**3GPP TSG-SA5 Meeting #158 *S5-247102***

Orlando, Florida, USA 18 - 22 November 2024

**Source: Huawei**

**Title: Adding evaluation of Network failure and risk prediction**

**Document for: Approval**

**Agenda Item: 6.19.5**

# 1 Decision/action requested

***The group is asked to discuss and approval.***

# 2 References

[1] 3GPP draft TR 28.915: “Management and orchestration; Study on management aspects of Network Digital Twin v1.1.0”.

[2] SP-231727 "New Study on management aspects of Network Digital Twin"

# 3 Rationale

The name evaluation of use case4: Network failure and risk prediction is missing. This is to add the evalution of use case 4.

# 4 Detailed proposal

It proposes to make the following changes to TR 28.915[1].

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| **1st Change** |

## 5.4 Use case4: Network failure and risk prediction

### 5.4.1 Description

Each operations for network optimization and maintenance on mobile network may cause potential network failures and risks, especially high-risk operations, such as potentially dangerous configuration modification, policy modification, software version upgrade, and board switching, which may cause network congestion and network breakdown. To avoid any impact on the physical network, we cannot carry out the potential high-risk network operations in the physical network directly without concerning any consequences, and we cannot use the physical network to evaluate possible network optimization strategy and solution directly. Therefore, it is the better way that these network operations and possible network optimization solutions can be simulated and evaluated using network digital twin.

Using NDT, high-risk operations can identify whether these operations may cause potential network failures and risks by performing necessary digital twin related operations, e.g. simulation, verification and evaluation. The NDT can also optimize, verify and evaluate possible network policies and solutions for the further risk avoidance. After simulating and evaluating by the NDT, the results of high-risk operations prediction and evaluation should be notified back to 3GPP network system.

In addition, SLA degradation and failure of single node in mobile network can also be predicted using the NDT. When it is predicted that the network resources in the network domain are not enough to maintain the SLA or hardware resources failure at some time in the future, the NDT should warn 3GPP management system to take actions for network failure and risk avoidance.

Another scenario of network slice risk prediction is described in clause 5.2 [1]. Using the NDT to predict risks, the ZSM framework can identify risks of specific service or network slice profile parameters not being met due to changing traffic and network conditions (e.g. a MD not being able to provide the network slice latency it committed for) and the NDT supports the ZSM framework to take actions before these risks materialize and therefore before the committed SLA/SLS are broken.

Therefore, 3GPP network system has needs to use network digital twin to predict and evaluate potential network failures and risks based on operator's requirements, such as predict possible network failures and risks posed by the high-risk operation. 3GPP management system can also use the NDT to evaluate and verify possible network policies and solutions to minimize the impact of high-risk operations.

### 5.4.2 Potential requirements

**REQ-NDT\_Failurerisk-1:** The NDT should have the capability allowing the consumer to request evaluation of the risk level for high-risk operations.

**REQ-ND****T****\_ Failurerisk-2:** The NDT should have the capability to provide the results of a simulation, including evaluation of risk level for high-risk operations.

**REQ-NDT\_ Failurerisk-3:** NDT should have a capability enabling the MnS consumer to configure the network scenario to be modelled for evaluating a Network failure.

**REQ-NDT\_ Failurerisk-4:** NDT should have a capability enabling the MnS consumer to configure the parameters of the NDT instance of the objects to be modelled for evaluating a Network failure.

### 5.4.3 Potential solutions

#### 5.4.3.1 Solution 1

Introduce an IOC for an NDT, which may be called NDT. This may be name contained in a subnetwork or managed function to respectively represent a standalone NDT and an NDT contained in another function, e.g. in a SON function.

The consumer can configure on to the NDT instance the network scenario to be modelled. The scenario can include the scope to be considered for evaluating Network failures and risks.

- Introduce a data type and an attribute on the NDT of the scope to be modelled or simulated by the NDT instance. This may be called nDTSimulationScope.

The consumer can configure the parameters of the NDT instance, including the configurations indicating the Network failure:

- Introduce a data type and an attribute on the NDT configuration plan. The datatype which may be called nDTConfigurationPlan indicates the parameter values to be applied by the NDT instance.

NOTE 1: The specific characteristics of Network failure and risk prediction can be added as an attribute of the nDTSimulationScope and nDTConfigurationPlan.

The NDT can provide output to the MnS consumer, the output including values on PMs and KPIs of all the objects that have been modelled by the NDT instance. These include the values indicating the impact of the Network failure which included the expected risks:

- Introduce a data type and an attribute on the NDT to represent the output of the NDT instance. This may be called nDTOutput and will contain attributes similar to those of existing network objects like cells.

NOTE: The specific characteristics of reports for Network failure and risk prediction can be added as an attribute of the nDTOutput.

### 5.4.4 Evaluation of potential solutions

The solution described in clause 5.4.3provides the NRM extension needed for the NDT to provide modelling of network behavior that supports network failure and risk prediction. The solution satisfies the requirements and is feasible to implement.

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| **End of Changes** |