3GPP TSG-SA SA2 Meeting #163 S2-2407108

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**Source: Ericsson, Qualcomm Incorporated, FirstNet, AT&T, NIST, Nokia, Nokia Shanghai Bell, Huawei, OPPO, Hisilicon, KPN N.V., LGE, Intel, MediaTek, Samsung, SHARP, US DHS Science & Technology, .……**

**Title: KI#1 and KI#2: Conclusions**

**Document for: Approval**

**Agenda Item: 19.7**

**Work Item / Release: FS\_5G\_ProSe\_Ph3 / Rel-19**

*Abstract of the contribution: This contribution proposes a conclusion for KI#1 on 5G ProSe multi-hop Layer-3 and Layer-2 UE-to-Network Relay over NR PC5 reference point and a conclusion for KI#2 on 5G ProSe multi-hop Layer-3 UE-to-UE Relay over NR PC5 reference point.*

# 1. Discussion

Based on the SA#163 Drafting session, the following conclusions were proposed for approval (using contents/principles from documents: S2-2407106, S2-2406135, S2-2406494, S2-2406803):

# 2. Text proposal

It is proposed to agree the following changes in TS 23.700-03 v0.3.0:

>>>> Start of Changes <<<<

# 8 Conclusions

## 8.x Conclusions for KI#1

The following principles are used for normative work:

 -    5G ProSe Multi-hop Layer-3 UE-to-Network Relay Communication with N3IWF support:

-    The 5G ProSe Layer Remote UE connects to N3IWF over 5G ProSe Layer-3 Intermediate Relay and Layer-3 UE-to-Network Relay.

-    The 5G ProSe Layer-3 Intermediate Relay neither selects N3IWF nor connects to N3IWF.

Support of multi-hop UE-to-Network Relays:

* Layer-3 multi-hop UE-to-Network Relay can proceed into normative work.
* The service authorization and policy/parameter provisioning procedures will be described in the normative phase.
* Standalone discovery & link setup/management is considered and both Model A and Model B are supported.
* When Model A discovery is performed, remote UE may choose intermediate relay based on the announcement message sent by the intermediate relay.
* When Model B discovery is performed, remote UE selects both the UE-to-Network Relay and the path to reach the UE-to-Network Relay. To perform link management, the DCR message is unicasted between Relays according to the path information included in the message. The path information is an (ordered) list of User Info ID of Relays in the selected path. Remote UE sends the selected path information to the Intermediate UE-to-Network Relay for communication setup.
* The 5G ProSe Direct Discovery message will be extended with an indication that multi-hop relay is supported, along with the hop count and the maximum number of hops.
* The maximum number of hops is provisioned by the network to both the 5G ProSe Remote UE and UE-to-Network Relays per RSC.
* The 5G ProSe Direct Discovery message may be dropped if the maximum number of hops is reached.
* The relay path is selected based on e.g., the PC5 signal strength, number of hops between the Remote UE and the UE-to-Network Relay UE, per-hop or cumulative QoS information. The path selection criteria and the support of these metrics can be determined during normative phase.
* The 5G ProSe Direct Communication procedure defined in TS 23.304 is reused for the Layer-2 link establishment between each pair of UEs in the path.
* End-to-end QoS management for multi-hop U2N Relays is done similarly to the end-to-end QoS management for single hop L3 U2N Relay as defined in TS 23.304 [x], with enhancement to handle QoS split over multiple legs of the PC5 interface.
* The QoS flows setup can be initiated by the network or the 5G ProSe Layer-3 Remote UE during Layer-2 link establishment or link modification procedure.
* UE-to-Network Relay allocates IP address/prefix, the Intermediate Relay may act as DHCP proxy or may relay IP allocation message (e.g. Router Solicitation, Advertisement).
* Details about remote UE report, Additional discovery message handling can be determined in the normative phase.

NOTE: Security aspects will be addressed by SA3.

## 8.y Conclusions for KI#2

The following principles are used for normative work:

For PDU type IP:

Support of layer-3 multi-hop UE-to-UE Relay to normative phase is based on solution #3 and #4, with the following reasoning:

- They are based on an existing MANET protocol (RFC 7181) which is a proven mobile ad-hoc routing protocol.

- The End UE is aware of other End UEs in the mobile ad-hoc network but the exact paths between the 5G ProSe End UEs is determined by the UE-to-UE Relays at the IP layer. The End UE does not have to manage the routing paths. Routing is performed at the IP layer.

- Topology changes in the ad hoc network, e.g., due to movement of End UEs, or Relays, is handled by the UE-to-UE Relays at IP layer based on MANET according to RFC 7181.

- MANET link state management at IP layer (e.g. RFC 7181) is reused. Whether further optimization for MANET operation is needed, e.g. reusing some existing PC5-S signalling to reduce MANET signalling, will be decided in the normative phase. For PDU type Ethernet and Unstructured:

The support of multi-hop UE-to-UE Relay is based on the extension of R18 methods as described in TS 23.304.

- For 5G ProSe multi-hop UE-to-UE Relay Discovery & link setup/management, both Model A and Model B are supported.

- The maximum number of hops could be decided per RSC, or be decided by End UE based on QoS requirements.

- UE-to-UE Relay includes its own User Info ID when relaying the discovery message.

- 5G ProSe End UE selects the multi-hop UE-to-UE Relay path to another 5G ProSe End UE.

- To perform link management, the DCR message is unicasted between Relays according to the path information included in the message. The path information is an (ordered) list User Info ID of Relays in the selected path. 5G ProSe End UE sends the selected path information to the UE-to-UE Relay for communication setup.

- The End-to-End QoS is handled hop-by-hop, by using Rel-18 QoS handling mechanism, each UE-to-UE Relay decides the QoS of adjacent PC5 hop and the remaining hops.

NOTE X: Security aspects will be addressed by SA3.