

*M. Satyanarayanan
Information Technology Center
Carnegie-Mellon University
22 September 1984*

What is it?

The Nutcracker is an Ethernet monitoring device built by Excelan Inc. It is a stand-alone unit incorporating an Intel-8086 processor, memory, a 10Mb Winchester disk, and a floppy drive. The software on the system is custom-built. Users cannot program the Nutcracker in the usual sense; instead, a menu-driven interface is used to set up experiments pertaining to Ethernet traffic generation and monitoring.

The Nutcracker's claim to uniqueness lies in the special Ethernet hardware it possesses. This hardware serves two fundamental functions:

It allows capture of minimally-spaced packets. Thus one can be sure that monitoring is accurate regardless of traffic conditions.

It provides a packet filtering capability. Essentially this is a pattern matching capability which can be set to capture packets with a particular bit pattern at specific locations. All other packets are ignored.

The Nutcracker is capable of accumulating Ethernet statistics as well as tracing predetermined fragments of all filtered packets. In addition it is capable of generating packets which are minimally separated in time, thereby loading the Ethernet to its maximum rated capacity. It can also be used to generate deliberately erroneous packets.

The Winchester disk stores all the system programs, experiment setups, and collected data. It is possible to make backup copies of these on a floppy.

Why is it relevant to us?

Given our use of Ethernet as the networking medium in the near future, we have a definite need for tools to monitor its status. Our existing tools consist of programs running on the IBM-PC and the Sun workstation running the standard 3-Com Ethernet interfaces in promiscuous mode to monitor traffic. Filtering is done in software.

While adequate for debugging and monitoring at low Ethernet loads, these tools are incapable of capturing packets transmitted at the maximum permissible Ethernet rate. Pathological situations in the network, and bursty traffic at times of heavy file system activity may cause such conditions to arise. Measurement of network traffic, and calibration of existing software monitors are other areas where an accurate monitor would be invaluable.

There is thus a clear need for the ITC to obtain a high-performance Ethernet monitoring device. The question is whether the Nutcracker meets our requirements.

Usage Experience

Positive Impressions

The overall structure of the software, its decomposition into subsystems, and the experiment set-up procedure were quite logical and convenient.

The constrained programmability of the Nutcracker does not seem to be a hindrance in practise. In fact, it allows a user to set up relatively complex monitoring experiments in a natural way, with very little effort.

Excelan's Technical Support turned out to be quite helpful. They were prompt in shipping out a new release of their software, getting back with answers to my queries, and on one occasion shipped out an Ethernet adaptor when my use of a DEC Ethernet adaptor was suspect. They were also gracious enough to extend our evaluation period to two months, when hardware problems caused us to lose time in our original evaluation period.

I did not have an opportunity to validate the Nutcracker's ability to capture packets at full speed. Assuming that it can, the tracing and cumulative statistics facilities ought to prove very useful.

Negative Impressions

The hardware turned out to be quite unreliable. There were three separate occasions when the Nutcracker claimed that the Winchester disk was damaged and unusable. In no case was the disk actually physically damaged; however, it was necessary to reformat the disk and reload it from floppies. Data and experiment set-ups on the the hard disk were lost during reformatting. It is not clear whether the problem is in the software, disk controller, or the disk itself. What matters is that the system deemed the Winchester unusable.

There were many unexplained system crashes that occurred during relatively innocuous user actions such as selecting a new menu item. There were also transient failures in booting off the Winchester; repeating the action usually cleared the problem.

From a functional point of view, a very serious shortcoming of the Nutcracker is its inability to communicate with any other computers on an Ethernet. An indispensable feature would IP/TCP file transfer support to Unix-based mainframes or workstations.

The floppy disk format is incompatible with the IBM-PC. It is not clear whether Excelan subscribes to any industry standard at all or whether it is proprietary. Combined with the inability to transfer files over the Ethernet, this implies that the Nutcracker is a totally isolated system. This is not acceptable for the kind of use we anticipate for an Ethernet monitor.

The user interface software left much to be desired :

Performance was poor. Seemingly trivial operations seemed to take forever.

The redisplay was slow. The incessant flashing of various highlighted areas on the screen was irritating.

The screen should be either totally in reverse video or normal. Leaving the entire screen dark but having text in reverse video rectangles is quite discomfoting.

Menus were nested, but selection of an item at some level popped you all the way back to the top level; this turned to be quite annoying when configuring an experiment.

There were states of the system where it was not clear what was happening: input was not accepted, yet no apparent ac-

tion was being performed by the processor.

A complete revamping of the user interface on the Nutcracker would make it much more usable.

The printer was useful only because of the absence of a file transfer capability. If the latter had been available it would have been much easier to ship files to a laser printer for printing, rather than using the relatively slow dot-matrix printer. If a file transfer capability is incorporated in future, the printer should be made optional.

The physical layout and aesthetics could be improved significantly. While these are not critical issues, it would still be nice to have a physically more compact and attractive unit.

Recommendation

Conceptually, and at a system architecture level, the Nutcracker seems to be what the ITC is looking for in an Ethernet monitor. However its current implementation leaves much to be desired. At its list price of approximately \$50K one expects a significantly more refined implementation and some additional functionality. I therefore recommend that we do not purchase the Nutcracker at the present time.

A revised implementation of the Nutcracker would be of interest to us if it addresses the issues that cause me concern. The ITC should also evaluate alternative Ethernet monitors as they become available, since we undoubtedly have a long-term need for one or more such devices.

