Internet Research Task Force
Internet-Draft
Intended status: Informational
Expires: April 28, 2022

D. Chen
H. Yang
K. Yao
China Mobile
G. Fioccola
Huawei Technologies

October 25, 2021

Network measurement intent
draft-yang-nmrg-network-measurement-intent-03

Abstract

As an important technical means to detect network state, network measurement has attracted more and more attention in the development of network. However, the current network measurement technology has the problem that the measurement method and the measurement purpose cannot match well. To solve this problem, this memo introduces network measurement intent, namely the process of realizing user or network operator to allocate network states as needed. And it can be as a specified user case of intent based network.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

Table of Contents

1. Introduction

With the rapid development of the current network, the scale of the network is getting larger and larger, while users' requirements for the network are getting higher and higher. At the same time, network resources are increasingly restrained. In order to realize the efficient allocation of network resources, it is necessary to understand the running state of the network, and network measurement, as a technical means to detect the network, has been paid of more and more attention. The continuous development of network measurement technology has also satisfied the higher and higher precision of network perception. However, both the traditional network measurement technology and the network telemetry technology, which has emerged with the development of software-defined network in recent years, need to occupy the network resources when detecting the network state and feeding back the detection results. Therefore, to some extent, the choice of network measurement methods, in addition to different accuracy of measurement results, will also cause different degrees of burden to the network.

In order to balance the accuracy of network measurement results with the network load, it is very important to choose the appropriate network measurement method according to the different requirements of network measurement. As a result, accurate on-demand network measurement technology is becoming more and more important. At the same time, the development of Intent based Network (IBN) enables the network to be configured according to users’ or network administrators’ intent. Therefore, we can combine network measurement with IBN, that is, the users’ or network administrators’ perceived demand for network state is regarded as network measurement intent.

We want to use the network measurement intent to achieve network performance acquisition based on user/network administrator intent-based, verify whether network measurement results meet the measurement intent, and further improve the accuracy of the configuration in IBN.

2. Definitions and Acronyms

CLI: Command-line Interface.

IBN: Intent based Network.

Policy: A set of rules that governs the choices in behavior of a system.

NMI: Network Measurement Intent, refers to based on user/network operator’s demand for network status, and automatically collect network status information on demand.

SLA: Service Level Agreement.

3. Connections to Existing Documents

As the rise of IBN, different groups have different definitions of intent. For example, the document [I-D.irtf-nmrg-ibn-concepts-definitions] defines intent as intent fulfillment and intent assurance. However, all different definitions of intent have some common characteristics, and can be classified according to [I-D.irtf-nmrg-ibn-intent-classification]. And in order to combine the network measurement intent with the existing drafts of IBN, we define the components of the network measurement intent processing process as follows:

At the same time, according to [I-D.irtf-nmrg-ibn-concepts-definitions], network measurement intent can be classified as network intent, operational task intent or some other kinds of intent. And a detailed flow of network measurement intents will be given

And in order to combine the NMI with the existing drafts of IBN, in this document we define the components of the NMI processing process as follows:

- NMI Recognition and Acquisition

- NMI Translation

- NMI Policy

- NMI Orchestration and pre-Verification

- Data Collection and Analytics

- NMI Compliance Assessment

4. Overview

As mentioned above, NMI refers to the on-demand measurement of the network state based on the user/network operators' perceived intent of the network state. We will present the detailed process of it within each part and take the measurement of busy network performances as a simple example.

- NMI Recognition and Acquisition.

  * In this function, NMI will be recognized by "ingesting" users' or network operators' measurement intent. They have the ability to identify the NMI of a certain network performance that users want to measure, such as delay, jitter, etc., and at the same time allow users to express the NMI of network performance in a variety of interactive ways to ensure the accuracy of the identification of the NMI. To achieve this functionality, such an interaction requires the use of the intent-northbound interface defined in the IBN.

- NMI Translation.

  * In this function, NMI needs to be translated into corresponding measurement policy, which includes but is not limited to network performance parameters to be measured (such as delay, jitter, and packet loss), time period to be measured, and measurement precision. For a simple example, in the measurement of busy network performances, due to dynamic changes such as daily network bandwidth occupancy rate, the period of network busy time is not fixed. As a result, NMI Policy generated by NMI Translation can determine the threshold when the network state is busy on the same day based on the historical data learned by AI.

- o NMI Policy

  * In this function, NMI policy needs to be translated into actions and requests taken against the specified network element. Therefore, NMI policy generated by NMI Translation must be executable, that is, corresponding underlying network devices must be able to support policy execution.. If the generated policy cannot be executed by the underlying device, the policy needs to be adjusted. And if the measurement results cannot meet the requirements, the policy also needs to be adjusted.

- o NMI Orchestration and pre-Verification.

  * In this function, according to the previous NMI Translation and NMI Policy step, NMI Orchestration and pre-Verification determines the measurement scheme according to the measurement policy generated by NMI Policy, and pre-verifies whether the measurement scheme is feasible.

  * Take busy time network measurement as an example, except for choosing of measurement schemes and contents, it also needs to determine whether the network is busy according to the current network state. In addition, this function performs automatic network deployment, such as in CLI mode.

- o Data Collection and Analytics.

  * In NMI, data collection and analysis should be based on the selected measurement scheme and the content to be measured that determined in previous steps, automatically realize the collection on demand, and generate corresponding data analysis results.

- o NMI Compliance Assessment.

   * At the end, this function verifies whether the results meets the requirement and whether the NMI is satisfied. If either of the two conditions is not satisfied, the NMI should be modified and re-enter the NMI Policy.

And he measurement flow diagram is shown as the following figure:

```
               +                  ^
     NMI input|                  |
    +---------v-------+          |
    | NMI Recognition |          |Measurement
    | and Acquistion  |          |Results
    +--------+--------+          |Feedback
             |                   |
    +--------v--------+          |
    | NMI Translation |          |
    +--------+--------+          |
             |               +---+----- -----+
    +--------v--------+      |NMI Compliance |
    |   NMI Policy    <------+Assessment     |
    +--------+--------+      +--^------------+
             |                  |
   +---------v-----------+   +--+--------------+
   | NMI Orchestration   |   | Data Collection |
   | and pre+Verification|   | and Analytics   |
   +---------+-----------+   +--^--------------+
             |                  |
         +---v------------------+---+
         |   Network Infrastructure |
         +--------------------------+
```

5. Concrete Examples

In this section, we will take SLA measurement intent as an example to illustrate each step of the process.

With the development of measurement technology in recent years, network measurement can be divided into active measurement, passive measurement and a combination of active and passive measurement. As mentioned above, no matter which measurement technology will occupy network resources. For example, if the transmission frequency of active measurement message is too fast, it will occupy too much bandwidth resources and affect the normal operation of actual business. While if the transmission frequency is too slow, some instantaneous network anomalies will be missed and the network status cannot be accurately reflected. Passive measurement requires real-time collection of actual business data. If the sampling rate is too high, a large amount of data will be accumulated in a short time.

The analysis system for real-time analysis of these data needs strong processing capacity; if the sampling rate is too low, some network anomalies will also be omitted.

How to balance and accurately measure the network state, especially the abnormal network affecting the service, while occupying as little network bandwidth as possible, and the processing capacity of the data analysis system is not high, this is the function that the NMI scheme based on IBN should realize.

In this section, we will consider two examples to illustrate each step of the process.

5.1. SLA measurement intent

Taking network SLA performance index -- time delay measurement as an example, the simple schematic diagram is as follows, different thresholds, warning value and alert value should be set for network delay in advance. When the delay value is below warning, the network is normal and the business is normal. When the delay is between warning value and alert value, the network fluctuation is abnormal, but the business is normal. When the delay exceeds the alert value, both the network and business are abnormal. For delay in different thresholds, different measurement strategies should be adopted:

- o When the network delay exceeds the alert value, or when the historical data predict that the delay will exceed the alert value, passive measurement requires 100% sampling of business data, and the transmission frequency of active measurement is modulated to the maximum. At the same time, the log and alarm data of the whole network equipment are collected to realize the most fine-grained measurement of the network, locate the root cause of the problem and repair the network in time.

- o When the network delay exceeds warning value but is lower than alert value, passive measurement samples 60% of business data, and the transmission message frequency of the active measurement is adjusted to the median value, and the running state data of some key devices in the network is collected synchronously.

- o When the network delay is less than warning value, passive measurement data is sampled at 20%, and active measurement message frequency is adjusted to the lowest, and the network equipment running state of key nodes can be collected as needed.

```
           ^ms
           |
           |
           |                         XX
           |                        X X            Sampling Rate 100%
           |                       XX X
     alert +--------------------------------------------------------+
           |                      X   X             Sampling Rate 60%
           |                     X    XX
           |                    X      X                XX
           |          XX        X      X                XXX
           |          XXX       X       X              X  X
           |         XX X      X        X             X   XX
           |         X   XX    X        X  XX   XX    X    XX
   warning +-------------------------------------------------------+
           |         X    XX  X          XX X  XX X  XX      XX
           |     XX  X     X  X          X   XX   XX X        X
           |    XX X X     X  X          X   XX    XXX         X
           |   X   XX       XXX          X         XX          X
           |   X   XX       XX           X
           |        X       XX                      Sampling Rate 20%
           |
           +----------------------------------------------------------->
```

Based on the above SLA time delay index measurement, different thresholds adopt different measurement strategies, the concrete steps of SLA measurement intent are as follows:

- o In NMI Recognition and Acquisition, SLA measurement intent is recognized, and business requirements and performance metrics are identified by interacting with users. Then the NMI Recognition and Acquisition module inputs the SLA measurement intent into the NMI Translation module.

- o The NMI Translation module combines the SLA measurement intent with the measurement policy in NMI Policy, and outputs the executable measurement policy, such as the message transmission frequency of active measurement, the sampling rate of passive measurement, the collection range of equipment running state, etc.

- o The NMI Orchestration and pre-Verification module arranges the measurement policy into the specific configuration and execution time of each device in the tested network. The NMI Orchestration and pre-Verification module verifies the implementation of the policy in the equipment and preanalyzes the measurement results.

- o The Data Collection and Analysis module will collect the measurement data according to the requirements of the previous step, make a simple analysis of the collected data, and then send the collected measurement data to the NMI Compliance Assessment module. After that, it feedback the measurement results to the user to complete the closed loop of the measurement task.

- According to the change of delay data in the measured data, the NMI Compliance Assessment module notifies the NMI Orchestration and pre-Verification module to modify the execution time of the policy in time, and at the same time updates the measured results to the delay history database to improve the accuracy of delay prediction. The NMI Compliance Assessment module evaluates whether the actual measurement results are in line with the user’s intent. If they are, the results will be fed back. If they are not, the NMI Policy module will be informed to adjust the policy, and then the measurement will be restarted.

5.2. Clustered performance measurement intent

The desired approach is to accurately measure the network state, especially when there are some issues affecting the service, but at the same time, reduce the resources to be employed to achieve the desired accuracy.

In this regard, the Clustered Alternate-Marking framework [RFC8889] adds flexibility to Performance Management (PM), because it can reduce the order of magnitude of the packet counters. This allows the NMI Orchestration and pre-Verification module to supervise, control, and manage PM in large networks.

RFC 8889 [RFC8889] introduces the concept of cluster partition of a network. The monitoring network can be considered as a whole or split into clusters that are the smallest subnetworks (group-to-group segments), maintaining the packet loss property for each subnetwork. The clusters can be combined in new connected subnetworks at different levels, forming new clusters, depending on the level of detail to achieve.

The clustered performance measurement intent represents the spatial accuracy, that is the size of the subnetworks to consider for the monitoring. It is possible to start without examining in depth and, in case of necessity, the "network zooming" approach can be used.

This approach called "network zooming" and can be performed in two different ways:

1. change the traffic filter and select more detailed flows;

2. activate new measurement points by defining more specified clusters.

The network-zooming approach implies that some filters, rules or flow identifiers are changed. But these changes must be done in a way that do not affect the performance. Therefore there could be a transient time to wait once the new network configuration takes effect. Anyway, if the performance issue is relevant, it is likely to last for a time much longer than the transient time.

The concrete steps of the clustered performance measurement intent are as follows:

- In NMI Recognition and Acquisition, the clustered performance measurement intent is recognized. Then the NMI Recognition and Acquisition module inputs the clustered performance measurement intent into the NMI Translation module.

- The NMI Translation module analyzes the clustered performance measurement intent and outputs the executable measurement policy, such as network partition and the spatial accuracy for the monitoring.

- The NMI Orchestration and pre-Verification module arranges and calibrates the measurement with the specific configuration to split the whole network into clusters at different levels.

- The Data Collection and Analysis module collects the measurement data from the different clusters, and then send these data to the NMI Compliance Assessment module. It verifies the performance for each cluster and send the measurement results to the user.

- The NMI Compliance Assessment module, in case a cluster is experiencing a packet loss or the delay is high, notifies the NMI Orchestration and pre-Verification module to modify the cluster partition of the network for further investigation. The network configuration can be immediately modified in order to perform a new partition of the network but only for the cluster with bad performance. In this way, the problem can be localized with successive approximation up to a flow detailed analysis. This is the so-called "closed loop" performance management.

6. Classification of NMI

In this section, we divide the network measurement intent into static NMI and dynamic NMI according to different requirement characteristics.

6.1. Static NMI

Static NMI refers to the measurement purposes remain unchanged and is independent of the network state/external environment. Static NMI can be translated into determined network performance indicator values, such as concrete delay values, network bandwidth occupancy, throughput and so on.

Because the static NMI can be translated into the measurement of the determined network performance parameters, the whole process is relatively simple and error-prone, and only needs to verify whether the measurement results meet the requirements.

6.2. Dynamic NMI

Dynamic NMI refers to the measurement purpose remains unchanged but the measurement process changes dynamically according to the network state/external environment. Dynamic NMI can also be translated into the measurement of determined network performance parameters, however, the values of network performance parameters will change with the changes of network states and external environment.

For example, the measurement of busy network performances mentioned in the previous. Although the corresponding network parameters for judging whether the network is busy are determined, the corresponding network parameters have different values according to different network states and external environments.

Due to the dynamic nature of dynamic NMI, its processing process is more complex than static NMI. It is not only necessary to verify the accuracy of demand analysis, but also to verify whether the final measurement results meet the requirements.

7. Summary

This memo introduces the network measurement intent, and give two concrete examples to illustrate the process of network measurement intent. On the basis of existing intent drafts, this memo can be used as a use case for IBN.

8. Security Considerations

TBD.

9. IANA Considerations

This document has no requests to IANA.

10. References

10.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC8889] Fioccola, G., Ed., Cociglio, M., Sapio, A., and R. Sisto, "Multipoint Alternate-Marking Method for Passive and Hybrid Performance Monitoring", RFC 8889, DOI 10.17487/RFC8889, August 2020, <https://www.rfc-editor.org/info/rfc8889>.

10.2. Informative References

[I-D.irtf-nmrg-ibn-concepts-definitions] Clemm, A., Ciavaglia, L., Granville, L. Z., and J. Tantsura, "Intent-Based Networking - Concepts and Definitions", draft-irtf-nmrg-ibn-concepts-definitions-05 (work in progress), September 2021.

[I-D.irtf-nmrg-ibn-intent-classification] Li, C., Havel, O., Olariu, A., Martinez-Julia, P., Nobre, J. C., and D. R. Lopez, "Intent Classification", draft-irtf-nmrg-ibn-intent-classification-04 (work in progress), September 2021.

Authors' Addresses

Danyang Chen
China Mobile
Beijing 100053
China

Email: chendanyang@chinamobile.com

Hongwei Yang
China Mobile
Beijing 100053
China

Email: yanghongwei@chinamobile.com

Kehan Yao
China Mobile
Beijing 100053
China

Email: yaokehan@chinamobile.com

Giuseppe Fioccola
Huawei Technologies
Riesstrasse, 25
Munich 80992
Germany

Email: giuseppe.fioccola@huawei.com