The Operations System Evolution Laboratory

Neal Scribner   The Operations System Evolution Laboratory was established as a showcase for Operations Systems Business Unit (OSBU) new products, ideas, and technology. The lab contributes to the evolution of operations systems products by providing a forum for direct customer feedback and by supporting the dissemination of new product ideas across the business unit. This paper discusses the motivation and objectives of the Evolution Laboratory, its logical and physical design, some of the projects undertaken, the organization of customer demonstrations, and a discussion of the benefits of the facility to both customers and employees.

Introduction

The need for an operations systems laboratory was recognized in the early 1980s, as the AT&T Network Systems Operations Systems Business Unit (OSBU) realized that divestiture was changing forever the former relationships of AT&T and its customers. As part of the OSBU's forward-looking work program, The Operations System (OS) Evolution Laboratory was established in 1986 at AT&T Bell Laboratories in Holmdel, N.J.

The Lab's Objectives

Several objectives were originally envisioned for the lab, and, over the years, it has served the OSBU in different ways. The most important use is to demonstrate operations products to customers from around the world. Also, the lab serves both customers and members of AT&T's research and development community as a showcase for new product ideas, new applications of existing products, and prototypes intended to demonstrate the technical feasibility of new operations technology.

Most of the prototypes are developed outside the lab, but several have been created by the group supporting the OS lab itself. Occasionally, the unique combination of facilities available in the lab provides a convenient place to perform integration testing of products and network elements that would be difficult to schedule elsewhere.

Facility Design

The physical layout of the lab (Figures 1, 2 and 3) is carefully designed to support the objectives. Access to network elements is essential, so the lab is adjacent to a larger networking equipment lab, the Digital Services Laboratory, a test and demonstration facility. This network laboratory houses a 5ESS® switch and a complete set of the latest AT&T transmission products—fiber terminals, multiplexers, subscriber loop carriers, and digital cross-connects, for both the domestic and international markets. A passageway through the Holmdel building's utility core facilitates access between the two labs and encourages collaborative projects. Thus, visitors typically can view Network Systems equipment in a "network" environment, then walk directly to our "network operations center."

This analogy to the real world is evident in the details of the OS lab itself. The operations systems computers and data communications equipment are housed separately in a glass enclosure, surrounded by a large carpeted area with attractive work center-style furniture, a conference table, and a rear-view projection system. The enclosure serves to block the noise of the equipment, and the work center furniture and lighting create an environment suitable for executive-level demonstrations.

The arrangement resembles an actual operations center design in several ways:

telephone company operations staff are generally provided a comfortable office environment separate from the equipment; and the use of rear and overhead projection is now common in the design of advanced operations centers. In fact, many of the customers who visited both the OS lab and the larger AT&T Network Operations Center (NOC), in Bedminster, N.J., were influenced to follow these design ideas both to improve their operations and to provide a product showcase for their own customers.

The lab has been partially redesigned once. As the number of customer demonstrations increased, the visual appearance was improved, a small lounge was added, and the podium area was redesigned for greater usability. Also, a prototype development lab was converted into a second conference area, as it is frequently necessary to host two visits simultaneously. A separate prototype lab was not really needed, since most of the prototypes developed in the lab are software.

Enough space is provided to attractively house and change the support computers and data communications gear. During the life of the lab, the replacement of older equipment with smaller, more compact equipment has provided adequate room for growth. This extra space also is an important management consideration when there is a need to install and demonstrate new products on short notice.

Systems Design

While the adjacent "network" equipment lab provides access to a complete set of network elements, the OS Evolution Lab contains the computers and workstations that support the operations systems products, data communications, and visual aids equipment for presentations. Operations systems run on general purpose computing and data communications equipment, as well as on a small amount of specialized processors used for accessing and testing network elements.

Some of the first installations in the lab were complete product installations, much as products would be installed in the field, with each product requiring its own computer. These installations had the additional benefit of testing and improving standard product delivery and installation procedures. More recently, several products and product demonstrations have been installed on general purpose servers from AT&T Global Information Solutions (GIS, formerly NCR), Sun Microsystems, Inc. or Hewlett-Packard Company. This change in approach reflects the evolution in the product line toward greater independence from computer-specific hardware vendors.

Complete networking capabilities are essential. All the computers and workstations in the lab are connected to each other with either a Datakit® virtual circuit switch network or an Ethernet*, TCP/IP network. (See Figure 3). These two local area networks are connected to each other, and each is connected separately to worldwide networks operated by AT&T. The Datakit switch network supports all of the usual lower-speed data communications protocols. The OS lab is connected to the nearby network equipment lab via DS1 (1.544 Mbits/s) links, as well as by the Datakit switch and Ethernet networks. There are some point-to-point and dial-up connections as well.

This network makes it possible to arrange demonstrations on short notice. A local exchange carrier (LEC) central office surveillance demonstration involved network elements in Idaho and New Jersey, for example, and surveillance systems in Idaho, Ohio, and New Jersey. Demonstrations of new OS products routinely make use of computers accessed at remote locations. Such demonstrations may also use a combination of network elements and OS systems in our Holmdel labs, together with OS systems in other locations.

A wide variety of workstations must be accommodated. In the lab's early years, "smart" (now called

Adjacent network equipment lab

Operations systems computers
and data communications

Conference

Model work
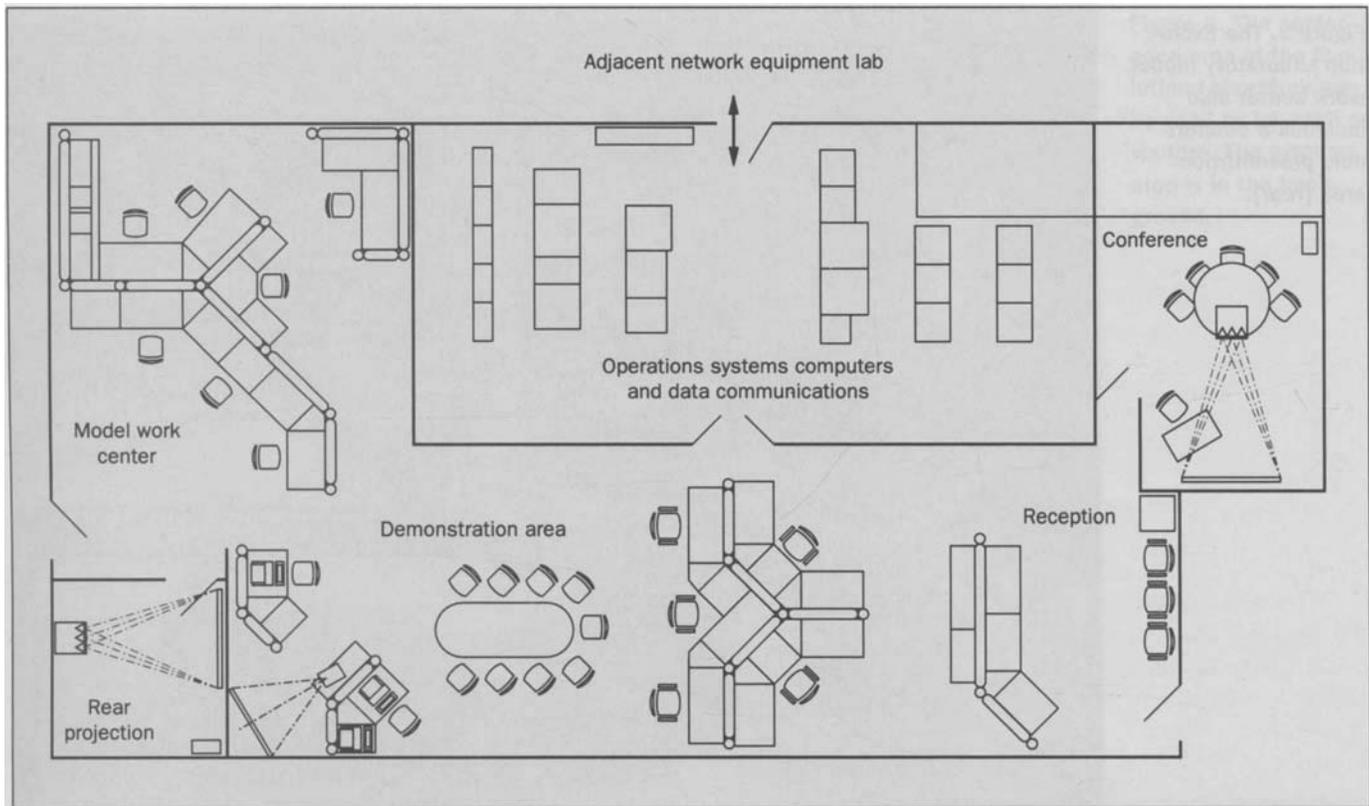center

Reception

Demonstration area

Rear
projection

**Figure 1. The floor plan of the Operations Systems Evolution
Laboratory built in Holmdel, N.J., for the Operations Systems
Business Unit (OSBU)**

"dumb") asynchronous terminals were used extensively.
Then came cluster controllers with multiple terminals,
followed by UNIX* workstations and personal computers.
Each of these must be connected both to the local net-
works and to remote locations, and terminal emulation
software of every description has been in use at one time
or another. Many of the workstations and terminals are
connected to the lab's video system, but generally it is
more convenient, in demonstrations, to use a workstation
at the podium.

The video system accommodates the highest
resolution workstations used in OS products, and pro-
vides adequate intensity for customer demonstrations.
Currently, the lab uses an Electrohome* 3100, with a
rear projection screen and modular video-source multi-
plexer. A simple transparency projector is used with a
second screen in the podium area. Thus, a presenter can

use a workstation displayed on an overhead screen, a
transparency on a second screen, and a white board, all
within about 15 feet of one another in the podium area.
The lighting was carefully designed to provide greater
flexibility, and a simple sound system suffices for audio.

Laboratory Projects

The projects undertaken in the lab have included
complex product demonstrations, product enhance-
ments, and prototypes of new product ideas. Examples
of each follow.

Craft Access Terminal. One popular OSBU product,
called the "Craft Access Terminal," allows outside craft
persons in the field to use a handheld terminal or laptop
to receive notification of outstanding customer troubles
that need to be fixed. The terminal also provides a way
to perform measurements and verify completed repairs
by accessing a centralized test system. In the OS lab
demonstration, calls were placed from a laptop in the lab
to a craft access system—also in the lab—which handled
the interactions with the laptop. The craft access system,

in turn, using Datakit switch connections with a central-
ized loop testing system in another location, invoked
tests of plain old telephone (POTS) lines on the 5ESS
switch in the network lab adjacent to the OS lab.

Test results are processed by the controller and
returned to the craft person's terminal by reversing the
communications sequence. The complexity of this
arrangement is typical of the routine operations in actual
use by public service providers, and it demonstrates the
unique capabilities of the OSBU's products to support
such complexity.

Switching Control Center System. During the initial
years of ISDN deployment, an enhancement for ISDN pro-
tocol analysis was designed and demonstrated for an
OSBU central office surveillance system product. This
system, called the Switching Control Center System
(SCCS), provides a central point of access and control to a
network of many switching machines. The user interface
of a personal computer-based ISDN protocol analyzer was

remoted from a central office location to the SCCS, and
integrated into that system's user interface. The interface
provided protocol analysis from a central location, where
expert staff could trouble shoot problems. Details of this
procedure were released and used by our customers.

User Interfaces. Recently, demonstrations of user
interface prototypes for complete operations systems
have generated valuable discussions with customers on
what they want. The user interface style of an OSBU
product for total network management (TNM) has been
used, for example, to develop demonstrations of the user
interface for both signaling system 7 (SS7) network
surveillance and management, and, separately, for the
integration of performance monitoring and alarm surveil-
lance in local wireless networks.

These demonstration prototypes provide a "win-
dow" into potential system functionality, and can be used
to help customers identify the most valuable features.
Both of these demonstrations have sparked much

Figure 3. The conference area of the Evolution Laboratory can be used by lab staff or visitors. The systems area is in the background.

customer interest, and have led to enhancements in our product line. The most recent explorations have been in the area of new client-server architectures for OSBU products, and in the use of object-oriented technology.

Current Directions

New demonstrations are added frequently, and reflect trends in telecommunications and computer technology. Recent additions have included a synchronous optical network (SONET) subnet controller, and an outside plant surveillance system that uses a graphical geographic information system as a base for displaying the outside plant.

We also are building a special area in the lab to showcase applications of the future. Examples include arrangements to support telecommuting operations staff using personal computers and ISDN, and the use of state-of-the-art multimedia methods for staff training and information access.

Customer Visits

Well over 100 customer groups visit the lab each year for product demonstrations, with a similar number of visits from groups within AT&T. Two staff members are responsible for the lab infrastructure and for coordinating visits. Customer account executives arrange the visits, and demonstrations generally are conducted by engineers from the participating product development groups. There also is a program to constantly improve the effectiveness of the presentations and of the lab itself. Customers benefit from seeing the latest operations technology demonstrated in a familiar environment, and OSBU product teams benefit by getting direct customer feedback on product features or proposed designs.

Conclusions

The success of this idea for a product and new technology demonstration facility is demonstrated by the OS lab's six-year history of increased usage. There were

Figure 4. This logical design of the Operations Systems Evolution Laboratory shows the operations systems (OSs), network elements, and data networking.
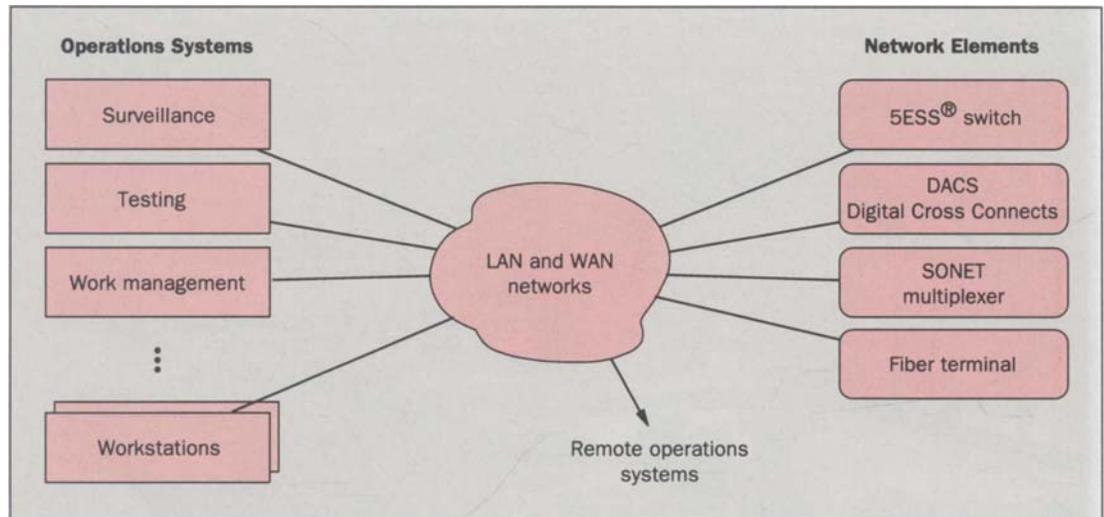
about four times as many visits and demonstrations in 1993 as during the first year, beginning in mid-1987. The combination of a development lab with a demonstration showcase, and product demonstrations with exploratory prototypes, has proven very effective in communicating our business unit's plans to customers, and in championing new approaches to operations systems development.

* Electrohome 3100 is a registered trademark of Electrohome Limited, Ethernet is a registered trademark of Xerox Corporation, and UNIX is a registered trademark of UNIX Systems Laboratory.

(Manuscript approved April 1994)

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