

The Network Simulator NS-2

NIST add-on

Neighbor Discovery

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2 Overview

When moving from one network to another, the Neighbor Discovery module is used to create a new IP address in the new network. A new module has been created in NS-2 in order to provide the functionality of Neighbor Discovery. This new agent is implemented to support multiple types of interfaces (Ethernet, UMTS, 802.11..) by using broadcast or unicast messages depending on the technology.

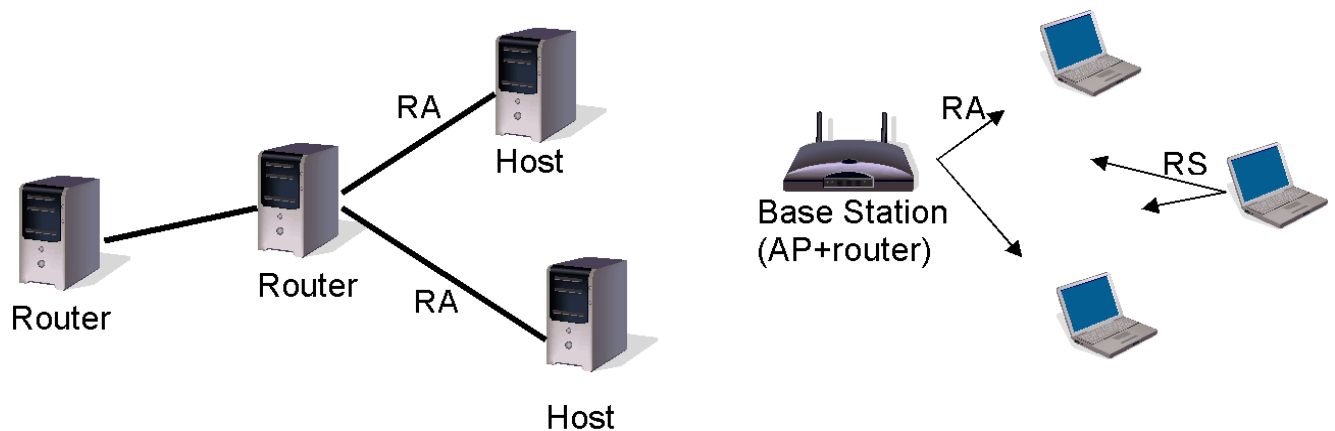


Figure 1: Overview of ND in Ethernet and 802.11

Section 3 presents the design of the ND Agent implemented in NS2. Section 4 presents the TCL configuration.

3 Design

3.1 Flow process

The ND Agent implementation is based on the information provided by RFC 2461 Neighbor Discovery for IPv6, but only a few elements have been implemented.

If the node is a router, it will send unsolicited Router Advertisement (RA) messages periodically (following a law $U[\min RtrAdvInterval, \max RtrAdvInterval]$). If a router receives RA messages, it will silently discard them. Upon reception of a Router Solicitation (RS), the router will decide if a reply can be sent or must be delayed depending on when the last RA was sent and when the next RA is scheduled.

A host can send RS messages to request the emission of an RA. The decision is made by an upper mobility management protocol. Upon reception of an RA, the ND checks in its table if the prefix is already known. If it is not, then it

creates an entry in the database and informs registered modules about the new prefix. Also using the information included in the RA message, a timer is used to determine when the prefix will expire if the node stops receiving the messages containing the same prefix. Every time a message arrives, it will update the prefix expiration time.

3.2 Support for different interfaces

The ND Agent is located in all nodes but must be configured depending on the node's type. In NS-2, some nodes (802.11) can generate broadcast packets while others do not have this capability (Ethernet, UMTS). To work around this problem, the ND Agent can be configured with a list of targets where it will send unicast messages.

3.3 Messages

There are two types of messages implemented in the ND Agent: The Router Solicitation (RS) and the Router Advertisement (RA).

The RA contains 2 options:

- One prefix information
- One advertisement interval

3.4 Files location

Coding and definitions of the Neighbor Discovery module are located in the following files:

- hsntg/nd.h: define the NDAgent
- hsntg/nd.cc: implementation of the NDAgent
- tcl/lib/ns-hsntg-nist.tcl: define default values for NDAgent

4 TCL Configuration

4.1 Creation

A utility method has been created to add the NDAgent into a node. Use \$node install-nd to add the ND module into a node (see tcl/lib/ns-hsntg-nist.tcl for implementation information).

4.2 Default values

This section contains the attributes configured by TCL and their default values (defined in tcl/lib/ns-hsntg-nist.tcl)

Name	Description	Default value
router_	Specify if the agent is located in the router or a host.	0
router_lifetime_	The lifetime associated with the	5

	router (in seconds)	
prefix_lifetime_	The lifetime associated with the prefix (in seconds)	5
broadcast_	Specify if the RA messages must be send in broadcast	1
minRtrAdvInterval_	Minimum time between 2 RAs (in seconds)	0.03
maxRtrAdvInterval_	Maximum time between 2 RAs (in seconds)	0.07
minDelayBetweenRA_		0.03
maxRADelay_	Maximum time for replying to an RS (in seconds)	0.005
default_port_	The port number where the agent is attached in the node	254

4.3 Commands

The following command are supported by the NDAgent

Command	Arguments	Description
start_ra	None	Start scheduling RA messages (for router only)
stop_ra	None	Stop scheduling RA messages (for router only)
send_rs	None	Send an RS (for host only)
dump-table	None	Dump the list of prefixes
set-minRtrAdv	Double	Set the minimum time between two RAs
set-maxRtrAdv	Double	Set the maximum time between two RAs
router-lifetime	Unsigned int	Set the router lifetime (in seconds)
prefix-lifetime	Unsigned int	Set the prefix lifetime (in seconds)
set-router	TRUE/FALSE	Specify if the agent must behave as a router or host
set-ifmanager	TCL reference	Set the interface manager that will receive notifications of new and expired prefixes
enable-broadcast	TRUE/FALSE	Set if the messages must be sent in broadcast or unicast
add-ra-target	NS Address	Add a target node for the RA messages
remove-ra-target	NS Address	Remove a target node for the RA messages
add-rs-target	NS Address	Add a target node for the RS messages
remove-rs-target	NS Address	Remove a target node for the RS messages