ATNP WG2 WP /_94

AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL
(ATNP) WORKING GROUP 2

Toulouse, France
10–22 March 1995

(Presented by the U. S. Panel Member)

(Prepared by Patrick Feighery, The MITRE Corporation)

WORKING PAPER

Discussion of Different Network Diagnostic Methods

SUMMARY

The papers addresses concerns over two different methods of network diagnostics which were raised at the last ATNP WP2. This paper examines the differences in approaches between using CLNP Partial Record Route and a network reachability function and a network connectivity function.

REFERENCES

[1] Hares, S. and Wittbrodt C, "CLNP echo (ISO 8473)", RFC 1575, Merit/NSFNET, Stanford University, February 1994.

[2] Hares, S. and Wittbrodt C, "Essential Tools for the OSI Internet", RFC 1574 Merit/NSFNET, Stanford University, February 1994.

[3] Scott, Dallas A, "Network Management and Security

Functions for the Phase One ATN", ATNP WG/1 WP/9, San Diego, 1994.

[4] ISO 8473 "Information Technology -- Protocol for Providing the Connectionless-mode Network Service" 1992 (E).

[5] ATN Manual Second Edition November 1993.

Section 1 Background

This paper will address the concerns raises at the last ATNP WG2 meeting about the network management (diagnostic) functions that are required for a Phase 1 implementation of the ATN. These concerns were raised when discussing the working paper "Network Management and Security Functions for the Phase One ATN" by Dallas A. Scott. This paper will examine the differences in approach between using CLNP Partial Record Route and a network reachability function and a network connectivity function.

The network reachability function is commonly known as ping and the network connectivity function is commonly known as traceroute.

Network diagnostic tools such as the ones listed above are required for systems to test network layer integrity. They are required to debug problems in the deployment and maintenance of any OSI internetwork.

This paper is divided into 4 sections. Section 2 describes how the ATN manual describes CLNP Partial Record Route and how it is used for network diagnostics. Section 3 describes the network reachability function and the network connectivity function. Section 4 discusses which method is better for network diagnostics.

Section 2 Overview of CLNP Partial Record Route

The following section examines how CLNP Partial Record Route has been specified in ISO 8473 and in the ATN manual for network diagnostics.

According to ISO 8473 the CLNP Partial Record Route can be used to record a path taken by a PDU as it traverses a series of Intermediate Systems.

Section 9 of the ATN manual is concerned with internetworking service. This section in its APRL does specify that the CLNP Partial Record Route function is mandatory.

Section 12 of the ATN Manual is concerned with system management provisions. CMISE is the require method to exchange system management information. This chapter does not mention information of network diagnosis via CLNP Partial Record Route.

There is no mention in the ATN manual on how this feature should be used as a network diagnostic tool.

Section 3 Overview of the Network Reachability and Network Connectivity Function.

The following section will describe the network reachability function and the network connectivity function diagnostic tools. Further discussion of these functions may be found in RFC 1574 Essential Tools for OSI Internet and RFC 1575 An Echo Function for CLNP (ISO 8473). Both documents can be ftp'd anonymously from ds.internic.net and are located in the /rfc directory.

3.1 Network Reachability Function

A network reachability function allows a node to determine whether a path exist from itself through the network to another node.

This function can easily be realized by using the existing CLNP Echo Request and Echo Response functions.

For a node N1 to determine if network reachability exists with another node N2, it sends a CLNP Echo Request PDU to N2 with the error report flag set. This PDU will be forwarded through the network to N2. If any Intermediate System (IS) which this PDU traverses is unable to forward it to N2, it shall send a CLNP Error PDU back to N1. If N2 receives the CLNP Echo Request PDU it shall send a CLNP Echo Response PDU to N1. Note according to ISO 8473 the entire CLNP Echo Request PDU shall be placed into the data part of the CLNP Echo Reply PDU.

N1 shall wait for a response from the CLNP Echo Request PDU. If the response is a CLNP Echo Response PDU from N2 network reachability exists.

If the response is an CLNP Error PDU, then N2 is unreachable. Also known is the IS which was unable to forward the PDU to N2.

3.1.1 Improvements

The network reachability function is also capable of providing route trip time. If the network reachability function inserts a time stamp in the data part of the CLNP Echo Request PDU, a route trip time can simply be calculated by subtracting the its current time from the time stamp it received in the encapsulated CLNP Echo Request PDU. A series of CLNP Echo Request PDUs may be sent to obtain an average round trip time.

3.2 Network Connectivity Function

A network connectivity function allows a node to determine the exact path traffic can be routed from itself through the network to another node.

This function can easily be realized by using the existing CLNP Echo Request function, the Echo Response function, and ability to set the Time To Live (TTL) value in CLNP PDUs.

For a node N1 to determine the exact path traffic can be routed through the network to node N2, it sends a series CLNP Echo Request PDU to N2 with the error report flag set. By setting the TTL field in the CLNP Echo Request PDUs a route can be traced through the network.

N1 sends a CLNP Echo Request PDU with the TTL field to 1. N1 will either receive a CLNP Error PDU or a CLNP Echo Reply PDU in response.

If N1 receives a CLNP Error PDU from a node other than N2 with reason lifetime expired, then that node is next hop traffic takes to N2. N1 increases the TLL field by one and sends another CLNP Echo Request PDU to N2.

If N1 receives a CLNP Error PDU from a node other that N2 with reason destination unreachable, N2 is not reachable.

If N1 receives a CLNP Echo Response PDU from N2 network reachability exist and the exact path traffic may take is known.

3.3 Compliance with OSI Standards

Both the network reachability function and the network connectivity function are fully compliant with the ISO 8473 1992 (E). No additional functionality is required of the network.

Section 4 Conclusion and Recommendation

The network reachability function and the network connectivity function are the simplest, most basic tools which are necessary to debug problems in the deployment and maintenance of an OSI internetwork. They will allow system administrators to easily diagnose internetworking problems. They are used in determining which nodes (Intermediate or End System) are available and the time required to reach them. These functions are so basic in network deployments, that ISO 8473 has been revised to include them as part of the CLNP standard many years ago.

Experience with global internetworking shows this is the correct methodology and the correct tools. The aeronautical community should follow the internetworking community methodology whom has many years experience in the daily operations of large scale networks.

It is recommended that the working group adopt the network reachability and network connectivity functions as diagnostic methods needed to debug problems in the deployment and maintenance of the ATN.