



Application Note



Using port-based DHCP with ROQSTAR Managed Ethernet Switches

Introduction

DHCP allows for a centralized assignment of IP addresses, which dispenses with the need to configure IP addresses statically in every single network device.

However, with standard pool-based DHCP the addresses are assigned dynamically, which means that a device will not always have the same address. Compared to a static assignment this makes communication between devices more difficult.

Especially in fixed network topologies having a fixed addressing scheme to ensure that a certain device always has the same, known IP address is desirable.

This goal can be realized by using port-based DHCP: A device connected to a certain port will always receive the same IP.

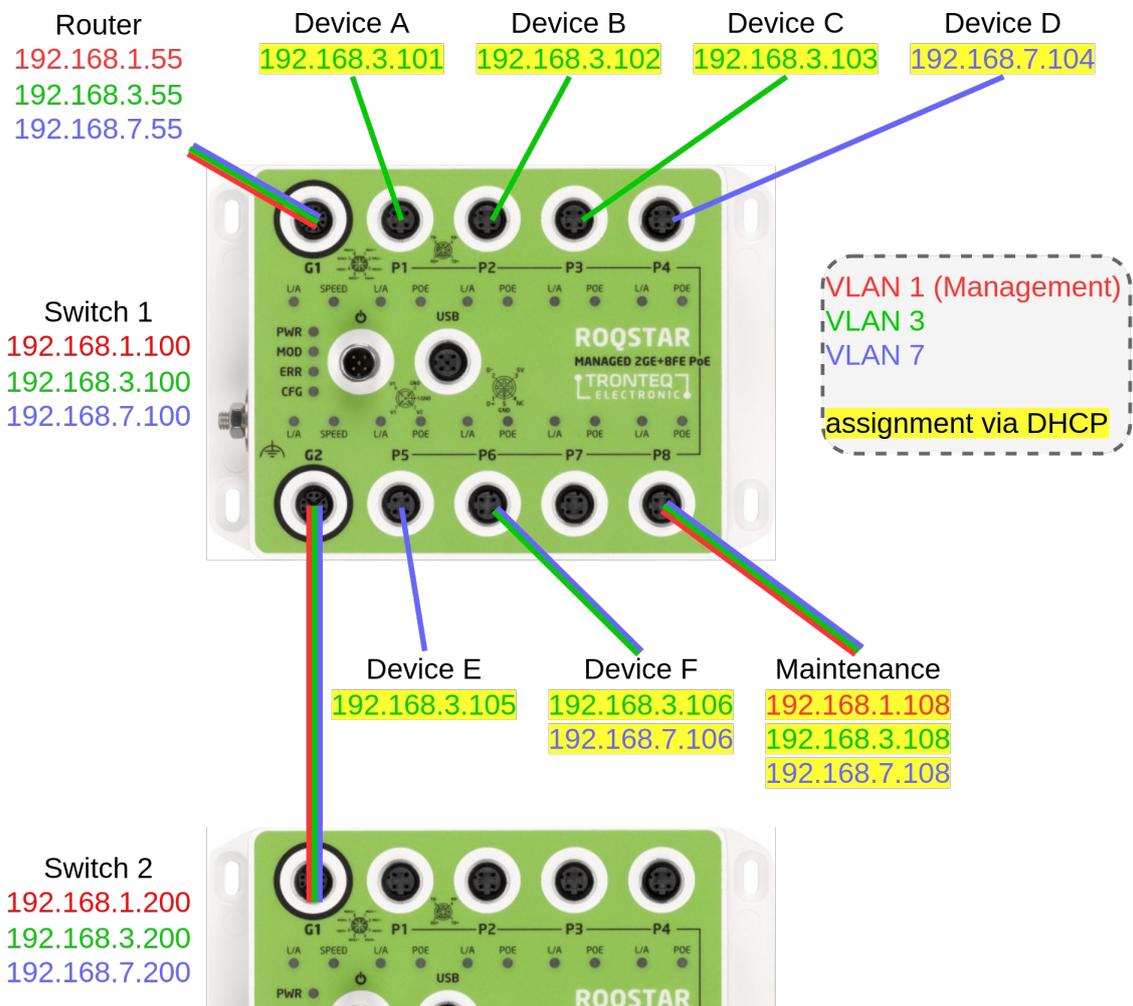
This document describes how to set up port-based DHCP with ROQSTAR Managed Gigabit Ethernet Switches.

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1 Usage scenario

The descriptions in this document are based on the following example scenario:



It consists of a Managed Gigabit Ethernet Switch and several peripheral devices.

More switches with similar peripherals connected to them could be added, as indicated by Switch 2. Care must be taken to keep IP addresses unique.

There are three VLANs, including one Management VLAN. The corresponding IP subnets are:

VLAN	IP Subnet	IP Subnet Mask
1	192.168.1.0	255.255.255.0
3	192.168.3.0	255.255.255.0
7	192.168.7.0	255.255.255.0

The ports used for connecting the switches, the router, Device F as well as the management port are configured as VLAN trunks, i.e. they are members of multiple VLANs and will transmit VLAN tags.

The other ports are untagged members of either of the two non-management VLANs.

The switches and the router have fixed IP addresses in each of the three VLANs. All other devices shall be issued IP addresses via DHCP, including the management port.



DHCP Clients

In order to utilize DHCP the peripheral devices must run a DHCP client.

Device F, for example, must request IP addresses in VLAN 3 and VLAN 7.

In addition to the IP address and subnet mask, the DHCP clients shall be offered the following parameters:

VLAN	DNS server IP	Gateway IP
1	192.168.1.55 (Router)	192.168.1.55 (Router)
3	192.168.3.55 (Router)	192.168.3.55 (Router)
7	192.168.7.55 (Router)	192.168.7.55 (Router)

2 Technical aspects

2.1 Port information

In order to be able to assign certain IP addresses based on the network port the requesting device is connected to, the DHCP server must know which port the DHCP request is coming from.

ROQSTAR Managed Ethernet Switches are able to gather this information for their local ports.

In scenarios where DHCP requests are forwarded the information can be preserved and transmitted by addition of DHCP option 82. That is not in the scope of this Application Note.

2.2 One server per VLAN

ROQSTAR Managed Gigabit Ethernet Switches have the ability to set up one DHCP server per VLAN. They can be configured independent from each other and are bound to the switch's corresponding IP subnets.

This way DHCP clients in multiple VLANs can be served in their proper subnet.

Since a port can be a member of multiple VLANs, it is possible to define port-based IPs in each of these VLANs. One such usage is the management port.

2.3 DHCP packet filtering

At ports where port-based DHCP is to be used, the switch must ensure that incoming DHCP packets are handled locally. They shall not be broadcast through the network, where they could be received and handled by other DHCP servers. This ensures that the DHCP client will only receive an offer of the desired IP address from the local switch.

This “filtering” causes the incoming DHCP packets to be consumed and handled by the switch’s software, they will be blocked from exiting any other port. The responses sent by the switch’s software will be sent out only at the client’s port. This keeps the DHCP communication for port-based assignment separate from the rest of the network.

Since a port can be a member of multiple VLANs, this filtering of DHCP packets is applied per VLAN. For example:

The ROQSTAR switch’s DHCP server for VLAN 3 is enabled and a port-based IP is defined for port P8. But in VLAN 4 there is no port-based IP defined (the DHCP server for VLAN 4 is either disabled or using pool-based assignment).

Then, for port P8, the DHCP packets belonging to VLAN 3 will be filtered; whereas the DHCP packets belonging to VLAN 4 will be handled normally (including broadcast).



Additional DHCP servers

Thanks to the filtering applied to the ports that use port-based DHCP, it is possible to run additional DHCP servers in the rest of the network. This includes other port-based and also pool-based assignment schemes.

Of course, in order to avoid IP conflicts, care must be taken to ensure there is no overlapping of the offered IP addresses across different servers – whether defined via pool or port-based.

2.4 Lease time and device exchange

With traditional DHCP the DHCP server grants the usage of an IP address to the client for an amount of time called the lease time. Excepting the voluntary freeing of the IP by the client, the IP will not be offered to another client during this time.

This is different with port-based DHCP: The defined IP will be offered to any client at this port, even if the lease time is not expired yet. Port-based DHCP is intended for a single client, not multiple devices, connected to a port.

A consequence of this special behaviour is that after exchanging a client device, the newly connected device will immediately be offered the same IP address.

3 ROQSTAR settings

A summary of the port-based settings for Switch 1:

Port	Description	VLAN	DHCP port-based
G1	Router	1 (tagged)	--
		3 (tagged)	--
		7 (tagged)	--
G2	Switch 2	1 (tagged)	--
		3 (tagged)	--
		7 (tagged)	--
P1	Device A	3 (untagged, Default VLAN ID)	192.168.3.101
P2	Device B	3 (untagged, Default VLAN ID)	192.168.3.102
P2	Device C	3 (untagged, Default VLAN ID)	192.168.3.103
P4	Device D	7 (untagged, Default VLAN ID)	192.168.7.104
P5	Device E	7 (untagged, Default VLAN ID)	192.168.7.105
P6	Device F	3 (tagged)	192.168.3.106
		7 (tagged)	192.168.7.106
P7	--		
P8	Maintenance	1 (untagged, Default VLAN ID)	192.168.1.108
		3 (tagged)	192.168.3.108
		7 (tagged)	192.168.7.108

The following shows the settings for Switch 1 as seen in the switch's web interface, as well as the sequence in which to apply them:

1) Port descriptions

Port Configuration

Port	Name
G1	Router
G2	Switch 2
P1	Device A
P2	Device B
P3	Device C
P4	Device D
P5	Device E
P6	Device F
P7	
P8	Maintenance

2) VLANs

Port VLAN Settings

Port	Default VID	Discard Tagged	Discard Untagged	Force Default VID
G1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G2	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P1	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P2	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P3	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P4	7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P5	7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P6	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P7	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P8	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Port VLAN Membership

VID	G1	G2	P1	P2	P3	P4	P5	P6	P7	P8
1	t	t	-	-	-	-	-	-	-	u
3	t	t	u	u	u	-	-	t	-	t
7	t	t	-	-	-	u	u	t	-	t

3) IP Interfaces (the switch's own IP addresses, one per VLAN)

IP Interfaces

Interface	Settings		
	IP Address	Netmask	Gateway
ipvlan1	192.168.1.100	255.255.255.0	192.168.1.55
ipvlan3	192.168.3.100	255.255.255.0	
ipvlan7	192.168.7.100	255.255.255.0	

4) DHCP servers (general parameters and port-based, each per VLAN)

DHCP Subnet Configuration

Subnet Settings		DHCP Server Settings		Type	Identifier	IP Address
DHCP Active: <input checked="" type="checkbox"/> Name: Local VLAN 1 Subnet IP Interface: 192.168.1.100/ipvlan1 Network: 192.168.1.0 Netmask: 255.255.255.0 DHCP Role: server Description: <input type="text"/>		<input type="checkbox"/> Other Server <input checked="" type="checkbox"/> This Switch Parameters: Gateway: 192.168.1.55 Primary DNS: 192.168.1.55 Lease Time: 86400 Default Pool: 0.0.0.0 0.0.0.0 <input type="button" value="Edit DHCP Parameters"/>		Option 82	Port P8	192.168.1.108
				Click to configure new static lease		
DHCP Active: <input checked="" type="checkbox"/> Name: Local VLAN 3 Subnet IP Interface: 192.168.3.100/ipvlan3 Network: 192.168.3.0 Netmask: 255.255.255.0 DHCP Role: server Description: <input type="text"/>		<input type="checkbox"/> Other Server <input checked="" type="checkbox"/> This Switch Parameters: Gateway: 192.168.3.55 Primary DNS: 192.168.3.55 Lease Time: 86400 Default Pool: 0.0.0.0 0.0.0.0 <input type="button" value="Edit DHCP Parameters"/>		Option 82	Port P1	192.168.3.101
				Option 82	Port P2	192.168.3.102
				Option 82	Port P3	192.168.3.103
				Option 82	Port P6	192.168.3.106
				Option 82	Port P8	192.168.3.108
				Click to configure new static lease		
DHCP Active: <input checked="" type="checkbox"/> Name: Local VLAN 7 Subnet IP Interface: 192.168.7.100/ipvlan7 Network: 192.168.7.0 Netmask: 255.255.255.0 DHCP Role: server Description: <input type="text"/>		<input type="checkbox"/> Other Server <input checked="" type="checkbox"/> This Switch Parameters: Gateway: 192.168.7.55 Primary DNS: 192.168.7.55 Lease Time: 86400 Default Pool: 0.0.0.0 0.0.0.0 <input type="button" value="Edit DHCP Parameters"/>		Option 82	Port P4	192.168.7.104
				Option 82	Port P5	192.168.7.105
				Option 82	Port P6	192.168.7.106
				Option 82	Port P8	192.168.7.108
				Click to configure new static lease		

The IP pools are disabled by setting them to 0.0.0.0 – 0.0.0.0.

Here the term “Option 82” is also used for port-based DHCP leases.

The web interface also shows which leases have been granted and are active, which is helpful for testing and troubleshooting.