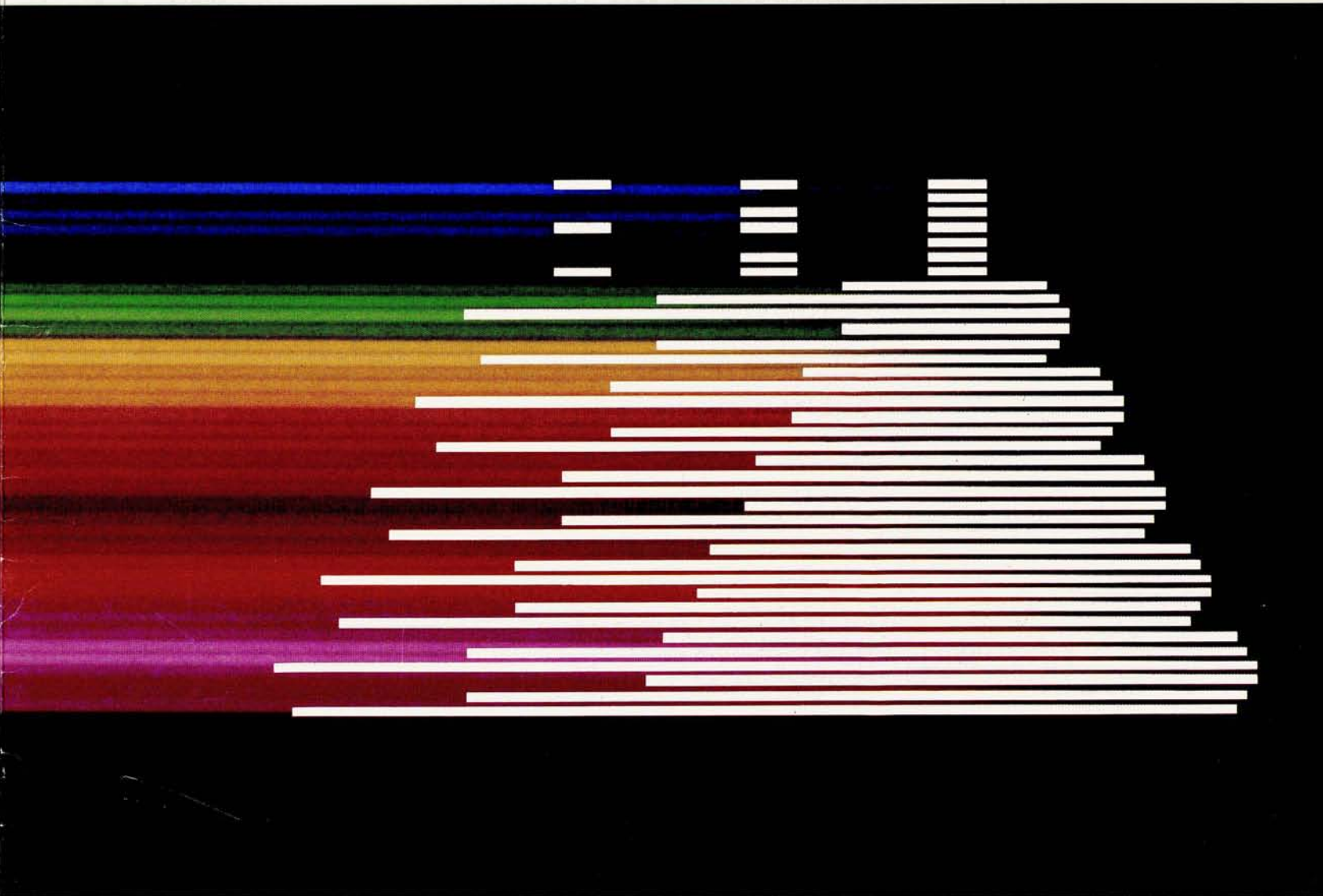# XEROX

The Xerox 1100 Series of Scientific Information Processors

Power Tools for Programmers

Xerox 1100 Series

The Xerox 1100 Series of Scientific Information Processors provides an affordable, high-performance line of personal computers for research, advanced system development, and rapid prototyping. The development of complex information systems requires an environment that supports the exploration of alternative designs. The Interlisp-D programming environment on the Xerox 1100 Series is such an environment. Interlisp-D, a powerful, personal machine implementation of the Interlisp dialect of LISP, combines the powerful programming tools of Interlisp and the personal machine features of the Xerox 1100 Series. The Interlisp-D software, together with the Xerox 1100 Series workstations, provides an integrated, interactive environment that greatly enhances programmer productivity, allowing rapid prototyping and encouraging exploratory programming.

Rapid Prototyping

The Xerox 1100 Series actively supports rapid prototyping of complex information systems. Rapid prototyping introduces a new dimension to system development. It is especially useful in the development of large, complex information systems, such as knowledge, or expert systems, which invariably possess high levels of uncertainty in their design. These applications demand a flexible environment which allows the system design to change and grow. The ability to experiment with alternative implementations enables the programmer to explore a range of possible solutions. Since Interlisp-D minimizes programming constraints, modifications are easily incorporated into an evolving system. Several features make the Xerox 1100 Series an ideal exploratory programming environment:

- **High resolution graphics display**
- **Interactive user interface**
- **Ability to mix interpreted and compiled code**
- **Multiprocessing capacity**
- **Support of an extensible, interpreted language**
- **Display-oriented programming tools**

Together, these features provide unprecedented support for rapid prototyping and exploratory development.

User Friendly Interaction

The dynamic user interface, designed and perfected at Xerox PARC, constitutes an ideal environment for rapid implementation of highly responsive user-oriented systems. A high bandwidth user interface is provided by combining the mouse pointing device and the high resolution interactive display. The mouse permits the user to rapidly specify and manipulate positions or regions on the display screen. The interactive display facilities include a complete set of raster graphic functions as well as a sophisticated display management system supporting multiple overlapping windows, menu driven selection of operations, and a wide range of built-in graphical abstractions. Functions are also provided to allow the user to display text in multiple fonts, manipulate raster images, and draw lines and spline curves. The large format, high resolution display and the sophisticated multiple window system allow concurrent sessions, close-up views, and simultaneous displays of multiple representations of complex data. It is easy to create windows with text, graphics, or both, and to make them scroll, update, and interact in useful ways with the end user. Interlisp-D allows the creation of specialized workstations which interact with their operators in a way which is customized to the application. The interactive style fostered by Interlisp-D makes it easy to develop consistent, uniform, and user friendly interfaces.

Interlisp-D:
An Ideal Language for Rapid Prototyping

Interlisp-D provides several features which make it ideally suited for use as a rapid prototyping environment. Interlisp-D is an interpreted, extensible, versatile, and flexible language. Because it is interpreted, Interlisp-D provides rapid turnaround time and quick results, which allow a designer to explore new ideas quickly and get immediate feedback. In addition, Interlisp-D's versatility allows for extensive program modifications to take place while programs evolve and structure changes. Features such as late binding and dynamic linking allow the programmer to defer aspects of the design until their specifications have stabilized.

Powerful Programming Tools

Interlisp-D provides a wide set of display facilities for using the Xerox 1100 Series' high-resolution display. Interlisp-D's programming tools provide a flexible environment to explore design alternatives for complex systems. The 1100 Series strategically combines these into a unified programming, user, and delivery environment.

1 Display Editor and Inspector

The Interlisp-D display-based structure editor allows the interactive editing of programs and other list data. Structure-based editing exploits the form of an object, emphasizes the meaning of its parts, and thus reduces errors. The data inspector extends this philosophy to both system and user data types, allowing easy inspection and modification of any object in the system.

2 Programmer's Assistant

The Interlisp-D Programmer's Assistant provides an intelligent assistant and bookkeeper that frees the programmer from much mundane detail. The Programmer's Assistant includes an error analysis capability and also monitors and records all user inputs. For example, a history is kept of the commands typed, their side-effects, and the results. Thus, one can request that a previous command or sequence of commands be repeated, modified and then repeated, or even undone (which

undoes all the changes it may have caused). Also provided is a spelling corrector that automatically corrects spelling mistakes using information from the local context. To simplify file managment for the programmer, Interlisp-D automatically keeps track of where in the file system each object is stored and which ones have been modified. In response to a simple request, the system can therefore save the user's state, updating all changed files automatically. The Programmer's Assistant provides a programming environment which cooperates in the development of programs allowing the user to concentrate on higher level design issues.

3 Debugging Tools

Interlisp-D contains debugging tools that allow the user to break and trace arbitrary functions, and examine the state of the machine at any desired level of detail. Not only can the state of a suspended computation be displayed and perused graphically, but it can manually be unwound to a specified point, the offending program edited, and execution resumed, all without loss of state. Also included is the capability of specifying complex, user-defined intervention conditions, such as allowing breaks only when a given function is called from another
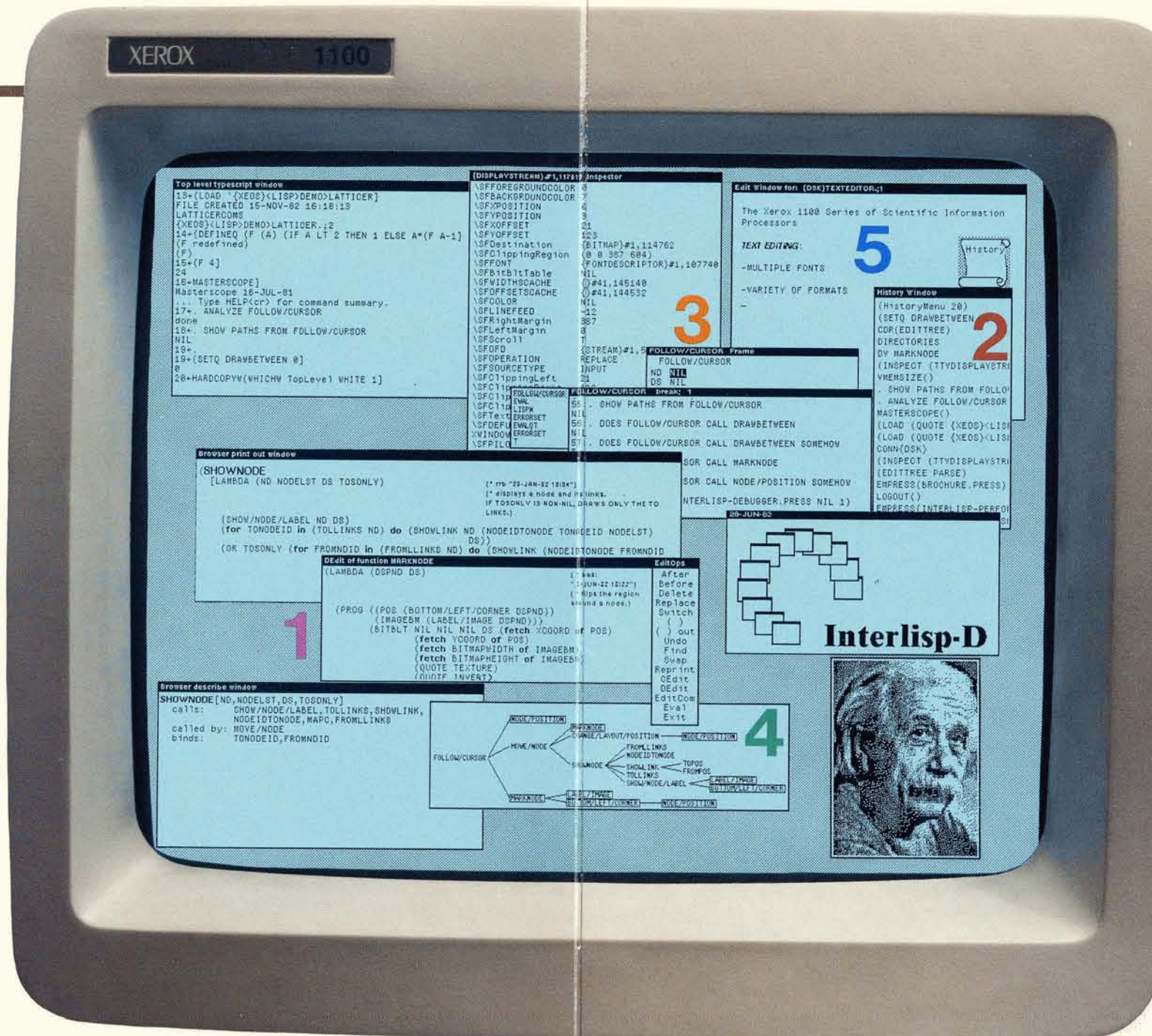
given function. These debugging tools allow bugs to be tracked down quickly and easily.
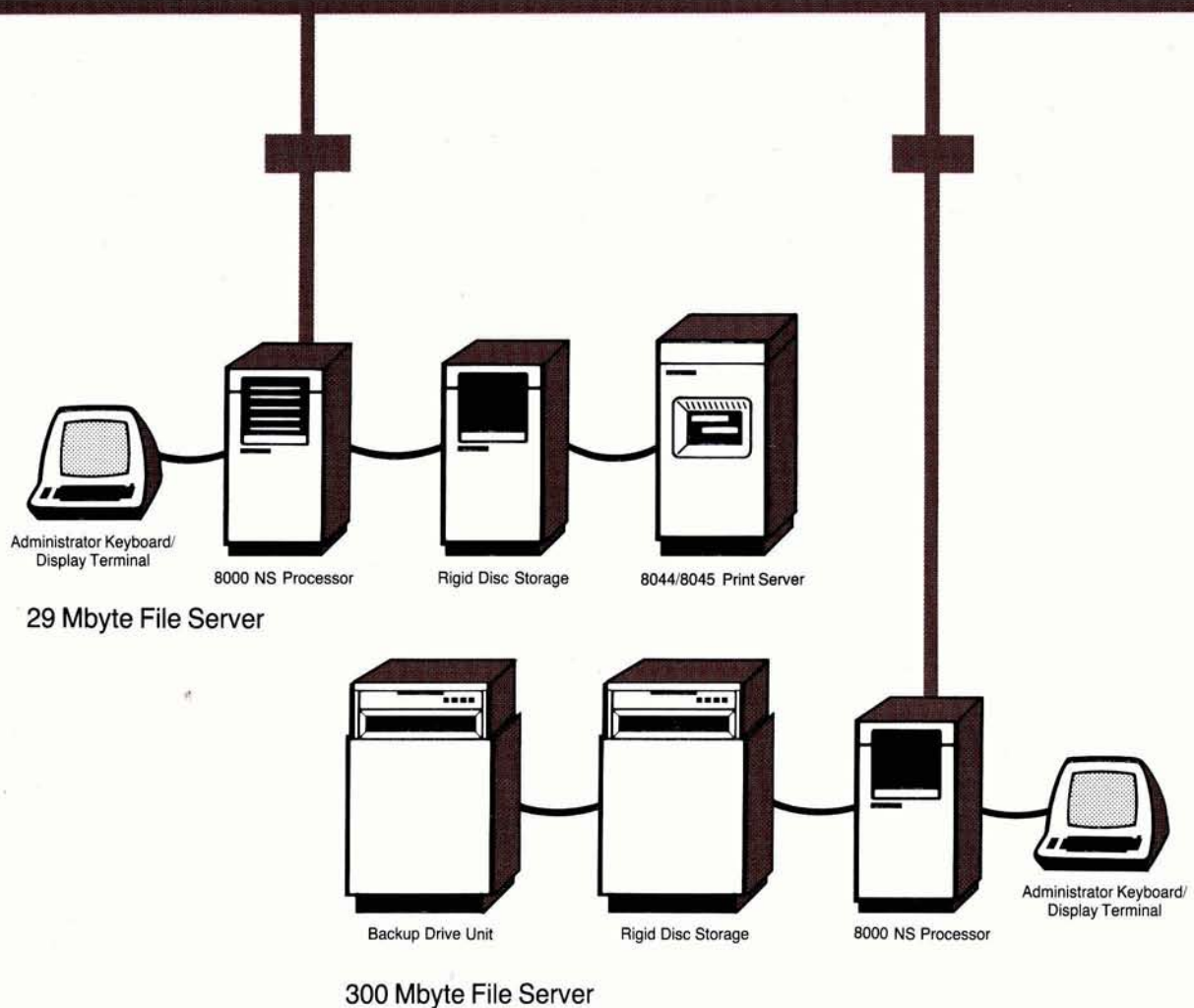
4 Program Analysis

Interlisp-D provides the Masterscope facility which can analyze a user's program and use that information to answer questions, display the program's structure and assist in the process of making modifications automatically. Because Masterscope is interfaced with the file package and editor, it re-analyzes a program whenever it is modified. Information about program calling structure, variable and data structure usage, and side effects can be graphically displayed and used to provide a map or browser for the system. The same information can be used to make systematic changes automatically. Further, Interlisp-D's measurement tools can be used to analyze the behavior of a system after it has been developed to pinpoint those areas that may need improvement.

5 A Professional Workstation

Interlisp-D also contains a growing collection of professional workstation facilities, such as text editing, file management, and electronic mail readers. These are directly available within the programming environment itself. Thus, they may be used by the programmer directly, or as building blocks to construct a specialized workstation. Interlisp-D provides an excellent environment for prototyping, engineering, and deploying workstations for a wide variety of complex information environments.

ETHERNET

Administrator Keyboard/
Display Terminal

8000 NS Processor

Rigid Disc Storage

8044/8045 Print Server

29 Mbyte File Server

Backup Drive Unit

Rigid Disc Storage

8000 NS Processor

Administrator Keyboard/
Display Terminal

300 Mbyte File Server

Networks and Communications

The Xerox 8000 Network Systems Communication Server allows remote networks, workstations, and servers to be integrated into a single, evolutionary environment. All Xerox 1100 Series machines are interconnected through the Xerox Ethernet. The Ethernet is a local area network providing economical access to a range of file servers, high quality printers, mainframes, electronic mail, and other shared resources. Interconnected local networks allow the user to run programs on other computers, obtain electronic mail, and access programs and data stored in machines throughout the world. Remote files are fully supported, so that files on a file server can be accessed in exactly the same manner as those on the local disk. In addition, complex text and graphics can be printed on a laser printer. Xerox 1100 Series computers have been networked with a wide variety of mainframes, including the DEC System-10/20s and DEC VAXs.

Delivery Environment

The Xerox 1100 Series workstations provide more than a software development system. Their user friendly environment is also an exceptional delivery vehicle for complex applications. The low cost 1108 makes it cost effective to deliver end-user applications in areas such as interactive symbolic computation, computer aided design, knowledge engineering, expert systems, and other areas of exploratory development, including a wide range of complex applications, such as the KL-ONE knowledge representation language, the MYCIN system for infectious disease diagnosis, the FORMS knowledge-based design environment for operator interfaces, and the West tutoring system.

XEROX