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Network Manager Tools Description

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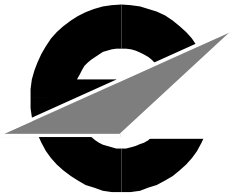
AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

Working Group 2

Hawaii 18-22 January 1999

SUMMARY

This paper provides background information on Network Management tools which have been perceived as necessary during discussions on fault, performance and accounting management concepts. Tools descriptions are informal and are intended to support requirement definitions.



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ATN PROJECT

Network Manager Tools Description

ATNIP Ref. : DED6/ATNCT/SYSMAN/DCI/JP_01

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Rev. No. : Issue 1.0

Date : 11/01/99

DOCUMENT CONTROL LOG

SECTION	DATE	REV. NO.	REASON FOR CHANGE OR REFERENCE TO CHANGE
	11/01/99	Issue 1.0	Creation

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1. Introduction

1.1 Scope

This paper provides background information on Network Management tools which have been perceived as necessary during discussions on fault, performance and accounting management concepts. Tools descriptions are informal and are intended to support requirement definitions.

1.2 Purpose of Document

This document has been prepared as a discussion document for use within Eurocontrol and in projects implementing Systems Management services.

1.3 References

1	ICAO DOC9705	ATN SARPs
2	DED6/ATNCT/ProATN_Sup /DCI/AW_43	Proposed Fault Management Concept
3		ACI and ProATN: Convergent MIB
4	ATNP/WG2/WP-478	Preliminary Draft Version 1.0 ATN Systems Management – Concept of Operations

2. Network Manager Tools and Procedures

2.1 Topology Display

2.1.1 General

A Network Manager shall be provided with a means to visualise:

- the topology of the managed domains:
    - systems
    - links
    - adjacencies
    - subnetworks
- the system status (when known)
- the link/adjacency status (when known)
- the subnetwork status (when known)

This display tool is not specifically tied to any management functions. Rather it is intended to serve as a common framework for GUI presentation of events and interaction with the Manager. This tool is expected to be available from standard Management Toolkits (at least generic parts).

Impacts on MIB are limited. Manager only requires MIB browsing and filtering functions. No specific attributes and notifications are required.

2.1.2 Topology Display for Packet Discards

A Network Manager shall be provided with a means to visualise:

- the topological distribution of packet discards
- the distribution of transport connection loss/QoS degradation events.
- link/adjacency down status (when known)
- system down status (when known)

Suitable GUI conventions shall be adopted for simultaneous representation of all these elements of information. Since transport disconnects and network discards are correlated, it is important that the Manager gets visual hints as to where the problem likely is.

The ATN will contain “natural” packet sinks in Backbone and Home RDs. Indeed when no direct route is known, a packet is forwarded to the backbone (or Home RD if it is destined to an airborne system). If this RD itself does not have a route, the packet is discarded. Those systems should be identified by the Network Management System as expected packet sinks and distinguished from other systems where discards normally do not occur. Both type of systems will probably have different thresholds.

As a network design issue, it will probably be desirable to have a single system within a given backbone/home RD which is assigned the packet sink role. This can be achieved by intra-domain routing configuration. This will limit the number of systems in a topology where packet discards are “expected”.

2.1.3 Topology Display for Congestion

A Network Manager shall be provided with a means to visualise:

- the topological distribution of packet discards due to congestion (cumulative and in last monitoring period)
- link/adjacency down status (when known)
- system down status (when known)

In routine tasks, the tool presents a view where each system indicates its congestion status (counters, possibly associated with color code). Depending on domain configuration, this tool helps in identifying shortages in resources, potential mis-configurations, etc.

This tool also helps in evaluating network activity over time. However this function is better addressed by performance monitoring tool.

The Manager is responsible for setting monitoring periods and thresholds so as to limit the risk of increased congestion due to management communications.

2.2 Traceroute and Echo

A Network Manager shall be provided with tools to generate ECHO PDUs from any point in the Internet, and to correlate the notifications of ECHO responses and Error Responses with ECHO requests. The generation and use of Test Data patterns as the payload of ECHO Request PDUs shall also be supported, including monitoring for inconsistencies between responses and requests.

This tool assumes that all implementations are capable of initiating ERQ/ERP NPDUs with Error bit set and partial route recording options. ERQ priority, security (Traffic Type), checksum and user data shall be configurable by the Network Manager. ERP corresponding options shall be those of the received ERQ unless ERQ data part contains an ERP header.

Content of the ERQ/ERP data part is transparent as long as the first octet differs from 0x81. No further constraints on the content/format of user data is required for the tool. The tool will adopt a data part content specification which allows ERQ and ERP to be correlated (unique identification). Further requirements on data part content are not considered desirable to minimise interworking problems.

In particular, time stamping should be provided in the MO Notification associated with the reception of ERQ/ERP, instead of carrying time stamps into ERP/ERQ data.

NMS traceroute tool shall support the following functions:

- Test of System Reachability. This property is verified via successful ERQ/ERP sequence for a given security/priority combination. Failure to reach a system should be reported through ER NPDU reception.

- One-way and two-way route display. All IS NETs traversed by ERQ/ERP NPDUs are listed as reported in Partial Route Recording option, for a given security/priority combination.

- Transit delays and round-trip calculations. Time stamping of events is derived from notification timestamps as reported by the Agent to Network Manager. If both source and destination systems are within the management domain, ERQ+ERP notifications enable calculation of both transit delays and round-trips. If destination system is outside management domain, only round-trips will be computed.

Related issues and proposed resolutions

I7	Should CLNP Echo reply be in SM Action response or in a separate Notification? *ECHO Req/Resp should use asynchronous notifications.*
I8	A SARPs PDR may be needed to enable Echo request / response correlation. For example a defined data format such as a timestamp.. *Notification timestamps are preferred to timestamp encoding in ERQ/ERP user data.* *It has been agreed that current SARPs text (APRLs) are defective in specifying the Echo function as it leaves the implementation open in the way ERP is constructed. A new PDR category "clarification" will be issued*

I9	Is it permissible to send Echo requests to airborne Routers? *ERQ to airborne should be allowed. They are currently allowed by SARPs. However, this may be restricted by local policies (e.g in Air-ground Routers).*
I10	Should it be permissible to send Echo requests to other (g-g) management domains. *By default ERQ to other management domains should be allowed. Transmission of ERQ/ERQ with route recording option across management domain boundary may be denied by local policy*

2.3 RIB/FIB Monitor and Browser

The NMS shall regularly monitor FIB and RIB state on each Router and report inconsistencies between a Router's FIB and RIB state.

The NMS shall also check the consistency of RIBs in adjacent Routers and report inconsistencies.

Consistency checks include:

a) adjRIB-in and adjRIB-out consistency on both sides of an adjacency

b) locRIB local preference calculation consistency across BISs of the same domain (assuming NMS knows the local preference calculation algorithm). NMS should first rely on notification by IDRP of inconsistent local preference calculation between BISs in the same domain. External consistency checks by NMS are required only when there is only one BIS in the domain or when IDRP itself is defective in performing checks.

c) adjRIB-out consistency with Domain policy rules (assuming NMS knows the policy rules and is able to "simulate" IDRP decision process)

d) locRIB and FIB consistency

Note: These checks require common RIB/FIB dump formats. This monitoring falls into preventive measures. It is likely that only key systems/adjacencies will be under such monitoring.

The NMS shall allow browsing of RIBs and FIBs of systems under analysis, e.g. when a fault is being investigated. This tool is then used in conjunction with previous traceroute and topology display tools.

NMS browsing tool should be able to build a topology map of the propagation of a given route throughout the network (tree from initiating BIS). This function is considered as desirable but not mandatory for effective management. IDRP Route Probe may be a more effective investigation tool.

2.4 CLNP Monitoring

The CLNP monitoring is an element of the toolset required for Performance Management. It can also be used for Accounting and Fault Management.

The NMS shall regularly monitor CLNP forwarding data counts and ATN Linkage MO counts in BISs and possibly ESs. The nature of the counters is highly dependent on the amount of details required by Management for performance monitoring and accounting.

Principles that apply:

- Counting shall be complete, i.e. each NPDU must be counted at least once.
- Counting should be minimal where possible. Ideally, each NPDU should be counted only once.
- Breakout per protocol is required (0x81, 0x82, 0x83, else).
- Breakout per traffic type may be imposed by local management for accounting purposes. This breakout may be irrelevant if all links support all traffic types.
- Breakout per priority or priority group may be imposed by local management for accounting purposes.
- Breakout per adjacency/link before compression is required.
- Separate counts of User Data and Header at CLNP level is not required as long as higher user data counters exist (e.g. TSDU) which can be used to evaluate global protocol overhead.
- Breakout per matching NSAP/NSAP Prefix may be imposed by local management for accounting purposes.

Realtime activity of the performance monitoring relies on periodic retrieval of (a subset of) counters. Thresholds on counters are also possible although not essential.

Offline activity of the performance monitoring relies on periodic retrieval of detailed logs and counters.

2.5 Subnetwork Connection Monitoring

This monitoring is an element of the toolset required for Performance Management. To a lesser degree it can also be used for Accounting and Fault Management.

The NMS shall regularly monitor sent and received data counts on subnetwork connections, and report variations between those at each end of a data link that exceed a set threshold during a reporting period.

Each subnetwork connection termination shall be logged and/or notified to the NMS. Information logged/notified shall contain the cumulative counts for the corresponding connection. These counters shall include at least the total of X.25 messages and data octets. These counters together with adjacency counters (from CLNP monitoring tool) shall be used to compute an average compression ratio.

For long-lived subnetwork connections (e.g. ground-ground fixed adjacencies) partial counts over a reporting period shall also be supported.

2.6 Transport and IDRP Monitoring

This monitoring is an element of the toolset required for Performance Management. To a lesser degree it can also be used for Accounting and Fault Management.

Each TP4/IDRP connection termination shall be logged and/or notified to the NMS. Information logged/notified shall contain the cumulative counts for the corresponding connection. These counters shall include at least the total of TSDU/UPDATE messages and corresponding data octets.

2.7 IDRP Route Probe

The NMS shall be capable of injecting a new IDRP route into a BIS local RIB in order to monitor its propagation into the network. Because of System Design constraints, this feature may be available in some systems only.

The NMS shall be capable of setting IDRP RIB “listeners” that notify the NMS of the reception of a given route. Because of System Design constraints, this feature may be available in some systems only.

This tool may be used for fault management to verify the correct behaviour of IDRP propagation or IDRP policy settings. It may also be used for performance monitoring of IDRP propagation.

3. Conclusion

The above list is not exhaustive. Other tools or NMS functions may be added as discussion on ATN MIB and NMS continues.