1. Introduction

The "End System to Intermediate System routeing Exchange Protocol for Use with ISO 8473" (ISO 9542) permits End systems (ESs) and Intermediate Systems (ISs) to exchange configuration and routeing information. This amendment is an enhancement to the protocol called *address administration*, which is concerned with design objective #1 of the ES-IS protocol (clause 0): "minimize the amount of *a priori* state information needed by ESs before they can begin to communicate with other ESs". The enhancement consists of a mechanism by which many types of ESs can obtain their own Network Entity Titles (NETs) by means of an ISO 9542 protocol exchange. Such a mechanism would eliminate the need for those types of ESs to have any *a priori* state information about their own Network Layer addressing values.

Implementation of the enhancement is optional. In its absence, ESs would need to be pre-configured with knowledge of their own Network Entity Titles. If an IS implements the enhancement, some or all of the ESs that use ISO 9542 to exchange routeing information with that IS may make use of the address administration mechanism; those that do not are unaffected.

2. Motivation for Address Administration

To the greatest possible extent, it is desirable to uncrate a new computer system, plug it in, and start using it without having to configure it manually. This is true of small non-shared ESs, such as personal computers and workstations. In many LAN-oriented networking configurations, most (if not all) of the attached ESs fall into this category. These ESs typically do not appear in a manually administered directory, since they are not sought by other systems (they are clients, not servers). For this reason, the choice of their Network Entity Title is not as important as it would be for a server system that must establish its identity on a relatively permanent basis so as to be accessible to client systems. It is still essential, however, for these systems to have Network Entity Titles that are globally unique.

Without the address administration feature, a network administrator must keep track of a large and varying population of systems and their Network Entity Titles to ensure uniqueness. This is typically an error-prone process; a chronic source of delays and disruptions in maintaining networks.

With address administration, on the other hand, a network administrator must keep track only of *shared* systems (servers). These systems appear in directories, because other systems must be able to locate them, and are typically much less numerous than non-shared systems. Requiring manual address administration for only these systems, then, considerably reduces the maintenance burden for network administrators.

3. Specification of Address Administration

Four new functions are required for address administration: *request address* by End Systems; *assign address* by Intermediate Systems; *record address* by End Systems; and *flush address* by End Systems. Two new PDUs are also required: the *request address* (RA) PDU and the *assign address* (AA) PDU.

Adding address administration to ISO 9542 as an optional feature requires the following modifications to the text:

3.1 Add the following as a fifth entry in the first list of objectives in clause 0:

> "e) how does a simple End System, which has not been pre-configured with its own NET, request a temporary assignment of a Network Entity Title and NSAP address(es) from an IS located on a common subnetwork?"

3.2 Add the following abbreviations to clause 4.1:

"AA PDU Assign Address Protocol Data Unit"

"RA PDU Request Address Protocol Data Unit"

3.3 Add the following parameters to clause 4.4:

"AHT Address Holding Timer"

"RART Request Address Retry Timer"

3.4 Change the third (single-sentence) paragraph of clause 5.1 to read as follows:

"Configuration Information also permits End Systems to obtain a temporary Network Entity Title without manual intervention, and to obtain information about each other in the absence of an available Intermediate System.

3.5 Add the following new paragraph at the end of clause 5.4.1.1:

"The End system can be informed of its own Network Entity Title. In a point-to-point subnetwork, if the physical link between the two systems is a transient one, this permits (but does not require) the intermediate system to employ a strategy of re-using a small number of Network Entity Titles to support many different End Systems."

3.6 Add the following text as a new point, d), in clause 5.4.2.1:

"d) An End System is optionally informed of its own Network Entity title. Once it obtains this information, it utilizes the Network Entity Title or, if desired, derived NSAP Addresses in subsequent interactions with other systems. However, it is not necessary or even permitted for an End System to use a Network Entity Title obtained in this way indefinitely."

3.7 Add the following clauses immediately before clause 6.4 (renumbering 6.4 and following clauses appropriately):

"6.4 Request Address Function

An End System might not have been pre-configured with knowledge of its own Network Entity Title. Such a system initiates a request for Network Entity Title by constructing a single RA PDU and issuing one (or more) SN-UNITDATA Request with the RA PDU as the SNSDU. Where an End System has more than one SNPA, it may optionally send one (or more) such RA PDU for each SNPA.

An End System may optionally implement a RART (Request Address Retry Timer) to place a bound on the waiting period between the issue of the Request Address PDU and the arrival of an Assign Address PDU. The value of this timer is a local matter. If this timer expires the ES has the option of resending the RA PDU or utilizing the procedures outlined in clause 6.6.

6.5 Assign Address Function in the IS

An intermediate system maintaining the appropriate subnetwork configuration information acts on the arrival of an RA PDU by determining a Network Entity Title for assignment to the End System that originated the RA PDU. Intermediate systems that do not support the address administration option discard the RA PDUs.

[Note: The way in which an intermediate system determines Network Entity Titles according to this function is not specified. The IS may use any algorithm that ensures unambiguous Network Entity Title assignment. That is, no Network Entity Title may be reported to more than one SNPA. The IS may report the same NET if requested from the same SNPA Address on separate occasions. For example, the IS may construct a Network Entity Title based on the RA PDU originator's source SNPA and local information, or maintain a manually administered database from which Network Entity Titles are selected according to some locally specified criterion. If more than one IS on a given subnetwork supports the address administration option, they must coordinate their Network Entity Title reporting algorithms to ensure that all Network Entity Titles are unambiguous. Such procedures would be out of the scope of this standard. For illustrative purposes, however, a static algorithm for address distribution could be one in which each IS participating in address administration would be assigned a range of addresses to distribute.]

[Note: If a bridged LAN is partitioned into logical subnetworks by controlling which bridges propagate multicasts and broadcasts, the coordination of assignments must span the entire bridged LAN. This ensures that a change in partition does not produce a duplicate Network Entity Title. Without such a stipulation, an End System could obtain a Network Entity Title before the repartition, continue to use it afterward, and conflict with an assignment made by a different IS with which it previously did not share a logical subnetwork.]

The intermediate system constructs an *assign address* (AA) PDU, placing the newly determined Network Entity Title in the appropriate field, and including an *address holding time* (AHT)[1], which represents the amount of time that the End System may continue to use it. The NET has the structure and semantics of an NSAP address in which the last octet is "zero" (See section 6.6). [The AHT should be much larger than the configuration information holding timer; see clause 6.1.2.] The IS issues one SN-UNITDATA Request with the AA PDU as the SNSDU. The SN-SOURCE-ADDRESS parameter from the previously received RA PDU is used as the SN-DESTINATION-ADDRESS parameter of the AA PDU.

[Note: The IS should not record the configuration for this End System as part of the "assign Address" function, since the End System is not <u>required</u> to use the assigned Network Entity Title as an NSAP address. The End System configuration is recorded only via the "record configuration" function described in clause 6.3.

The configuration information provided by subsequent ESH PDUs will reflect usage of the NET contained in the AA PDU as either an NSAP with no modifications or NSAPSs derived from the NET via adding code points in the last octet of the NET. This also allows the IS to determine if the End System, which may have received AA PDUs from other ISs, had indeed chosen the NET that it issued. If the IS determines that its NET had not been used by the ES, then that NET will be free to be issued on subsequent Assign Address PDUs.]

6.6 Record Address Function in the ES

The record address function extracts the assigned Network Entity Title from an AA PDU it receives. If it receives more than one AA PDU, in the case of multiple intermediate systems on the same subnetwork participating in address administration, it chooses one by a method that is a local matter. It starts an address holding timer (see clause 6.7) using the address holding time contained in the AA PDU. The assigned Network Entity Title may be used as an NSAP address. If the End system employs more than one NSAP address for its operation, it may derive additional NSAP addresses from the assigned Network Entity Title by using the code points provided by the "zeros" in the last octet. [Note: The method of derivation is not specified in this standard.]

[1]Editor's note: The semantics of an AHT=Zero is not clear at this time. National Body comment is encouraged on this point.

If there is no response to the *Request Address* PDU, ie. the *Request Address Retry Timer* (RART) expires, or no IS exists, the ES has the option of assigning a "local" address by using AFI = 49 and the DSP = SNPA. Note that this "local" NSAP has significance only within the subnetwork that the ES resides.

6.7 Flush Address Function

If an End System acquires a Network Entity Title through the operation of the "request address" function, it shall implement an address holding timer associated with this Network Entity Title. The initial setting of this timer shall be obtained from the AHT field of the *Assign Address PDU*. If the timer expires, the End System shall discard the Network Entity Title and all derived NSAP addresses. It may perform the "request address" function to obtain a new Network Entity Title.

[Note: This ensures that Network Entity Titles that have been erroneously or improperly assigned (as, for example, by a malfunctioning Intermediate System) will eventually be purged. To provide continuous service, the ES may invoke the "request address" function before expiration of the AHT. When this function is used to obtain a "new" Network Entity Title, it is entirely possible for the "new" one to be the same as the "old", depending on how the Intermediate Systems have implemented their Network Entity Title administrative algorithms.]"

There is an additional cause to discard the Network Entity Title (and derived NSAP addresses). This is if the ES changes its SNPA through which the NET was obtained.

3.8 Add the following code points to Table 2, clause 7.2.5:

RA PDU - bits 00001

AA PDU - bits 00011

3.9 Change the first paragraph of clause 7.2.6 to read as follows:

"The Holding Time field specifies the maximum time for the receiving Network Entity to retain the configuration/routeing/address administration information contained in this PDU."

3.10 In the first paragraph of clause 7.3.1, third sentence, add the following term after the term ending "... Intermediate System Network Entity Title (NET);":

"The AA PDU carries an End System Network Entity Title (NET);"

3.11 Add the following clause immediately before clause 7.3.5 (renumbering 7.3.5 and following clauses appropriately):

"7.3.5 Network entity Title Parameter for an AA PDU

The Network Entity Title parameter is the Network Entity Title that is being provided to the End System in response to the Request Address PDU. It is encoded in the PDU as shown in Figure 4."

3.12 Change the title of Figure 4 to read as follows:

ISH, AA, or RD PDU —— Network Entity Title Parameter

3.13 Change the first sentence of clause 7.4.2 to read as follows:

"The Security option may appear in the ESH, ISH, RA, AA, or RD PDU"

3.14 Change the second sentence, second paragraph of clause 7.4.2 to read as follows:

"When carried in the ESH, RA, AA, or ISH PDU, the Security parameter conveys security information about the transmitting system."

3.15 Change the first sentence of clause 7.4.4 to read as follows:

"The Priority Option may appear in the ESH, ISH, RA, AA, or RD PDU."

3.16 Change the second sentence, second paragraph of clause 7.4.4 to read as follows:

"When carried in the ESH, RA, AA, or ISH PDU, the Priority parameter conveys the priority of the transmitting system."

3.17 Add a new clause 7.8:

7.8 Request Address (RA) PDU

The RA PDU has the following format:

				Octet
Network Layer Protocol Identifier				1
Length Indicator				2
Version/Protocol ID Extension				3
Reserved (must be zero)				4
0	0	0	Type	5
Checksum				6,7
Options				8 … m-1

Figure 13: RA PDU Format

3.18 Add a new clause 7.9:

7.9 Assign Address (AA) PDU

The AA PDU has the following format:

				Octet
Network Layer Protocol Identifier				1
Length Indicator				2
Version/Protocol ID Extension				3
Reserved (must be zero)				4
0	0	0	Type	5
Address Holding Time (AHT)				6,7
Checksum				8,9
NET Length Indicator (NETL)				10
Network Entity Title (NET)				11 … m-1
Options				m … n-1

Figure 14: AA PDU Format

3.19 Add the following entries to Table 3, clause 8.1:

Request Address	new 6.4	0	0	0	—	—
Assign Address	new 6.5	—	—	—	0	0
Record Address	new 6.6	0	0	0	—	—
Flush Address	new 6.7	0	0	0	—	—

3.20 Add the following term at the end of clause A.2.2:

"AA: the status following this symbol applies only when the PICS states that Address Administration is supported."

3.21 Add the following entries to the "End System" section of the PICS Proforma (clause A.4):

a) Subgroup 1 - Protocol Function

AA	Is Address Administration Supported?		O	Yes No

b) Subgroup 2 - Functions Supported

RqAd	Request Address	New 6.4	AA:M	Yes No:X___
RcAd	Record Address	New 6.6	AA:M	Yes No:X___
FlAd	Flush Address	New 6.7	AA:M	Yes No:X___

c) Subgroup 3 - PDUs supported

RA-s	<s> Request Address	New 6.4, 7.8	AA:M	Yes No:X___
AA-r	<r> Assign Address	New 6.5, 7.9	AA:M	Yes No:X___

d) Subgroup 4 - PDU fields supported

NETA-r	<r> Network Entity Title- AA	New 7.3.5	AA:M	Yes No:X___

e) Subgroup 5 - Parameter Ranges

RARTv	What range of values can be can be set for the Request Address Retry Timer?	New 6.4	AA:O	Yes No

3.22 Add the following entries to the "Intermediate System" section of the PICS Proforma (clause A.4):

a) Subgroup 1 - Protocol Function

AA	Is Address Administration Supported?		O	Yes No

b) Subgroup 2 - Functions supported

AsAd	Assign Address	New 6.5	AA:M	Yes No:X___

c) Subgroup 3 - PDUs supported

RA-r	<r> Request Address	New 6.4, 7.8	AA:M	Yes No:X___
AA-s	<s> Assign Address	New 6.5, 7.9	AA:M	Yes No:X___

d) Subgroup 4 - PDU fields supported

NETAA-s	<s> Network Entity Title	New 7.3.5	AA:M	Yes No:X___

3.23 Add the following terms to Table 4, Annex C (State Tables):

AHT	Address Holding Timer expiry
RART	Request address Retry Timer expiry
AA	Assign Address PDU received
RqA	Address required
RA	Request Address PDU received

3.24 Add the following entries to Table 5, Annex C (State Tables - Predicates):

Pa	System supports Address Administration
P6	Address Holding Timer has expired
P7	Received RA PDU
P8	Request Address Retry Timer has expired

3.25 Add the following entries to Table 6, Annex C (State Tables - Specific Actions):

AHT-reset	Stop and restart Address Holding Timer
RART-reset	Stop and restart Request Address Retry Timer
FlushA	Flush NET and all derived NSAP Addresses
AA:SN-SA	Send Assign Address PDU with SN-DA=received SN-SA
RecordA	Record new NET and derived NSAPs
RA:IS	Send RA PDU with SN-DA=ALL_ISs

3.26 Add the following entries to Table 7, Annex C (End System State Table):

RqA	Pa	RA:IS;RART-reset	New 6.4, 6.7	Ready
	Pa$\wedge$P8	RA:IS;RART-reset	New 6.4, 6.7	Ready
AHT	Pa$\wedge$P6	RA:IS	New 6.4	Ready
AA	Pa	FlushA;RecordA;AHT-reset	New 6.4, 6.7	Ready

3.27 Add the following entry to Table 8, Annex C (Intermediate System State Table):

RA	Pa$\wedge$P7	AA:SN-SA	New 6.5	Ready