Overview of INET Framework

11/16/10

Acknowledgements

- Manual and tutorials available online at: http://inet.omnetpp.org/index.php?n=Main.HomePage

- INET framework package available for download at: https://github.com/inet-framework/inet/downloads

Background Information

- INET is a simulation model suite for TCP/IP and Internet-related protocols for OMNET++

- Includes:
  - IPv4, IPv6, TCP, SCTP, UDP protocol implementations
  - Several application models
  - MPLS model with RSVP-TE and LDP signaling
  - Link Layer models: PPP, Ethernet, 802.11
  - Support for mobile and wireless simulations

OMNET-Based Simulation Framework

- INET builds upon OMNET++
  - Modules that communicate by message passing
- Network is a compound module that contains host, router, and other modules
- Compound modules used to represent hosts, routers, switches, other network devices
- Compound modules assembled from simple modules
  - Simple modules represent protocols, applications

INET Modules

- Modules are organized into packages
- Packages are organized according to OSI layers
  - Ex) *inet.applications, inet.transport*

INET Architecture

- Modules and protocols
- Common modules in hosts and routers
- Common modules at network level
- Communication between protocol layers

Modules and Protocols

- Protocols represented by simple modules
- Simple module's external interface is described in NED file and implementation is in a C++ class
  - Ex) TCP, IP
- Combine simple modules to form hosts and other network devices
- Network interfaces
  - Ex) Ethernet, 802.11
- Some other modules (that do not implement protocols):
  - RoutingTable
  - NotificationBoard
  - FlatNetworkConfigurator
  - ConstSpeedMobility
  - ChannelControl

Common Modules in Hosts and Routers

- InterfaceTable
  - Contains table of network interfaces (eth0, wlan0, etc) in the host
- RoutingTable
  - Contains IPv4 routing table
- RoutingTable6
  - Contains IPv6 routing table
- NotificationBoard
  - Facilitate communication of modules

Common Modules at Network Level

- FlatNetworkConfigurator
  - Assigns IP addresses to hosts and routers, sets up static routing
- ScenarioManager
  - Makes simulations scriptable (sets up and controls simulation experiments, schedules specific events to take place at specified times)
- ChannelControl
  - Required for wireless simulations
  - Keeps track of which nodes are within interference distance of other nodes

Communication Between Protocol Layers

- When upper-layer protocol wants to send a data packet over a lower-layer protocol:
  - Upper-layer module sends message object representing the packet to lower-layer module
  - Lower-layer module encapsulates it and sends it
  - If reverse process, lower-layer performs decapsulation

- Control info
  - Small value objects attached to message objects
  - Contain information for next protocol layer (not to be sent out to other hosts and routers over the network)

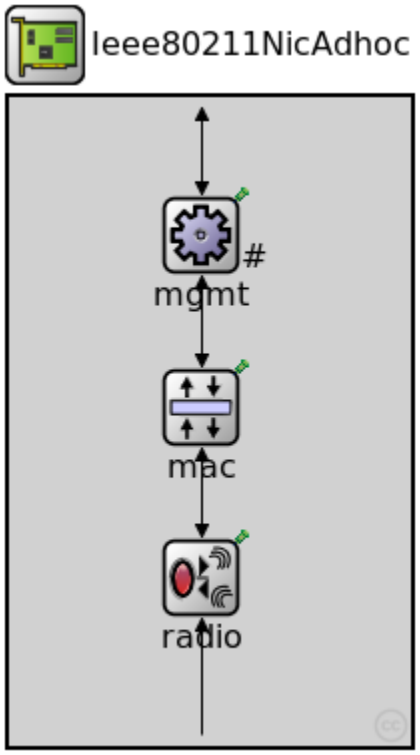
INET Models

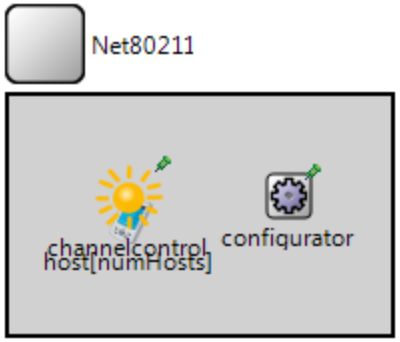
- Ethernet
- IEEE 802.11
- UDP
- TCP
- SCTP
- MPLS

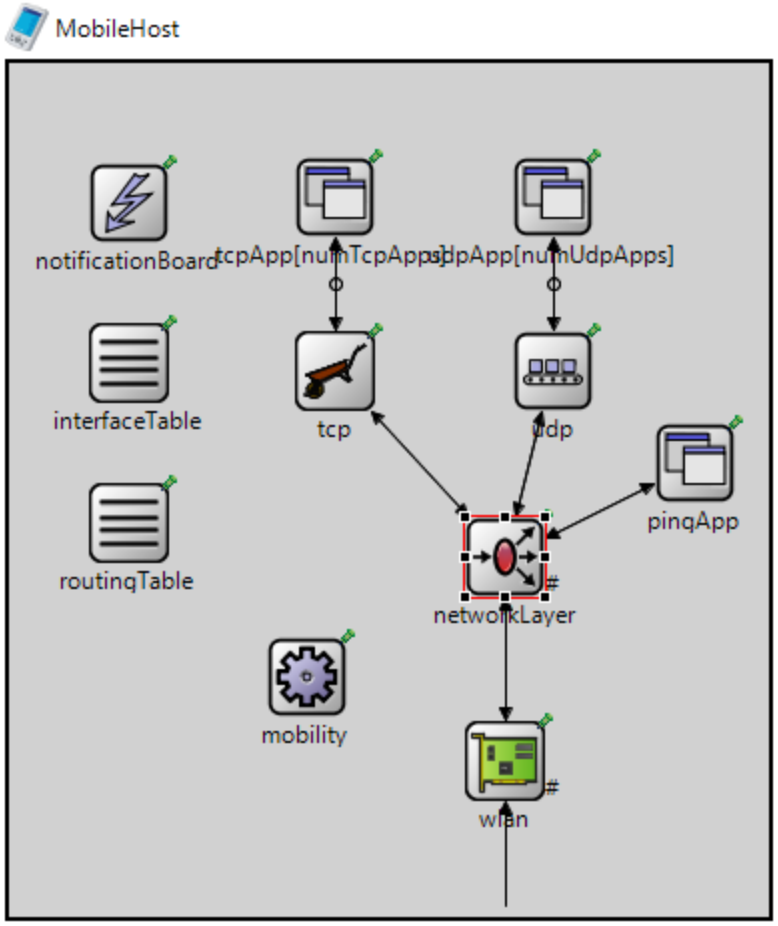
Looking at an example model

- 802.11
  - Several interfaces (NIC) available:
    - Ieee80211Nic: a generic (configurable) NIC
    - Ieee80211NicAdhoc: for ad-hoc mode
    - Ieee80211NicAP, Ieee80211NicSTASimplified: for use in an access point
    - Ieee80211NicSTA, Ieee80211NicSTASimplified: for use in an infrastructure-mode station
  - 4 layers of NIC
    - Agent – instructs management to perform scanning, authentication, and association
    - Management – encapsulation/decapsulation of data packets,
    - MAC – transmission of frames according to CSMA/CA
    - Physical layer – model characteristics of radio channel

802.11 Model (Ieee80211Adhoc)







Extending INET

- Can add own protocols easily into INET
  - Create subdirectory for new protocol in corresponding OSI Layer (ex. new routing protocol should be placed in INET/Network subdirectory)
  - Extend makefiles to include new protocol into the build