Network Address Translation

Overview of network address translation

From UIW Release 17.16.1, AP supports the Network Address Translation (NAT) feature. This feature ensures smooth and efficient roaming for Automated Guided Vehicles (AGVs) by using a single public IP address for AGVs to access the outside network. It assigns port numbers to each application on the AGV, managing data flow for both downstream and upstream directions.

Note

- NAT is supported only in the Layer 2 mode of the AP.
- The NAT/PAT feature supports rules configuration for TCP and UDP traffic only.

This feature supports the following functionalities:

- NAT with Port Translation (NAPT)
- Source NAT (SNAT)

NAT with Port Translation (NAPT) for downstream traffic manages and routes incoming data packets to the correct inside device. It uses an address table to find a specific application's inside private IP address and port number to forward the packet. For more information, see Downstream Data Flow using NAPT for AGVs.

Source NAT (SNAT) for upstream traffic modifies the source IP address and port numbers of the outgoing packets from inside network devices before sending them to an external network. For more information, see Upstream Data Flow using SNAT for AGVs.

Advantage of NAT

A common IP address scheme for on-board vehicle systems reduces the complexity of uniquely identifying all vehicle equipment and facilitates access from external systems.

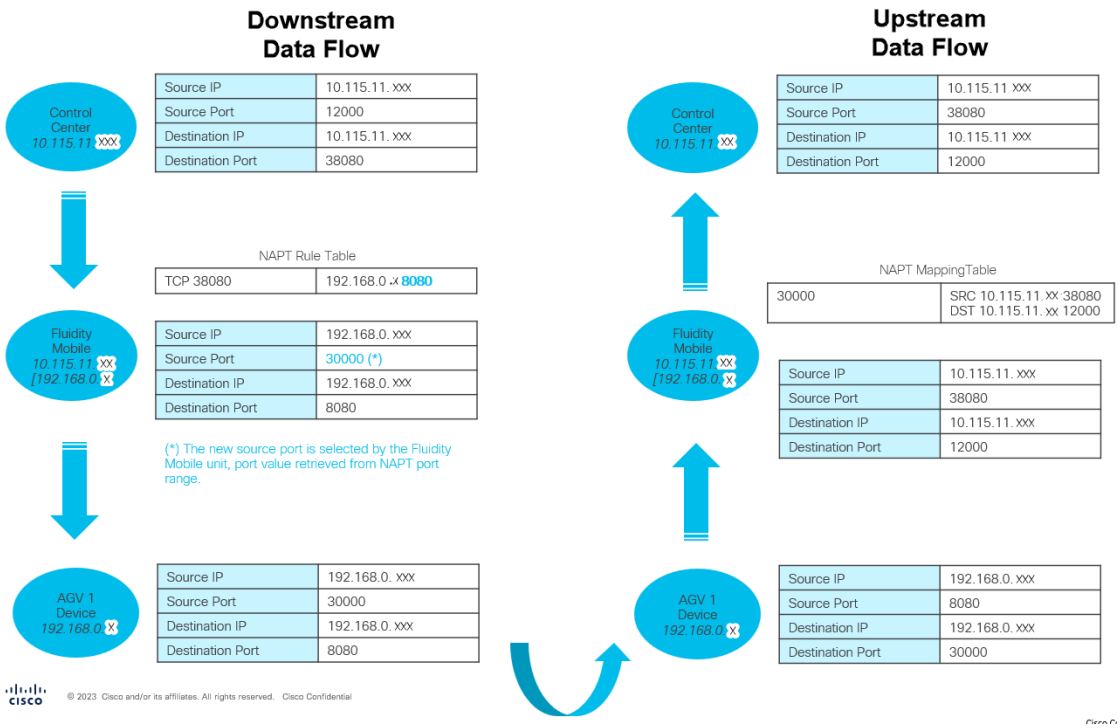
Downstream data flow using NAPT for AGVs

Downstream refers to the flow of data from the outside network to the AGV's inside network. The AP acts as a gateway between the outside and inside networks. When an AP receives a packet from the outside network, NAPT uses the address table to find the inside private IP address and port number of a specific application to forward the packet.

By using NAPT:

- Devices from the outside network can connect to services on the AGVs' inside network.
- APs in the AGVs' inside network can direct data flow to specific ports.

Figure 1: Example of Downstream Data Flow using NAPT:



Assign port numbers using NAPT for AGVs

NAPT assigns different port numbers to various services on an AGV. This ensures that responses from the outside network is sent to the correct service on the AGV.

Reserved outside port numbers for NAPT configuration

Protocol / Port Number	Service	Notes
TCP and UDP	—	Port numbers from 1 to 1023 are not allowed on both TCP and UDP protocols. **Attention** From UIW release 26.1.1, you can use port numbers from 1 to 1023 on both TCP and UDP protocols. However, use these ports with caution, as they belong to the reserved category of ports.
UDP/1812-1813	RADIUS	—
UDP/6600 UDP/6610	Industrial Wireless Monitor	On-Premises UDP and ping
UDP/<telemetry port>	Industrial Wireless Telemetry	• Port number configured for Industrial Wireless Telemetry protocol varies. • The default value configured for Telemetry is 30000.

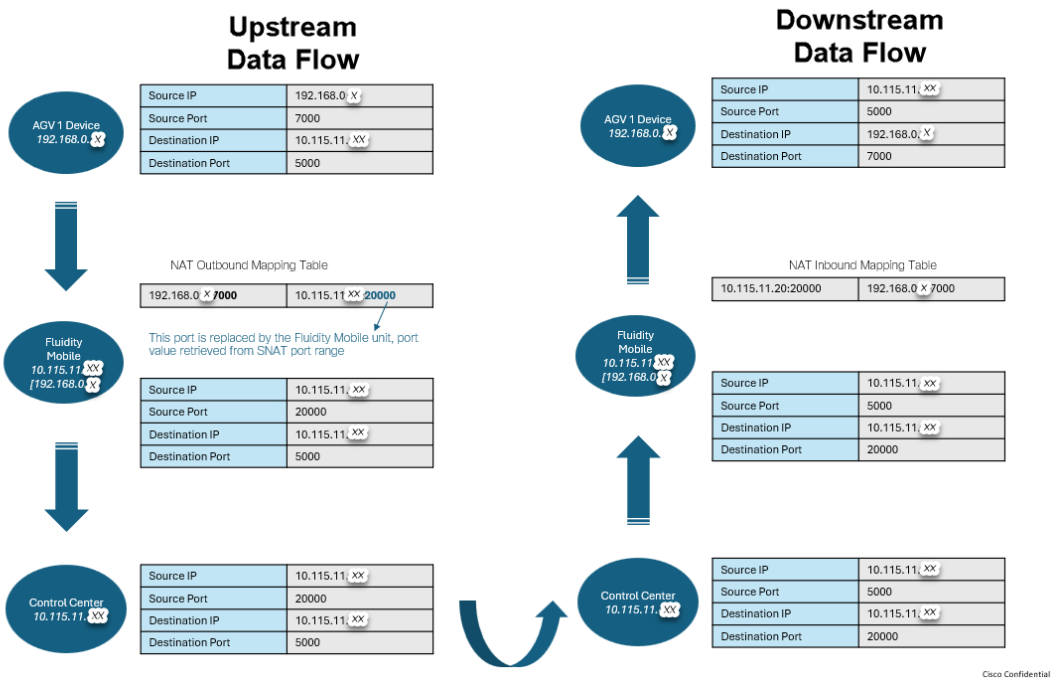
NAPT rule on AP

A NAPT rule sends data flow to specific ports on inside hosts. A typical NAPT rule consists of `<Protocol, Global Destination Port, Translated Local Destination IP, Translated Local Destination Port>`, where the protocol can be either UDP or TCP.

Upstream data flow using SNAT for AGVs

Upstream refers to the flow of data from the inside network to the outside network. The AP serves as a gateway between the inside and outside networks. When the AP sends a packet from the inside network to the outside network, SNAT changes the source IP address and source port in the outgoing packets to match the public IP and port.

Figure 2: Example of Upstream Data Flow using SNAT:



Configure NAPT using CLI

Perform this task to configure NAPT functionality to enable downstream data flow on the AP.

Procedure

Step 1 Use the **configure ip nat enable** command to enable the NAT rules on the AP.

```
Device# configure ip nat enable
```

Note
You can use the **configure ip nat disable** command to disable the NAT configuration on the AP.

Step 2 Use the **configure ip nat inside ipv4** *ipv4-address netmask* command to configure inside IPv4 address on the NAT.

```
Device# configure ip nat inside ipv4 192.168.70.2 255.255.255.0
```

Step 3 Use the **configure ip nat inside port range** *first-port-number second-port-number* command to configure inside port range on the NAT.

```
Device# configure ip nat inside port range 32000 33000
```

The valid range for the inside port is 1 to 35000. This range must not overlap with the SNAT port range. By default, the minimum port value is 30000 and the maximum is 35000. The minimum configurable value for both ranges is 1.

Step 4 Use the **configure ip nat entry add proto** {**TCP** | **UDP**} **outside port** *outside-port-number* **inside ipv4** *inside-ipv4-address* **port** *inside-port-number* command to configure protocol, outside port value, inside IPv4 address, and inside port value on the NAT.

```
Device#configure ip nat entry add proto TCP outside port 38080 inside ipv4 192.168.0.2 port
8080
```

Step 5 Use the **write** and **reload** command to save the current configuration.

```
Device#write
```

```
Device#reload
```

NAPT configuration example

```
Device#configure ip nat enable
Device#configure ip nat inside ipv4 192.168.0.1 255.255.255.0
Device#configure ip nat inside port range 32000 33000
Device#configure ip nat entry add proto TCP outside port 38080 inside ipv4 192.168.0.2 port
 8080
Device#write
Device#reload
```

Configure SNAT using CLI

Perform this task to configure SNAT functionality to enable upstream data flow on the AP.

Procedure

Step 1 Use the **configure ip nat enable** command to enable the NAT rules on the AP.

```
Device# configure ip nat enable
```

Note
You can use the configure **ip nat disable** command to disable the NAT configuration on the AP.

Step 2 Use the **configure ip nat inside ipv4** *ipv4-address netmask* command to configure inside IPv4 address on the NAT.

```
Device# configure ip nat inside ipv4 192.168.70.2 255.255.255.0
```

Step 3 Use the **configure ip nat outside port range** *left-limit-port-number right-limit-port-number* command to configure outside port range on the NAT.

```
Device# configure ip nat outside port range 22000 23000
```

The valid range for the outside port is 1 to 25000. This range must not overlap with the NAPT port range. By default, the minimum port value is 20000 and the maximum is 25000. The minimum configurable value for both ranges is 1.

Note
When a TCP/UDP port below 1024 is configured, the system displays the following warning:

```
Port values below 1024 may conflict with system services and are not recommended.
```

Step 4 Use the **write** and **reload** command to save the current configuration.

```
Device# write
Device# reload
```

SNAT configuration example

```
Device#configure ip nat enable
Device#configure ip nat inside ipv4 192.168.0.1 255.255.255.0
Device#configure ip nat outside port range 22000 23000
Device#write
Device#reload
```

Delete NAT rule using CLI

Use the **configure ip nat entry del** command to delete the specific NAT rule on the AP.

```
Device#configure ip nat entry del 0
```

Delete all NAT rules using CLI

Use the **configure ip nat entry del all** command to delete all the NAT rules on the AP.

```
Device#configure ip nat entry del all
```

Verify NAT configuration using CLI

Use the **show ip nat config** command to see the status of NAT configuration.

```
device#show ip nat config
NAT: enabled
IP: 192.168.1.144
Netmask: 255.255.255.0
NAPT port range: 30000-35000
SNAT port range: 22000-23000
TCP timeout: 300
UDP timeout: 300
NAT max rules: 100
```

Verify NAT translations using CLI

Use the **show ip nat translations** command to see all the NAT translations.

```
Device#show ip nat translations

NAT: enabled

Port NAT Translations
```

```
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TCP Translations
(192.168.50.4, 4000, 192.168.50.1, 34200) => (10.115.11.157, 4443, 10.115.11.250, 51010)
(10.115.11.250, 51010, 10.115.11.157, 4443) => (192.168.50.1, 34200, 192.168.50.4, 4000)

UDP Translations
None

Source NAT Translations
----------------------
TCP Translations
(192.168.50.4, 51178, 10.115.11.250, 4000) => (10.115.11.157, 20292, 10.115.11.250, 4000)
(10.115.11.250, 4000, 10.115.11.157, 20292) => (10.115.11.250, 4000, 192.168.50.4, 51178)
UDP Translations
(10.115.11.250, 3000, 10.115.11.157, 22068) => (10.115.11.250, 3000, 192.168.50.4, 38318)
(192.168.50.4, 38318, 10.115.11.250, 3000) => (10.115.11.157, 22068, 10.115.11.250, 3000)
```