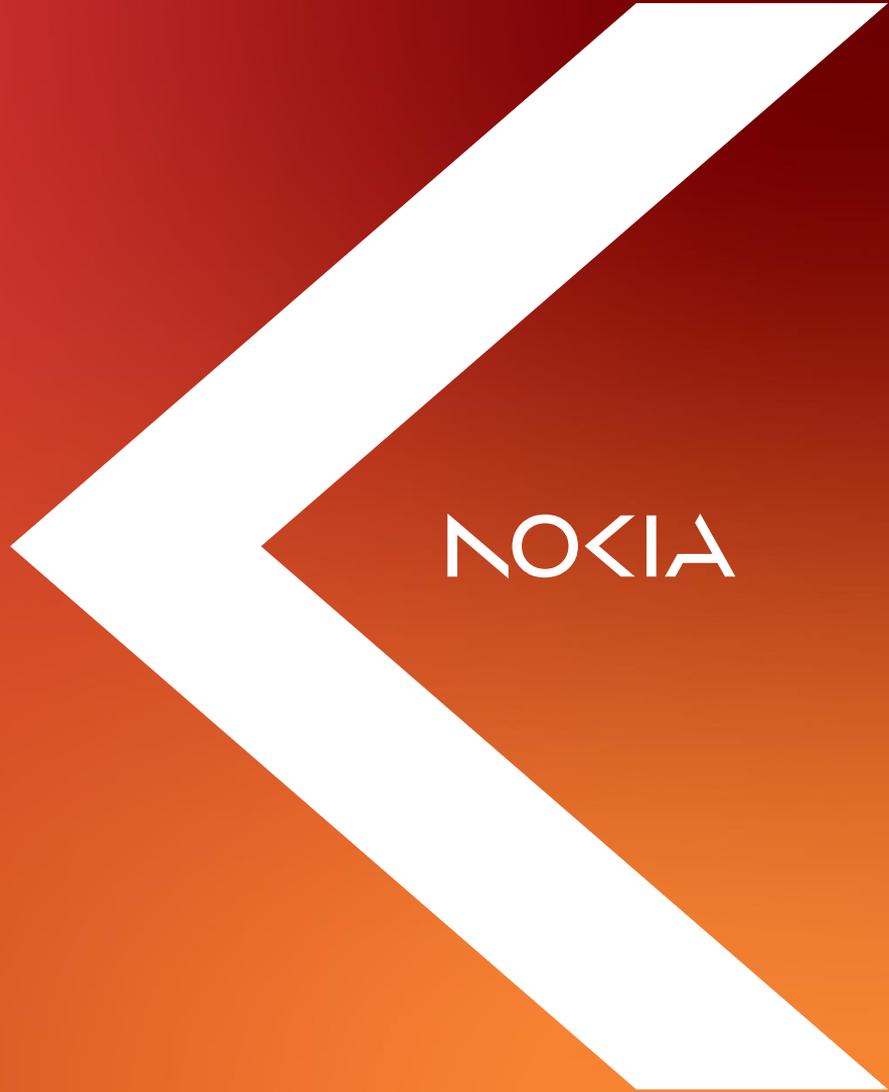


# DL Data Forward Tunnels

Nagaraja (Nag) Rao; Nokia

The Nokia logo is a large, white, stylized arrow pointing to the left, set against a red-to-orange gradient background. The word "NOKIA" is written in white, uppercase letters inside the arrow's shaft.

NOKIA

Table 8.2.118-1: Interface Type value

| Interface value                                | Values (Decimal) |
|--|------------------|
| S1-U   | 0                |
| S5 /S8-U (NOTE 1)                              | 1                |
| S4-U   | 2                |
| S11-U  | 3                |
| S12  | 4                |
| Gn/Gp-U (NOTE 2)                               | 5                |
| S2a-U  | 6                |
| S2b-U  | 7                |
| eNodeB GTP-U interface for DL data forwarding  | 8                |
| eNodeB GTP-U interface for UL data forwarding  | 9                |
| SGW/UPF GTP-U interface for DL data forwarding | 10               |
| N3 3GPP Access                                 | 11               |
| N3 Trusted Non-3GPP Access                     | 12               |
| N3 Untrusted Non-3GPP Access                   | 13               |
| N3 for data forwarding                         | 14               |
| N9 (or N9 for non-roaming, see NOTE 3)         | 15               |
| SGi  | 16               |
| N6   | 17               |
| N19  | 18               |
| S8-U   | 19               |
| Gp-U   | 20               |
| N9 for roaming                                 | 21               |

| Interface value                                | Values (Decimal) |
|--|------------------|
| Iu-U   | 22               |
| N9 for data forwarding                         | 23               |
| Sxa-U  | 24               |
| Sxb-U  | 25               |
| Sxc-U  | 26               |
| N4-U   | 27               |
| SGW/UPF GTP-U interface for UL data forwarding | 28               |
| N6mb/Nmb9                                      | 29               |
| N3mb   | 30               |
| N19mb  | 31               |
| Spare  | 32 to 63         |

**NOTE 1:** If separation of roaming and non-roaming traffic is desired this value should only be used for the S5-U interface and "S8-U" (decimal 19) should be used for the S8-U interface.

**NOTE 2:** If separation of roaming and non-roaming traffic is desired this value should only be used for the Gn-U interface and "Gp-U" (decimal 20) should be used for the Gp-U interface.

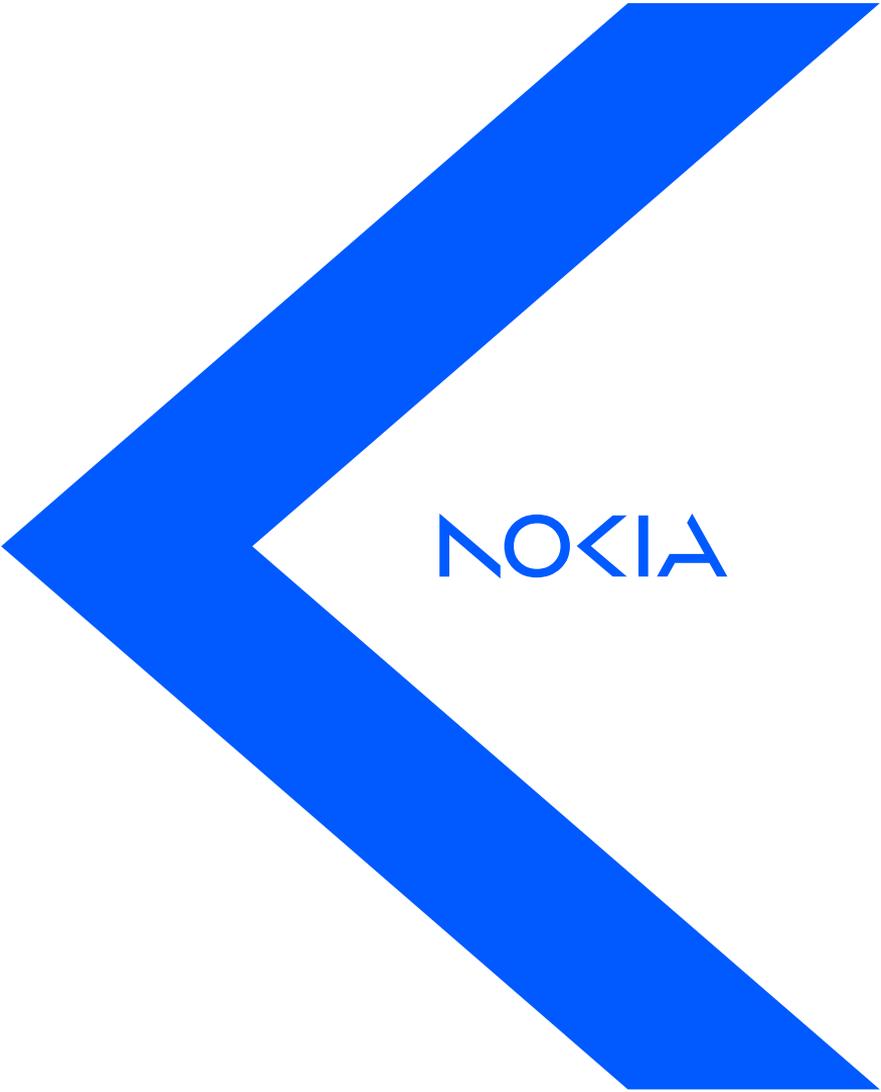
**NOTE 3:** If separation of roaming and non-roaming traffic is desired, this value should only be used for N9 non-roaming interfaces and (decimal value "21") should be used for N9 roaming interfaces.

# 5G-5G Handover (N2-based)

The Nokia logo is positioned on the right side of the slide. It consists of the word "NOKIA" in a white, sans-serif font, centered within a large white circle. The background of the slide is a blue-to-green gradient, and the circle is partially cut off by the right edge.

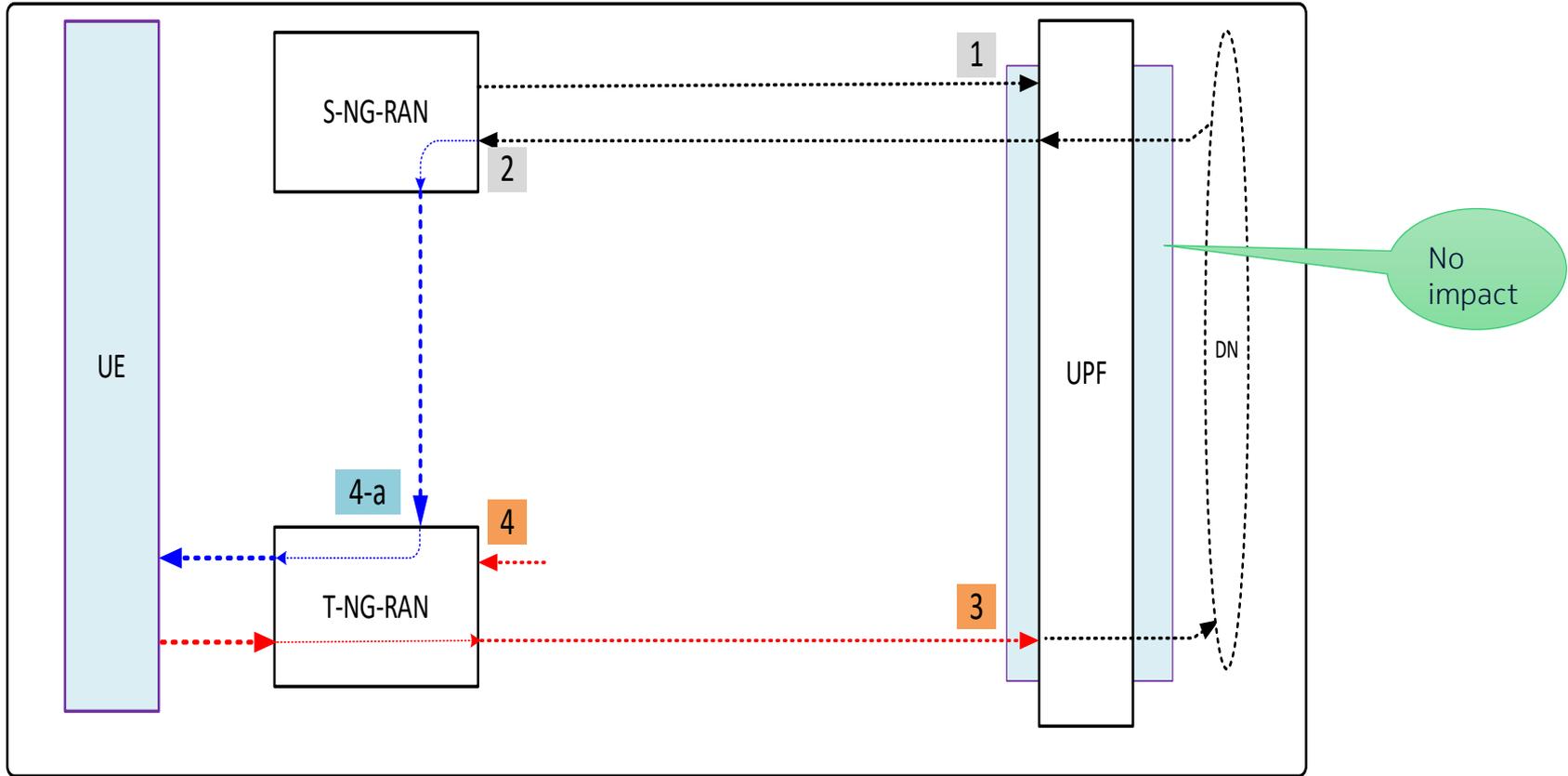
NOKIA

Non-roaming

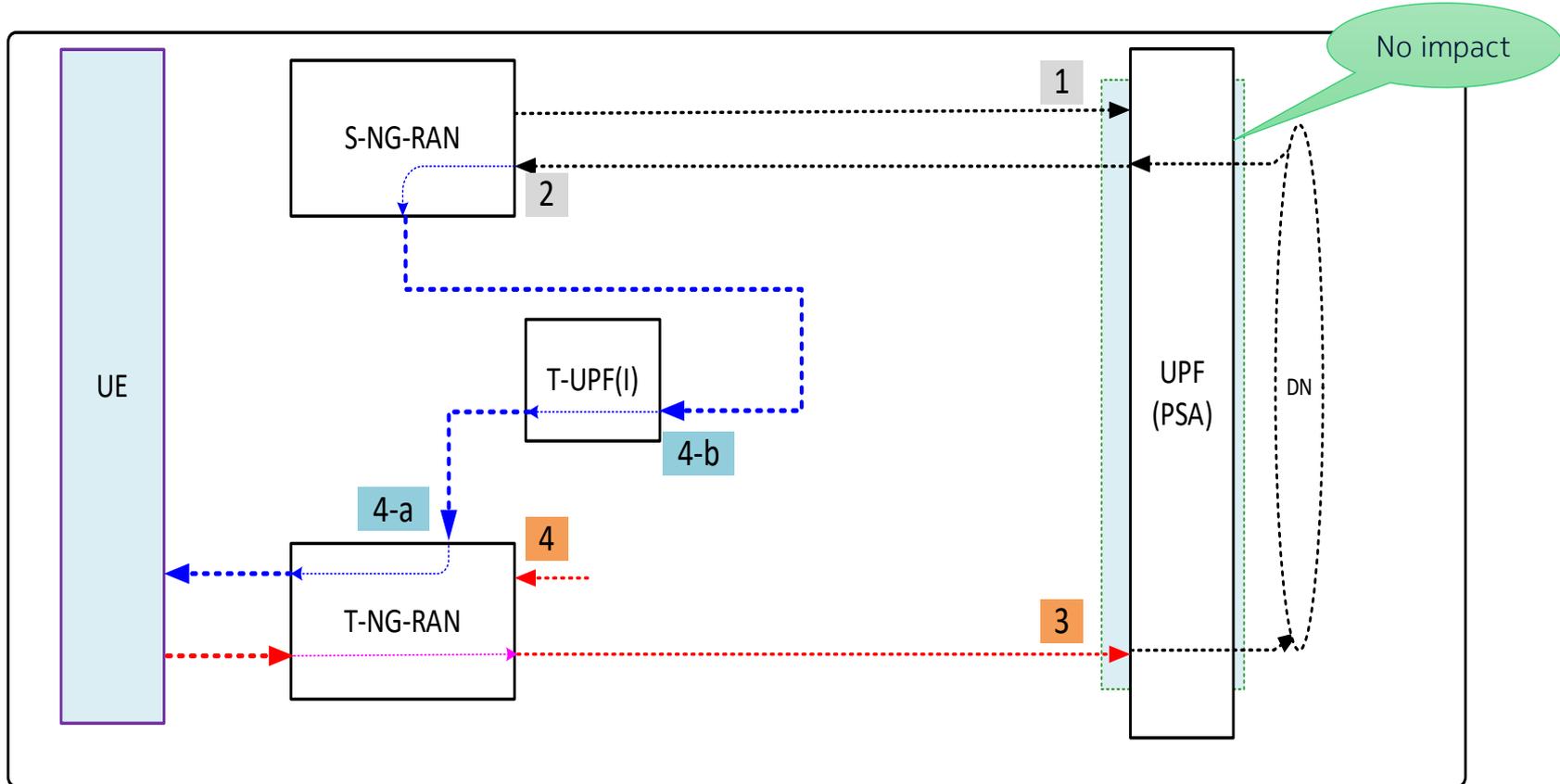
The Nokia logo is a large, stylized blue arrow pointing to the left, with the word "NOKIA" in blue capital letters centered within the arrow's shaft.

NOKIA

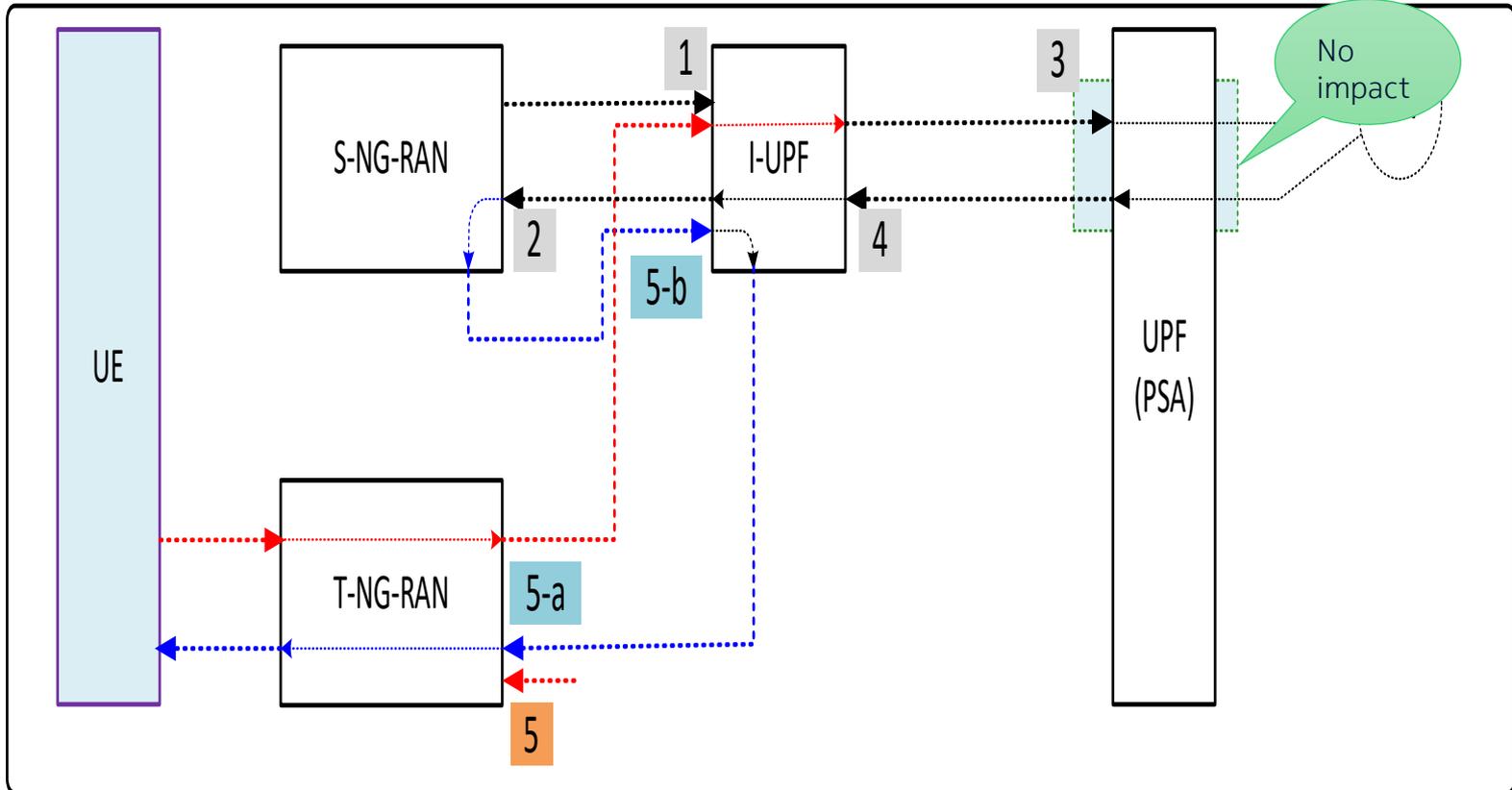
# Direct DL Data Forward without UPF relocation



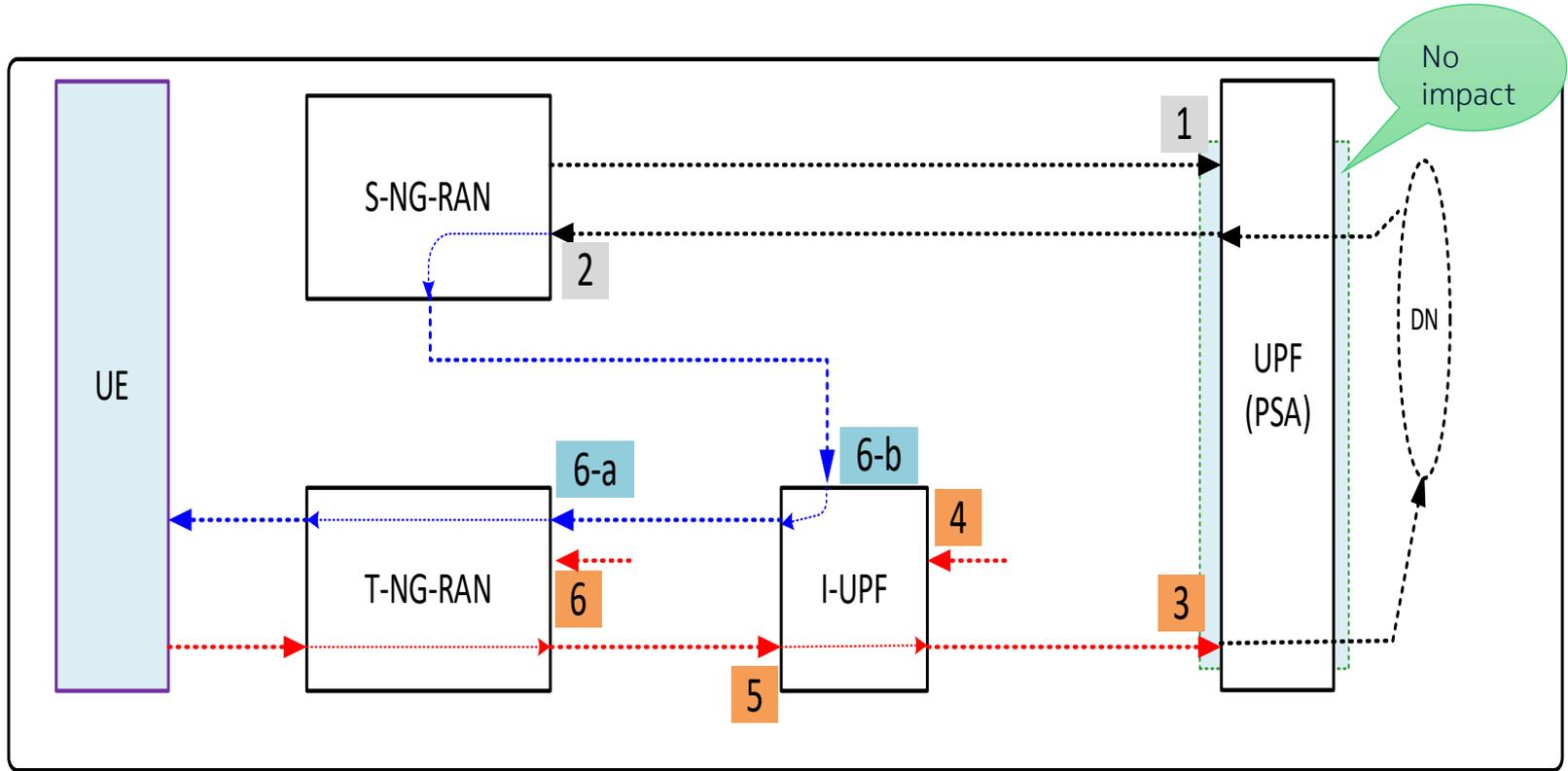
# Indirect DL Data Forward without UPF relocation



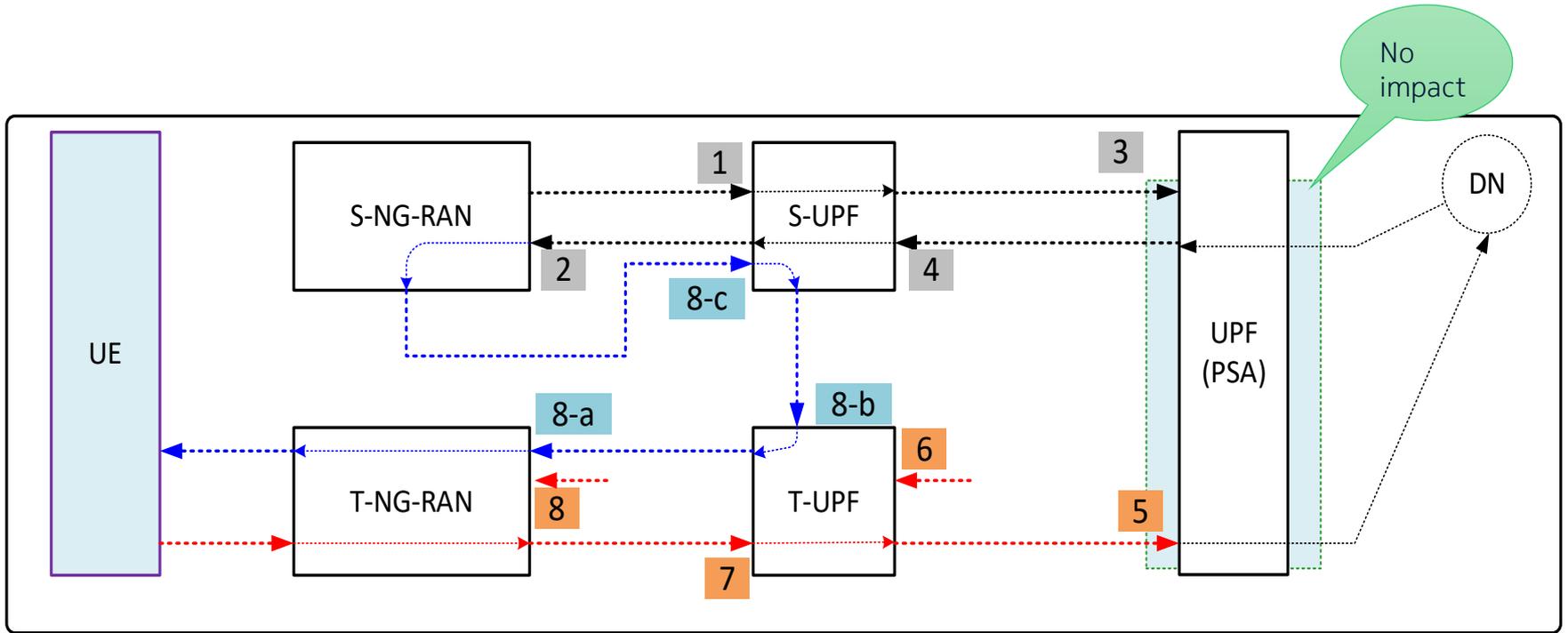
# Indirect DL Data Forward without UPF relocation – case 2



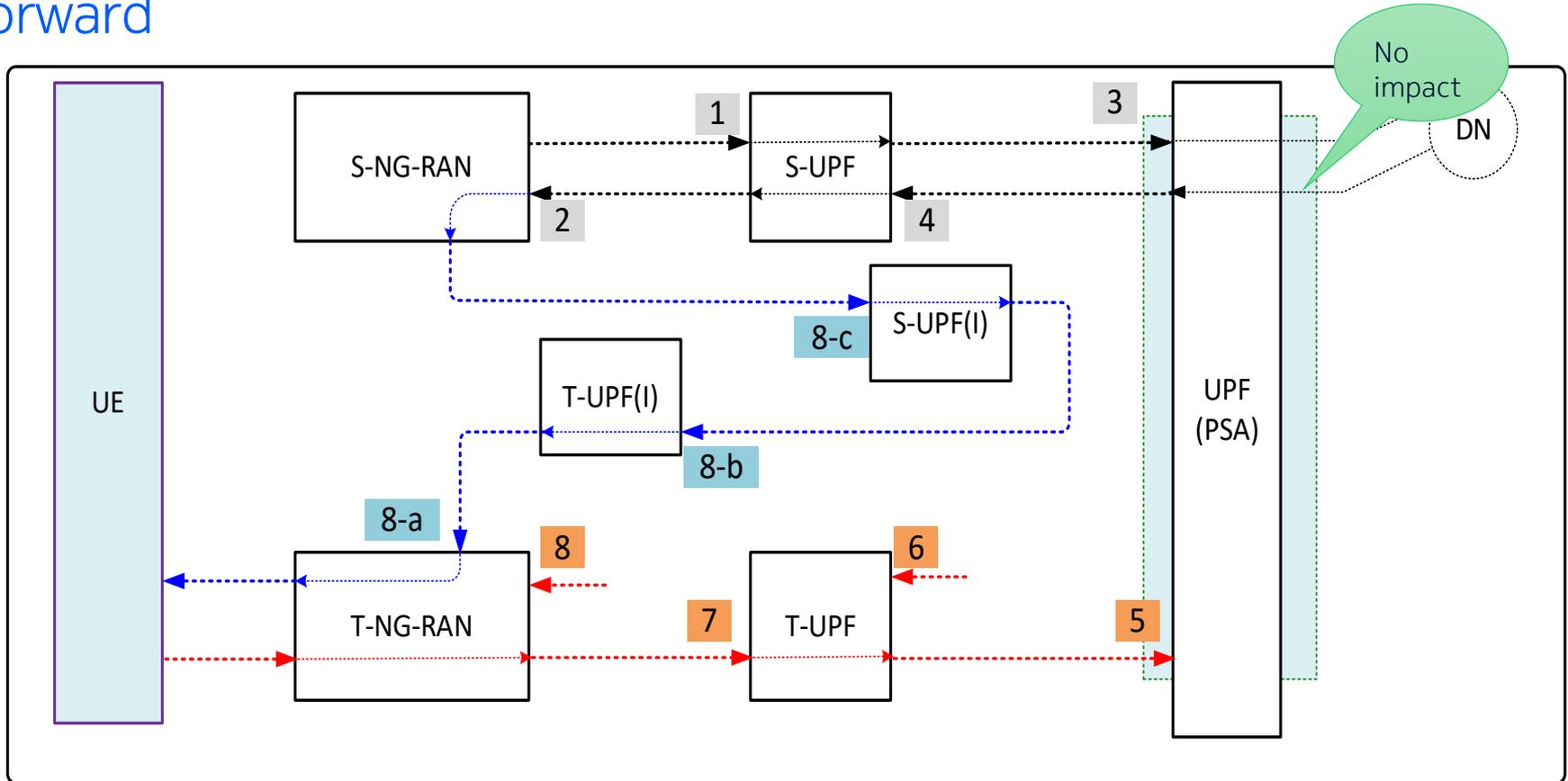
# Indirect DL Data Forward with UPF relocation



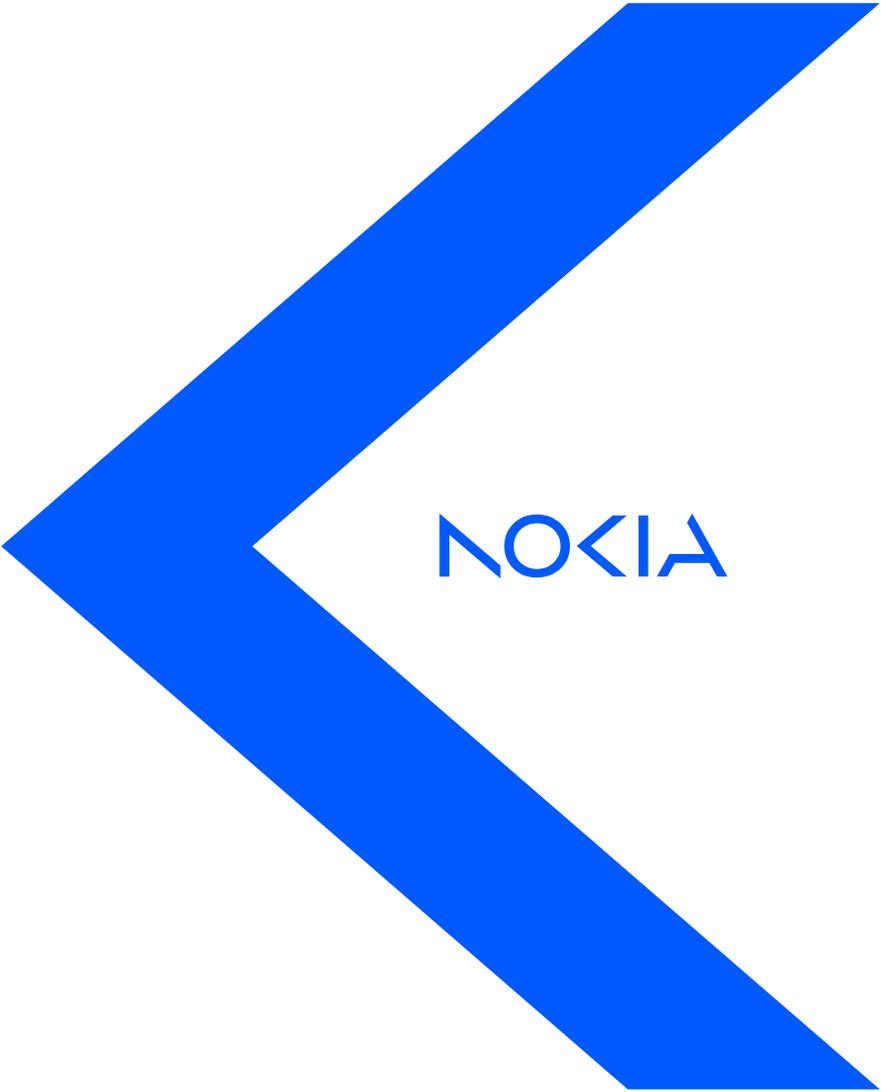
# Indirect DL Data Forward with UPF relocation – case 2



# Indirect DL Data Forward with intermediate UPFs for DL data forward

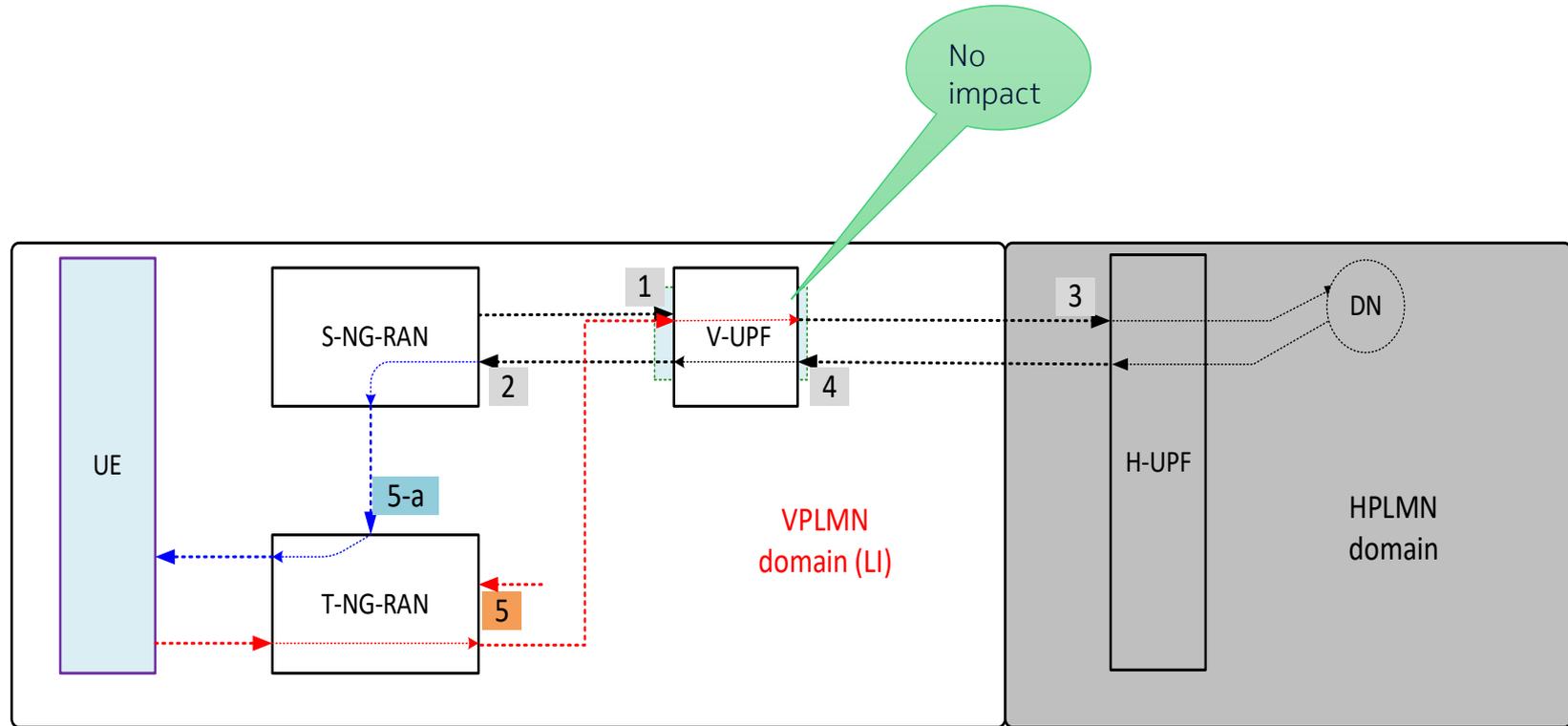


# Roaming

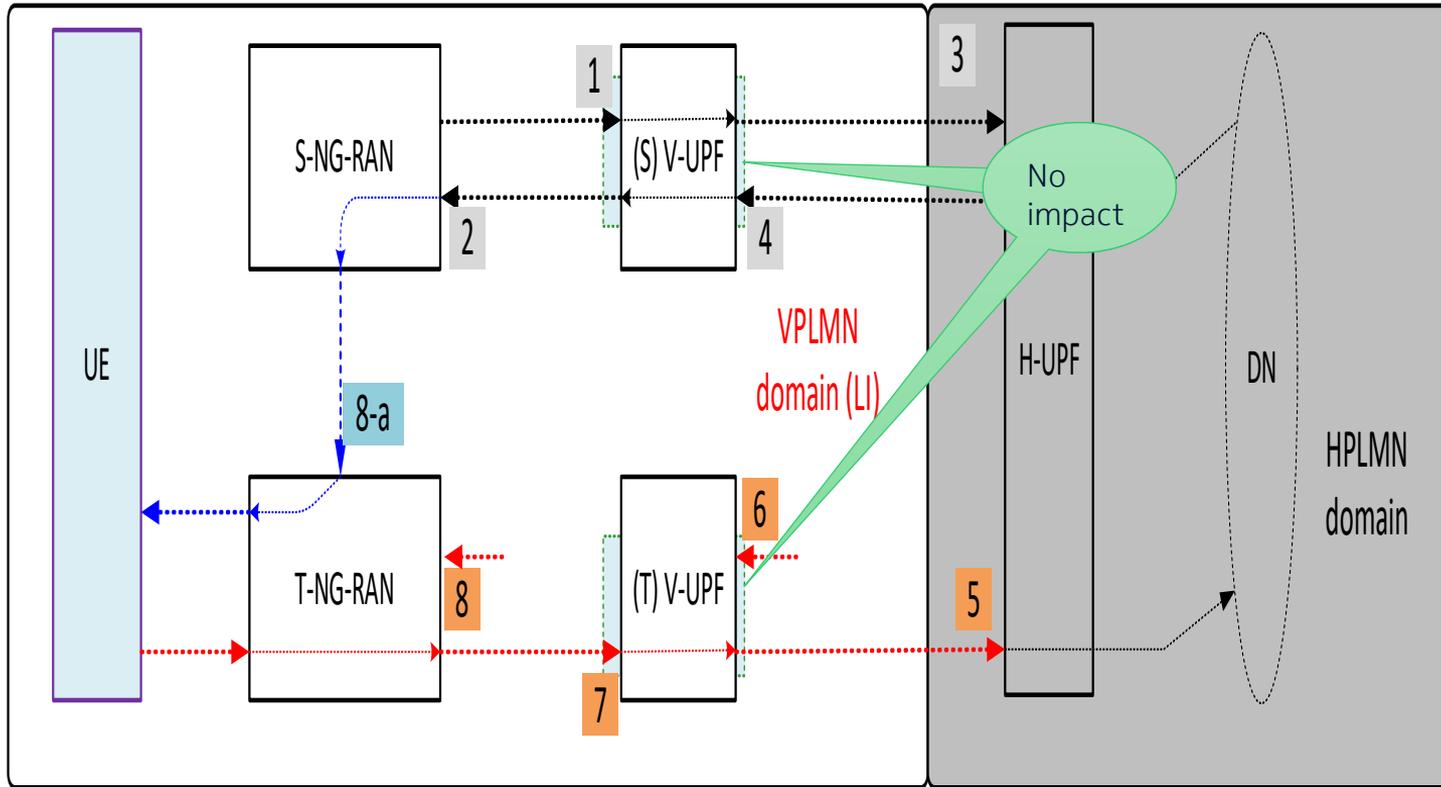
The Nokia logo is a large, stylized blue arrow pointing to the left, with the word "NOKIA" in blue capital letters centered within the arrow's shaft.

NOKIA

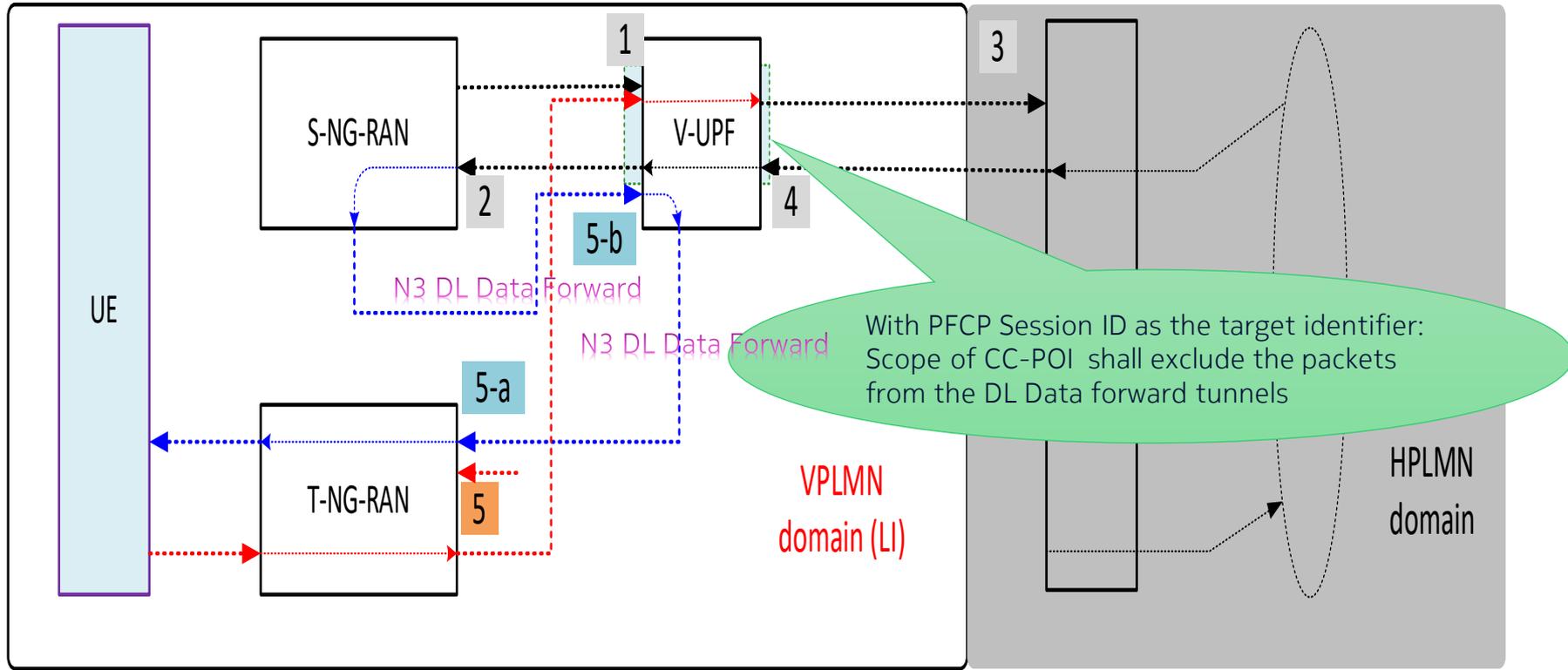
# Direct DL Data Forward – VPLMN (without V-UPF relocation)



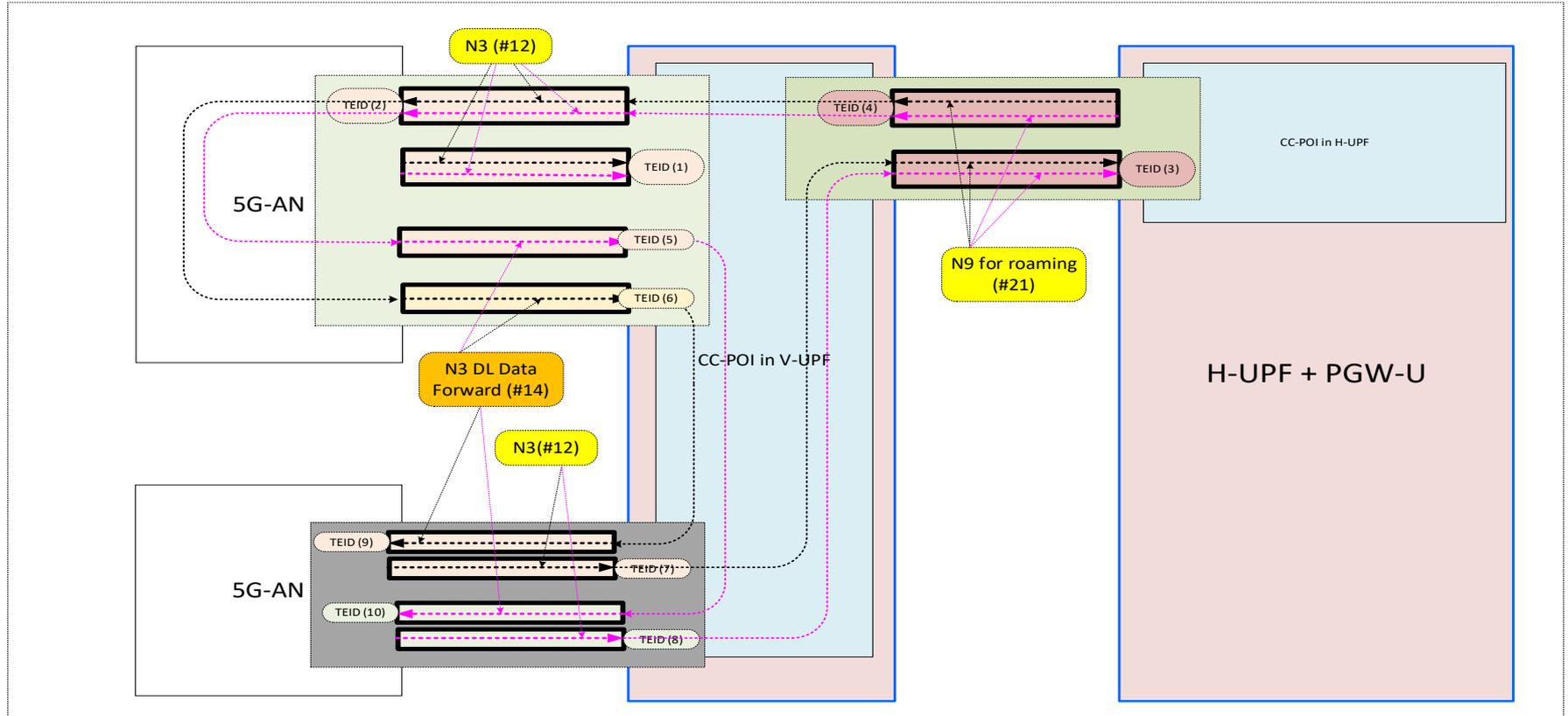
# Direct DL Data Forward – VPLMN (with V-UPF relocation)



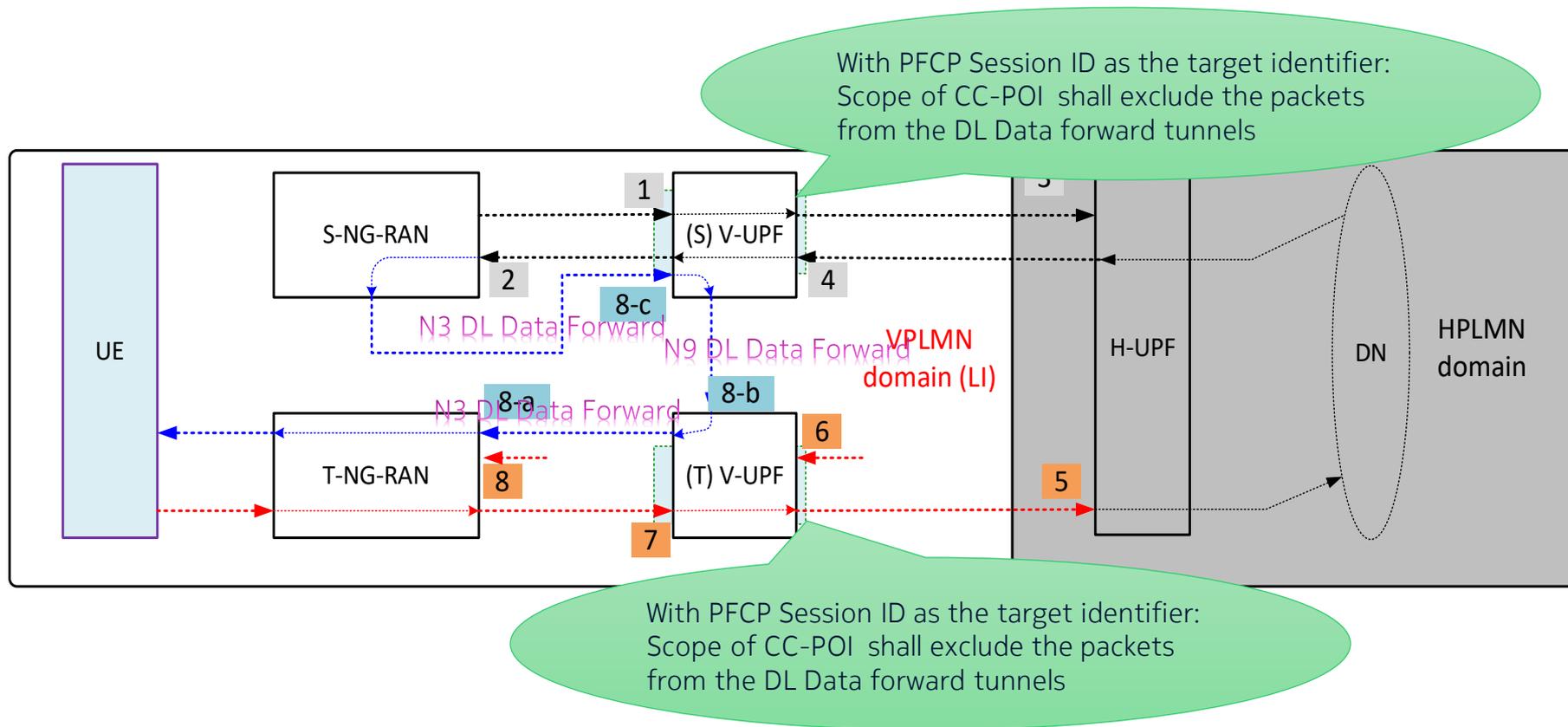
# Indirect DL Data Forward without UPF relocation



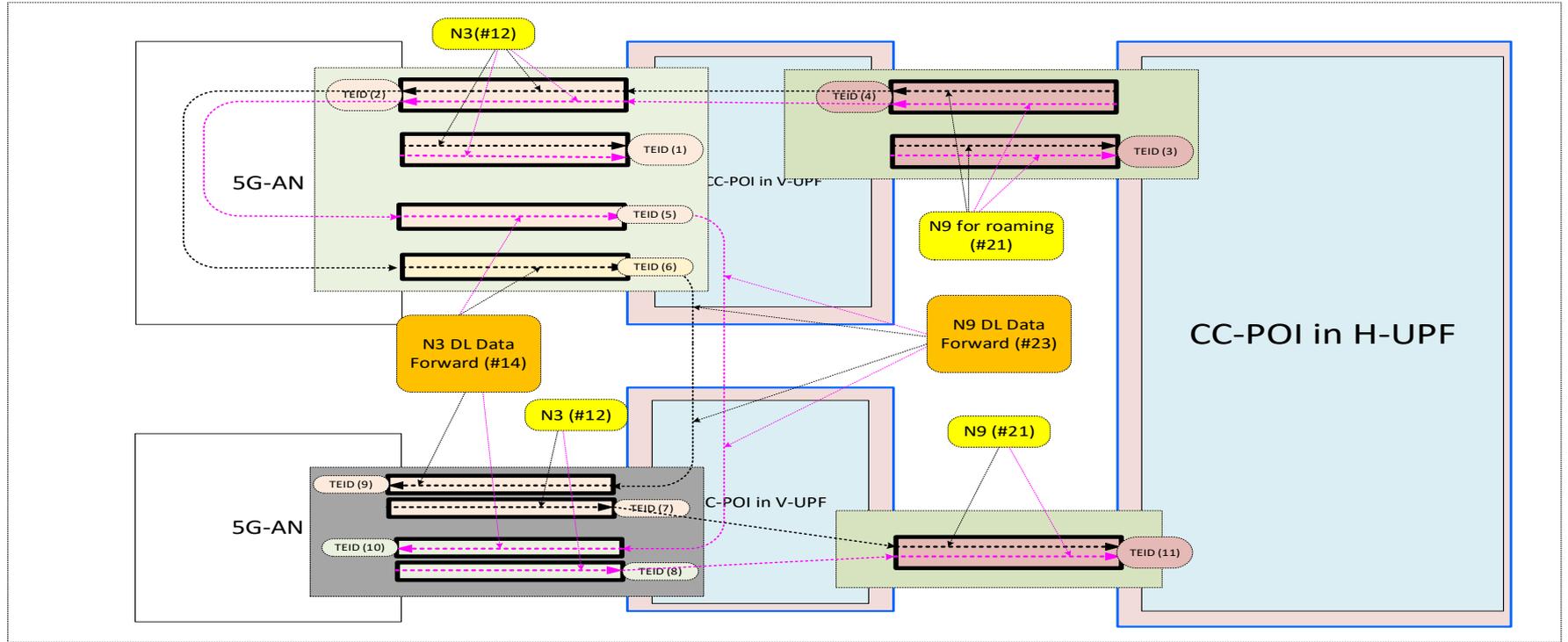
# Indirect DL Data Forward without UPF relocation



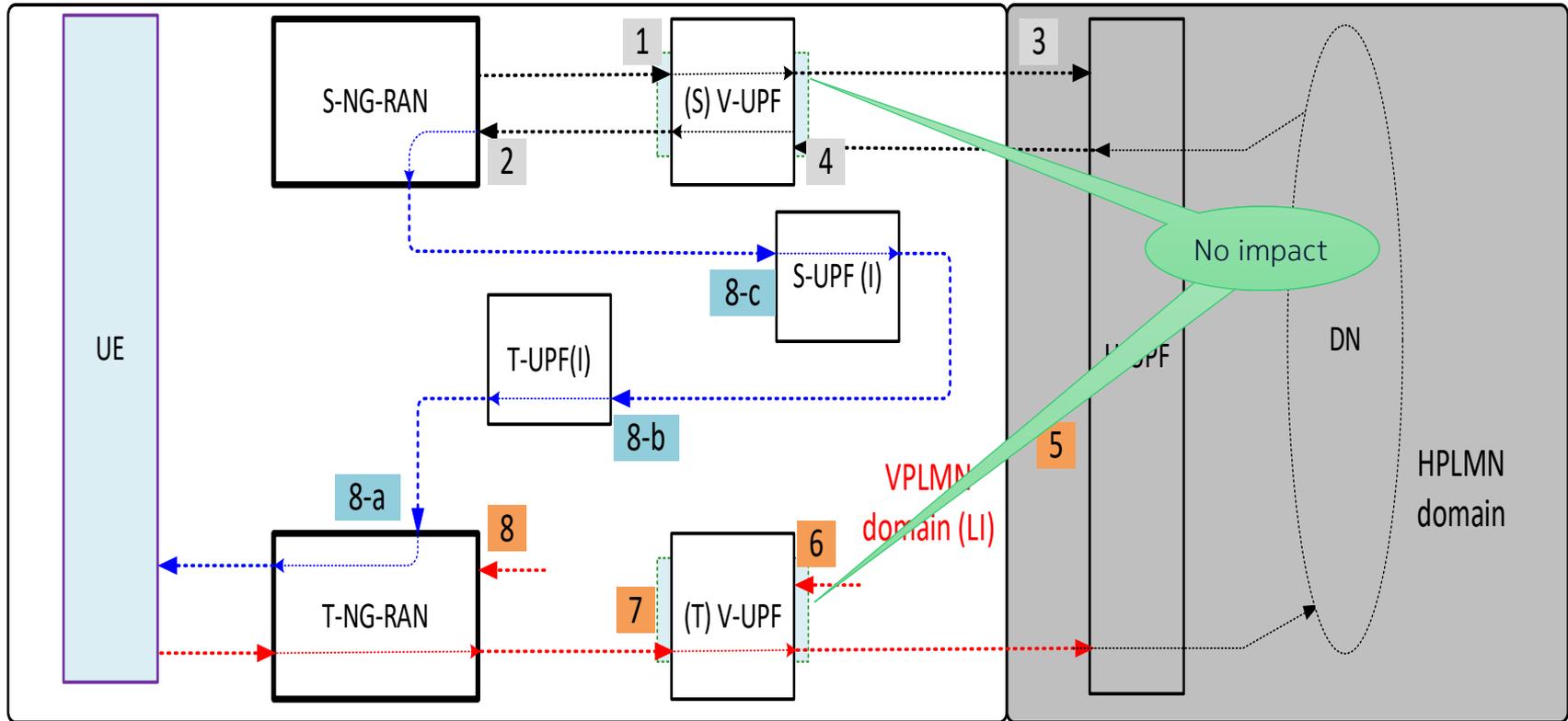
# Indirect DL Data Forward (VPLMN) with V-UPF relocation



# Indirect DL Data Forward (VPLMN) with V-UPF relocation



# Indirect DL Data Forward with intermediate UPFs for DL data forward

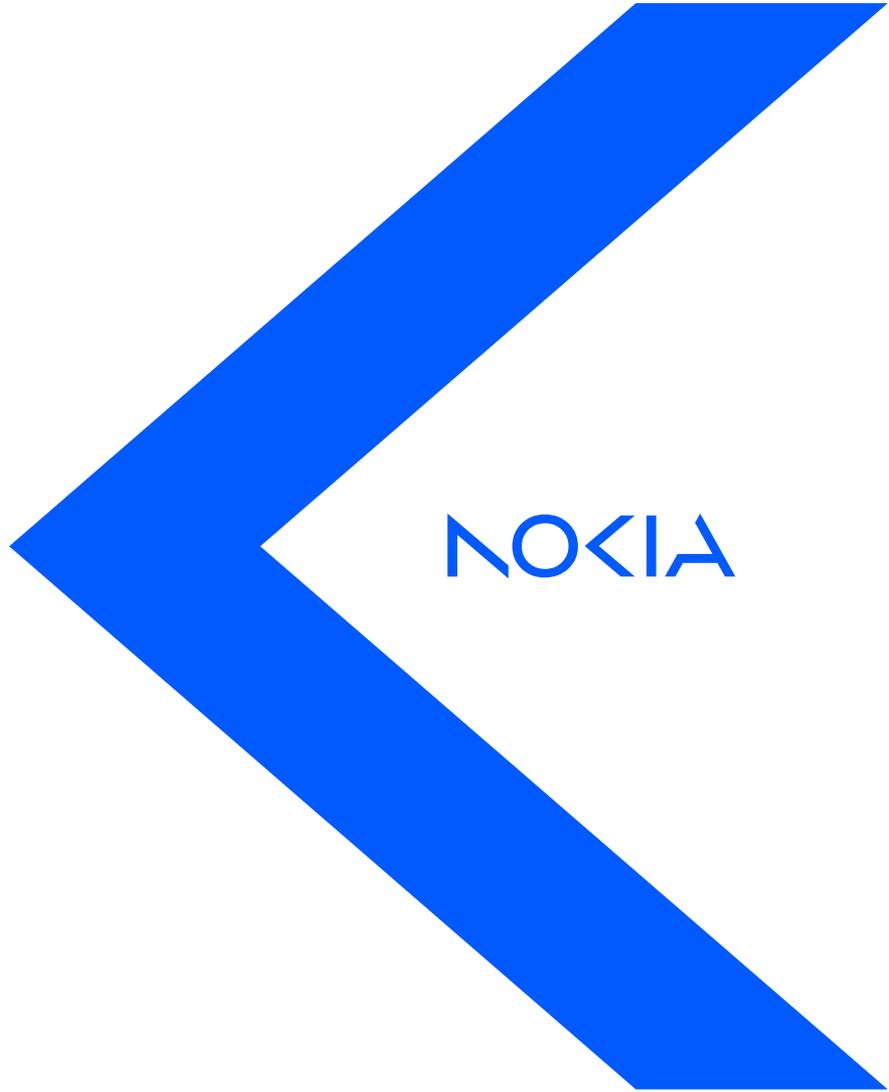


# 5G-4G Handover (N26-based)

The Nokia logo is a large white circle with a thick border, centered on the right side of the slide. Inside the circle, the word "NOKIA" is written in a white, sans-serif font.

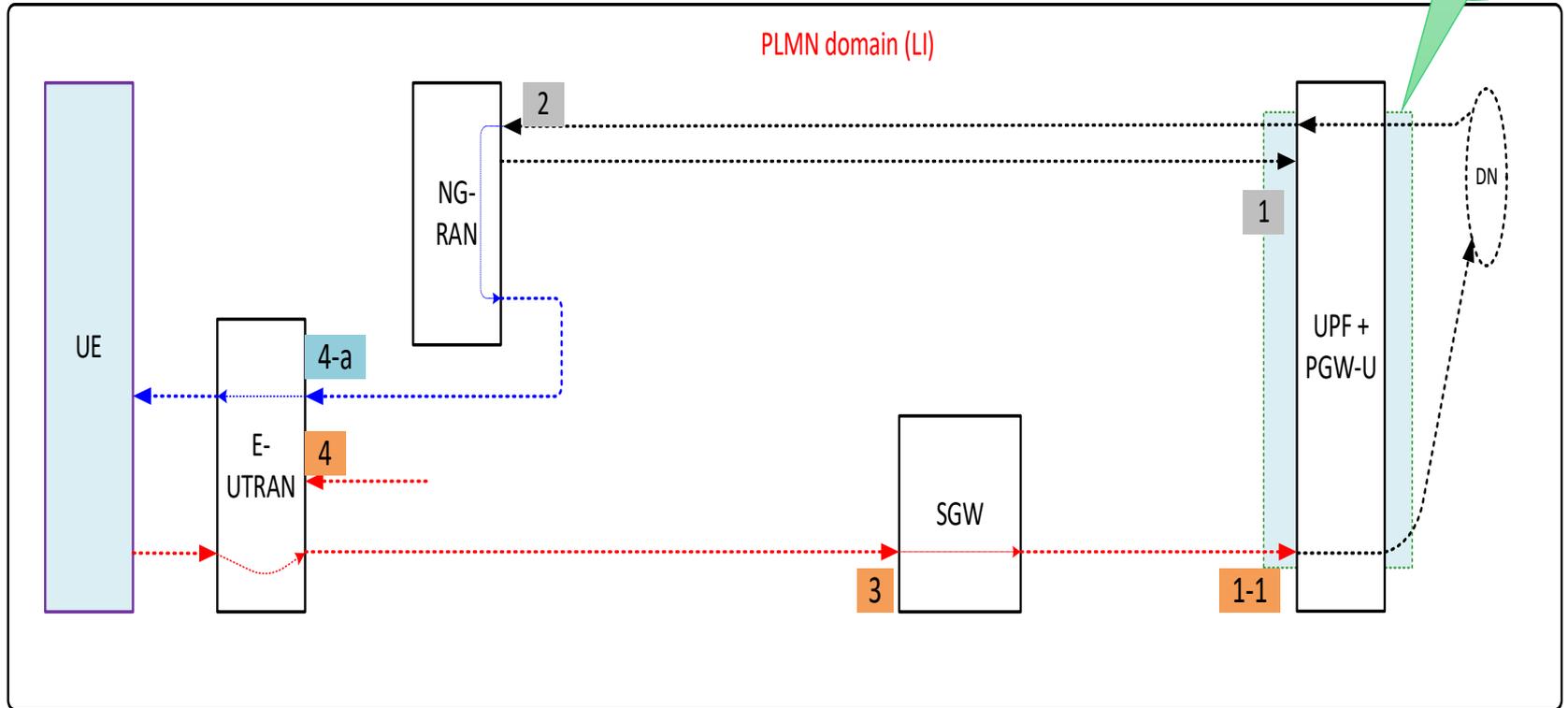
NOKIA

Non-roaming

The Nokia logo is a large, stylized blue arrow pointing to the left, with the word "NOKIA" in blue capital letters centered within the arrow's shaft.

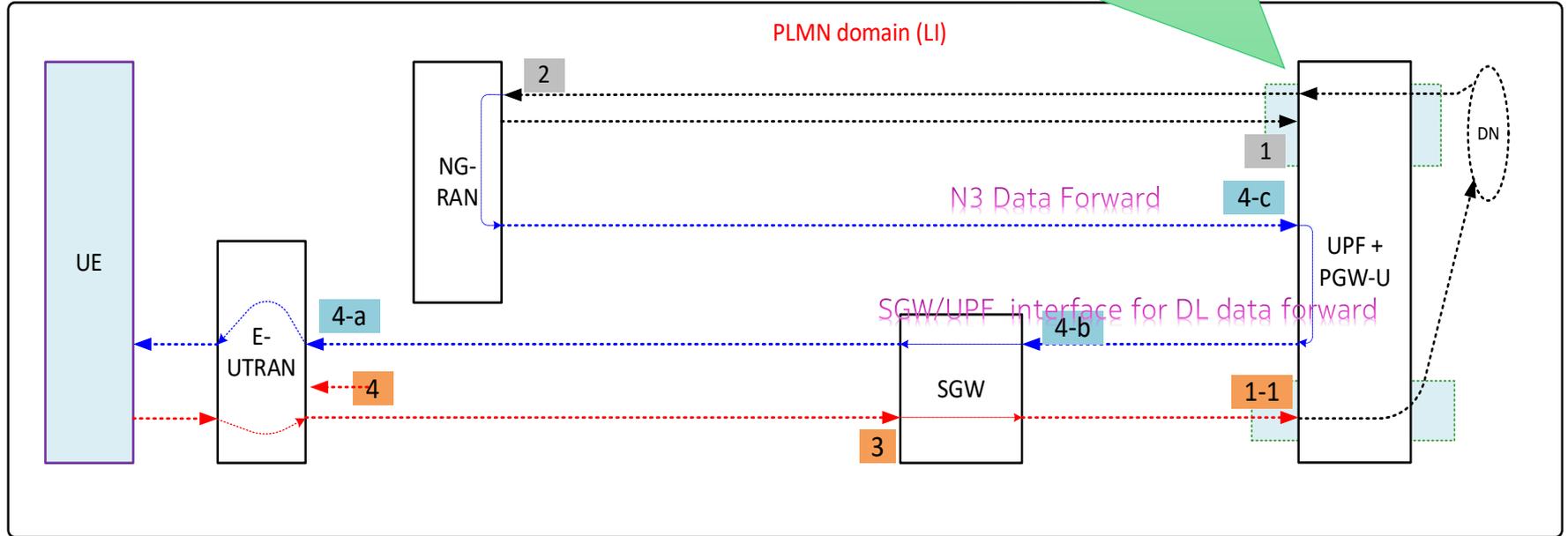
NOKIA

# Direct DL Data Forward – no roaming

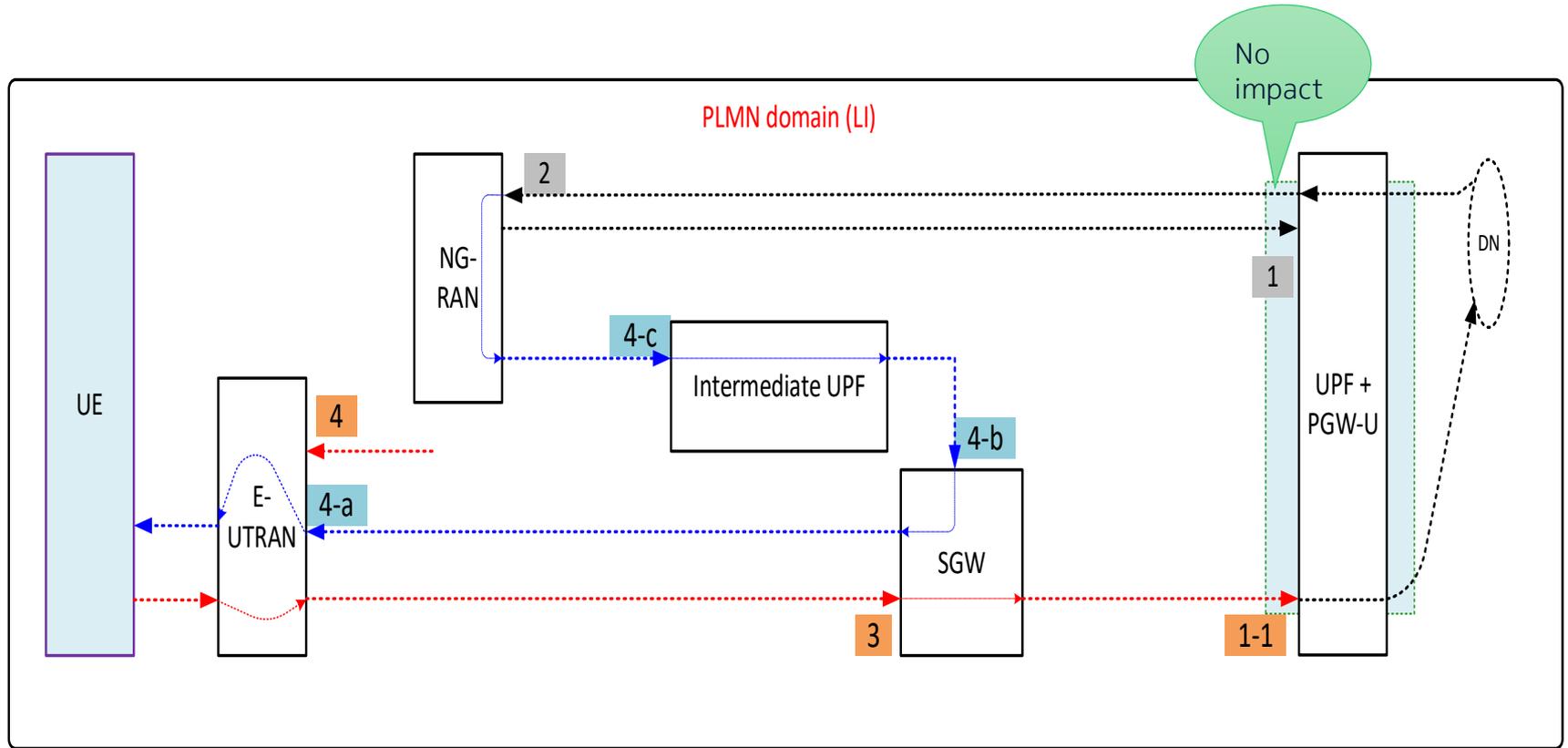


# Indirect DL Data Forward

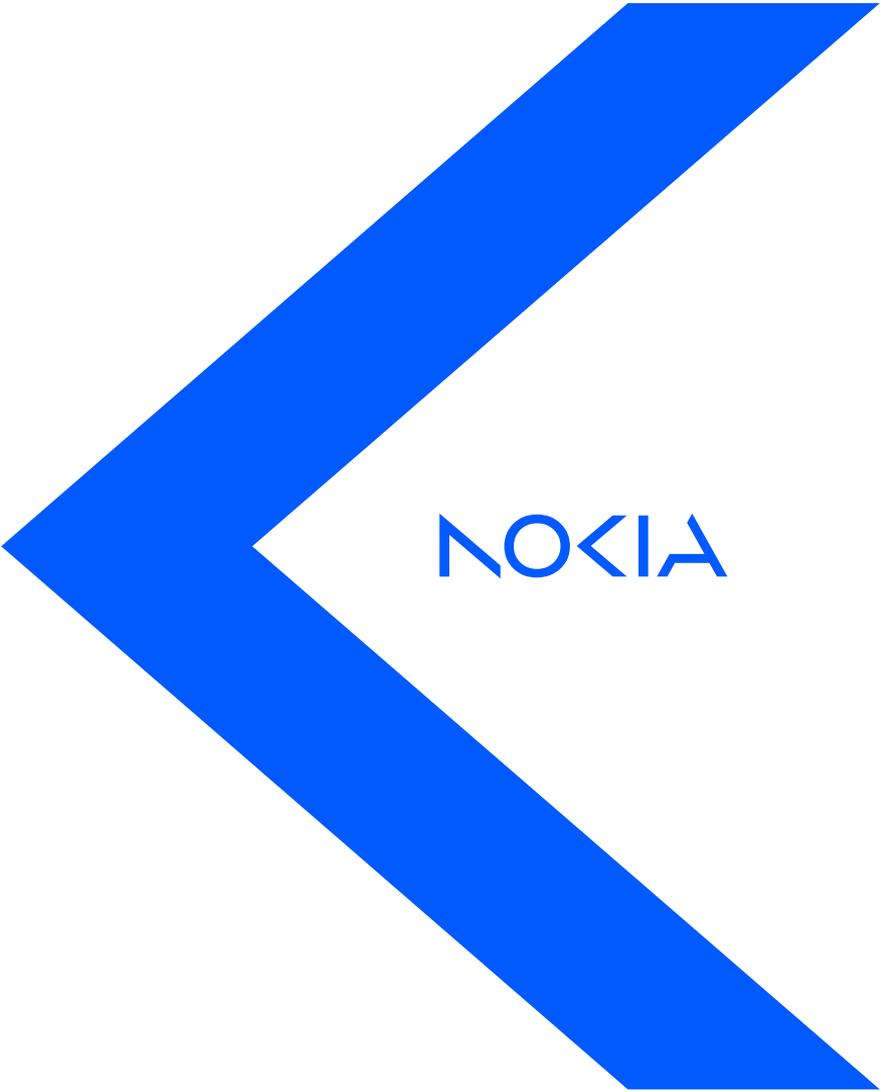
With PCFP Session ID as the target identifier:  
Scope of CC-POI shall exclude the packets  
from the DL Data forward tunnel



# Indirect DL Data Forward with intermediate UPF for DL data forward

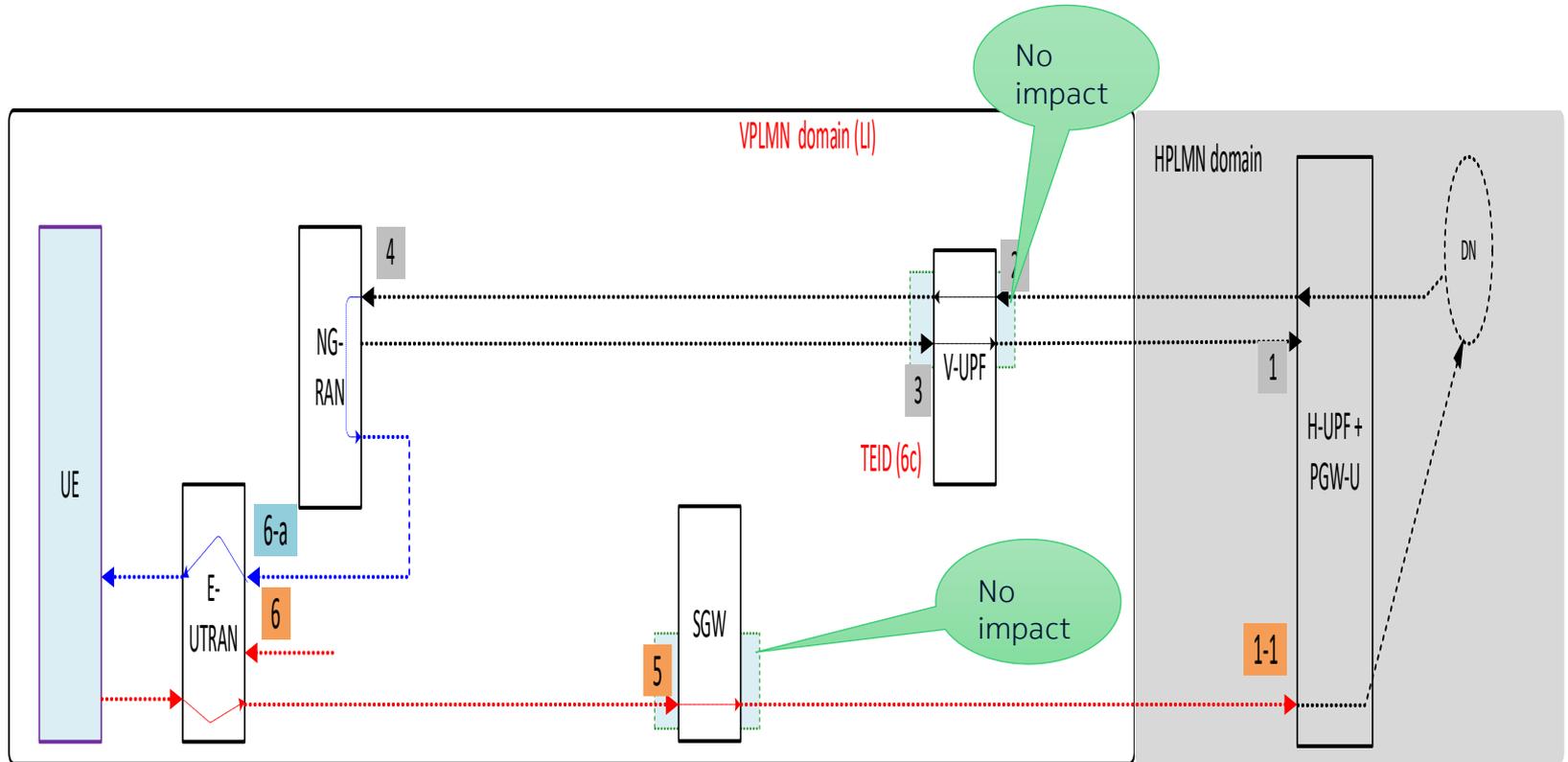


# Roaming

A large, thick blue arrow pointing to the left, with the word "NOKIA" in blue capital letters centered inside its shaft.

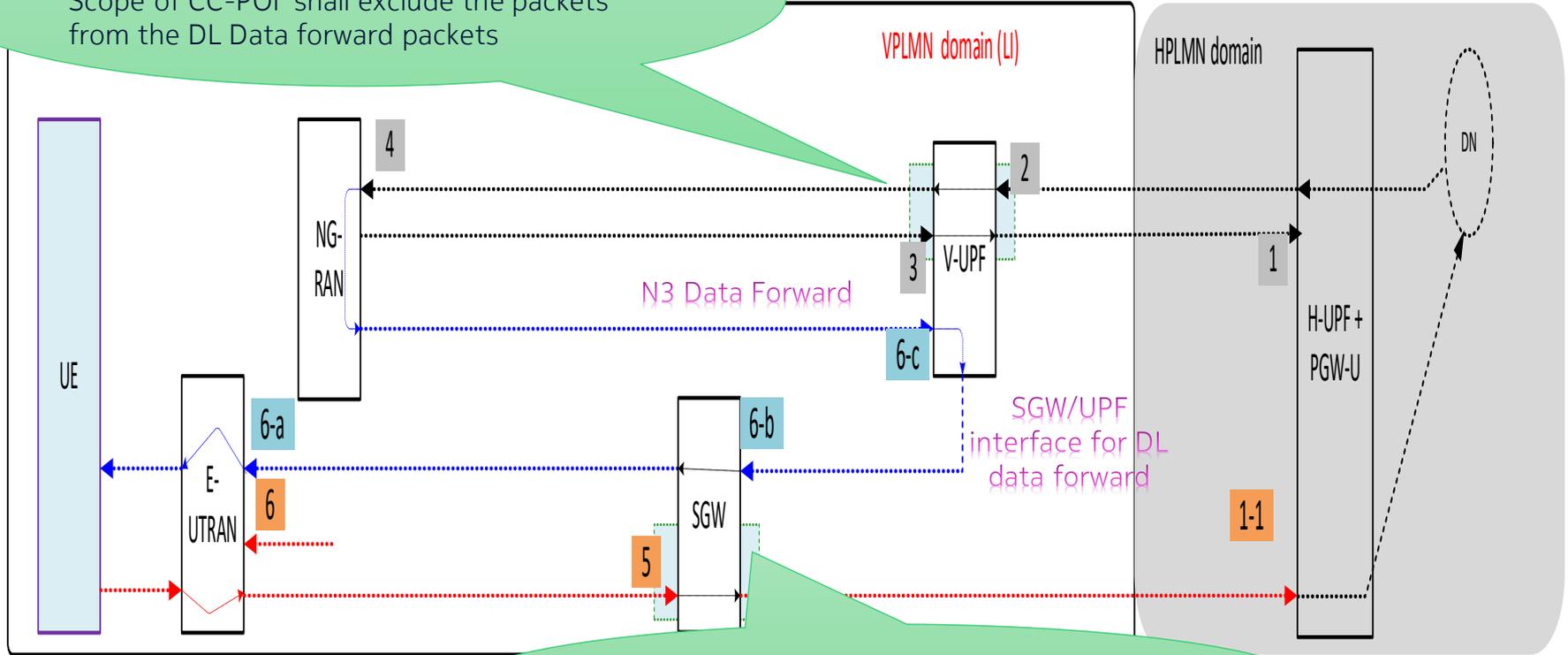
NOKIA

# Direct DL Data Forward – VPLMN



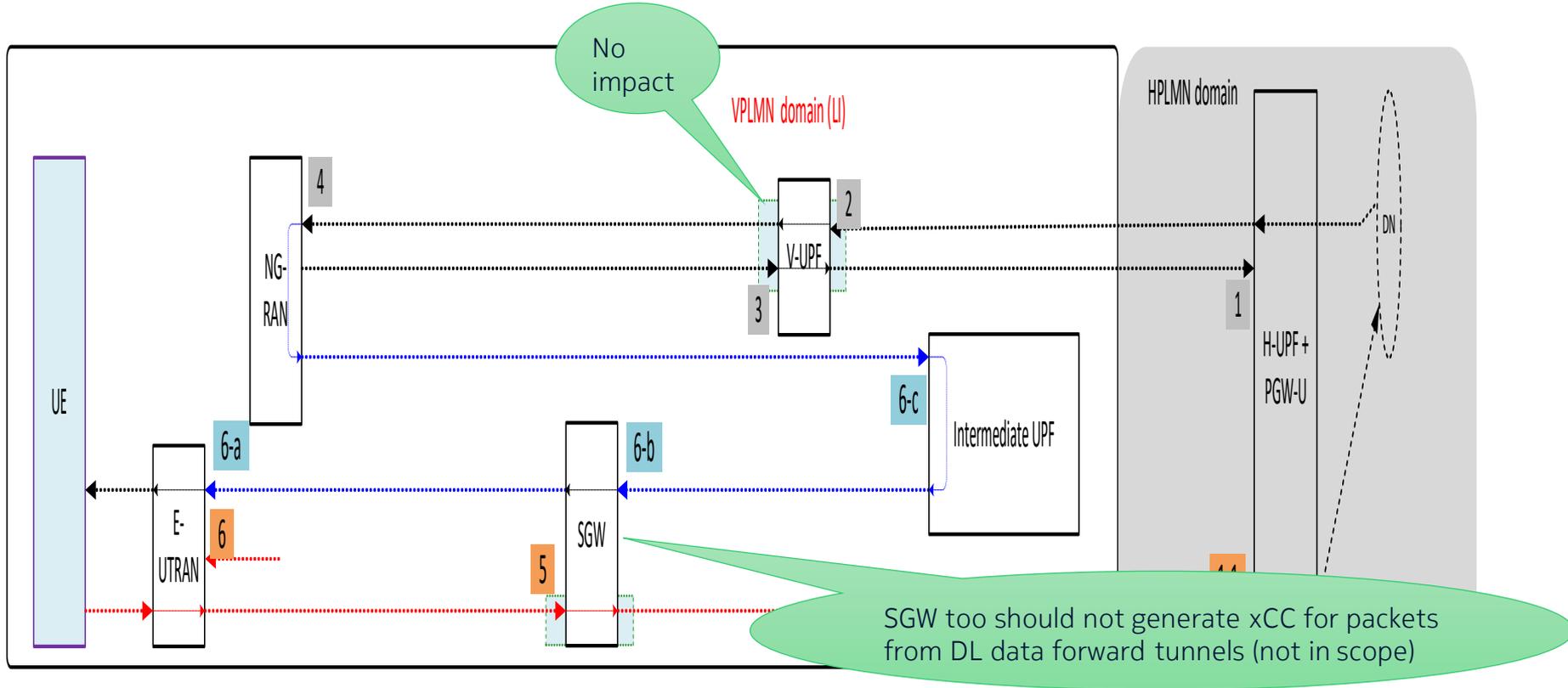
# Indirect DL Data Forward

With PCFP Session ID as the target identifier:  
Scope of CC-POI shall exclude the packets  
from the DL Data forward packets



SGW too should not generate xCC for packets  
from DL data forward tunnels (not in scope)

# Indirect DL Data Forward with intermediate UPF for DL data forward

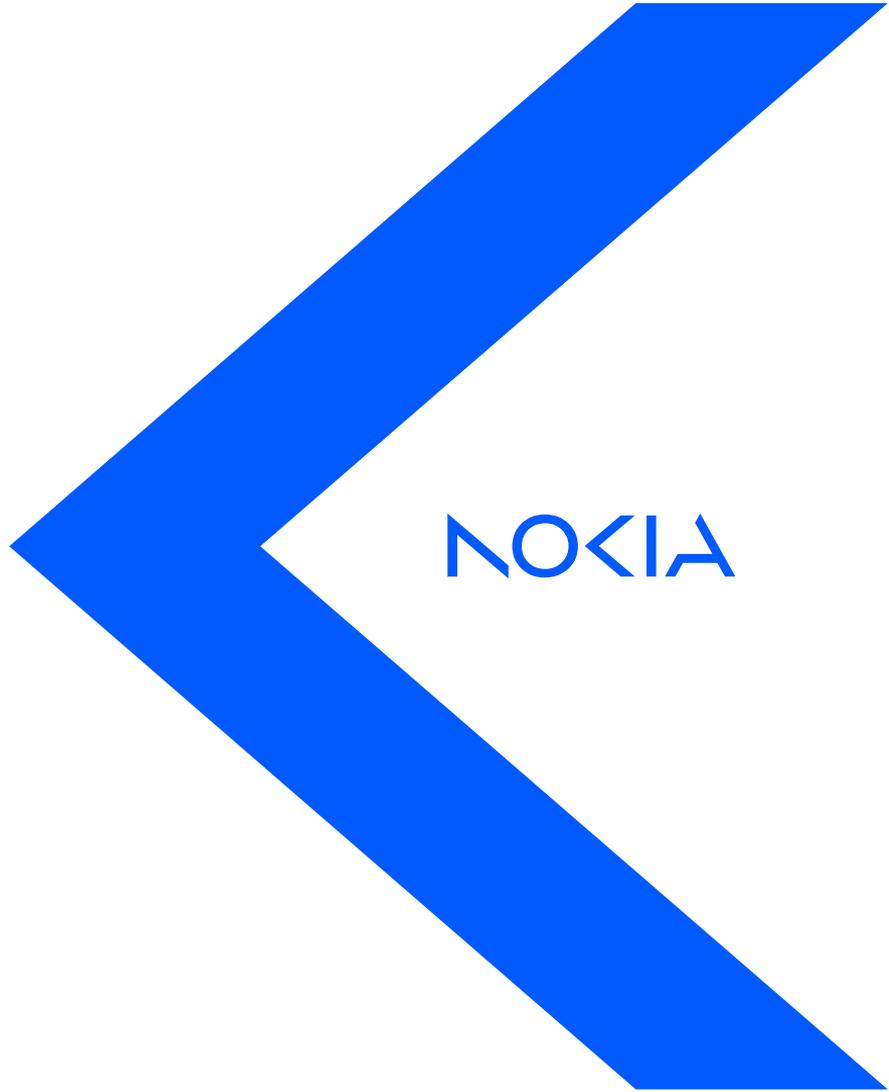


# 4G-5G Handover (N26-based)

The Nokia logo is a large white circle on a blue-to-green gradient background. Inside the circle, the word "NOKIA" is written in white, uppercase, sans-serif font.

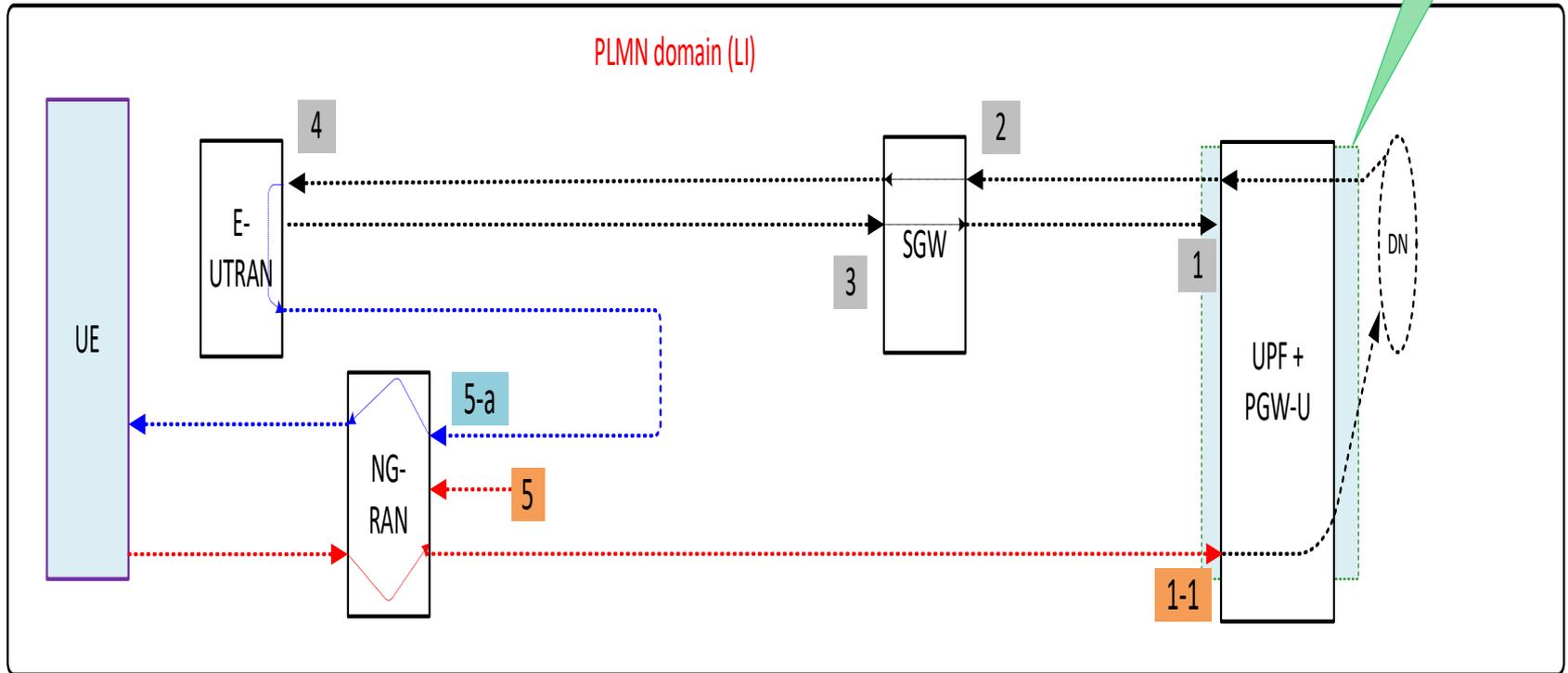
NOKIA

Non-roaming

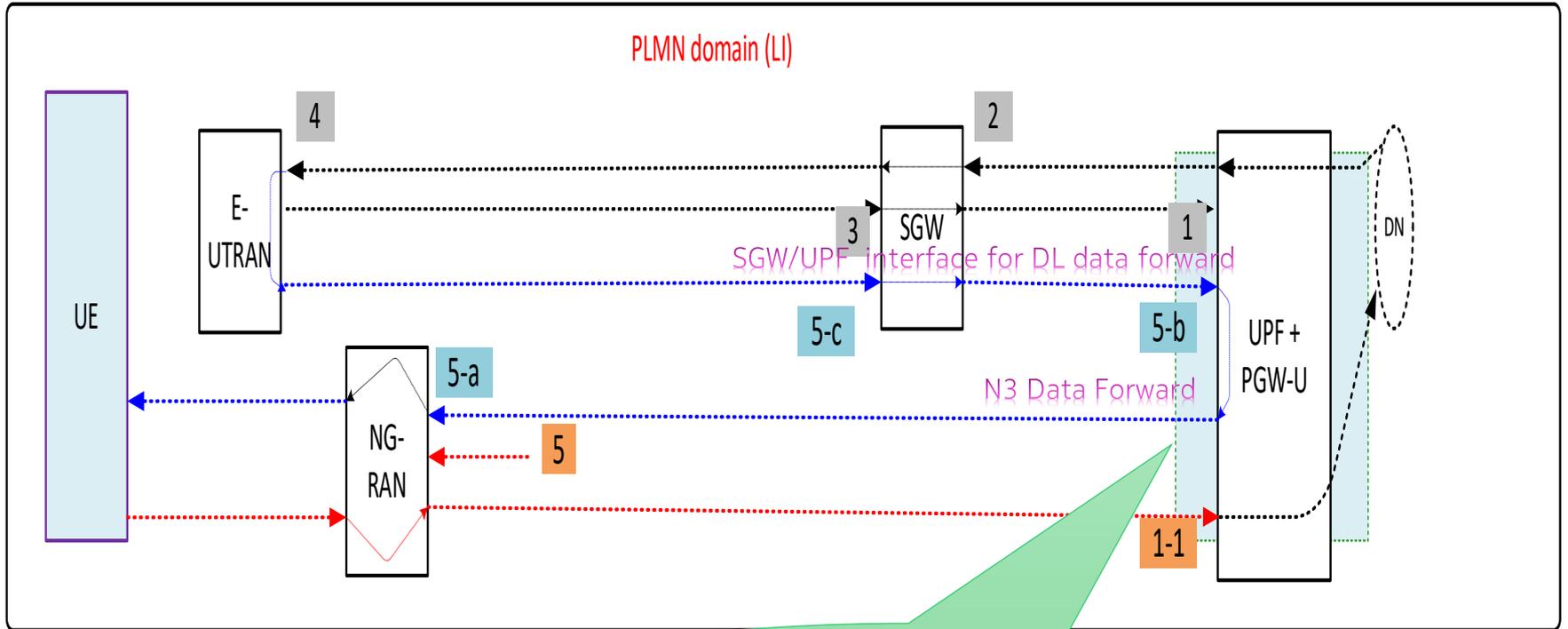
The Nokia logo is a large, stylized blue arrow pointing to the left, with the word "NOKIA" in blue capital letters centered within the arrow's shaft.

NOKIA

# Direct DL Data Forward – no roaming

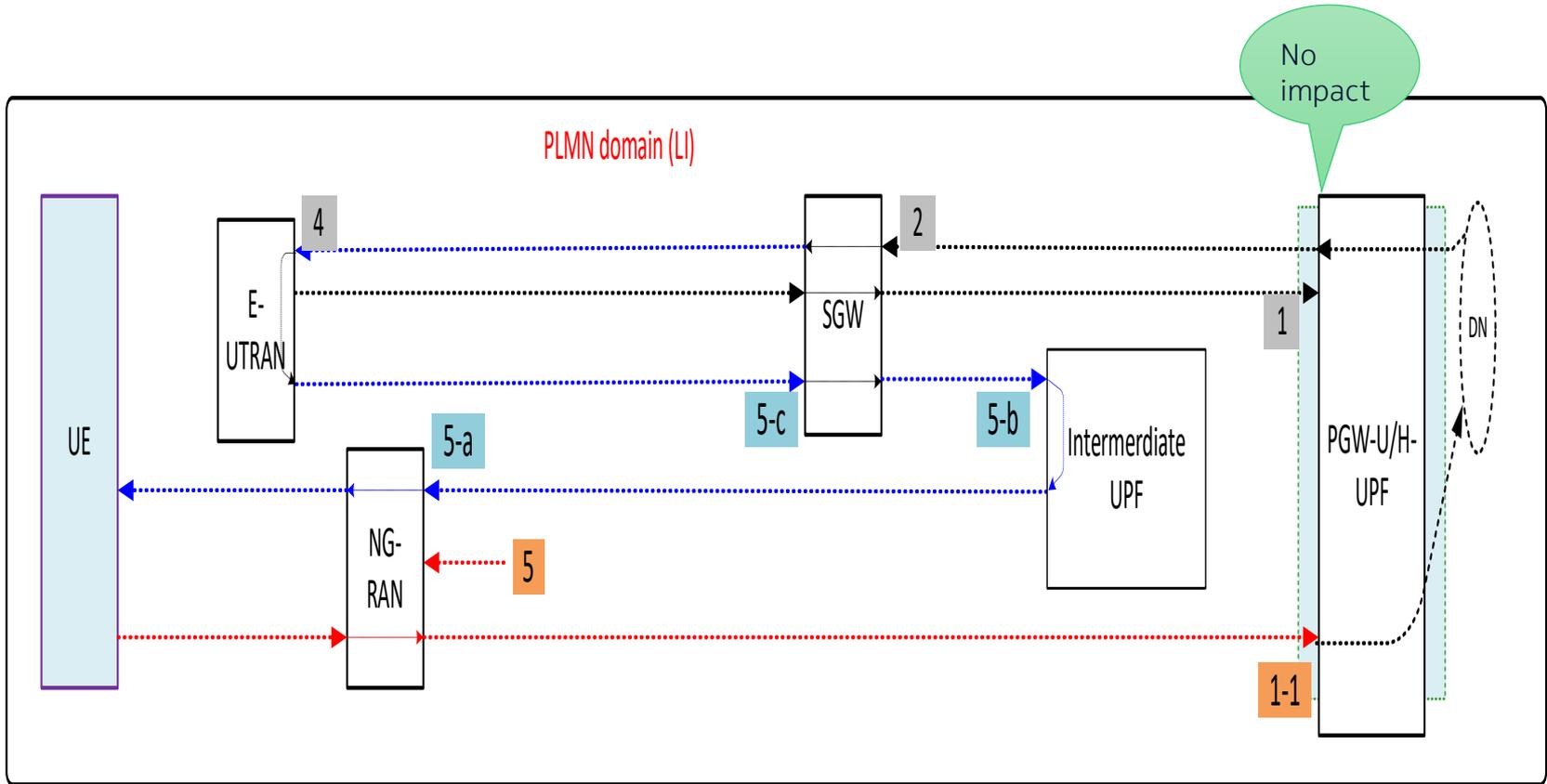


# Indirect DL Data Forward

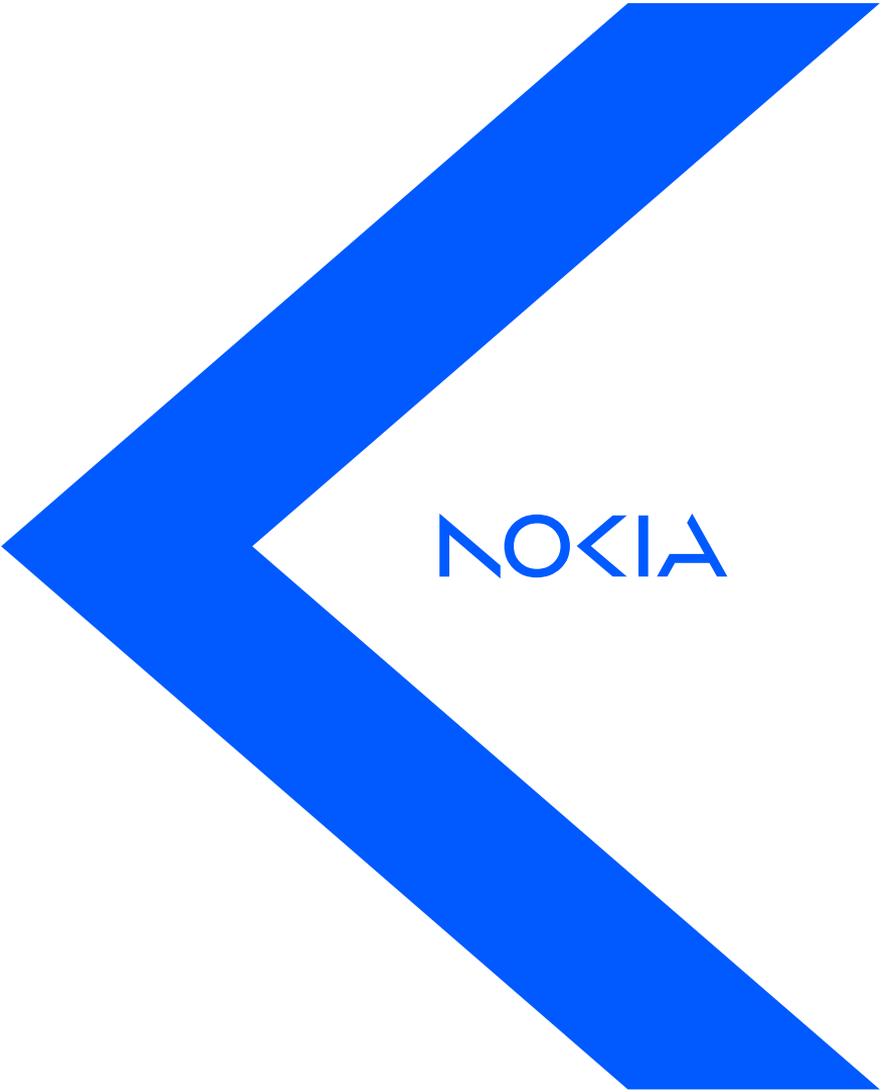


With PFCP Session ID as the target identifier:  
Scope of CC-POI shall exclude the packets  
from the DL Data forward tunnel

# Indirect DL Data Forward with intermediate UPF for DL data forward

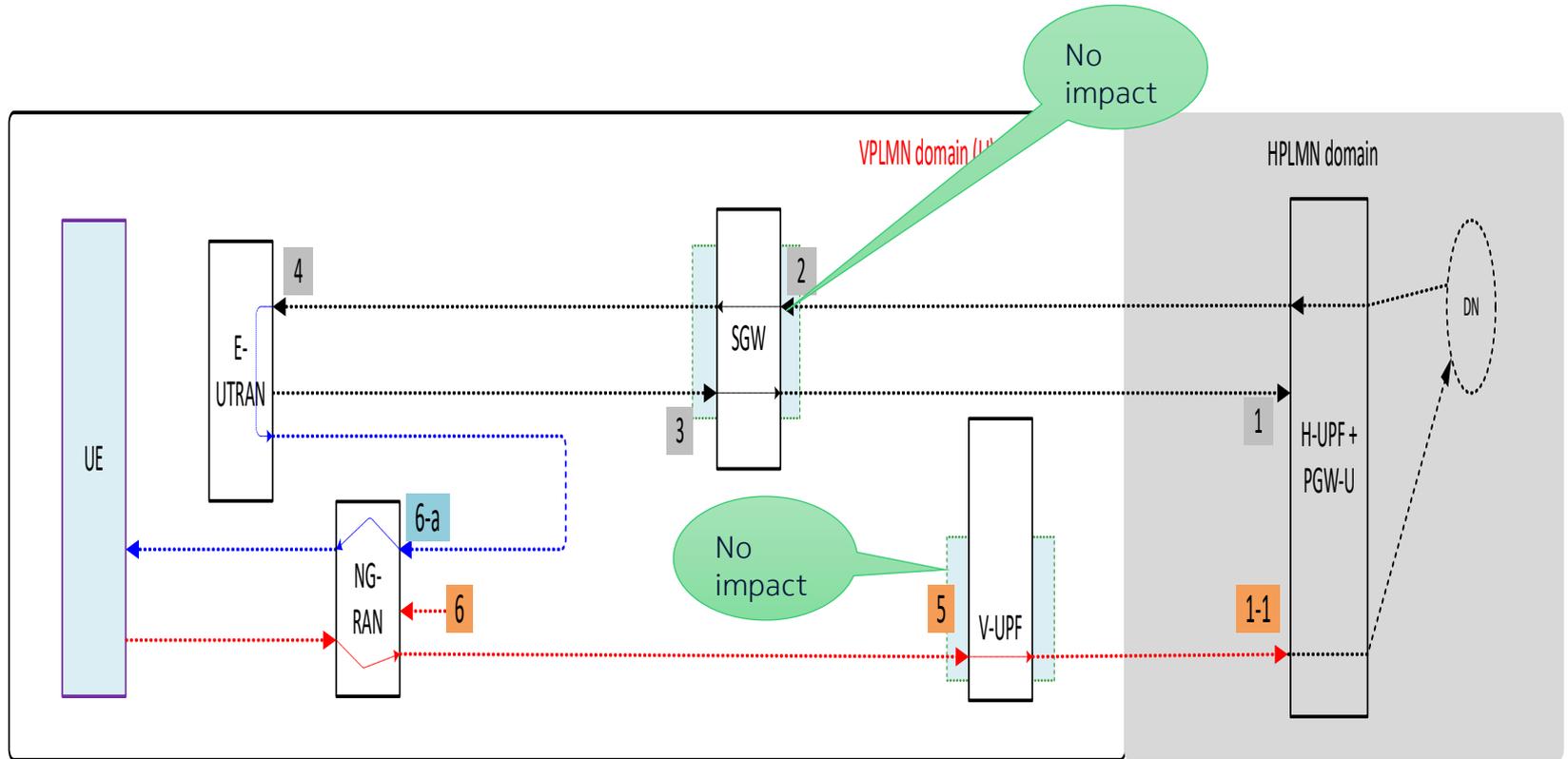


# Roaming

The Nokia logo is a large, stylized blue arrow pointing to the left, with the word "NOKIA" in blue capital letters centered within the arrow's shaft.

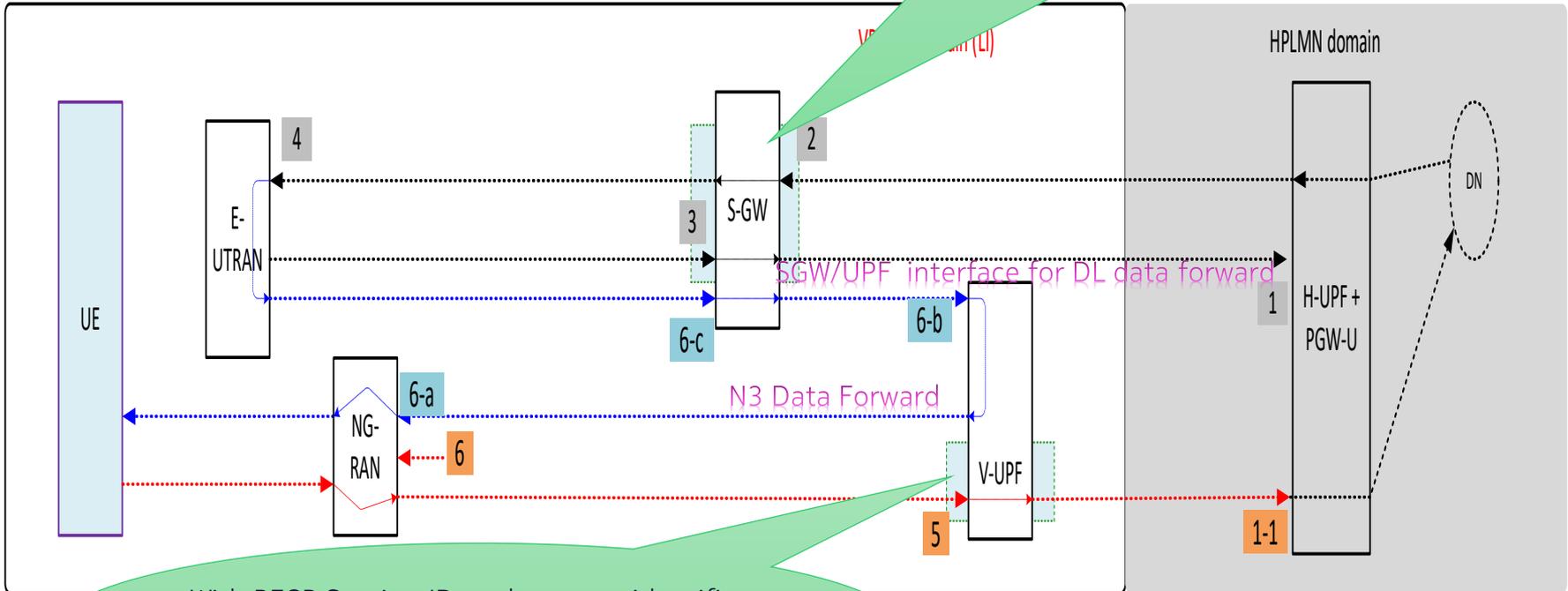
NOKIA

# Direct DL Data Forward – VPLMN



# Indirect DL Data Forward

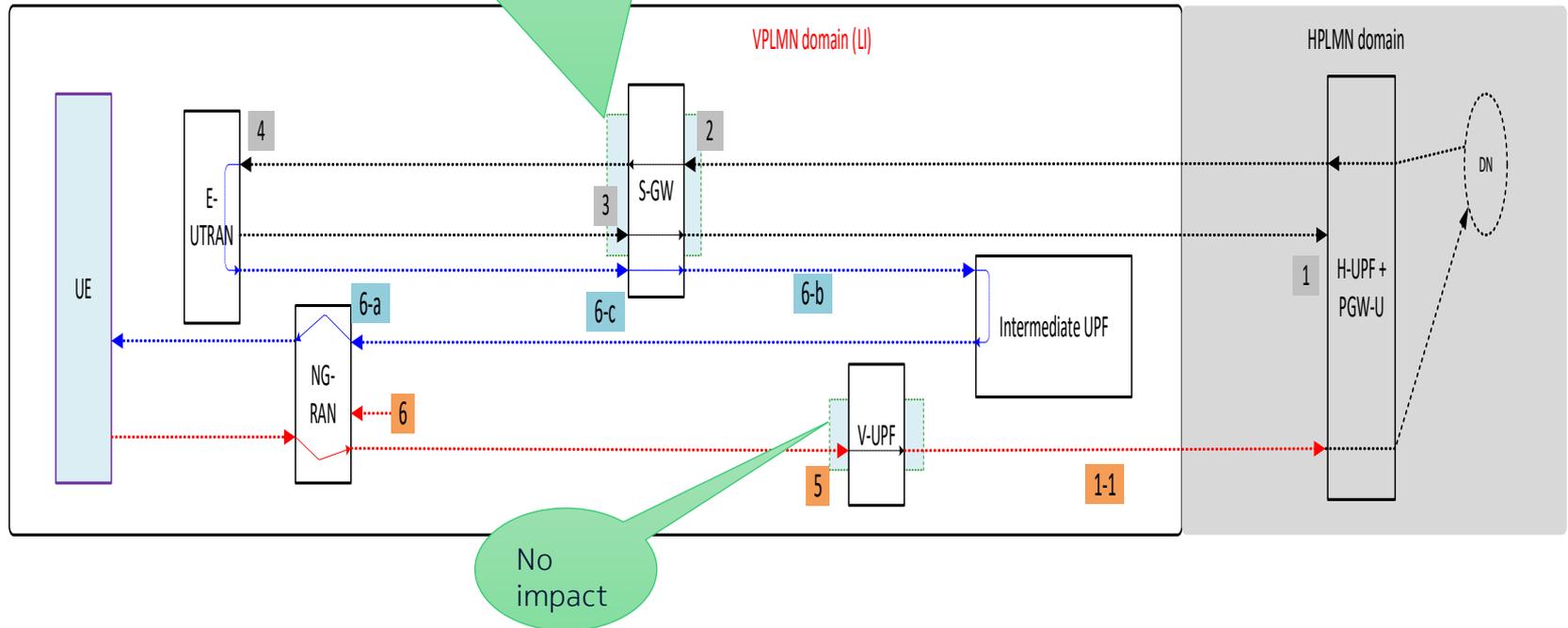
SGW too should not generate xCC for packets from DL data forward tunnels (not in scope)



With PCF Session ID as the target identifier:  
Scope of CC-POI shall exclude the packets  
from the DL Data forward tunnel

# Indirect DL Data Forward with intermediate UPF for DL data forward

SGW too should not generate xCC for packets from DL data forward tunnels (not in scope)



When the CC-POI generates the xCC from the outgoing IP packets:

- The N4: PFCP Session Modification request (see TS 29.244 [15], clause 7.5.4) with Forwarding Parameter IE in FAR (see TS 29.244 [15], table 7.5.2.3-2) of Create FAR IE (see TS 29.244 [15], clauses 7.5.4.17 and 7.5.2.3) containing the Destination Interface Type with any of the following values:
  - N3 data forwarding (value 14).
  - N9 data forwarding (value 23).
  - SGW/UPF GTP-U interface for DL data forwarding (value 10).

When the CC-POI generates the xCC from the incoming IP packets:

- The N4: PFCP Session Modification request (see TS 29.244 [15], clause 7.5.4) with PDI IE (see TS 29.244 [15], table 7.5.2.2-2) of Create PDR IE (see TS 29.244 [15], clauses 7.5.4.17 and 7.5.2.2) containing the Source Interface Type with any of the following values:
  - N3 data forwarding (value 14).
  - N9 data forwarding (value 23).
  - SGW/UPF GTP-U interface for DL data forwarding (value 10).

The case of CC-POI present in the UPF checking for the IP packets from the DL data forwarding tunnel for not generating the xCC happens when both of the following are true:

- PFCP session ID used for the DL data forwarding tunnel is used as the target identifier within the CC-POI where the xCC is generated.
- The same UPF that has the CC-POI with that PFCP session ID as the target identifier is used for the DL data forwarding tunnel.

When a different PFCP session ID is used for the DL data forwarding tunnel, the generation of xCC can be avoided by default in the sense by CC-TF in the SMF not sending the LI\_T3: ActivateTask with the PFCP session ID used for the DL data forwarding tunnel as a target identifier to the CC-POI.

Likewise, when a different UPF (e.g. intermediate UPF) is used for the DL data forwarding tunnel, the generation of xCC can be avoided by default in the sense by CC-TF present in the SMF not sending any LI\_T3: ActivateTask to the CC-POI present in that different UPF.

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