:  3  Restart:  3
```

There are two IP addresses, local and peer. The local IP address is for the IPCP interface on the unit you are configuring, and the peer IP address is for the IPCP interface on the other unit.

The default IP addresses are **192.168.254.0** and **192.168.254.1**. This is a 32 bit subnet mask (255.255.255.255) so the IP address of 192.168.254.0 is a valid IP address.

Both the Berlin and London units have the same IPCP setting. That means that both units have the local IPCP IP address of **192.168.254.0**. Beause you cannot have have an IP address used more than once, you must change the address of one of the units:

```
Berlin[ppp-ppp0]# ipcp local ip address 192.168.254.1
Berlin[ppp-ppp0]# ipcp peer ip address 192.168.254.0
Berlin[ppp-ppp0]# exit
Berlin[config]#
```

Checking the link state

To check the link state, enter the following command:

```
London# show interface ppp ppp0
```

The following output will display:

```
No Shutdown
Multilink: Enabled   Min-Initial-Frag-Size: None
Device(s):
  hdlc4 (establish)
  hdlc5 (holdoff)
  hdlc6 (slave)
  hdlc7 (master)
Active
Holdoff:   5 seconds
LCP:
  Echo-Failure:   5  Echo-Interval:  5  Max-Configure: 10  Max-Failure: 10
  Max-Terminate: 3  Restart:        3  MRU:         1540  MTU:         1540
IPCP:
  Local IP:        192.168.254.0
  Actual Local IP:        192.168.254.0
  Peer IP:         192.168.254.1
  Actual Peer IP:         192.168.254.1
  Max-Configure: 10  Max-Failure:   10  Max-Terminate:  3  Restart:  3
```

You will see the status of the HDLC interfaces. **Establish** means that the unit is trying to bring up the link. **Holdoff** means that the link is down and the unit is currently *not* trying to establish the link. When the link is down, it will go back and forth between holdoff and establish. **Master** means the link is up; it is the link that will control the other links. You should only ever see one master, and it can be any link. **Slave** is a link that is up and following the master link.

A correctly configured IPCP is shown below:

```
London# show interface ppp ppp0
No Shutdown
Multilink: Enabled   Min-Initial-Frag-Size: None
Device(s):
  hdlc4 (slave)
  hdlc5 (slave)
  hdlc6 (master)
  hdlc7 (slave)
Active
Holdoff:   5 seconds
LCP:
  Echo-Failure:   5  Echo-Interval:  5  Max-Configure: 10  Max-Failure: 10
  Max-Terminate: 3  Restart:        3  MRU:         1540  MTU:         1540
IPCP:
  Local IP:        192.168.254.0
  Actual Local IP:        192.168.254.0
  Peer IP:         192.168.254.1
  Actual Peer IP:         192.168.254.1
```

Configure the routing table

Although your PPP is up, you still cannot pass traffic. The routing table can be viewed with the following command:

```
London# show route
System Routing Table
Flags: C – dhCp, D – Dynamic, G – use Gateway, H – target is a host
       R – useR, U – route is Up, S – System
```

Pos	Destination	Gateway	Netmask	Flags	Metric	TOS	Interface	Source
0	192.168.254.0	*	255.255.255.255	UHS	0	0	ipcp0	192.168.254.1
1	192.168.200.0	*	255.255.255.0	US	0	0	eth0	192.168.200.1

London needs a route to the 172.16.0.0 network (The network off of Berlin's eth0).

```
London# configure
London[config]# route 172.16.0.0 netmask 255.255.0.0 gateway 192.168.254.0
London[config]# show route
System Routing Table
Flags: C – dhCp, D – Dynamic, G – use Gateway, H – target is a host
       R – useR, U – route is Up, S – System
```

Pos	Destination	Gateway	Netmask	Flags	Metric	TOS	Interface	Source
0	192.168.254.0	*	255.255.255.255	UHS	0	0	ipcp0	192.168.254.1
1	192.168.200.0	*	255.255.255.0	US	0	0	eth0	192.168.200.1
2	172.16.0.0	192.168.254.0	255.255.0.0	UGR	0	0	ipcp0	

```
London[config]#
```

Now that London has a route to Berlin's eth0, Berlin needs a route to London's eth0:

```
Berlin# configure
Berlin[config]# route 192.168.200.0 netmask 255.255.255.0 gateway 192.168.254.1
Berlin[config]#
```

Saving your configuration

Enter the following command:

```
London# copy running-config startup-config
```

Or, enter the command:

```
London# write
```

Make sure you save both units:

```
Berlin# write
```

Additional Information

For additional help or any questions, contact Patton Technical Support:

Contacting Patton

If you have any additional questions please feel free to contact Patton's Technical Support:

• E-mail support—e-mail sent to **support@patton.com** will be answered within 1 business day

• Telephone support—standard telephone support is available five days a week—from **8:00 am** to **5:00 pm EST** (**1300** to **2200 UTC**)—by calling **+1** (**301**) **975-1007**

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