

Student Guide to Java Network Workbench 2

JNW2 is a logical successor to the original Network Workbench (NW), which was written in C++. Two principal documents describe NW: *Understanding Internet Protocols* by Pullen (Wiley, 2000) and Pullen, *The Network Workbench: Network Simulation Software for Academic Investigation of Internet Concepts (Computer Networks, March 2000)*. The basic design of JNW2 is consistent with these references. One major difference is that a serious effort has been made to use exemplary Java programming methods and thereby to generate very clear code in JNW2.

The basic operation of JNW2 follows a paradigm we will discuss in class:

- Define network topology
- Use algorithms and data structures that reflect how the network protocols in question work
- Represent variability using a random number generator
- Break down the operation into a very fine time steps (discrete events)
- Keep the events associated with these time steps in a linked list
- Simulation steps forward through the timelist, producing output that shows what happens at each significant step
- Collect statistics as the simulation proceeds and print out the statistics after the simulation concludes

Many network simulators much more sophisticated than JNW2 exist, both open source (such as NS3) and commercial (such as OPNET). These are powerful tools for study and analysis of networks, but they require significant time to learn. NW (and now JNW2) is intended to be easy to learn and to provide as much scaffolding as possible in a way reflecting that intention, leaving for the student the role of programming the core functions of the network protocols (where the algorithms are provided). Except for the project solutions, all of the JNW2 code is available as open source.

Installing JNW2 is very simple:

1. Download and install NetBeans (latest version)
2. Download JNW2.zip and unzip it in a working directory (I use NetBeansProjects because it's easy to find JNW2 in NetBeans that way).
3. Open the JNW2 project in NetBeans and then right click on the project icon at left edge of the window; select Properties and then Run; then set the Main Class to JNW2.RunSimulation. At this point you're ready to work on a JNW2 project (see separate descriptions).

JNW2 graphic user interface (GUI) that we will use toward the end of the course but thus far it produces only input network descriptions, not graphic network performance output. Therefore, assignments will use only text output (the information needed is in many cases most effectively presented in text). The text

interface is based on a logger (see class SimLogger in the top level code directory). The simulation code exploits this by flagging INFO level logger outputs either to one of the 5 layers in the "Internet Stack" we've studied, or to other features such as BitStuffing and CRC-FCS. The topology for a JNW2 network is contained in a configuration file, which also defines the layers/features selected for logger INFO.

JNW2 has two command-line parameters, which can be set in the same NetBeans Properties->Run panel where the main() program is selected:

1. Name of the configuration file for network topology, in the JNW2/configs directory (or the full path-name of that file if elsewhere)
2. (optional) Path-name of a file where logger output is to be written (by default it goes to System.out)

Most modules of JNW2 include a main() method (many of them donated by students) that can be used to test the code in that module by itself, without complicating factors that might be introduced by the rest of JNW2.