**3GPP TSG-WG SA2 Meeting #140E e-meeting *S2-2005366r28***

**Elbonia, August 19 – September 01, 2020 (revision of S2-200xxxx)**

**Source: Huawei, HiSilicon**

**Title: KI#1: Evaluation of solutions and conclusions**

**Document for: Approval**

**Agenda Item: 8.3**

**Work Item / Release: FS\_enh\_EC / Rel-17**

**Abstract:** *This contribution proposes the evaluation and conclusion for KI#1: Edge application discovery.*

# 1 Discussion

As discussed before the meeting, it is proposed to categorize the solutions in to 3 categories, i.e. Solutions not directly on EAS discovery, solutions for non-DNS based EAS discovery and solutions for DNS based EAS discovery. Some of the solutions are evaluated as the following 7.X clause and conclusions are proposed as 9.X.

# 2. Text Proposal

It is proposed to capture the following changes in the TR 23.748.

\* \* \* \* First change \* \* \* \*

# 7 Overall Evaluation

Editor's note: This clause will provide evaluation of different solutions.

## 7.X Evaluation of solutions for KI#1: Discovery of Edge Application Server

### 7.x.y Evaluation of Solutions for Key Issue #1 for Session Breakout

The following solutions describes DNS based EAS discovery for Session breakout case.

Table 7.x.3-1: Evaluations of solutions for DNS based EAS discovery for session breakout case

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Connectivity mode** | **Candidate Solutions** | **High-level descriptions** | **Evaluation** |
| 10 | Scenario 2  (Session Breakout) | Sol #2 | Configure the local DNS address for the UE based on UE location by SMF.  Reconfiguration of the mapping table between local DNS and its serving areas on SMF. | In case of ULCL, the local DNS address is additionally provided to UE. This will cause UE be aware of ULCL insertion/change, and also cause all DNS queries go towards local DNS. If local DNS cannot resolve the query, it needs to connect other central DNS for further resolving hence cannot apply to the case that no direct connection between local and central DN. This solution can support the encrypted DNS request. For this solution, there is no need for network replacing DNS request IP address, which is a total solution for DNS based EAS discovery. |
|  |  |  |
|  |  |  |
| 10 | Scenario 2  (Session Breakout) | Sol#3 | DNS based solution using ECS option.   * The EC Translation Table in DNS AF contains the network topology information and FQDNs. * The DNS AF selects a suitable EAS based on the UE location and set of break-out point in relation to the selected EAS.   Dynamic ULCL/BP insertion | The basic idea is covered by Sol#22.  Independent DNS AF leads to inefficient signalling interaction between the DNS AF and core network to transfer UE location and trigger dynamic ULCL insertion. |
| Sol#4 | DNS based solution using ECS option or traffic forwarding to a local DNS server. | Does not describe dynamic insertion of UL CL/BP (based on DNS request) but is a valid solution for option 3 of solution 22 |
| Sol#5 | DNS based solution using ECS option.  UE location provided by routable IP address at egress UPF-PSA interface to N6.  AF influenced routing with anycast destination (service address) and traffic filter in ULCL.  Support of anycast routing in N6 to application domain. | UE location with routable address at UPF-PSA egress should be extended to cover translation of IPv4 NAT, non-topological IPv4/IPv6 at UPF-PSA or N6 before DNS resolver.  Provisions anycast (service) address in PCF/UDR with AF influenced routing or OAM. Rel 16 procedures for traffic filter in ULCL to steer Do53, DoT and DoH.  Application domain should use anycast addressing and N6 routing should support dynamic route updates.  This solution is covered in the solution#22. |
| Sol#6 | Adds ECS option by SMF in the DNS query message routed to the C-DNS.  Dynamic ULCL/BP insertion  Support of anycast routing. | CN impact:  The handling of DNS query by SMF. |
| Sol#8 | For the anycast DNS, the UPF holds or release the DNS request based on the SMF instruction.  Dynamic ULCL/BP insertion | DNS triggered dynamic insertion of ULCL is covered in sol#22.  DNS timeout-resend mechanism will cause additional delay to the application layer. |
| Sol#9 | DNS query forwarding via 5GC in case of no connectivity between the central DN and the L-DN. | This idea of "transferring DNS query via SMF to local UPF" is covered by sol#22. This solution gives details on interaction between NEF and AF/DNS server. |
| Sol#11 | Support DNS over HTTPS (DoH)  The basic idea is same as Solution#3 | See solution#3 |
| Sol#14 | Service Switch mechanism:  I-UPF forwards the copy of DNS response message to the Edge network. The HTTP request, the destination address of which is the Service Switch, is redirected to the ME service.  Another similar idea is captured in the solution#15. | DNS based Service Switch discovery, in which the Service Switch can be treated as a specific EAS. The DNS handling function in the edge hosting environment is similar with part of the LDNSR function. DNS query based ULCL insertion and configuration is covered by sol#22.  The call flows between ME services and Service Switch are out of 3GPP scope. |
| Sol#15 | Option 1: Supporting DNS handling function in UPF anchor.  Option 2: Supporting DNS handling function in I-UPF(ULCL or BP) | The Option 1 is optimised, at which the PSA checks the address of the Service Switch included in the DNS response message and triggers the SMF to insert I-UPF. The DNS handling function in the UPF is similar with part of LDNSR function.  The call flows between ME services and Service Switch are out of 3GPP scope. |
| Sol#19 | An Address Resolution Function (ARF) is deployed, which operates as a DNS Server/Proxy and receives all DNS queries from the UE via the user plane. | The functionality of Address Resolution Function (ARF) is similar with solution #22(LDNSR based solution).  The AF should be able to resolve the DNS queries in collaborative scenarios, i.e. when enough information is available from the AF, via NEF/PCF, and from the SMF. Whether this resolution is done by co-locating/including the ARF functionality with the DNS system deployed by the operator, as a stand alone function of the 5GC, or co-located/included as part of the PSA UPF, should be a deployment option.  Deploying ARF both locally and centrally, with relevant information fed from AF, would address collaborative scenarios between the App providers and the Operator. |
| Sol#20 | Dynamic ULCL/BP insertion | The functionality of DNS Inspector is covered in the solution #22(option 3b). |
| Sol#22 | Option 1: Adds ECS option by LDNSR in the DNS query message routed to the C-DNS.  Option 2:   * 2A: Forwards the UL DNS Query to an L-DNS by LDNSR. * 2B: Forwards the UL DNS Query via 5GC in case of no connectivity between the central DN and the L-DN.   Option 3:  3A: Forwards the UL DNS Query to local PSA based on the traffic filters on ULCL/BP with ECS.  3B: Forwards the UL DNS Query to local PSA based on the traffic filters on ULCL/BP with replacing destination IP address | Solution #22 includes different options for different scenarios and covered the commonalities of solutions on this scenario. While for Option2, there are two cases, one is that the LDNSR is configured to the UE as DNS server, and the other is that the LDNSR is not configured to the UE as DNS server. For the latter case, the LDNSR needs to change the target IP address in DNS request, whether this can be done or not and whether there is security risk is depending on SA3 judgement.  So, the Option 1, Option2 with LDNSR configured to UE as DNS server, and Option 3 of Sol#22 are recommended as basis for DNS-based EAS discovery in Session Breakout scenario for normative specifications  The LDNSR should be able to resolve the DNS queries in collaborative scenarios, i.e. when enough information is available from the AF, via NEF/PCF, and from the SMF. Whether this resolution is done by co-locating/including the LDNSR functionality with the DNS system deployed by the operator, as a stand alone function of the 5GC, or co-located/included as part of the PSA UPF is FFS. |

\* \* \* \* Second change \* \* \* \*

# 9 Conclusions

Editor's note: This clause will list conclusions that have been agreed during the course of the study item activities.

## 9.X Conclusions for key issue #1

### 9.X.y Conclusion of Solutions for Key Issue #1 for Session Breakout

For Session Breakout connectivity mode, Option 1 and Option 2 (i.e. UE is configured with LDNSR address) of Sol#22 are recommended as basis for DNS based EAS discovery in normative phase.

Editor' Note: Whether there is security risk for Option 3 of Sol#22 is depending on SA3 decision and FFS.

Editor’s Note: the following is for further conclusion: In scenarios in which the AF provides enough EAS deployment information to UDR using Nnef\_TrafficInfluence, the LDNSR should be able to resolve the DNS queries (using information provided by SMF), in order to avoid security and privacy issues derived from interactions with external parties DNS’ servers or internet DNS servers.

Editor’s Note: the following are for further conclusion: 1) whether the LDNSR is either supported by the UPF or by a standalone NF 2) whether solution 22 needs to be revisited (or a solution like in clause. 6.2.3.2 needs to be added) to ensure there is neither security nor privacy concern (solution 22 may not be applicable in some cases like ciphering of DNS signalling between the UE and a third party DNS)

\* \* \* \* End of changes \* \* \* \*