

ATSSS when roaming and lack of ATSSS support in VPLMN

Source: Nokia, Nokia Shanghai Bell, Telecom Italia
Agenda Item: 7.3
Work Item/Release: ATSSS / Rel-16

Scenarios to be addressed

- Some description of non-roaming and roaming scenarios is available in [S2-1911064](#) (ZTE).
- Two high-level scenarios need to be addressed:
 - 1- UE is registered in same VPLMN over the two accesses and VPLMN does not support ATSSS
 - 2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS

VPLMN not supporting ATSSS means either a Rel-15 based network or a Rel-16 based network not implementing ATSSS.



1- UE registered in same VPLMN over the two accesses and VPLMN does not support ATSSS

- ATSSS functionality cannot be activated for the UE due to no ATSSS support in VPLMN.
- Case 1a –the H-SMF selected by V-AMF does not support ATSSS (non-homogeneous support of ATSSS in HPLMN).
 - The request from the UE will be treated as a single access PDU session.
 - It is then up to the UE to either accept this single access PDU session or release the PDU session.
- Case 1b - the H-SMF selected by V-AMF supports ATSSS
 - Downgrading to single access PDU session seems a logical option to align with case 1a.
 - If the request is rejected by H-SMF then the UE logic has to be modified to possibly trigger a single access PDU session afterwards, also leading to extra signaling.
 - If the two different behaviors above are required to be specified and H-SMF decides on which option to use as per H-SMF policy, an indication is needed in SM PDU Session Establishment Request message for H-SMF to understand that the request is related to ATSSS (since any indication in UL NAS Transport would not be forwarded by VPLMN).



2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS

- Case 2a - The UE initially requests MA PDU session on VPLMN2 not supporting ATSSS.
 - ATSSS can not be activated since UE may request user plane resources for the second access on the same VPLMN2.
 - No additional changes needed once case 1 is concluded, and likely the MA PDU request from the UE can be downgraded to single access PDU session.

- Case 2b - The UE initially requests MA PDU session on VPLMN1 supporting ATSSS
 - The MA PDU request will initially be accepted by H-SMF if the UE is allowed to request MA PDU sessions per UE subscription and/or network policy.

NOTE: this case also includes the scenario when the UE requests MA PDU session over non-3GPP access in HPLMN and then requests user plane resources over 3GPP access in VPLMN.



2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS

🌿 Solutions have been proposed in SA2#136 to address the issue of adding a second leg to an MA PDU session established with user plane resources on one access only ([S2-1912115](#), ZTE). In all the solutions the UE ends up with user plane resources established on one access only, i.e. ATSSS functionality is not available, even though the MA PDU session was initially accepted.

Option 1	Option 2	Option 3
MA PDU request indication in request type, as per CT1 specifications	MA PDU request indication and request type are separate indications in UL NAS Transport	MA PDU request indication in request type, as per CT1 specifications
Different H-SMFs are selected in HPLMN	Same H-SMF is selected in HPLMN	Different H-SMFs are selected in HPLMN
UDM impacts and new logic	No UDM changes required	UDM impacts and new logic
New cause code to the UE needed	New cause code to the UE needed	New cause code to the UE needed
Undefined UE behaviour after rejection of the second leg	Undefined UE behaviour after rejection of the second leg	UE releases MA PDU session on initial access



2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS

- Another solution was discussed during SA2 conference call on December 23, where the AMF indicates to the UE, "via the "5GS network feature support" IE in the NAS Registration Accept that it supports ATSSS. This allows the UE to only provide Request Type = "MA PDU request" in case AMF has indicated support."
- With this solution, similarly as for options 1 to 3 on previous slide, ATSSS would not be possible. The UE ends up with an MA PDU session established, but user plane resources are established on one access only and ATSSS functionality can not be used.



2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS

- Case 2b - The UE initially requests MA PDU session on VPLMN1 supporting ATSSS
 - Different H-SMF is selected for second leg establishment. In such scenario, the MA PDU session is likely going to be released and ATSSS is not possible.
 - Same H-SMF is selected: H-SMF could add the second leg for the MA PDU session even though VPLMN2 does not support ATSSS. Or at least we could leave the decision to H-SMF what to do in such scenario. But this requires that H-SMF is aware that this is the establishment of the second leg for an existing MA PDU session.

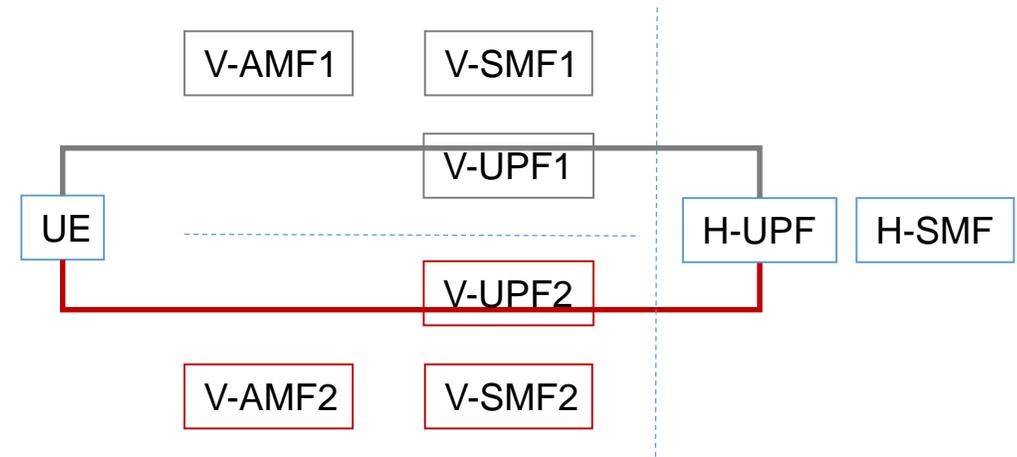
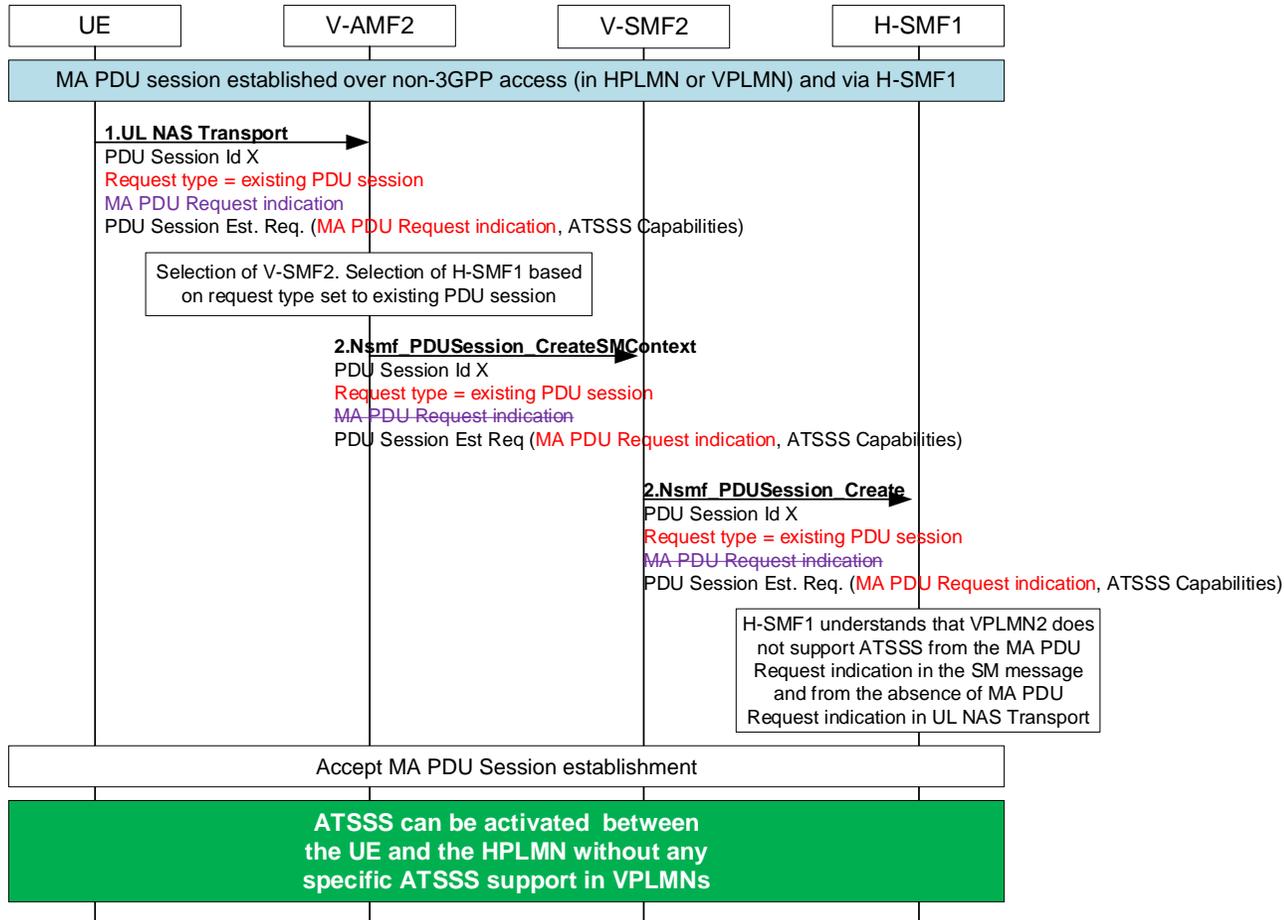


2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS

- 🌿 Case 2b - The UE initially requests MA PDU session on VPLMN2 supporting ATSSS
 - Proposed approach
 - Avoid breaking existing PDU session by forcing selection of the same H-SMF by V-AMF1 and letting H-SMF aware that the UE request is a request related to an existing PDU session.
 - This can be achieved by the UE using “existing PDU session” as request type (as per changes in 4.22.7 in [S2-1912135](#))
 - However currently stage 3 (TS 24.501) assumes the UE will use request type set to MA PDU request, and then the AMF will change this to initial request.
 - When H-SMF receives existing PDU session type and same PDU session ID, there is a need to let H-SMF know this is about adding a second leg for the MDA PDU session instead of requesting handover for the existing PDU session. MA PDU request indication is then still needed, this should be an SM level indication (“MA PDU Request” indication, “MA PDU Network-Upgrade Allowed” indication) since UL NAS Transport indication will not be forwarded by non-ATSSS capable V-AMF.

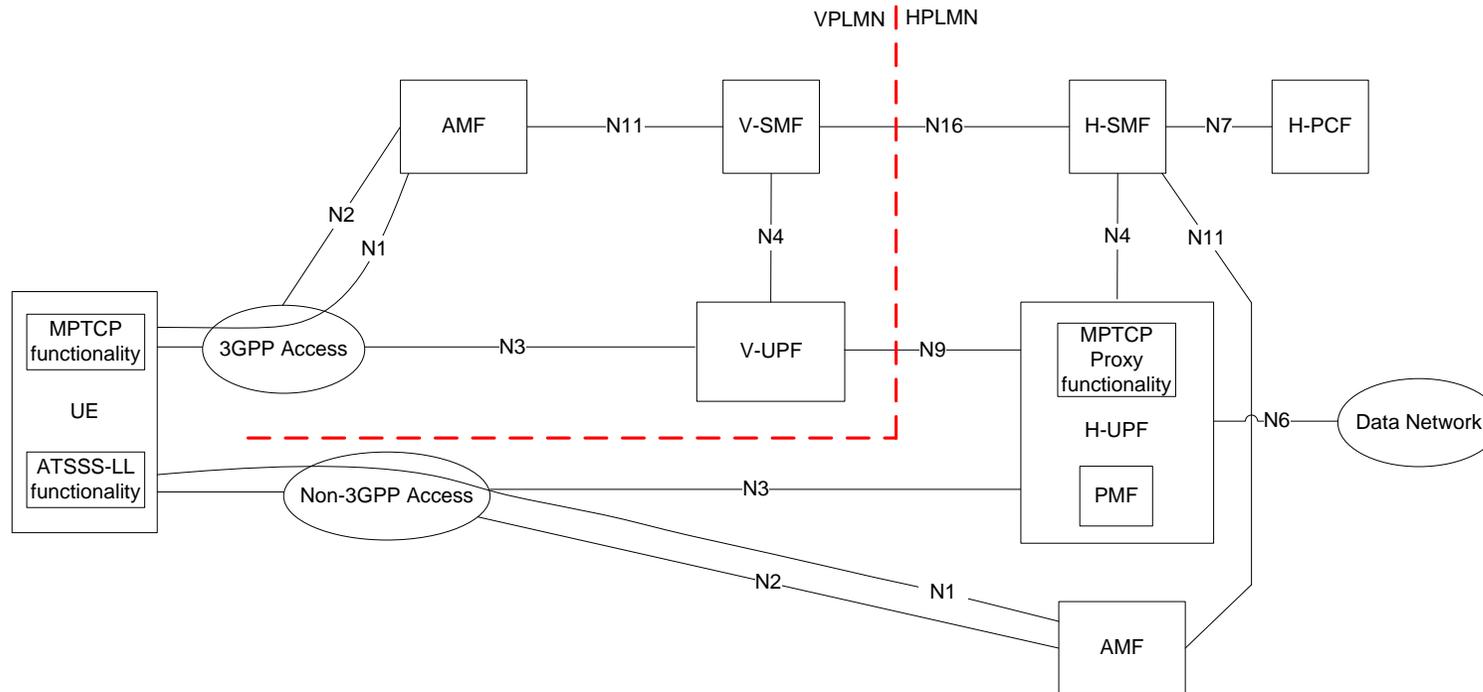


2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS



UE and H-UPF can apply ATSSS
 The two user plane paths are in different VPLMNs, no specific ATSSS support is required from VPLMN1

2- UE is registered in two different PLMNs and at least one of the PLMNs does not support ATSSS



When the UE is registered to a VPLMN over 3GPP access and to HPLMN over non-3GPP access, and when the MA PDU session is established via non-3GPP access, the user plane resources can be established in VPLMN for 3GPP access, and H-UPF can apply ATSSS independently of VPLMN support for ATSSS, i.e. V-UPF will only see one leg and will not apply any ATSSS functionality.

Figure 4.2.10-3: Roaming with Home-routed architecture for ATSSS support (UE registered to different PLMNs)

Summary for the proposals

Proposal 1

Allow ATSSS to be activated by HPLMN in the scenario where the UE requests MA PDU session activation via PLMN (NOTE) supporting ATSSS, and the UE requests user plane resources for the other access via VPLMN not supporting ATSSS:

NOTE: the MA PDU session establishment can be done via HPLMN directly, or via VPLMN supporting ATSSS.

This proposal is based on the fact that no real ATSSS capability is required from VPLMNs in such scenario, ATSSS functionality applies only between the UE and the HPLMN (H-UPF).

Some similarity with hybrid access defined in TS 23.316 where the MA PDU session is established with no ATSSS support in EPC.

When the UE request MA PDU session via VPLMN not supporting ATSSS, then H-SMF does not activate ATSSS, thus leading to a clean situation where the UE does not have an MA PDU session established without the possibility to add user plane resources on the second access on that same VPLMN.



Summary for the proposals

Proposal 2

“MA PDU Request” indication or “MA PDU Network-Upgrade Allowed” indication is needed in UL NAS Transport to allow V-AMF supporting ATSSS in VPLMN to select an appropriate V-SMF, i.e. a V-SMF supporting ATSSS. This indication in UL NAS Transport should be separate from the request type, otherwise Rel-15 AMF implementations or Rel-16 AMF implementations not supporting ATSSS will treat this indication as “initial request” (as per current stage 3), which creates issues later on for selecting proper H-SMF as well as for subsequent H-SMF behavior.

Summary for the proposals

Proposal 3

The UE uses “existing PDU session” as request type when requesting user plane resources on the second access, thus allowing selection of the same H-SMF by V-AMF. This is already specified in TS 23.502 clause 4.22.7.

Proposal 4

In order to let H-SMF know that the request is about ATSSS when the VPLMN does not support ATSSS, thus allowing H-SMF to have all information at hand for proper decision, an SM level indication (“MA PDU Request” indication or “MA PDU Network-Upgrade Allowed” indication) is needed in PDU Session Establishment Request message. This indication is also needed for H-SMF to differentiate between adding a second leg of an MA PDU session (as per proposal 2) from handover request of the MA PDU session to the other access.



Summary for the proposals

 **The following companion Rel-16 CRs implement proposals 1 to 4:**

- S2-2000462 on TS 23.501
- S2-2000463 on TS 23.502