

Voice over IP (VoIP) LLDP Configuration for Dell Networking N-Series switches

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1 Introduction

Dell Networking N-Series Switches provide some automated features for supporting VoIP applications that were not previously available on Dell PowerConnect Switches. These features reduce configuration statements and the time to deployment for a Campus LAN VoIP Solution. Certain configuration selections that would be required in past Dell Networking Switch configurations are no longer required in the Dell Networking N-Series but there are some configuration parameters that are required for a successful VoIP configuration. This Document will discuss the changes from older PowerConnect Switch VoIP configurations to the N-Series.

Dell Networking N-series Switches have two methods for discovering devices and device capabilities that are attached to switch ports, LLDP and ISDP. Link Layer Discovery Protocol (LLDP) is an Industry Standard that is used by all major Switch manufacturers and VoIP Solution providers. Industry Standard Discovery Protocol (ISDP) is a compatible version of Cisco's Cisco Discovery Protocol (CDP). Cisco VoIP devices use CDP for device discovery and can use LLDP. Cisco is the only VoIP Solution provider that uses CDP for device discovery. Dell Networking N-Series switches support LLDP and ISDP (interoperates with Cisco CDP). In the Dell Networking N-Series Switches, both ISDP and LLDP are enabled by default.

The switch identifies the device as a VoIP phone by one of the following protocols:

- CDP or ISDP for Cisco VoIP phones
- DHCP vendor-specific options for Avaya VoIP phones
- LLDP-MED for most VoIP phones

The previous versions of Dell Networking Campus Switches, PowerConnect used specific configuration commands to provide discovery for VoIP devices using LLDP and LLDP-MED. This required inputting the VoIP device manufacturer OID code in to the Switch configuration.

This is an example of a working PowerConnect 5500 LLDP configuration for Mitel VoIP devices.

```
voice vlan oui-table add 08000f Mitel
voice vlan id 100
lldp med network-policy 1
voice vlan 100
vlan-type tagged up 6 dscp 46
lldp med network-policy 2
voice-signaling vlan 100
  vlan-type tagged up 3 dscp 46
interface gigabitethernet1/0/1

spanning-tree portfast
lldp med enable network-policy
  location poe-pse inventory
  lldp med network-policy add 1
  lldp med network-policy add 2
switchport mode trunk
switchport trunk allowed vlan remove 100
voice vlan enable
```

The commands above tell the phone to boot on VLAN 100 tagged via DHCP.

In the Dell Networking N-Series, some of these commands are not necessary (Dell EMC has already taken care of OID, DSCP and automated some LLDP configuration statements. The Dell Networking N-Series Switches also use a different interface switch mode configuration for a VoIP Solution, 'switchport mode general'. Switchport mode general allows a port to support multiple VLANs but not have to be configured as a 'trunk' port. General ports can act like access or trunk ports or a hybrid of both.

Table 21-2. Switchport Mode Behavior

Mode	VLAN Membership	Frames Accepted	Frames Sent	Ingress Filtering
Access	One VLAN	Untagged/ Tagged	Untagged	Always On
Trunk	All VLANs that exist in the system (default)	Untagged/ Tagged	Tagged and Untagged	Always On
General	As many as desired	Tagged or Untagged	Tagged or Untagged	On or Off

2 N-Series Switch Default Configuration

Let's start by reviewing the N-Series Switch in a 'defaulted' configuration for LLDP. The N-Series Switch has numerous features that have been already enabled. The Command Line Interface (CLI) does not show all the defaulted configuration parameters in the CLI 'running configuration'. The running-configuration show basic information AND configuration statements that are changed from the defaults.

For example in the defaulted N-Series Switch configuration, the only VLAN present is VLAN 1 and all ports belong to VLAN 1. Protocols necessary for initial switch operation like Spanning-tree are enabled but not shown in the 'running-config' display. The discovery Protocols ISDP and LLDP are enabled for all ports but for LLDP, we will have to make a few configuration changes to enable the N-Series Switches to operate like the PowerConnect 5500 did in our Mitel VoIP LLDP example

This is an N-series Switch defaulted configuration with two additional configuration statements. An IP address was added to VLAN 1 to allow the Web interface to be displayed and a new User was added with a Password and a Privilege of 15, the highest.

!Current Configuration:

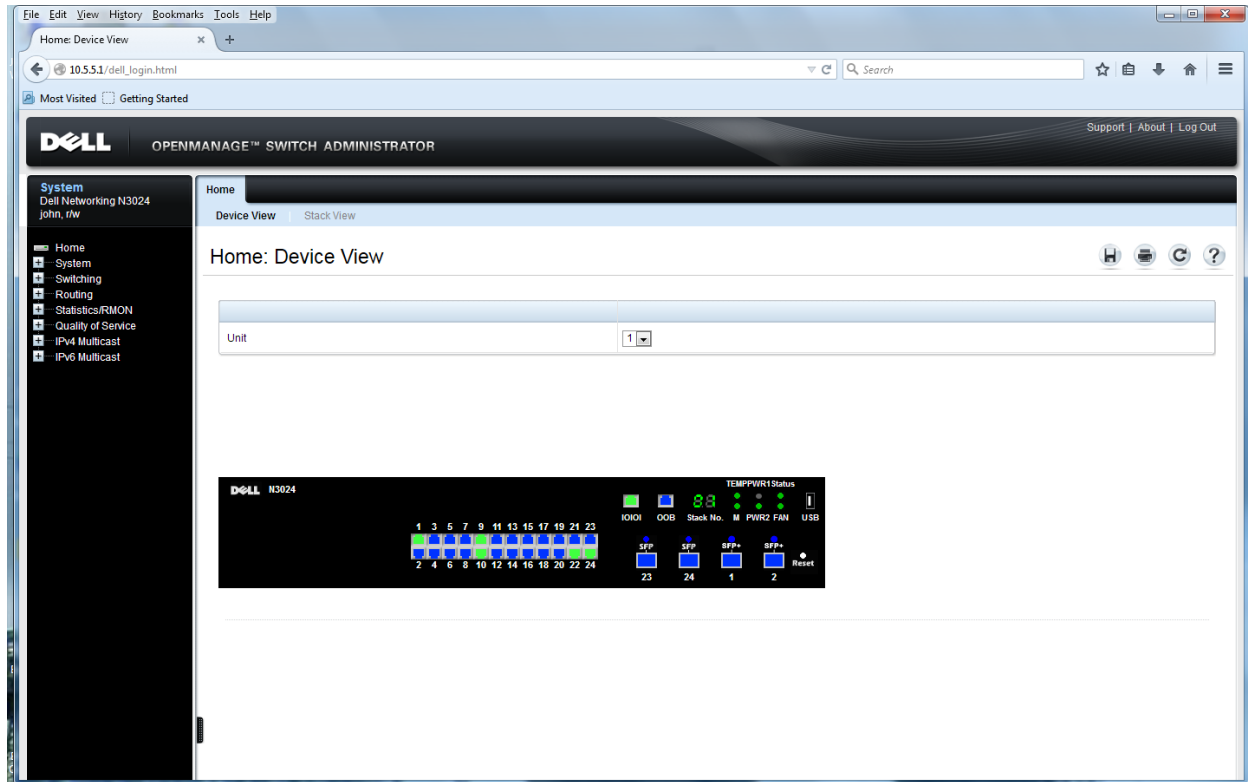
```
!System Description "Dell Networking N3024, 6.1.2.4, Linux 3.6.5-601418a5"
!System Software Version 6.1.2.4
!
configure
slot 1/0 1      ! Dell Networking N3024
stack
member 1 1      ! N3024
exit
interface vlan 1
ip address 10.5.5.1 255.255.255.0
exit
username "john" password 1c065ad7087eb8ce058b02e38654a2c4 privilege 15 encrypted
snmp-server engineid local 800002a203f8b1562b9ab2
exit
```

BEST PRACTICES

It is not recommended to use VLAN 1 for Data or Voice configurations. VLAN 1 can represent a security risk. In the N-Series, VLAN is the default (by default the 'native' VLAN). Ports that are unassigned to other VLANs are configured to VLAN1.

3 Web Interface

This is the Web Interface Starting page. It shows a map of the switch with status for the Switch and Interfaces and a set of configuration menus on the left panel.



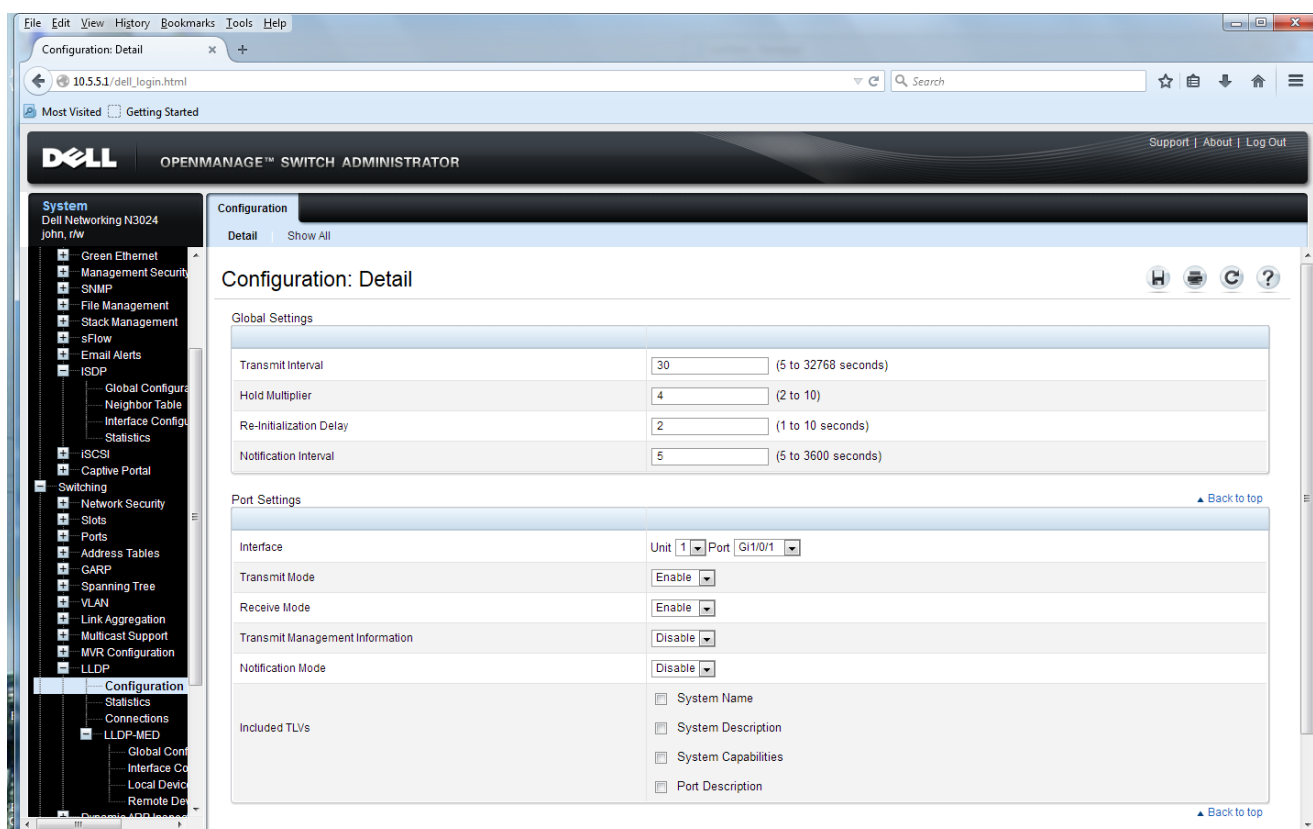
4 Default Switch Configuration for LLDP

We will look at the default LLDP Configuration using the Web Interface.

What is LLDP?

LLDP is a standardized discovery protocol defined by IEEE 802.1AB. It allows stations residing on an 802 LAN to advertise major capabilities physical descriptions, and management information to physically adjacent devices allowing a network management system (NMS) to access and display this information.

LLDP Configuration at Switch Default



Notice Transmit Management Information and Notification Mode are disabled. The included TLV's are not checked.

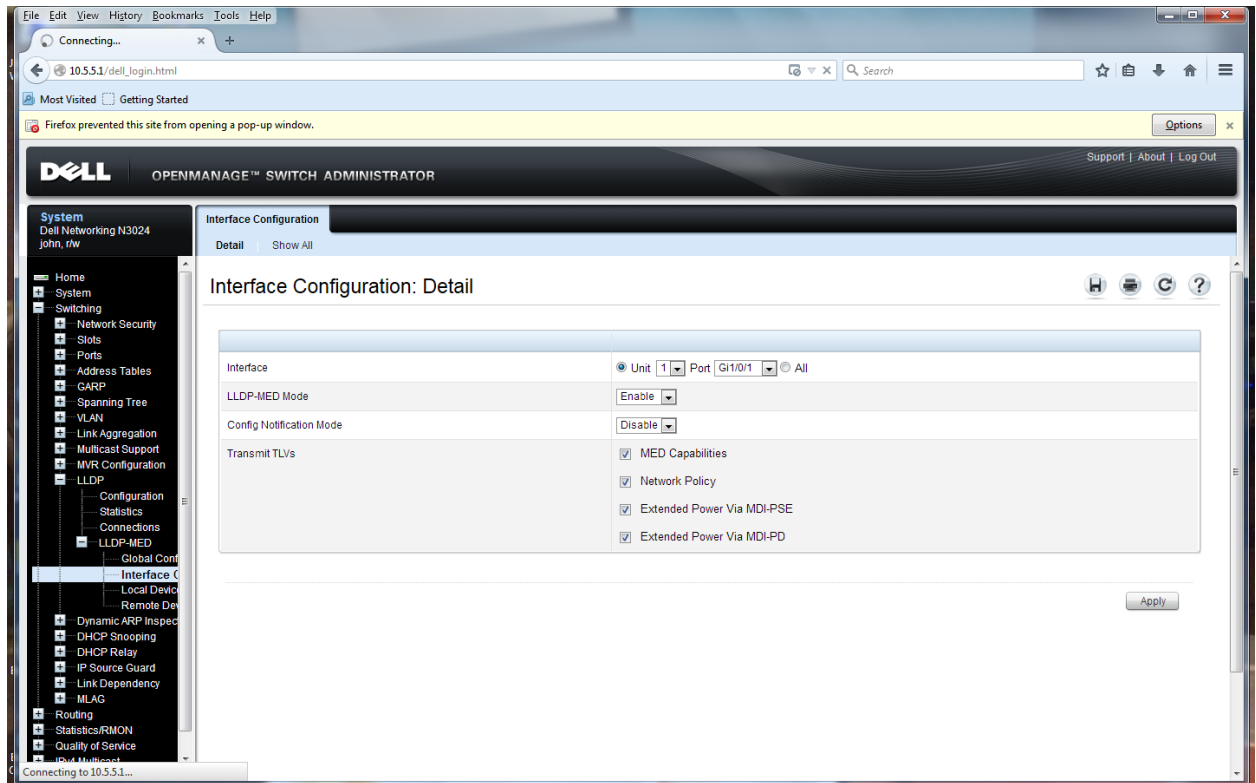
If we use the CLI, this is the LLDP default Configuration display.

console(config)#show lldp interface all

LLDP Interface Configuration

Interface	Link	Transmit	Receive	Notify	TLVs	Mgmt
-----	-----	-----	-----	-----	-----	-----
Gi1/0/1	Down	Enabled	Enabled	Disabled		N
Gi1/0/2	Down	Enabled	Enabled	Disabled		N
Gi1/0/3	Down	Enabled	Enabled	Disabled		N
Gi1/0/4	Down	Enabled	Enabled	Disabled		N
Gi1/0/5	Down	Enabled	Enabled	Disabled		N
Gi1/0/6	Down	Enabled	Enabled	Disabled		N
Gi1/0/7	Down	Enabled	Enabled	Disabled		N
Gi1/0/8	Down	Enabled	Enabled	Disabled		N
Gi1/0/9	Up	Enabled	Enabled	Disabled		N
Gi1/0/10	Up	Enabled	Enabled	Disabled		N
Gi1/0/11	Down	Enabled	Enabled	Disabled		N
Gi1/0/12	Down	Enabled	Enabled	Disabled		N
Gi1/0/13	Down	Enabled	Enabled	Disabled		N
Gi1/0/14	Down	Enabled	Enabled	Disabled		N
Gi1/0/15	Down	Enabled	Enabled	Disabled		N
Gi1/0/16	Down	Enabled	Enabled	Disabled		N
Gi1/0/17	Down	Enabled	Enabled	Disabled		N
Gi1/0/18	Down	Enabled	Enabled	Disabled		N
Gi1/0/19	Down	Enabled	Enabled	Disabled		N
Gi1/0/20	Down	Enabled	Enabled	Disabled		N
Gi1/0/21	Down	Enabled	Enabled	Disabled		N
Gi1/0/22	Up	Enabled	Enabled	Disabled		N
Gi1/0/23	Down	Enabled	Enabled	Disabled		N
Gi1/0/24	Up	Enabled	Enabled	Disabled		N
Te1/0/1	Down	Enabled	Enabled	Disabled		N
Te1/0/2	Down	Enabled	Enabled	Disabled		N
Tw1/0/1	Detach	Enabled	Enabled	Disabled		N
Tw1/0/2	Detach	Enabled	Enabled	Disabled		N

LLDP also has a Media EndPoint Device (MED) configuration. This is how the LLDP-MED Interface looks on a defaulted N-Series Switch.



Notice the **Config Notification Mode** is disabled.

If we use the CLI, this is the LLDP default Configuration display.

console(config)#do show lldp med interface all

TLV Codes: 0- Port Description, 1- System Name
2- System Description, 3- System Capabilities

Interface	Link	configMED	operMED	ConfigNotify	TLVsTx
-----	-----	-----	-----	-----	-----
Gi1/0/1	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/2	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/3	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/4	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/5	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/6	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/7	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/8	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/9	Up	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/10	Up	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/11	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/12	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/13	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/14	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/15	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/16	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/17	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/18	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/19	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/20	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/21	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/22	Up	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/23	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/24	Up	Enabled	Disabled	Disabled	0,1,2,3
Te1/0/1	Down	Enabled	Disabled	Disabled	0,1,2,3
Te1/0/2	Down	Enabled	Disabled	Disabled	0,1,2,3
Tw1/0/1	Detach	Enabled	Disabled	Disabled	0,1,2,3
Tw1/0/2	Detach	Enabled	Disabled	Disabled	0,1,2,3

5 Voice VLAN

Voice VLAN and LLDP-MED

The interactions with LLDP-MED are important for Voice VLAN:

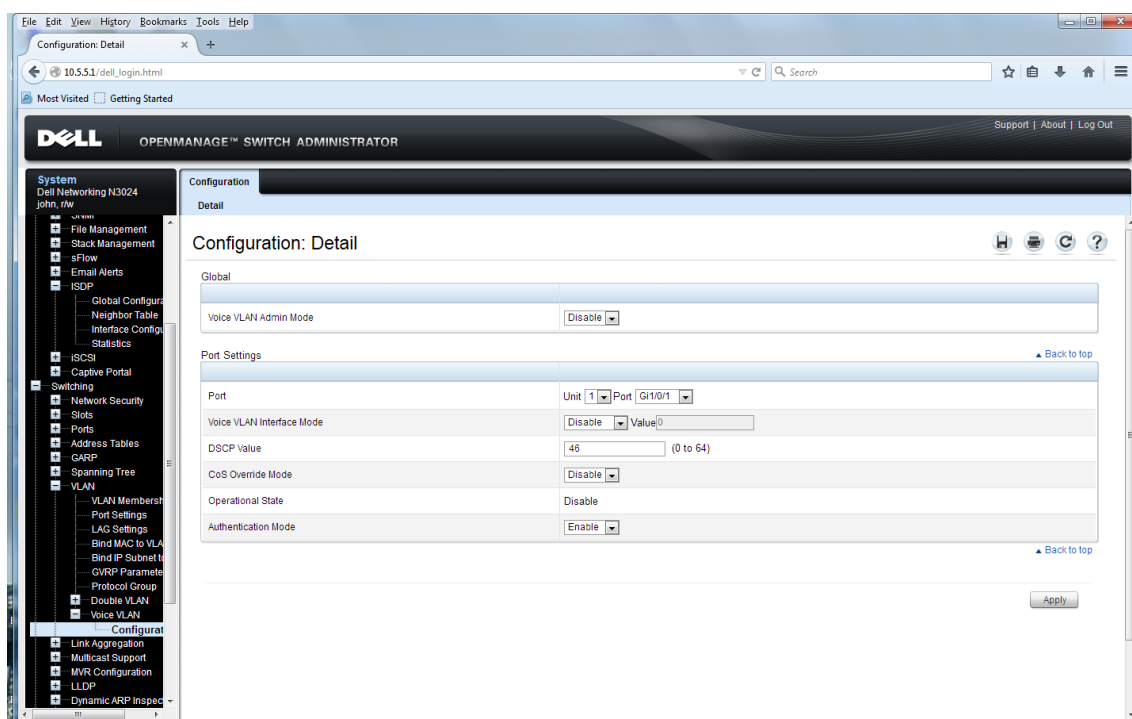
- LLDP-MED notifies the Voice VLAN component of the presence and absence of a VoIP phone on the network.
- The Voice VLAN component interacts with LLDP-MED for applying VLAN ID, priority, and tag information to the VoIP phone traffic.

The N-Series has a Voice VLAN feature to provide configured defaults for the proper operation of a VoIP Solution.

Voice VLAN

The Voice VLAN feature enables switch ports to carry voice traffic with defined priority. The priority level enables the separation of voice and data traffic coming onto the port. Voice VLAN is the preferred solution for enterprises wishing to deploy voice services in their network.

Voice VLAN



Using the CLI the same information can be shown.

console(config)#do show voice vlan interface all

```
Interface..... Gi1/0/1
Voice VLAN Interface Mode..... Disabled
Voice VLAN COS Override..... False
Voice VLAN DSCP Value..... 46
Voice VLAN Port Status..... Disabled
Voice VLAN Authentication..... Enabled

Interface..... Gi1/0/2
Voice VLAN Interface Mode..... Disabled
Voice VLAN COS Override..... False
Voice VLAN DSCP Value..... 46
Voice VLAN Port Status..... Disabled
Voice VLAN Authentication..... Enabled

Interface..... Gi1/0/3
Voice VLAN Interface Mode..... Disabled
Voice VLAN COS Override..... False
Voice VLAN DSCP Value..... 46
Voice VLAN Port Status..... Disabled
Voice VLAN Authentication..... Enabled
```

6

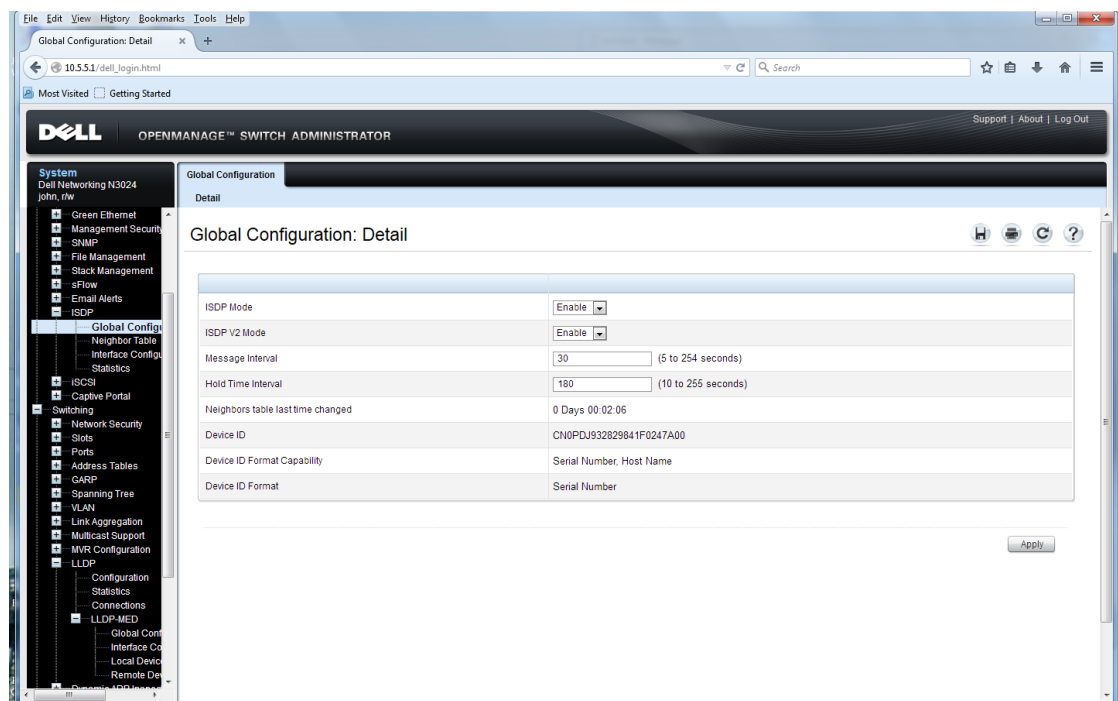
Default Switch Configuration for ISDP

As stated previously, ISDP is an interoperable version of Cisco's CDP that is available on Dell Networking N-Series Switches.

What Is ISDP?

The Industry Standard Discovery Protocol (ISDP) is a proprietary Layer 2 network protocol that inter-operates with Cisco devices running the Cisco Discovery Protocol (CDP). ISDP is used to share information between neighboring devices. The switch software participates in the CDP protocol and is able to both discover and be discovered by other CDP-supporting devices.

This displays the N-Series Switch default configuration for ISDP.



console(config)#show isdp

```

Timer..... 30
Hold Time..... 180
Version 2 Advertisements..... Enabled
Neighbors table time since last change..... 0 days 00:02:06
Device ID.....
CN0PDJ932829841F0247A00
Device ID format capability..... Serial Number, Host
Name
Device ID format..... Serial Number
  
```

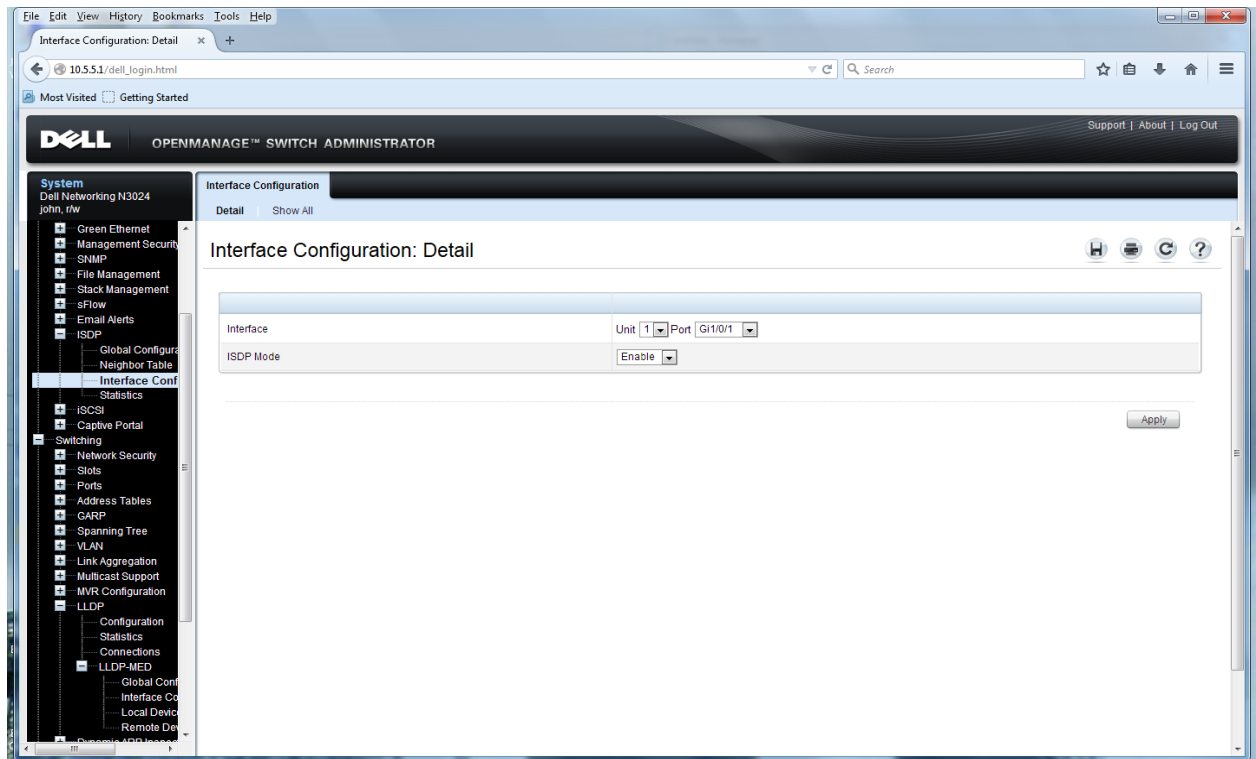
ISDP Neighbor Table

The screenshot displays the Dell OpenManage Switch Administrator web interface. The left sidebar shows a navigation tree with the 'Neighbor Table' option selected under the 'ISDP' section. The main content area is titled 'Neighbor Table: Detail' and includes a 'Detail' tab. Below the title, there is a 'Capability Codes' section with a text box containing the codes: 'R - Router, T - Trans Bridge, B - Source Route Bridge, S - Switch, H - Host, I - IGMP, r - Repeater'. The 'Neighbor Table' section contains a table with the following data:

Device ID	Interface	IP Address	Version	Holdtime(secs)	Capability	Platform	PortID	Protocol Version	Last Time Changed
John3024P_Dot1	Gi1/0/10	10.168.1.10.100.100.1	6.1.2.4	178	R	N3024P	Gi1/0/10	2	0 Days 0h: 2m: 6s
John3024P_Dot1	Gi1/0/24	10.168.1.1	6.1.2.4	178	R	N3024P	Gi1/0/24	2	0 Days 0h: 2m: 6s

Below the table, there is a 'Clear' button and a 'Back to top' link.

ISDP Interface Table



Using the CLI, this is the display to show ISDP for all interfaces.

console(config)#show isdp interface all

Interface	Mode
-----	-----
Gi1/0/1	Enabled
Gi1/0/2	Enabled
Gi1/0/3	Enabled
Gi1/0/4	Enabled
Gi1/0/5	Enabled
Gi1/0/6	Enabled
Gi1/0/7	Enabled
Gi1/0/8	Enabled
Gi1/0/9	Enabled
Gi1/0/10	Enabled
Gi1/0/11	Enabled
Gi1/0/12	Enabled
Gi1/0/13	Enabled
Gi1/0/14	Enabled
Gi1/0/15	Enabled
Gi1/0/16	Enabled
Gi1/0/17	Enabled
Gi1/0/18	Enabled
Gi1/0/19	Enabled
Gi1/0/20	Enabled
Gi1/0/21	Enabled
Gi1/0/22	Enabled
Gi1/0/23	Enabled
Gi1/0/24	Enabled
Te1/0/1	Enabled
Te1/0/2	Enabled
Tw1/0/1	Enabled
Tw1/0/2	Enabled

7 Configuring the Dell Networking Switch for LLDP, LLDP-MED

These are the configuration tasks for implementing VoIP using LLDP, LLDP-MED (instead of ISDP) .This configuration covers VoIP Solutions that do not use or require CDP (Cisco Discovery protocol / ISDP) for device discovery.

It is recommended that the Voice VLAN feature be enabled to automate the configuration tasks for VoIP

QOS configuration commands. We'll assume that the user is logged into the CLI, has the interface in enable mode and has executed the command 'config'.

```
console(config)#vlan 5,10
```

This configures VLAN Interfaces 5 and 10. In this example we will use VLAN 5 for Data and 10 for Voice

```
console(config)#voice vlan
```

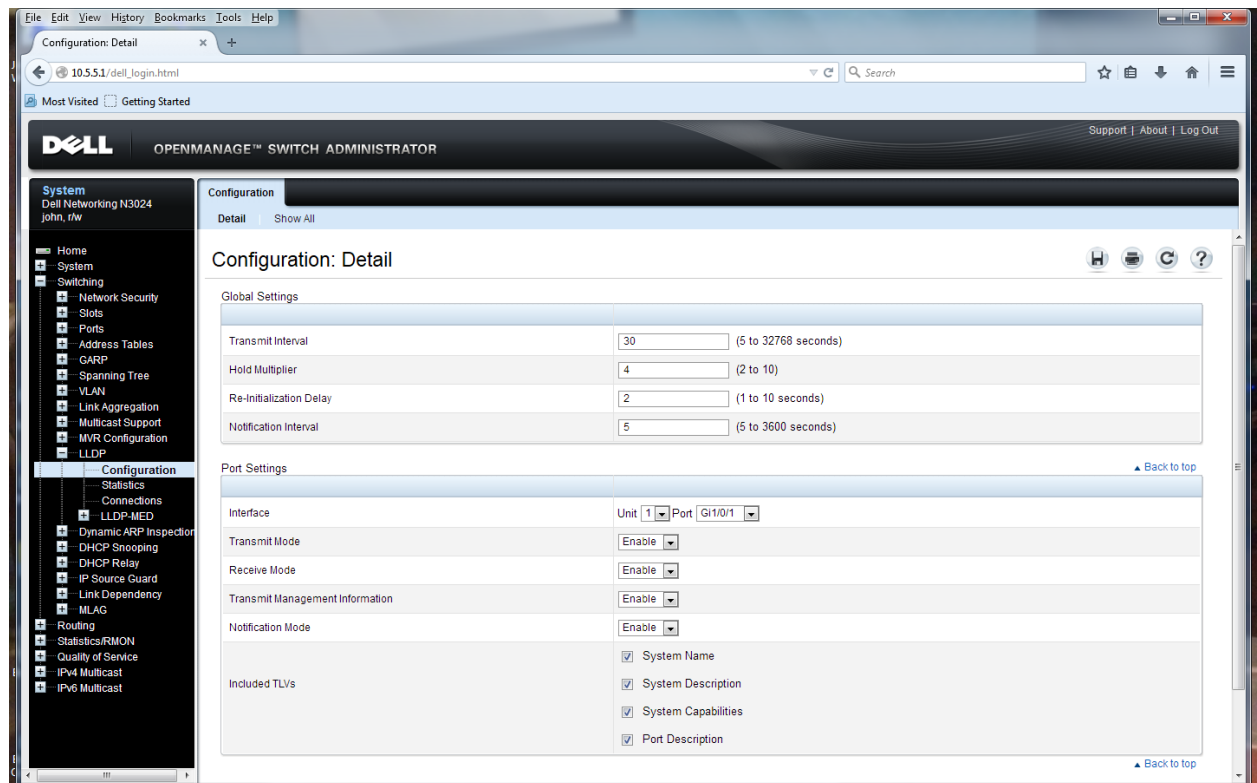
This enables the voice vlan feature.

```
console(config)#voice vlan 10
```

This sets the Voice VLAN to VLAN 10.

We will use the Web interface to enable the LLDP, LLDP-MED features required to enable VoIP Discovery and the passing of device information to the switch. We will check the settings with the CLI. We can compare them to the default switch settings that were documented at the beginning of this document.

In the Switching Section of the Web Interface LLDP can be selected. Enable Transmit Management Information and Notification Mode for the ports and check the TLV's we would like include.



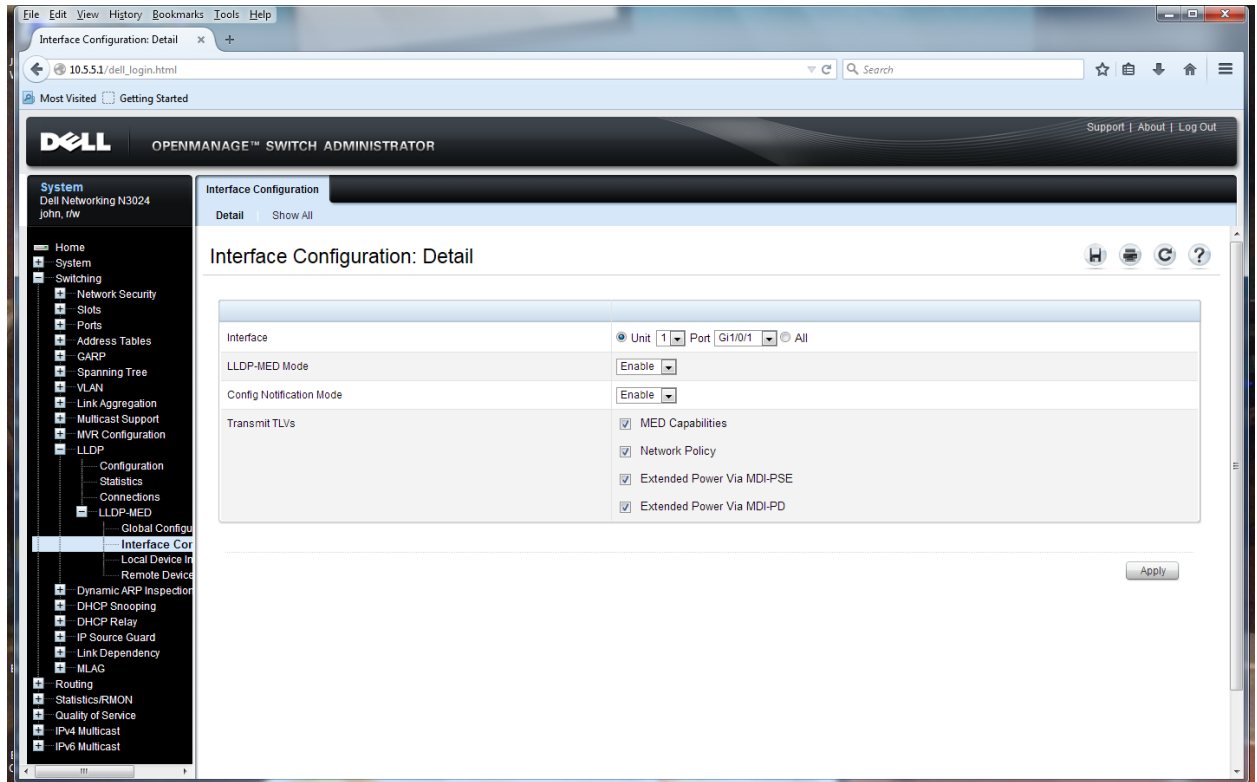
Checking the LLDP configuration in the CLI we see that the interface has changed enabling notify, management, and including TLV's.

```
console(config)#do show lldp interface all
```

LLDP Interface Configuration

Interface	Link	Transmit	Receive	Notify	TLVs	Mgmt
-----	-----	-----	-----	-----	-----	-----
Gi1/0/1	Up	Enabled	Enabled	Enabled	0,1,2,3	Y
Gi1/0/2	Down	Enabled	Enabled	Disabled		N
Gi1/0/3	Down	Enabled	Enabled	Disabled		N

To configure LLDP-MED select the Interface Configuration section and enable Config Notification Mode. Notice that we can select all interfaces using the 'O All' radial button.



Checking the configuration in the CLI, we see a change in the interface configuration where ConfigNotify has been enabled.

```
console(config)#do show lldp med interface all
```

```
TLV Codes: 0- Capabilities,          1- Network Policy
            2- Extended PSE,          3- Extended Pd
```

Interface	Link	configMED	operMED	ConfigNotify	TLVsTx
Gi1/0/1	Up	Enabled	Disabled	Enabled	0,1,2,3
Gi1/0/2	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/3	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/4	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/5	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/6	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/7	Down	Enabled	Disabled	Disabled	0,1,2,3
Gi1/0/8	Down	Enabled	Disabled	Disabled	0,1,2,3

8 Dell VoIP Switch Configuration

The deployment of VoIP in an infrastructure is usually done with the Switch Ethernet POE port connected to the VoIP Device and the PC (data device) connected to the switch in the VoIP Device.

This results in one POE drop to a desk that can handle both Voice and Data. The switch configuration will use 'tagged' VLANs for the Voice and untagged (sometime referred to as the 'Native' VLAN on the port) VLAN for the Data. For the N-Series switches, we use the configuration 'switchport mode general' for supporting Voice and Data VLANs on the same port. As a reminder, it is a **Best Practice to use VLAN ID other than 1**.

This would be a typical port configuration for port that supports VoIP and Data.

```
interface Gi1/0/1
switchport mode general
switchport general pvid 5
switchport general allowed vlan add 5
switchport general allowed vlan add 10 tagged
voice vlan 10
voice vlan auth disable
exit
```

We may also want to set a strict COS (Class of Service) queuing for Voice.

```
classofservice dot1p-mapping 5 5
cos-queue min-bandwidth 0 0 5 5 10 30 40 cos-queue strict 5
```

Configuration TIP – use interface range commands to configuration a number of ports with the same configuration.

```
console(config)#interface range gigabitethernet 1/0/1-10
```

This is the configuration showing Voice VLAN, LLDP Interface changes, LLDP-MED interface changes, the Interface changes to support Voice / Data on the same port and the Class of Service changes.

```
!Current Configuration:
!System Description "Dell Networking N3024, 6.1.2.4, Linux 3.6.5-601418a5"
!System Software Version 6.1.2.4
!
configure
vlan 5,10
exit
slot 1/0 1      ! Dell Networking N3024
stack
member 1 1      ! N3024
exit
interface vlan 1
```

```

ip address 10.5.5.1 255.255.255.0
exit
interface vlan 10
ip address 10.10.10.1 255.255.255.0
exit
username "john" password 1c065ad7087eb8ce058b02e38654a2c4 privilege
15 encrypted
!
interface Gi1/0/1
switchport mode general
switchport general pvid 5
switchport general allowed vlan add 5,10
lldp transmit-tlv port-desc sys-name sys-desc sys-cap
lldp transmit-mgmt
lldp notification
lldp med confignotification
voice vlan 10
exit
snmp-server engineid local 800002a203f8b1562b9ab2
exit

```

Differentiated Service Code Point (DCSP) mappings for Voice are already setup by default.

```

console#show voice vlan interface gigabitethernet 1/0/1

Interface..... Gi1/0/1
Voice VLAN Interface Mode..... Enabled
Voice VLAN ID..... 10
Voice VLAN COS Override..... False
Voice VLAN DSCP Value..... 46
Voice VLAN Port Status..... Disabled
Voice VLAN Authentication..... Enabled

```