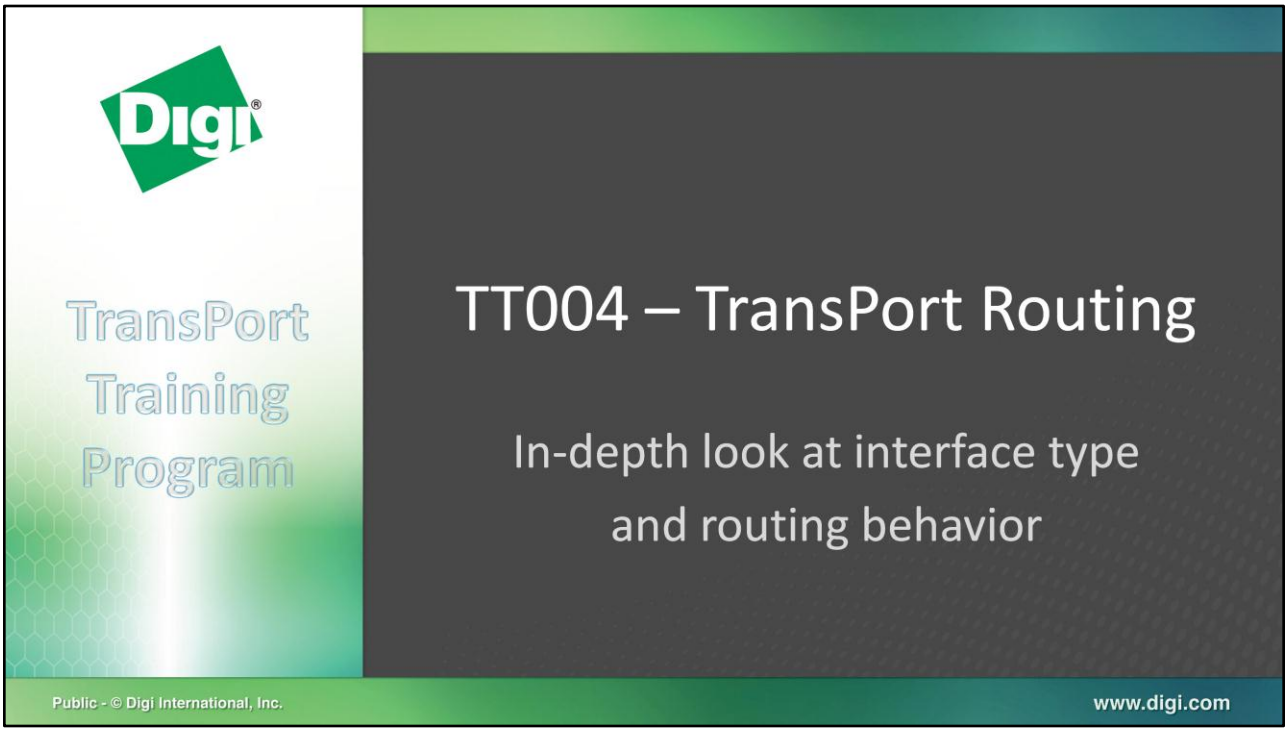

TransPort
Training
Program
TT004 – TransPort Routing
In-depth look at interface type
and routing behavior
Public - © Digi International, Inc.
www.digi.com

Agenda

- Interface Types
- Route types and routing tables
- Routing Protocols
- Routing modes
- Route metrics
- Dial-on-demand interfaces
- Always on interface

Interface Types

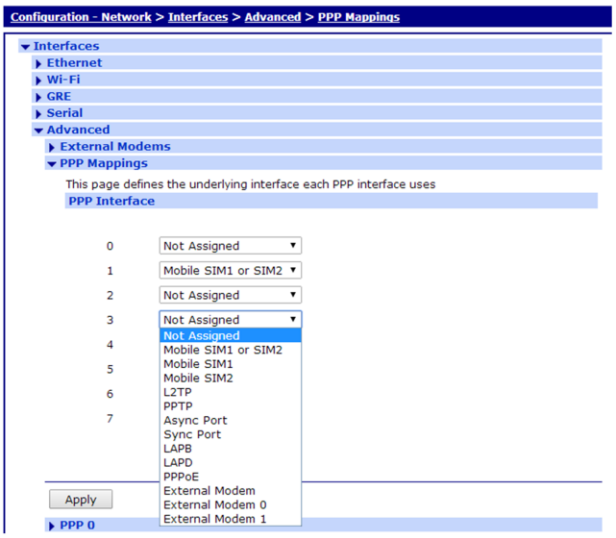
- Transport supports 4 types of interfaces in routing
  - PPP (Point to Point)
  - ETH (Ethernet Physical)
    (Ethernet Logical)
  - TUN (GRE Tunnel) [VPN Module]
  - OVPN (Open VPN Tunnel) [VPN Module]
- These are the only interfaces you will ever see in the routing table
- Each physical interface must be linked to one of the 4 interface types above to be used with IP.
- Demonstration of routing table via CLI and web.

Interface States

- UP
- DOWN
- OOS (Out of Service)
- An interface (and routes pointing at the interface) can be put out of service by
  - Dial on demand activation failure (PPP only) - covered later in this module
  - Firewall - covered in module TT010 Stateful Route Inspection
  - "Always on" interface disconnected (PPP only) – covered later in this module
  - Failure of an auto ping (Eth only) – note that it is usually preferable to use SRI firewall rules
- An interface (and routes pointing at the interface) can be brought back into service by:
  - Timeout of out of service counter.
  - Firewall based interface testing - covered in module TT010 Stateful Route Inspection
  - Other interfaces changing state – configure interfaces to remove oos state on in routing table
  - Always on interfaces connecting

Physical Interface Linkage

- Each physical interface must link to a routable interface
  - xDSL (ADSL and VDSL) eth or PPP depending on encapsulation
  - Ethernet → Eth
  - Cellular → PPP
  - Serial → PPP
  - Wi-Fi → Eth
  - PSTN → PPP
  - ISDN → PPP
  - PPTP → PPP
  - L2TP → PPP
- For cellular and/or PSTN physical interfaces, PPP must be linked to a Modem Call Control entity known as modemcc.
- The linkage can be configured on the PPP entity configuration page, but in addition on the "PPP Mappings" web page shown opposite.



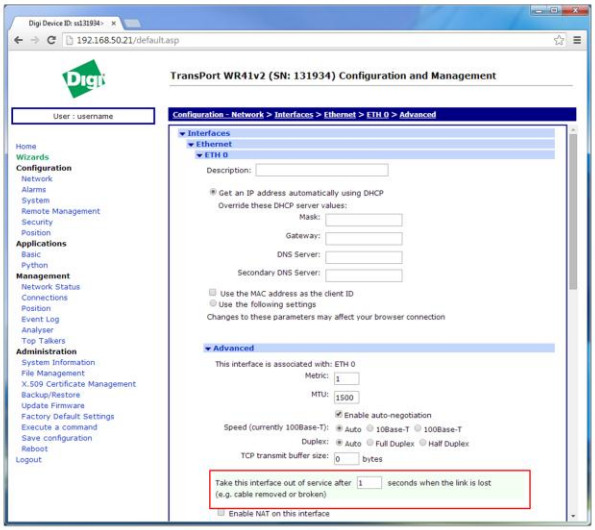
PPP(Point to Point Protocol)

- PPP has two modes of activation
  - Dial on demand
  - Always on
- The behaviour of the routes is different depending upon the PPP mode of activation.
- Routes will go out of service automatically if an always ON PPP is not connected.

  (If this also needs to happen before a PPP has ever been connected, then the imoos PPP parameter must be enabled. Note that this is enabled in the standard factory default configuration file.)

Ethernet Link State

- Configured Ethernet interfaces will normally be considered “up” (with routes pointing at the interfaces in service) even if the Ethernet cable is disconnect.
- To change this behaviour configure the link_deact parameter which is “Take this interface out of service after x seconds when the link is lost”
- When an Ethernet interface is out of service, routes pointing at the interface will also be out of service.
- This is important for failover scenarios e.g. primary WAN link is Eth and backup is Cellular.



Ethernet Hub vs Isolate Modes

- Multi-port TransPorts have two modes of operation:
  - HUB mode (default):
    - All Ethernet ports are linked together
    - Behaves like an Ethernet hub or switch.
    - Router will responds to all of its Ethernet IP addresses on all of its ports
    - Ethernet Hub group
      - Used in Hub mode to create port groups
      - Somewhat combines Hub and Port Isolate modes
      - E.g., group 3 ports for LAN connection and 1 port for WAN
      - VLAN Tagging
  - Port Isolate
    - All ports are isolated from each other
    - Router only responds to its Eth 0 IP address on physical port "LAN 0", its Eth 1 IP address on physical port "LAN 1", etc.
    - Router will not respond to its Eth 1 address on port "LAN 0" unless routing has been configured appropriately.
- Configuration not stored in config.da0 file for security reasons
- Note: VLAN tagging is not available when the router is configured for Port Isolate mode.

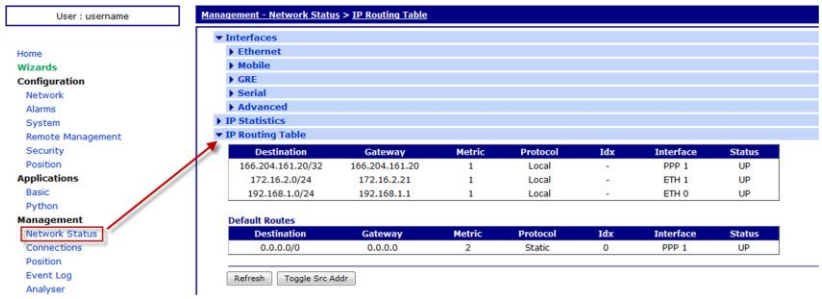
8

The ***Configuration - Network > Interfaces > Ethernet folder opens to list configuration pages for each of the available Ethernet instances on the unit. Each page allows the user to configure parameters such as the IP address, mask, gateway, etc.***
On units with only one Ethernet port, if more than one Ethernet instance exist these are treated as logical Ethernet ports. These instances can be used to assign more than one Ethernet IP address to a router.
On units with more than one physical Ethernet port, the Ethernet instances refer to the different physical Ethernet ports. These units can be configured for either "HUB" mode or "Port Isolate" mode.
In **HUB mode** all the Ethernet ports are linked together and behave like an Ethernet hub or switch. This means that the router will respond to all of its Ethernet IP addresses on all of its ports (as the hub/ switch behavior links the ports together).
In **Port Isolate** mode the router will only respond to its Ethernet 0 IP address on physical port "LAN 0", its Ethernet 1 IP address on physical port "LAN 1", etc. The router will not respond to its Ethernet 1 address on port "LAN 0" unless routing has been configured appropriately.
When configured for HUB mode it is important that no more than one of the router's ports is connected to another hub or switch on the same physical network otherwise an Ethernet loop can occur. The default behavior is "HUB" rather than "Port Isolate".
Ethernet Hub group
On units with a built-in hub/switch, the Ethernet Hub Group parameter for each port is normally set to 0. This means that all ports "belong" to the same hub. If required however, the Hub Group parameter may be used to isolate specific ports to create separate hubs. For example, if Ethernet 0 and Ethernet1 have their Group parameter set to 0 whilst Ethernet 2 and Ethernet 3 have their Group parameter set to 1, the unit will in effect be configured as two 2-port hubs instead of one 4-port hub. This means that traffic on physical ports "LAN 0" and "LAN 1" will not be visible to traffic on physical ports "LAN 2" and "LAN 3" (and vice versa). Group numbers can be 0 – 3 or use 255 for an interface to be in all groups. This parameter is not available on the web page when the unit is configured for Port Isolate mode.

Routing Protocols

- Routing protocols are often used when there are multiple paths to a destination.
- Examples BGP, RIP, OSPF, nHRP
- Inject dynamic routes into the routing table
- Advertise routes to other routers

Routing Table



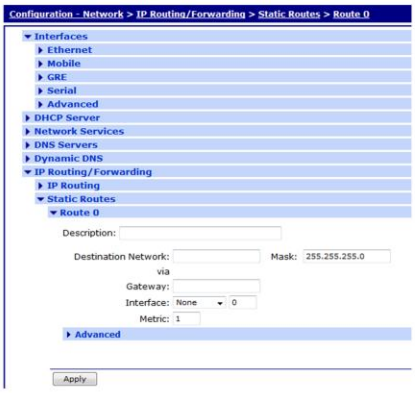

```
route print
       Destination          Gateway    Metric    Protocol  Idx Interface  Status
-------------------------------------------------------------------------------
  166.204.161.20/32   166.204.161.20       1       Local     -   PPP 1       UP
     172.16.2.0/24      172.16.2.21       1       Local     -   ETH 1       UP
    192.168.1.0/24      192.168.1.1       1       Local     -   ETH 0       UP

         0.0.0.0/0                        2      Static     0   PPP 1       UP

OK
```

Dynamic Routes

- Dynamic routes are created automatically when an interface is configured or connected
- For example configuring an Ethernet 0 interface with an IP address of 192.168.1.1 and mask of 255.255.255.0 will cause a dynamic route to be created automatically
- Thus any packet with destination IP address in the range 192.168.1.0 to 192.168.1.255 will automatically be routed through to the Ethernet 0 interface

Static Routes

- Static routes can be added by configuring a route in Configuration - Network > IP Routing/Forwarding > Static Routes > Route X (where X is an instance number)
- The minimum configuration required to add a static route is:
  - IP Address
  - Mask
  - Interface
  - Interface number
- If a static route is "pointing" at an Ethernet interface then optionally a *gateway IP address* can be added
  - If a gateway IP address is not added then the gateway IP address configured for the Ethernet interface itself will be used automatically



CLI Command: "route [n] [parameter] [value]"

Default Routes

- Default routes can be added by configuring a route in Configuration - Network > IP Routing/Forwarding > Static Routes > Default Route X (where X is an instance number)
- Default routes will match packets with any destination IP address (when in service) that are not defined in any other route
- If a default route is configured, packets with destination IP addresses that do not match any of the dynamic or static routes will be sent out the interface specified in the first "in service" default route

Routing Modes

- The TransPort has 2 routing modes available:
  - *CIDR routing mode* - Default mode on new TransPorts
  - *TransPort routing mode* - the original routing method and may be seen on existing /legacy installations

- This parameter rarely needs to be changed
  - Web GUI: Configuration - Network > IP Routing/Forwarding > IP Routing
  - CLI command: `ip 0 cidr [off|on]`

Routing Order – CIDR routing mode

- CIDR routing is enabled – This is the *Default* mode
- When the TransPort receives an IP packet to route, the routing table is used to decide through which interface to send the packet
- Usually the destination IP address of the IP packet is compared with the IP Address and Mask of each entry in the routing table
- There may be *more than one match* and in this case the *most specific route* is used to route the packet. I.e., a matching /24 route is used *before* a matching /16 route
- If multiple routes match the destination and have the same prefix length, the index number of the routes in the routing table is used to determine the route.
- CLI command = **`ip 0 cidr on`** – ensure this is present in config.da0

15

CIDR routing is disabled in TransPort routing mode

Turn CIDR on and do not use the old routing mode. Old routing order of precedence is included here for reference:

When the TransPort receives an IP packet to route, the routing table is used to decide through which interface to send the packet

Usually the destination IP address of the IP packet is compared with the IP Address and Mask of each entry in the routing table in index order *regardless of the order* in the routing table or length of mask

There may be more than one match and in this case the *index number* of the route is taken into account

Order: Static routes are checked first, then dynamic routes, then default routes

CLI command = **`ip 0 cidr off`**

Route Metrics

- Route Metric settings can be set to override the order in which the routes are searched.
- Routes with lower metric numbers will always be used in preference to routes with higher metric numbers even if the routes with higher metric numbers appear first in the routing table.
- Route metrics can be configured by means of the route parameters:
  - Connected Metric
  - Disconnected Metric
- Route metrics can be altered automatically according to various circumstances. This is in order to provide automatic backup connection paths.
- Routes and interfaces can be put out of service.
  - Whenever an interface is out of service (oos) any route pointing at the interface will also be out of service
  - Whenever a route is out of service, the metric value will be set to 16

Always-on interface not connected

- An always-on PPP interface that is not connected will automatically be out of service (interface routes = metric 16 for TransPort routing mode or 17 for CIDR mode) if it is not connected, unless the TransPort has just started up
- If there is a severe problem with an always-on PPP interface the routes pointing at it will automatically be out of service and any backup interface configured will be used instead automatically
- An always on PPP interface can also be configured to go out of service if the first attempt at activating the interface after start up fails. (This is the Configuration - Network > Interfaces > Advanced > PPP 1 > Advanced "Put this interface "Out of Service" when an always-on connection attempt fails") In config.fac so enabled by default.

Dial-on-demand interface activation failure

- Not widely used for cellular/ADSL interfaces
- Route in/out of service behaviour for dial-on-demand interfaces is different than always-on interfaces. (e.g. a PPP instance with the "Always on mode" parameter turned on is an always-on interface)
- The discussion here applies to dial-on-demand PPP interfaces only
- By default, a route pointing at a dial-on-demand interface will not go out of service if something goes wrong
- Setting the "IP route out of service time (s)" parameter (Configuration - Network > IP Routing/Forwarding > IP Routing) to a non-zero value will cause a route to go out of service (for the value of time specified) if a PPP interface fails to activate

The mobile PPP interface should normally be left as "Always On."

Dial-on-demand interface activation failure

- If another route (either further down the routing table or that normally has a higher metric) exists for the same destination IP network, the next time the TransPort receives a packet to route the interface specified by the alternate route will be used instead.
- The alternate route and interface will be used until the “IP route out of service time” has expired. Once this time expires the original route will come back into service again.
- Careful use of the “Connected Metric” and “Disconnected Metric” parameters can be used to determine whether the original interface is used as soon as it returns to service or only when the backup interface has disconnected e.g. due to inactivity

Advanced Route Parameters

- Source v destination routing
- Interface deactivation when a route comes in/out of service. (e.g. terminate cellular when Wi-Fi becomes available)
- Power up delay

Cover use case in some detail, e.g. with a diagram

SarOS Failover Techniques

- ICMP pings
- Firewall – SRI TCP/UDP/ICMP
- SRI + Testing and Recovery
- Routing Protocols (BGP/OSPF/RIP) GRE usually needed
- VRRP +

Summary

- Interface Types
- Route types and routing tables
- Routing Protocols
- Routing modes
- Route metrics
- Dial-on-demand interfaces
- Always on interface

Hands-On Practical Session Routing

HOPS

- Eth to cellular failover (link_deact + auto ping -> OOS)
- Configuration of hub mode vs port isolate mode
- Configuration of hub groups