WiNG5 How-To Guide

Network Address Translation

July 2011

Revision 1.0

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1. Introduction:

Network Address Translation (NAT) provides the translation of an Internet Protocol (IP) address within one network to a different known IP address within another network while in transit across a traffic routing device. With typical deployments, NAT is used as an IP masquerading technique to hide private IP addresses behind a single, public facing, IP address.

The NAT feature is available on all controller models, the RFS40x0, RFS6000 and RFS7000. It is also available on all access points (AP7131N, AP532, AP6511, AP650) when routing the traffic from the wired and wireless clients, and is not restricted to the standalone access points.

1.1 Overview:

NAT functions by designating one or more interfaces as ***Inside*** while others as ***Outside***.

- Inside – A set of networks subject to translation.
- Outside – All other addresses (typically valid public Internet addresses)

NAT uses a stateful translation table to dynamically map the ***Inside*** addresses to a single ***Outside*** address and then rewrites the IP headers so that the source IP packets appear to originate from the traffic routing device's ***Outside*** IP address. In the reverse path, responses from hosts through the ***Outside*** address are forwarded to the originating ***Inside*** IP address using the state information for the session in the translation table. The translation table rules and state are established dynamically and are flushed when no new traffic refreshes their state.

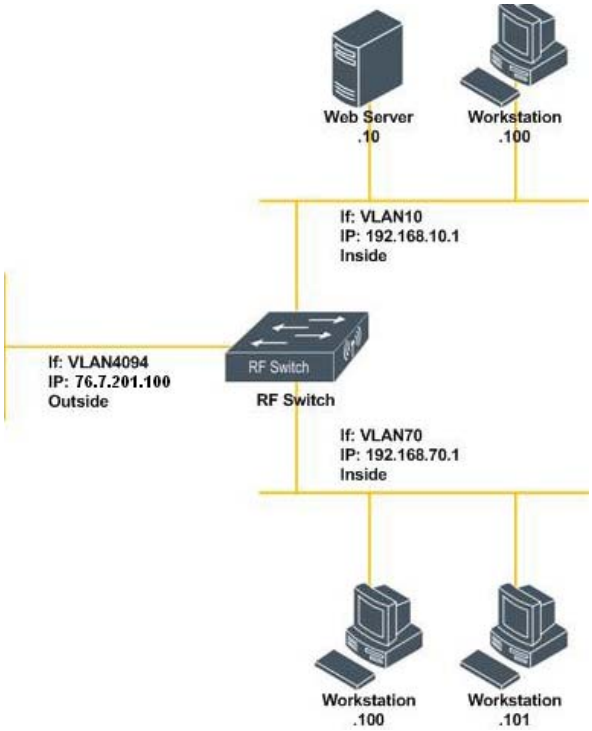


Figure 1.1 – Network Address Translation

NAT translation can occur in both directions. Most commonly translation will occur from the ***Inside*** interfaces to ***Outside*** interfaces providing private addressed hosts with Internet access. However static address translation can also be configured to translate specific ports on the ***Outside*** interface to a specific host a port

on the ***Inside*** interface. A typical application for static NAT would be to allow hosts on the public internet to communicate with a web server behind the traffic routing device that is using private IP addresses which is not reachable from the public internet. The NAT service is used to provide outbound Internet access to wired and wireless hosts connected to a traffic routing device like RFS4000, RFS6000, RFS7000 or the access points AP7131N, AP6532, AP6511 or AP650, when routing traffic from connected devices.

1.2 Applications:

The most common application for NAT is to provide internet access by translating private addresses (RFC 1918) with one or more public internet addresses. This application often called **dynamic or many-to-one NAT** allows multiple hosts on the inside network to communicate with hosts on the public internet without exhausting valuable IPv4 space.

Other common application includes providing communications between hosts on overlapping networks during mergers and acquisitions which is common in banking and healthcare verticals. Additional common NAT applications include providing access to specific hosts and services on the inside network from hosts on the outside network allowing HTTP and other services to be served to public hosts without having to locate the server on the internet.

1.3 Restrictions:

Network Address Translation (NAT) only provides IP address translation services and does not provide firewall or filtering. The RF Controller includes a stateful packet inspection(SPI) firewall which can be used with NAT to restrict which IPv4 traffic can be received and routed by the individual IP interfaces on the RF Switch.

When deploying dynamic or static NAT it is recommended that a firewall rule be created and applied to the outside interface. For example when dynamic NAT is being used, a single firewall rule can be created and applied to the outside interface to deny all inbound traffic. As the integrated firewall is fully stateful, traffic originating from hosts on the inside network will pass freely through the firewall, however traffic originating from the outside network attempting to go inside will be blocked.

When static NAT is being deployed, the firewall rule can be modified to permit inbound traffic on the outside interface for the specific ports that are being translated. For example to allow HTTP a permit rule for destination TCP port 80 could be added before the deny all rule.

For examples of how to configure the stateful packet inspection firewall, please reference the Wireless Firewall How-To Guide.

2. Pre-Requisites:

2.1 Requirements:

The following requirements must be met prior to attempting this configuration:

- One (or more) RF Switches are installed and operational on the network with two or more virtual interfaces defined.
- One (or more) Access Ports configured and adopted by the RF Switch.
- One (or more) WLAN profiles are configured and assigned to adopted radios.
- A Windows XP workstation is available with Microsoft Internet Explorer or Mozilla Firefox to perform Web UI configuration.
- Two (or more) wireless workstations are available to test and verify NAT operations.
- Optionally a web server is available on the internal network to test port forwarding.
- The reader has read the Motorola Solutions WiNG5 System Reference Guide.

2.2 Components Used:

The information in this document is based on the following Motorola hardware and software versions:

- 1 x RFS6000 Version 5.1.0.0-074R.
- 1 x AP7131N.

Registered users may download the latest software and firmware from the Motorola Solutions Support Site http://support.symbol.com.

3. Configuration:

The NAT can be configured on the controllers or the access point profiles. Or the NAT profile can be configured on the device to override the service at the device level.

The following sections outline the configuration steps required to enable dynamic and static NAT on an RF Switch:

1) Dynamic NAT [Section 3.1]:
2) Static NAT [Section 3.2]:

3.1 Dynamic NAT:

Dynamic NAT provides a simple way to provide Internet access for private addressed hosts by dynamically translating private addresses to a single public IP address. This allows enterprises to provide Internet access to users without having to address internal hosts with publically routable IP addresses using valuable IPv4 address space and exposing the hosts to threats.

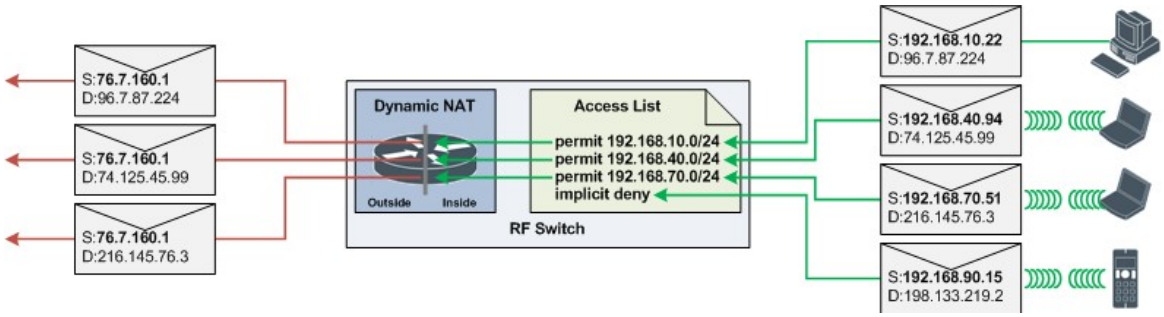


Figure 3.1 – Dynamic NAT Example

As shown in figure 3.1, wired and WLAN clients located on management, data and guest subnets are provided with Internet access through the RF Switch using Dynamic NAT. In this example the RF Switches internal interfaces vlan10 (management) , vlan40 (data) and vlan70 (guest) have been designated as NAT ***Inside*** interfaces and the public interface vlan4094 has been designated as a NAT ***Outside*** interface. This configuration will allow the RF Switch to translate packets received on the management and guest ***Inside*** interfaces to the ***Outside*** public IP address.

In addition a firewall IP Rule has been created with entries to only allow NAT translation for wired and wireless hosts in specific subnets. In this example, the IP rule allows the following:

1) Packets received from hosts in the 192.168.10.0/24 management subnet and the 192.168.40.0/24 data subnet will be translated.
2) Packets received from hosts in the 192.168.70.0/24 guest subnet will be translated.
3) Packets received hosts in the 192.168.90.0/24 voice subnet will not be translated.

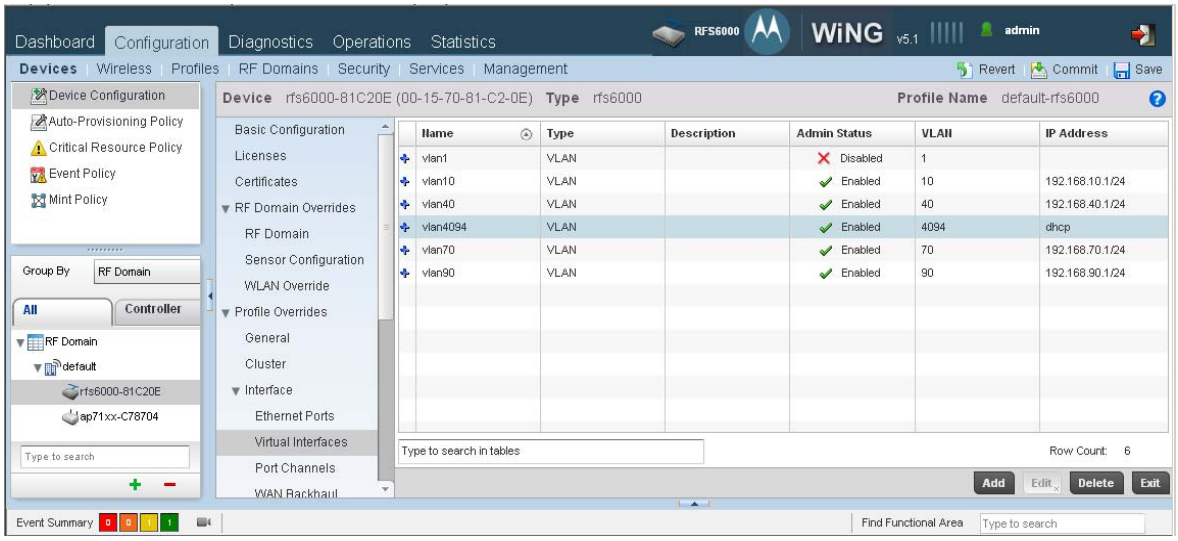
3.1.1 Web UI Configuration:

The following configuration example will demonstrate how to enable dynamic NAT for internet access for specific IP subnets using the Web UI. The configuration is done on the RFS6000 controller at device level.

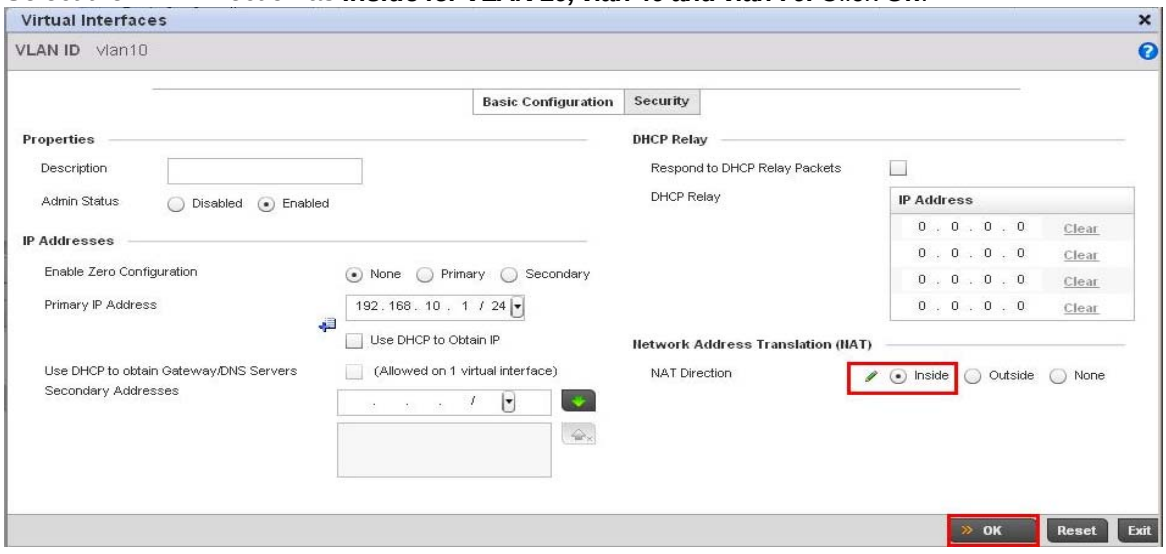
1) Specify the interface ***Type*** for the virtual ***Interface***. In this example the management vlan10, data vlan40 and guest vlan70 virtual interfaces will be designated as ***Inside*** and the Internet vlan4094 will be designated as ***Outside***. Click ***OK***.

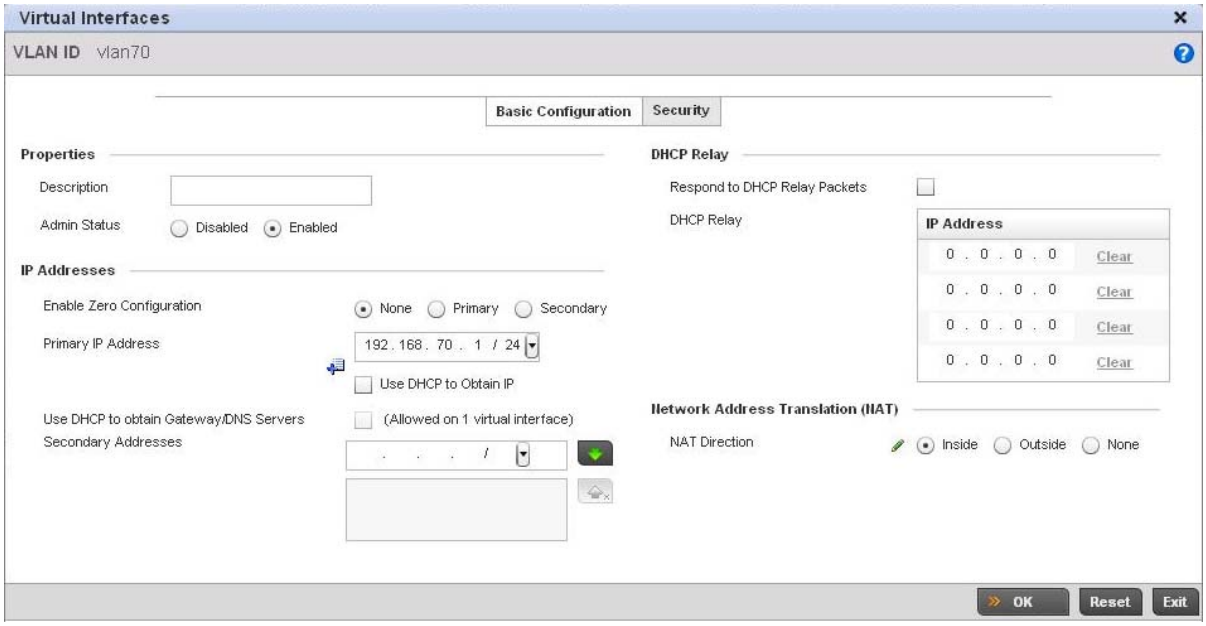
Interface	Type
Vlan10	Inside
Vlan40	Inside
Vlan70	Inside
Vlan4094	Outside

2) Navigate to the ***Configuration > Devices > RFS6000-81C203 > Interface > Virtual Interfaces*** window***.*** Select the virtual Interface for ***VLAN 10*** and click ***Edit***.

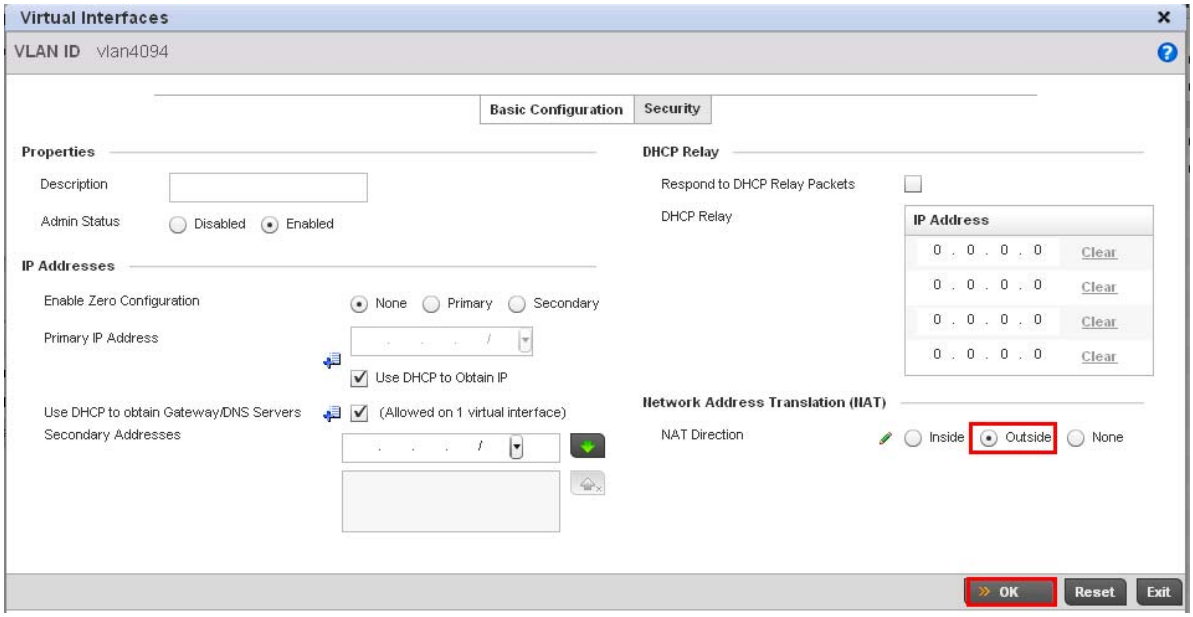


3) Select the NAT Direction as ***Inside for VLAN 10, vlan 40 and vlan 70.*** Click ***Ok***.

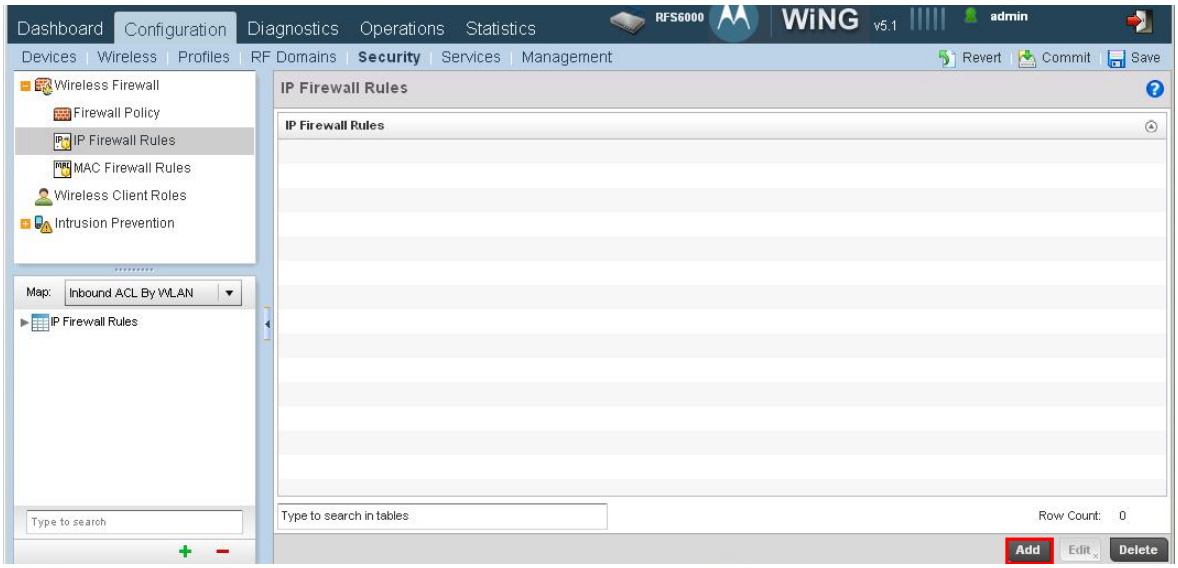




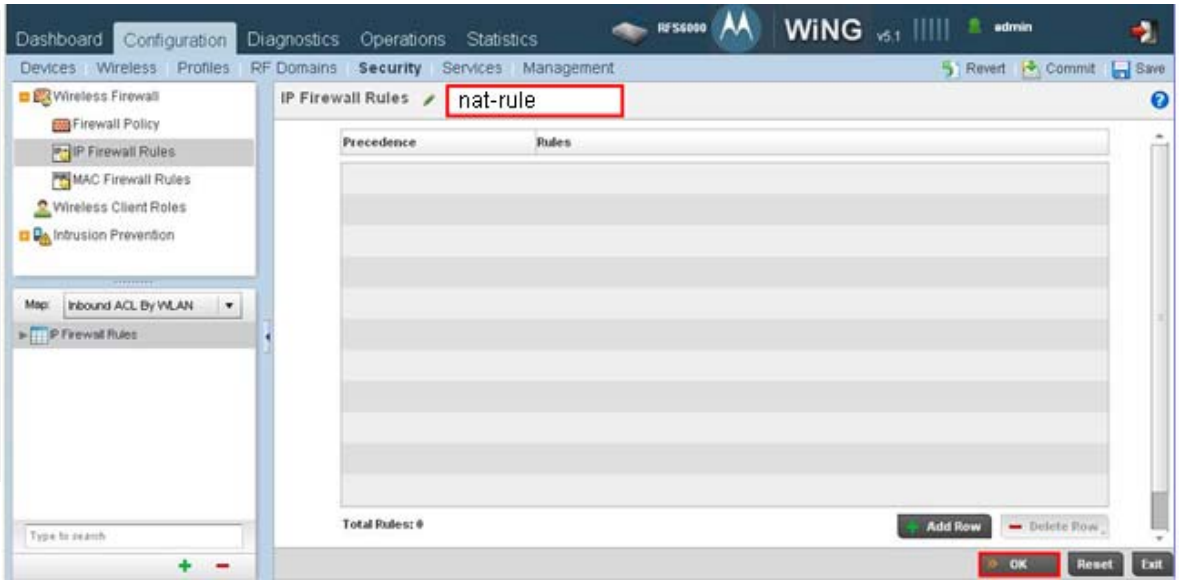
4) Select the NAT Direction as ***Outside*** for ***VLAN 4094.*** Click ***Ok***.



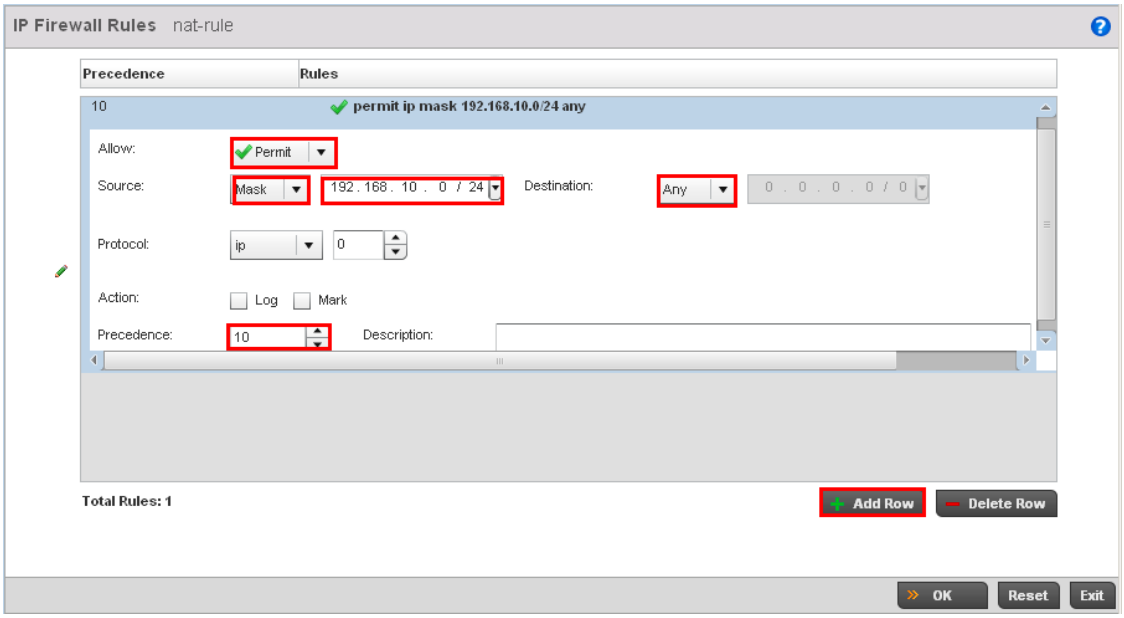
5) Navigate to the ***Configuration > Security > Wireless Firewall > IP Firewall Rules*** window. Click ***Add*** to create an ACL to tell the RF Switch which source subnets to NAT for Internet access.

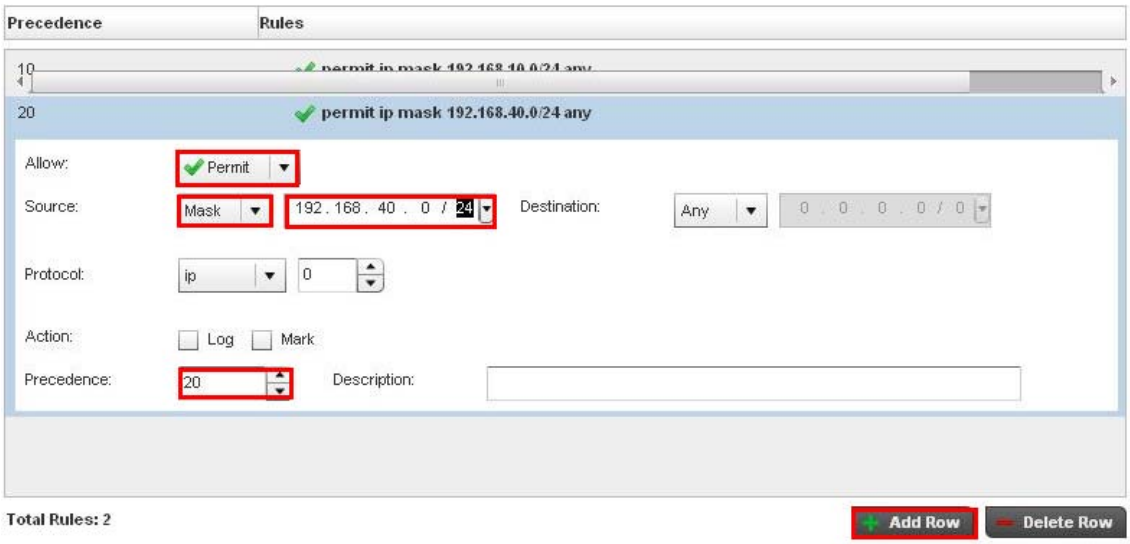


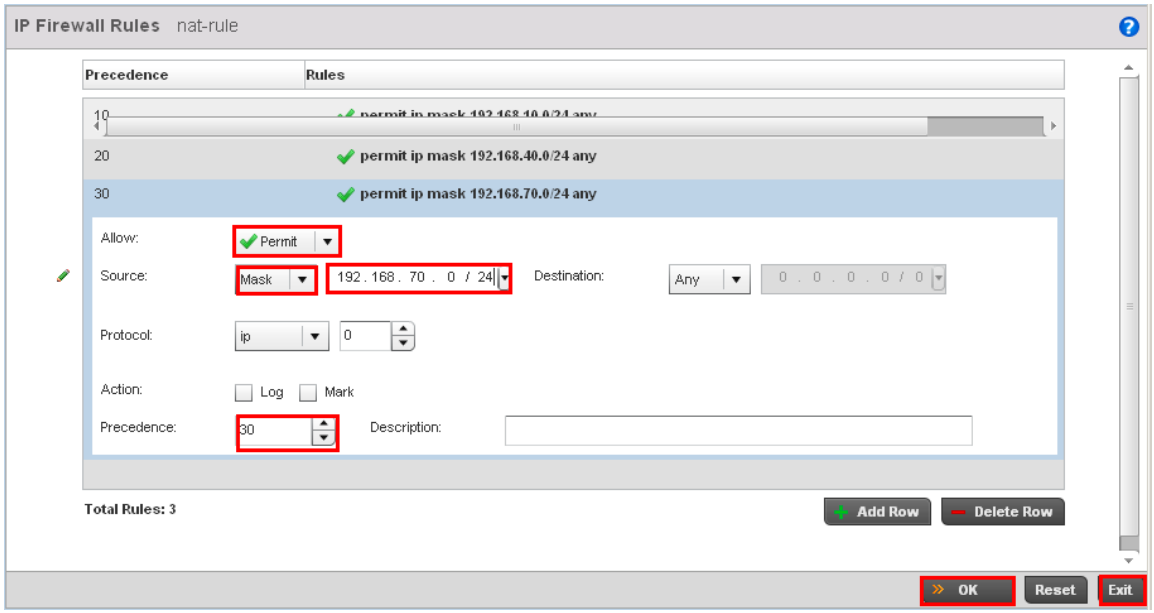
6) Enter a unique name **nat-rule**. Click ***OK***.



7) In the ***Add Row*** window create a rule for each subnet you wish to provide Internet access to. For each rule set the ***Operation*** to ***Permit*** and specify the ***Source Mask*** and ***Source Address***. In this example the management (192.168.10.0/24), WLAN data (192.168.40.0/24) and WLAN guest (192.168.70.0/24) subnets will be permitted Internet access. Click ***OK*** after creating each rule.

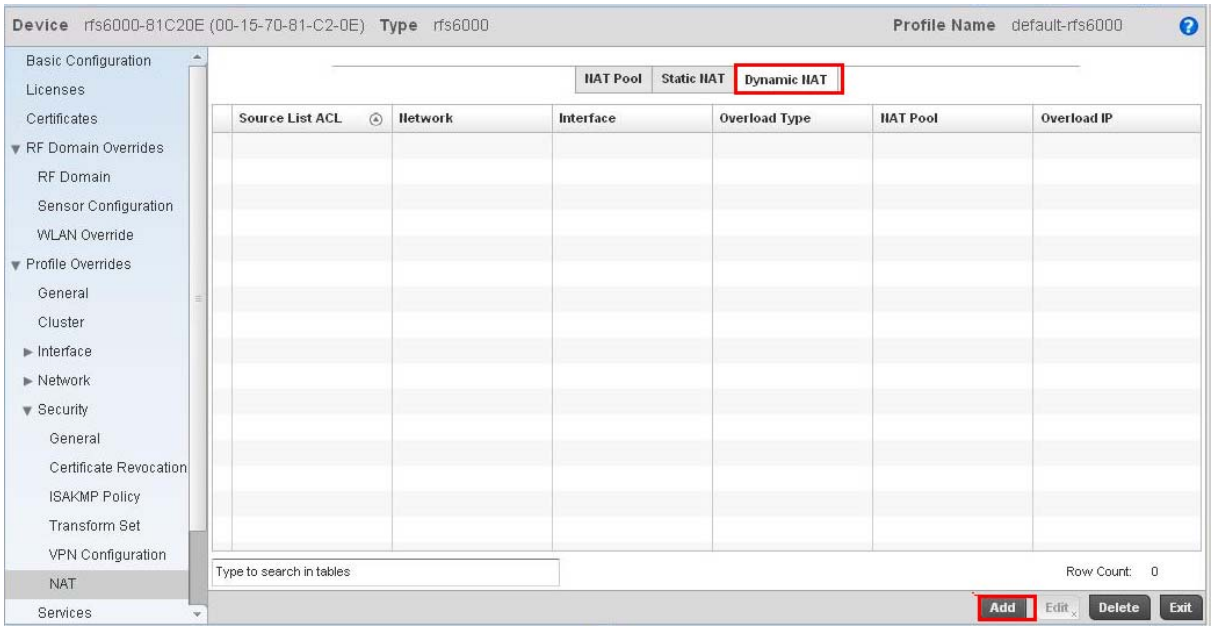




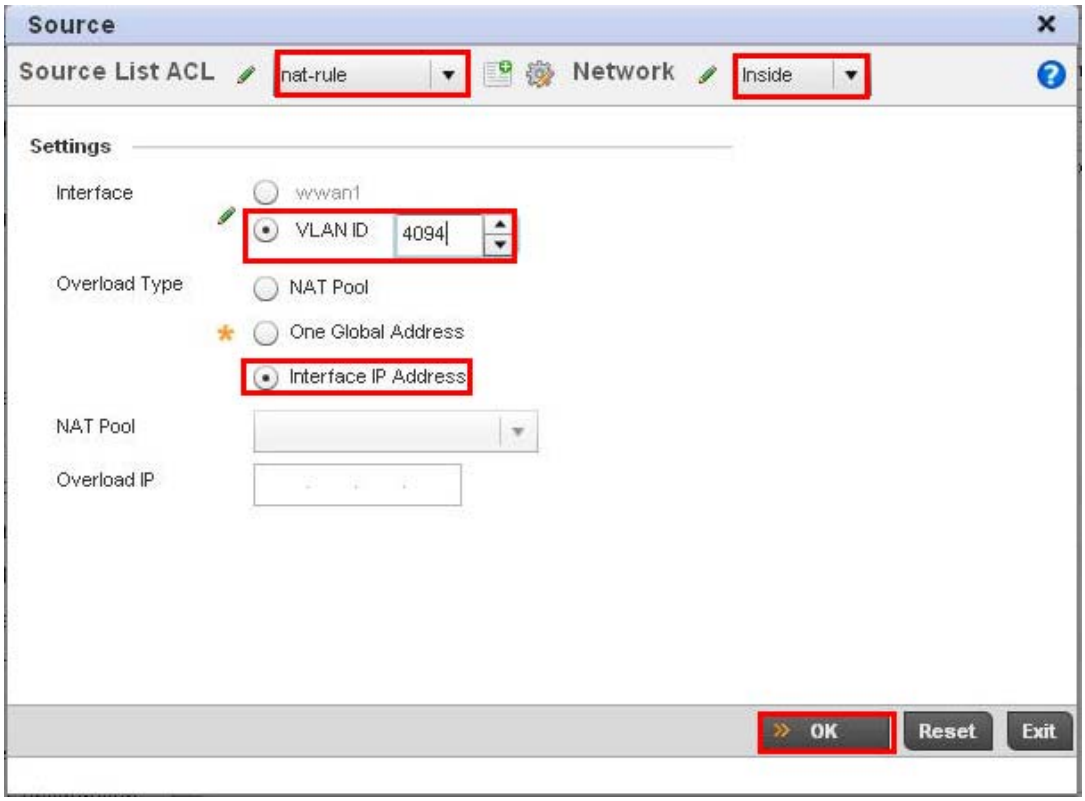


Optionally, the RF Switch may permit NAT for any source subnet by creating a ***permit any*** rule.

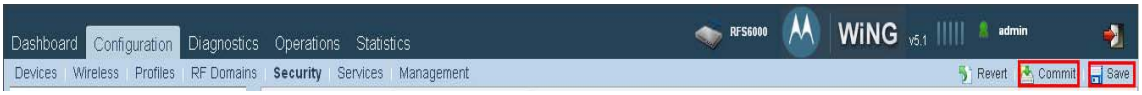
8) Navigate to the ***Configuration > Devices > RFS6000-82c201 > Security > NAT*** *window*. Select the ***Dynamic NAT*** tab then click ***Add***. This will create a dynamic NAT rule translating private addresses defined in the ACL received on *inside* interfaces to the public *outside* internet ***vlan 4094***.



9) Select the Source List ACL **nat-rule** created in step 5. Set the **Network *Type*** to ***Inside***. Set the Interface to the public outside virtual interface ***vlan 4094***. Select the **Overload Type** as **Interface IP Address** to automatically select the IP address assigned to the Virtual Interface vlan 4094. Click ***OK*** and **Exit.**



10) Click **Commit** to apply and ***Save*** *to* save changes.



For security it is recommended that a firewall rule be created and applied to the outside interface to block all inbound traffic. For examples of how to configure the stateful inspection firewall, please reference the Wireless Firewall How-To Guide.

3.1.2 CLI Configuration:

The following configuration example will demonstrate how to enable dynamic NAT for internet access for specific IP subnets using the CLI:

1) Specify the interface ***Type*** for the virtual ***Interface***. In this example the management vlan10, data vlan40 and guest vlan70 virtual interfaces will be designated as ***Inside*** and the Internet vlan4094 will be designated as ***Outside***. Click ***OK***.

Interface	Type
Vlan10	Inside
Vlan40	Inside
Vlan70	Inside
Vlan4094	Outside

```
rfs6000-81C20E*#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
rfs6000-81C20E(config)*#rfs6000 00-15-70-81-C2-0E
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#interface vlan 10
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan10)*#ip nat inside
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan10)*#..
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#interface vlan 40
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan40)*#ip nat inside
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan40)*#..
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#interface vlan 70
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan70)*#ip nat inside
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan70)*#..
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#interface vlan 4094
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan4094)*#ip nat outside
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan4094)*#..
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#exit
rfs6000-81C20E(config)*#
```

2) Create an ACL to identify which source subnets to NAT for Internet access

```
rfs6000-81C20E(config)*#ip access-list nat-rule
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#
rfs6000-81C20E(config-ip-acl-nat-rule)*# permit ip 192.168.10.0/24 any rule-precedence 10
rfs6000-81C20E(config-ip-acl-nat-rule)*# permit ip 192.168.40.0/24 any rule-precedence 20
rfs6000-81C20E(config-ip-acl-nat-rule)*# permit ip 192.168.70.0/24 any rule-precedence 30
rfs6000-81C20E(config-ip-acl-nat-rule)*#exit
rfs6000-81C20E(config)*#
```

3) Create a dynamic NAT rule translating private addresses defined in the ACL received on *inside* interfaces to the public *outside* internet ***vlan 4094***.

```
rfs6000-81C20E(config)*#rfs6000 00-15-70-81-C2-0E
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*# ip nat inside source list nat-rule
interface vlan4094  overload
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#exit
rfs6000-81C20E(config)*# commit write
```

3.2 Static NAT:

Static NAT can be used for multiple applications such as providing a direct one-to-one translation for Internet access; however the most common application is to provide port forwarding services allowing specific ports on a public interface to be forwarded to a host on the private network such as a web server or VPN gateway. Often referred to as port forwarding or port address translation, static NAT can be configured to forward TCP or UDP packets received from hosts on the public internet to hosts located on the private network without having to obtain public addresses or deploy dedicated servers in a DMZ.

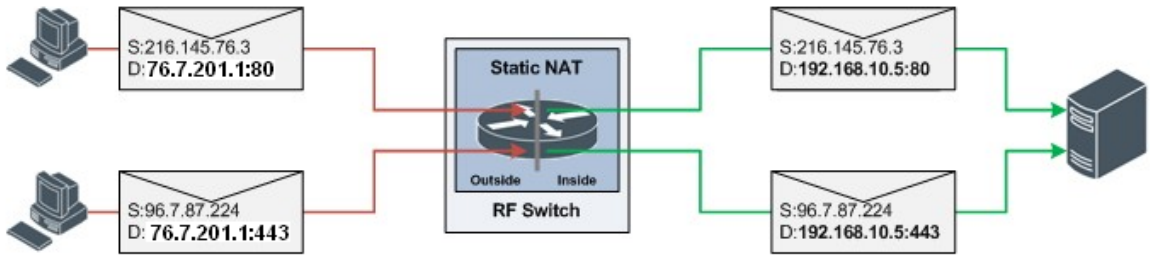


Figure 3.2 – Static NAT Example

As shown in figure 3.2, static NAT translation has been used to translate TCP port 80 and 443 packets received on the ***Outside*** public interface vlan4094 to a web server located on the ***Inside*** management interface vlan10.

Static NAT can only translate unique TCP or UDP ports on the outside interface to an internal host. If translation is required for multiple instances of a common port (example HTTP), unique ports must be defined on the outside interface. Table 4.3.2 shows an example Static NAT configuration unique TCP ports have been defined on the outside interface that are translated to two internal hosts listening on TCP port 80 & 443.

Outside IP Address	Outside TCP Port	Inside IP Address	Inside TCP Port
76.7.207.1	80	192.168.10.5	80
76.7.207.1	81	192.168.10.6	80
76.7.207.1	443	192.168.10.5	443
76.7.207.1	444	192.168.10.6	443

Table 3.2 – Static NAT Translation Example

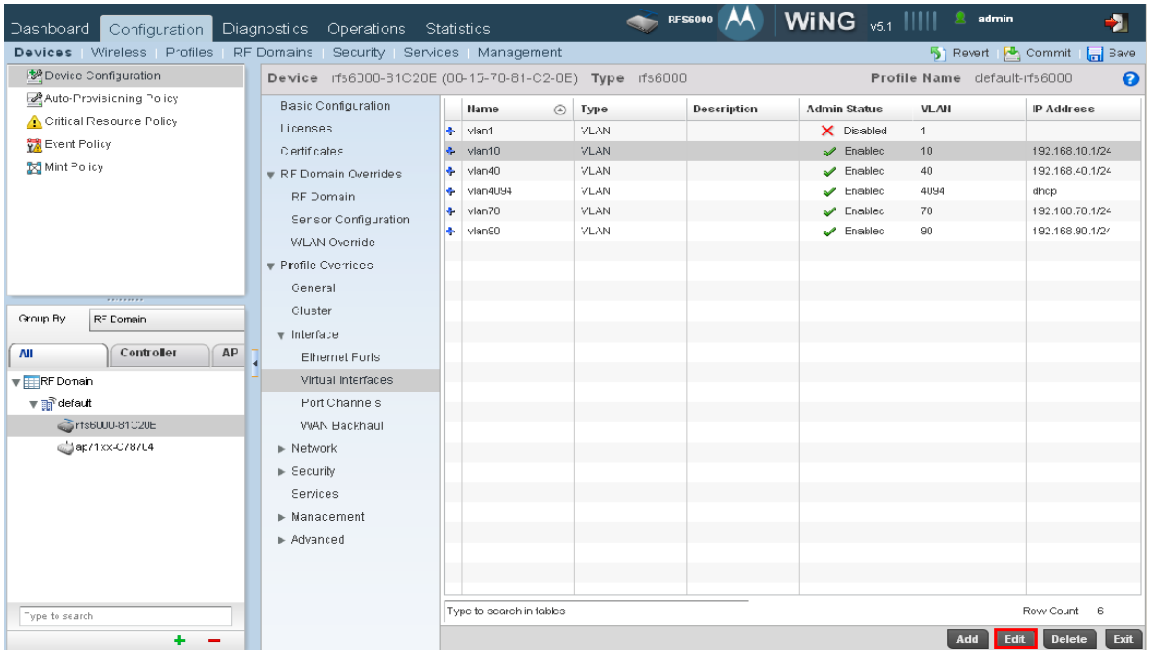
3.2.1 Web UI Configuration:

The following configuration example will demonstrate how to enable static NAT to provide port forwarding for specific ports using the Web UI:

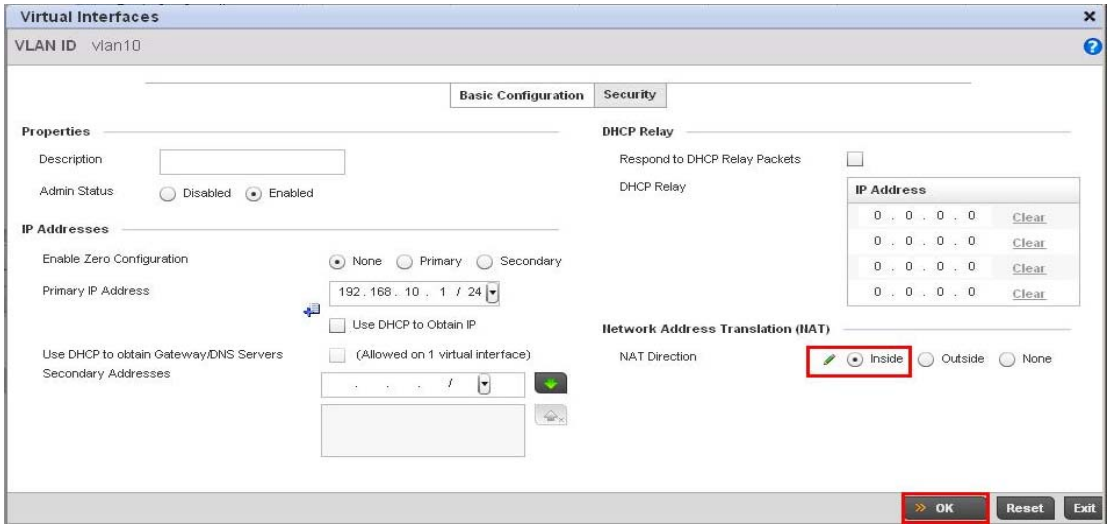
1) Specify the interface ***Type*** for the ***virtual Interface***. The management vlan10 will be designated as ***Inside*** and the Internet vlan4094 will be designated as ***Outside***.

Interface	Type
Vlan10	Inside
Vlan4094	Outside

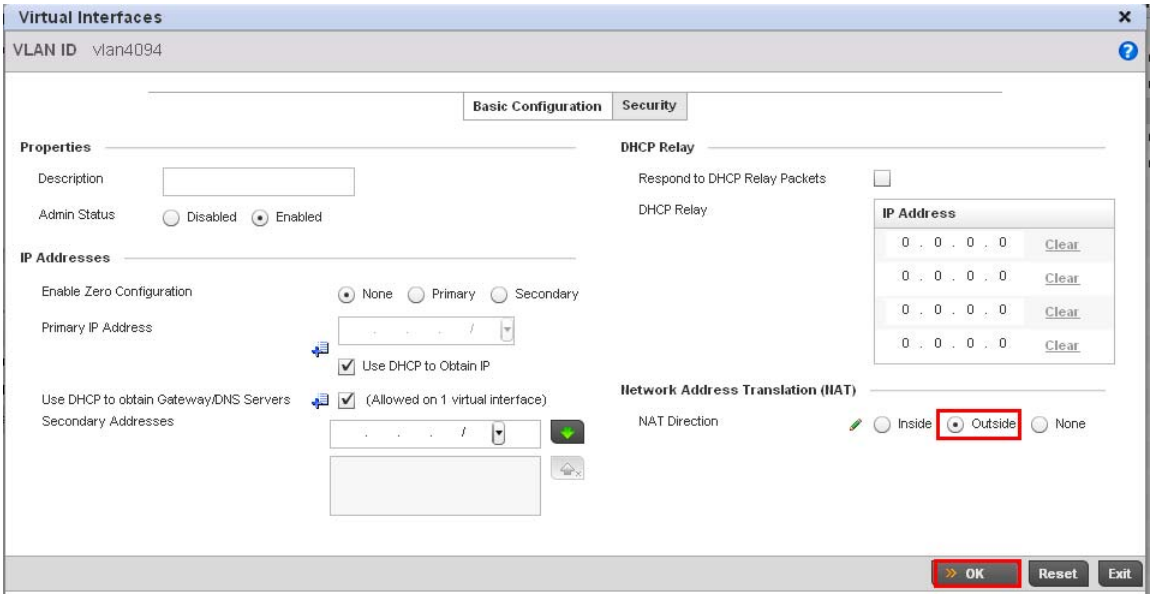
2) Navigate to the ***Configuration > Devices > RFS6000-81C203 > Interface > Virtual Interfaces.*** Select the virtual Interface for ***VLAN 10*** and click ***Edit***.



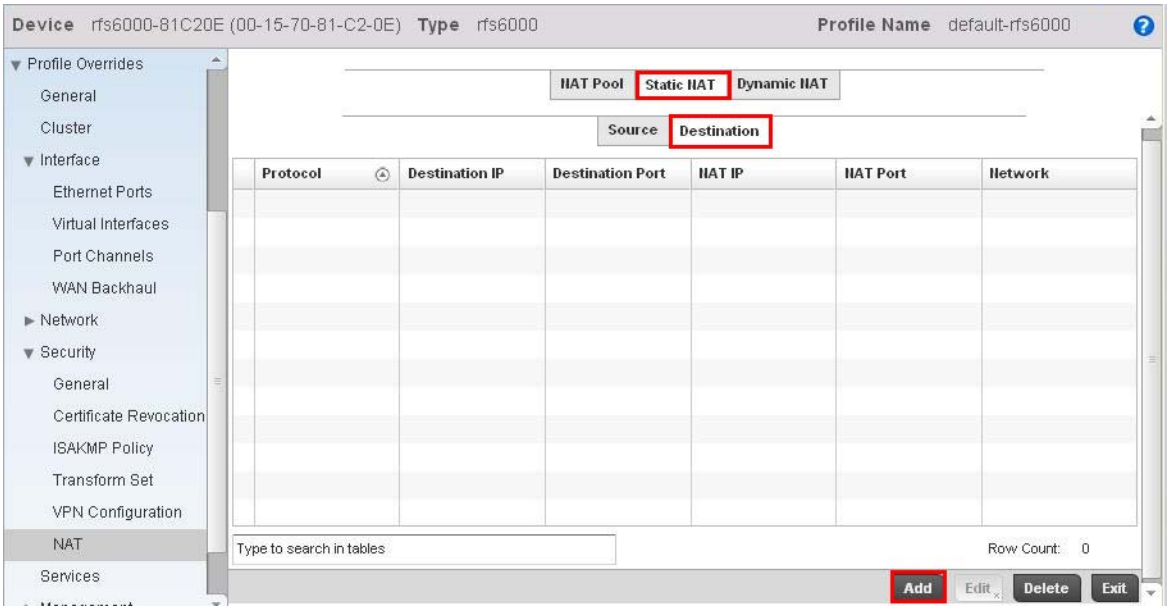
3) Select the NAT Direction as ***Inside for VLAN 10.*** Click ***Ok***



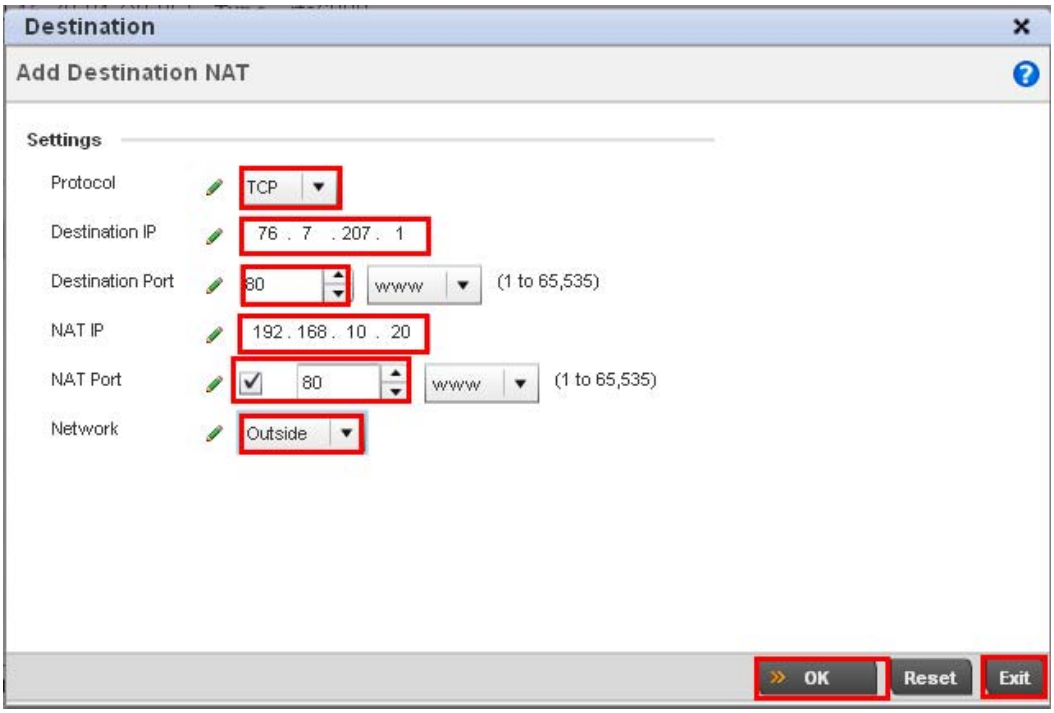
4) Select the NAT Direction as ***Outside*** for ***VLAN 4094.*** Click ***Ok***.

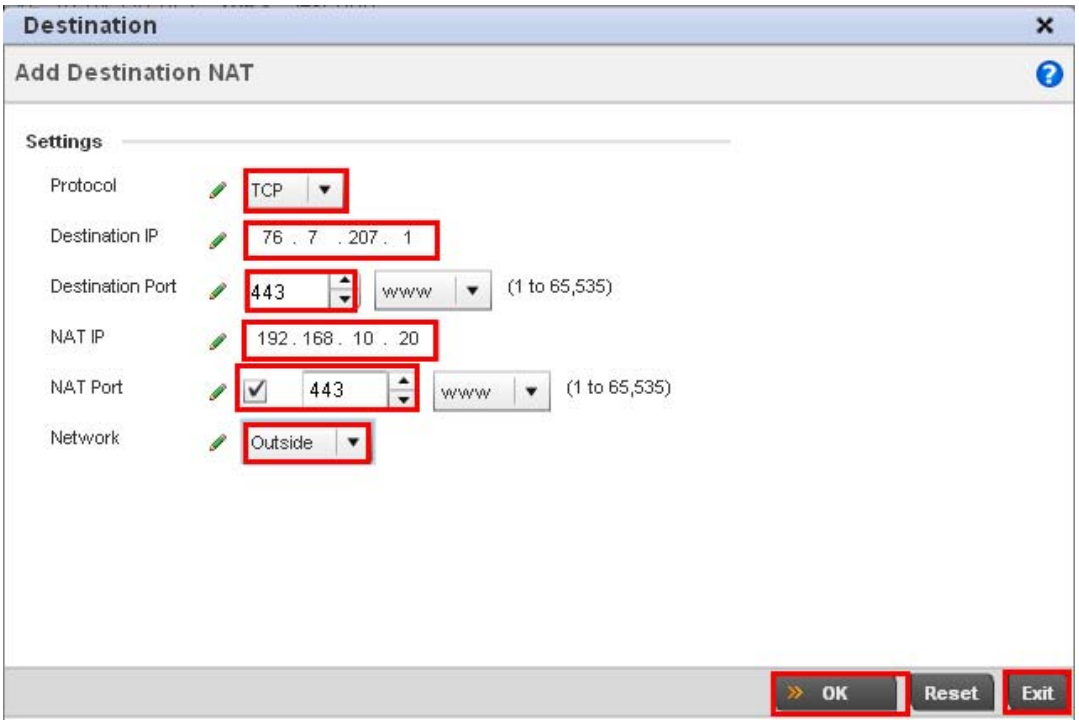


5) In this example we will create two static NAT rules to translate ***TCP*** port ***80*** and ***TCP*** port ***443*** traffic received on the public ***Outside*** interface ***vlan4094*** to a web server ***192.168.10.20*** on the ***Inside*** management interface ***vlan10.*** Navigate to the **Configuration > Devices > RFS6000-name > *Security > NAT*** window. Select the ***Static NAT > Destination*** tab and click ***Add***.



6) Select the ***TCP*** protocol. Set the ***Destination IP*** to the IP address of the public outside Interface and the ***NAT IP*** to the private server IP address. Define the ***Destination Port*** and NAT port values (80 and 443 in this example). Select the Network type as ***Outside***. Click ***OK*** and ***Exit***.





5) Click ***Commit*** to apply and ***Save*** to save changes.

For security it is recommended that a firewall rule be created and applied to the outside interface that will permit destination TCP port 80 and 443 traffic but block all other traffic. For examples of how to configure the stateful inspection firewall, please reference the Wireless Firewall How-To Guide.

3.2.1 CLI Configuration:

The following configuration example will demonstrate how to enable static NAT to provide port forwarding for specific ports using the Web UI:

1) Specify the interface ***Type*** for the ***virtual Interface***. The management vlan10 will be designated as ***Inside*** and the Internet vlan4094 will be designated as ***Outside***.

Interface	Type
Vlan10	Inside
Vlan4094	Outside

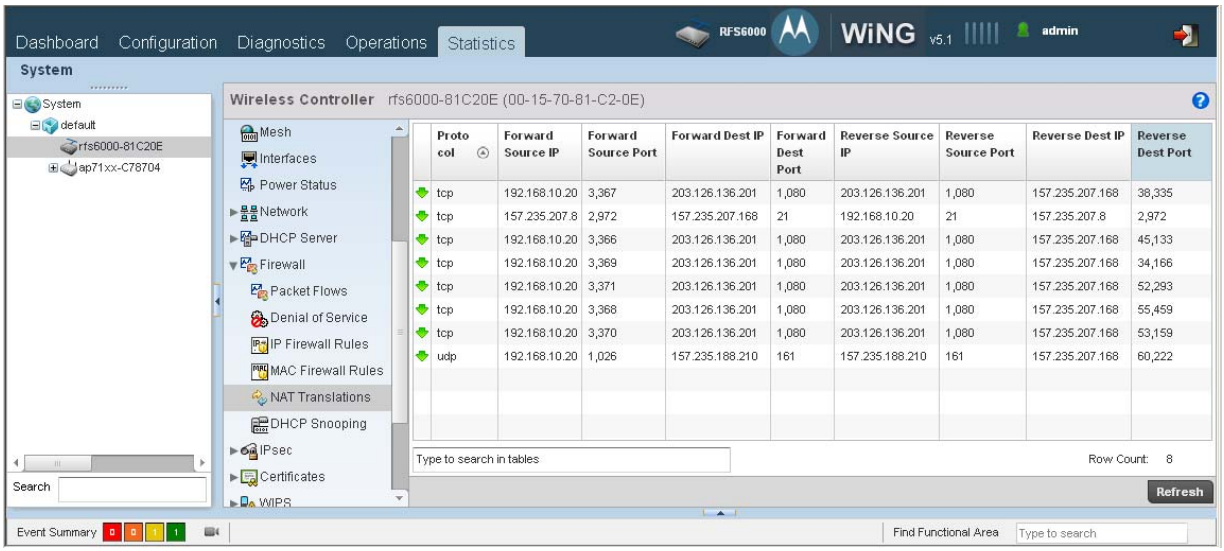
```
rfs6000-81C20E*#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
rfs6000-81C20E(config)*#rfs6000 00-15-70-81-C2-0E
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#interface vlan 10
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan10)*#ip nat inside
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan10)*#..
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#interface vlan 4094
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan4094)*#ip nat outside
rfs6000-81C20E(config-device-00-15-70-81-C2-0E-if-vlan4094)*#..
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#exit
rfs6000-81C20E(config)*#
```

2) Create two static NAT rules to translate ***TCP*** port ***80*** and ***TCP*** port ***443*** traffic received on the public ***Outside*** interface ***vlan4094*** to a web server ***192.168.10.20*** on the ***Inside*** management interface ***vlan10***. **Save** and **Apply** the changes.

```
rfs6000-81C20E(config)*#rfs6000 00-15-70-81-C2-0E
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*# ip nat outside destination static
76.7.207.1 80 tcp 192.168.10.20 80
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*# ip nat outside destination static
76.7.207.1 443 tcp 192.168.10.20 443
rfs6000-81C20E(config-device-00-15-70-81-C2-0E)*#exit
rfs6000-81C20E(config)*# commit write
rfs6000-81C20E(config)*#
```

4. Viewing NAT Translations

The NAT translations can be seen in the ***Statistics > <Rf-domain> > RFS6000-81C2OE > Firewall > NAT Translations.***


Dashboard
Configuration
Diagnostics
Operations
Statistics
RFS6000
WiNG
v5.1
admin
System
System
default
rfs6000-81C20E
ap71xx-C78704
Search
Wireless Controller rfs6000-81C20E (00-15-70-81-C2-0E)
Mesh
Interfaces
Power Status
Network
DHCP Server
Firewall
Packet Flows
Denial of Service
IP Firewall Rules
MAC Firewall Rules
NAT Translations
DHCP Snooping
IPsec
Certificates
WIPS
Protocol
Forward Source IP
Forward Source Port
Forward Dest IP
Forward Dest Port
Reverse Source IP
Reverse Source Port
Reverse Dest IP
Reverse Dest Port
tcp 192.168.10.20 3,367 203.126.136.201 1,080 203.126.136.201 1,080 157.235.207.168 38,335
tcp 157.235.207.8 2,972 157.235.207.168 21 192.168.10.20 21 157.235.207.8 2,972
tcp 192.168.10.20 3,366 203.126.136.201 1,080 203.126.136.201 1,080 157.235.207.168 45,133
tcp 192.168.10.20 3,369 203.126.136.201 1,080 203.126.136.201 1,080 157.235.207.168 34,166
tcp 192.168.10.20 3,371 203.126.136.201 1,080 203.126.136.201 1,080 157.235.207.168 52,293
tcp 192.168.10.20 3,368 203.126.136.201 1,080 203.126.136.201 1,080 157.235.207.168 55,459
tcp 192.168.10.20 3,370 203.126.136.201 1,080 203.126.136.201 1,080 157.235.207.168 53,159
udp 192.168.10.20 1,026 157.235.188.210 161 157.235.188.210 161 157.235.207.168 60,222
Type to search in tables
Row Count: 8
Refresh
Event Summary
Find Functional Area
Type to search

5. Reference Documentation:

Description	Location
Motorola Solutions WiNG 5 System Reference Guide	http://support.symbol.com
Motorola Solutions WiNG 5 CLI Reference Guide	http://support.symbol.com