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Reprint

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CLASS – global communication from your desktop

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CLASS – global communication from your desktop

The rapidly growing need for communication across departmental and corporate boundaries, as well as over long distances, has prompted the integration of Volvo's existing mix of PC/LAN environments into a common global infrastructure for local PC networks. The system developed to meet this need is known as CLASS (Common LAN Services).

CLASS is a global service which enables a computer user to log on from a PC connected to the system anywhere in the world, while retaining his own desktop environment and authorisation integrity.

As a new environment for PC networks, CLASS was developed by Volvo Data Corporation for the Volvo Group as a whole. The concept was based on the Group's common IS/IT strategies which, in essence, specify that all information must be easily accessible from any point in the company's global network, subject only to authorisation restrictions.

The aim is to meet the growing demand for a new, common standard to simplify communication and interaction across the Volvo organisation.

Global standard essential

Individual Volvo Group companies have been developing their own PC/LAN approaches since the mid-1980s, resulting in the emergence of a large number of different methods of connecting PCs to the corporate network, not just within the organisation, but within the individual companies themselves.

Until recently, this 'system' has functioned relatively well since PC users have found mainframe terminal emulation to be sufficient for their communications needs. In addition, users have, until now, been interacting and sharing data mainly within their own working groups; in other words, on their own local networks.

Now, however, the need to communicate across departmental and corporate boundaries, frequently over long distances, is increasing very rapidly, imposing major demands on the client/server systems of the various parties involved. To meet these demands, the different PC/LAN environments in existence at present must be integrated to create a common global infrastructure.

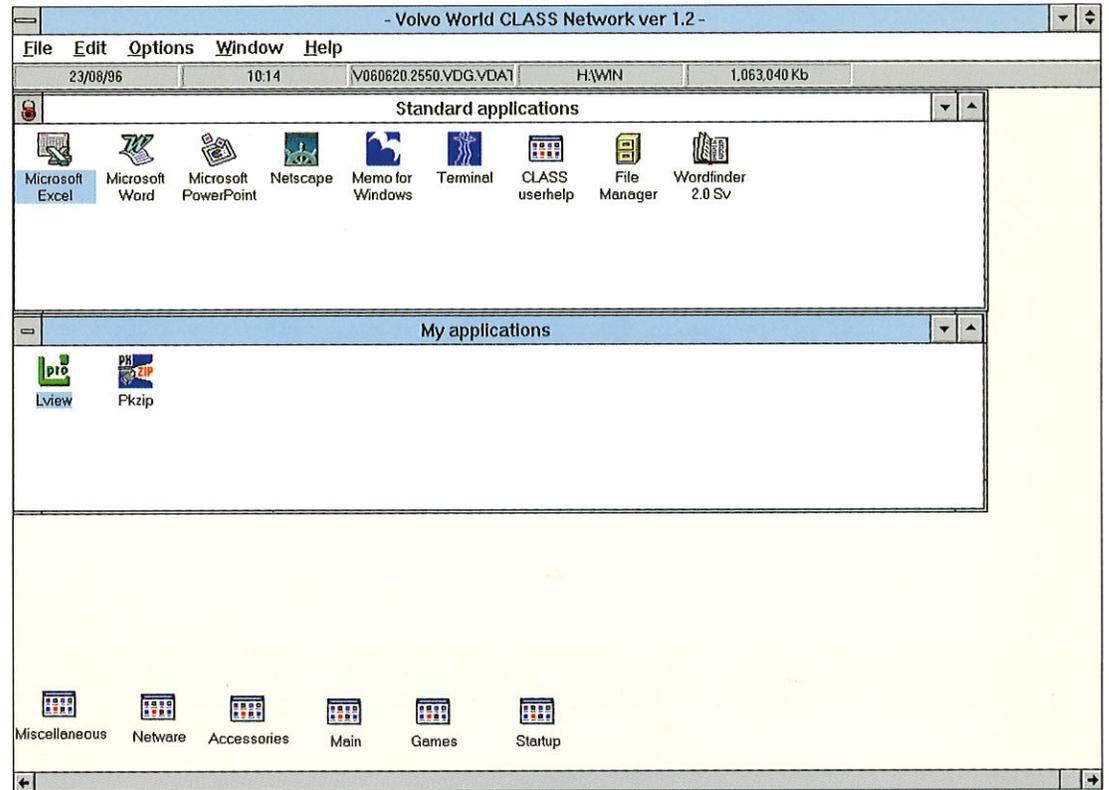
CLASS facilitates corporate cooperation

A common global network standard offers many advantages to the user, the individual company and the IS organisation alike.

By providing a global infrastructure common to the entire Volvo Group, CLASS enables users connected to the

As a new environment for PC networks, CLASS was developed by VDC for the Volvo Group as a whole

Fig. 1
Graphical Windows
interface.



CLASS implements all of the elements agreed by the companies in their IS/IT strategies

service to interact over long distances, share files and printers, communicate, exchange information and run common company client/server applications.

CLASS implements all of the elements agreed by the companies in their IS/IT strategies. This is achieved in a cost-effective manner with the aid of shared resources. The future IS/IT development of the local companies is also assured by version management, whereby the software is updated regularly in step with the needs of the Group as a whole.

Several new applications based on client/server architecture and designed for global implementation throughout the organisation are under development at present. Each local site (a geographically defined location with a CLASS installation) will be responsible for providing the operating environment in which these applications will be run.

CLASS has been conceived to meet the stringent availability and security requirements of the operation. The system also provides guaranteed interaction and commu-

nication with other sites connected to it, while facilitating the transfer of resources and personnel between different sites or departments.

CLASS is being developed in versions, the first of which has been introduced during the first half of 1996. The system provides the IS organisation with the support and assistance which it requires to establish the complex distributed client/server environment in a standardised manner.

Windows-based graphical user interface

The user interface is the reliable and proven Microsoft Windows, version 3.10. Among other features, version 2 of CLASS will include support for Windows NT and Windows 95 clients.

Workstations connected in accordance with CLASS architecture must comply with a certain minimum specification to ensure basic functionality. The MS-DOS operating system must be installed first and a client program which supports network communications – currently Novell NetWare, minimum version 4.1 – then superimposed.

Fig. 2 Novell Directory Services (NDS)

NDS – a common Volvo directory of all objects and their properties (users, printers, disks) – is a global, distributed X.500-like database available to any technical server in CLASS.

A single NDS ensures that objects are named and used in a consistent manner throughout the project.

The user interface is the reliable and proven Microsoft Windows

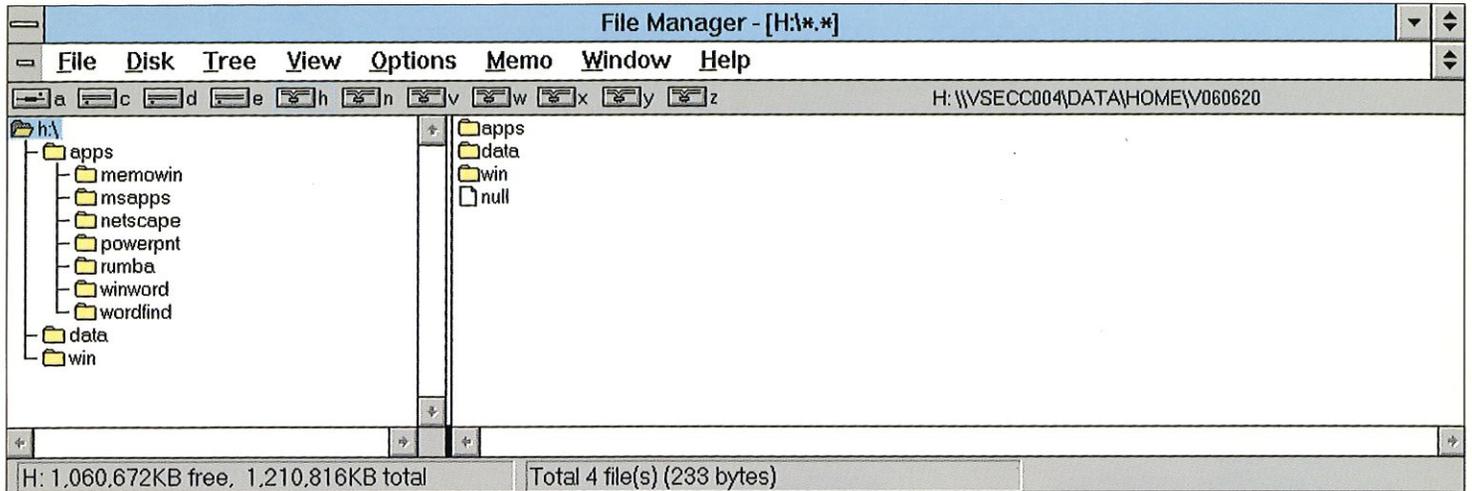


Fig. 1 shows the user interface for a CLASS workstation. The 'Standard Applications' group in the top half of the screen contains applications common to Volvo. The content of the group is fixed and cannot be altered by the user (this also applies to the minimised groups and icons at the bottom of the picture). The 'My Applications' area provides space for site-specific and individual applications and software.

Individual workstation in cyberspace

NDS (Novell Directory Services) is essential if CLASS is to be perceived as a global environment. The individual user's authorisation to access resources will be available at all worldwide sites where CLASS is installed. NDS is a global, distributed X.500-like database in which all users and their network resources are defined.

Each individual workstation is linked or mapped in relation to the desired network resource. Using his allocated rights, the user can view only his own directories and user data. The workstation directory hierarchy is standardised so that a user can access his own environment from any workstation on the network.

Fig. 3 is an example of how a user may be mapped. Although all home directories are stored in H:\, the user can view only his own. The home directory includes a standardised hierarchy of sub-directories.

System levels

A standard package of network systems, operating systems, tools and applications, which is included in all versions of CLASS, is provided at Volvo Group level. Volvo Data Corp. is responsible for the maintenance of this standard, which is locked into the system to prevent inadvertent alterations or deletions.

Supplementary applications adapted to a company standard (Apps2 in Fig. 4) exist at company level. Since this stan-

dard consists of the software which is standard to a given company, company-specific customisation is carried out at this level. Applications and tools are also supplied and maintained at company level.

Local customisation – an extremely important aspect of CLASS – is easily carried out by trained personnel at the individual site, using tools and applications specific to its particular needs. Site-specific service consists of the supply and maintenance of software by the local administration. At

Fig. 3
Standardised directory hierarchy.



Photo: Roger Lundstien

Local customisation is easily carried out by trained personnel at the individual site

Marketing Communication's Gunilla Eklind, the person responsible for CLASS launching activities.

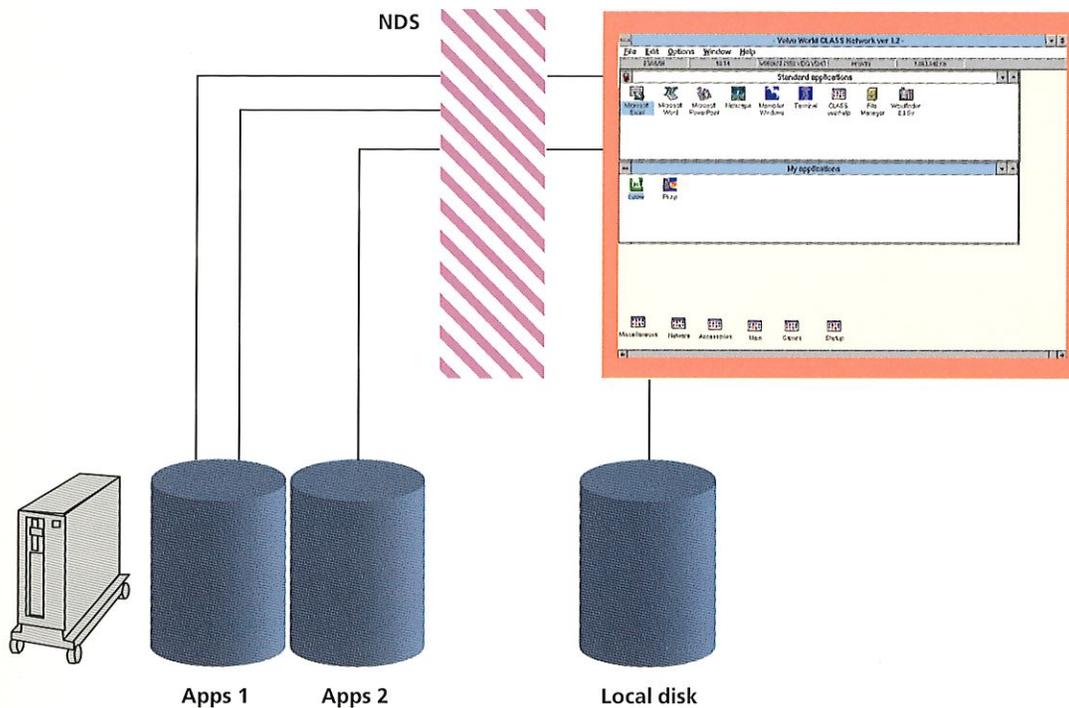


Fig. 4
Desktop environment
control configuration.

this level, an individual user also has the facility of loading software customised to his own requirements.

Workstation – host computer communications

TN3270 and TN VT320-compatible emulators are used to access mainframe and VAX/VMS machines respectively, affording access to conventional 3270 and VT320 environments for applications.

A similar implementation is carried out for 5250 to facilitate access to the AS/400 environment. X-emulation is used for accessing UNIX.

The Volvo Corporate Network is used as the transfer medium for communication with the host computer, with which the workstations communicate logically by means of a transfer protocol (TCP/IP).

The operation and monitoring of host computer communications at the workstations is carried out in conventional manner by the existing operating function and its support organisation.

Server architecture

The server architecture on a network must comply with the CLASS architecture already specified by Volvo. CLASS servers are divided into program, support and data servers, a classification which has the advantage of minimising the consequences of an operational failure.

The structure of CLASS is such that it provides a high level of redundancy in the event of server failure, with other servers 'taking over' the particular function or resource. This solution also affords documented lower response times and higher operational reliability.

On a small site, all server functions may be integrated in a single unit, albeit at the expense of redundancy.

A site may be equipped with one or more program servers, depending on size, network loading and other factors. In hardware terms, a program server may be regarded as a support server.

The user loads the software, including the user interface (Windows) from the program server. Apart from a virus checker, no programs will normally be installed locally. Each program server has the capacity to support and manage about 150 users simultaneously.

Each logged-on user is assigned to a specific data server which, among other functions, manages the user's home directory. Backup copies of this server are made in accordance with a schedule specified by the site manager. Each data server has the capacity to support and manage about 450 users simultaneously.

A site may be equipped with a number of different support servers depending on size, function and area of application. A 3270 gateway, a print server and a name server are typical examples. Since a help server does not carry the same load as a file or data server, it may be specified for a higher or lower load in terms of performance, while its functionality is specified by the site manager. The size and capacity of the servers on a site are based on a number of factors, of which the load and the number of users are among the most important.

All servers must be installed in a failure-protected area or be equipped with an uninterruptible power supply (UPS). The site manager is responsible for ensuring that these measures are implemented and monitored.

CLASS software

Volvo deals with a large number of software licences annually. To administer these efficiently, CLASS incorporates a tool which keeps effective track of the number of licences and simultaneous users. This information may then be used to advantage for licence reporting and internal calculation of licence costs.

The software and the versions to be used in the CLASS environment have been specified in accordance with current IS/IT strategies and Product Board standards. These decisions will apply until further notice.

The basic environment is based on Novell NetWare 4.1, Novell Directory Services (NDS) and the ManageWise system management tool.

The following software and versions are currently defined as global applications. This means that they are distributed from a central server.

The Volvo Corporate Network is used as the transfer medium for communication with the host computer

- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint
- Microsoft Project
- Rumba terminal emulation (3270, 5250, VT)
- HCL eXceed X-emulation
- Memo for Windows
- System Management tools
- Acrobat Reader
- Middleware for accessing BAS (Business Application Servers)
- Netscape

Efficient printer management

Printer management is an important aspect of CLASS, which is designed to manage several different environments simultaneously, and to provide both users and the help desk function with enhanced support and tools.

All printers connected to the network are addressed in the CLASS environment via the TCP/IP protocol. The exact printer management solution will vary depending on the size of the site.

Volvo users must be linked primarily to the local printer (or printers) connected to their 'own' local server. Five standard printer drivers must also be installed in Windows 3.10 to enable users to access other printers quickly in the event of a problem with the main printer.

The printers must either be equipped with an internal network card or printbox, or be connected directly to the network via a TCP/IP address.

Security of information

Volvo's security policy states that information must be regarded as a resource and must be protected from unauthorised use, alteration, destruction or disclosure to unauthorised parties. All information must have a designated owner.

The security administration must be decentralised. Information must be classified as 'Secret', 'Confidential' or 'For company use only', the level of security required being based on the home location of the information. CLASS has been

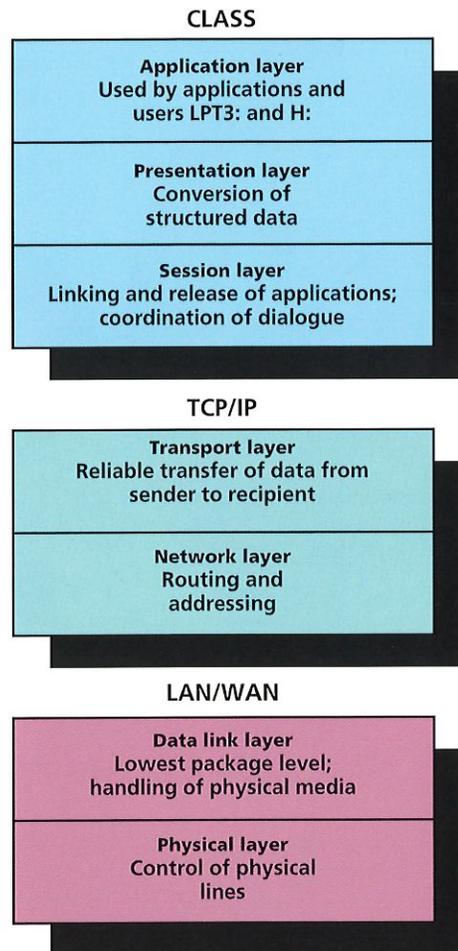
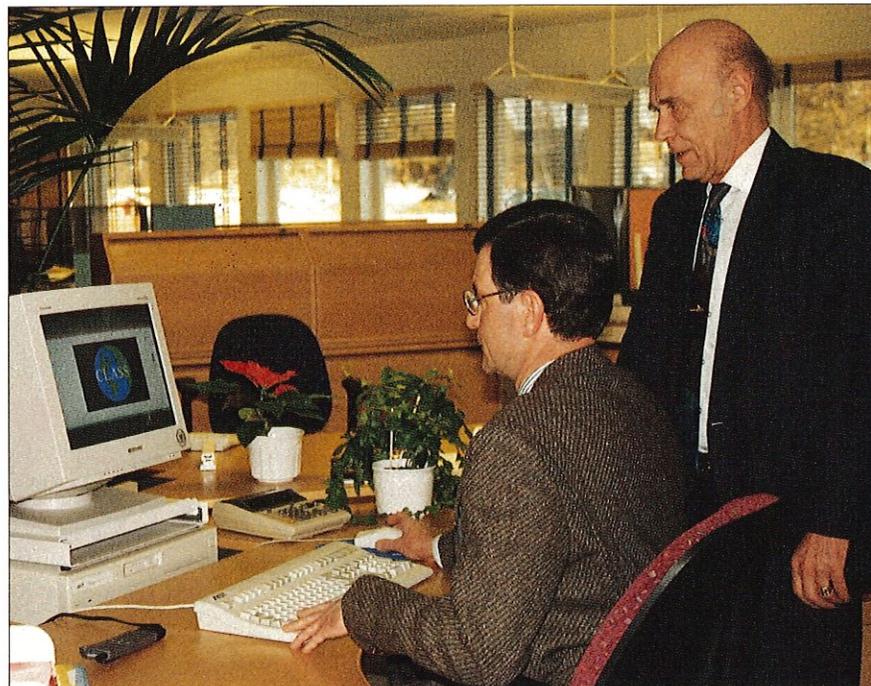
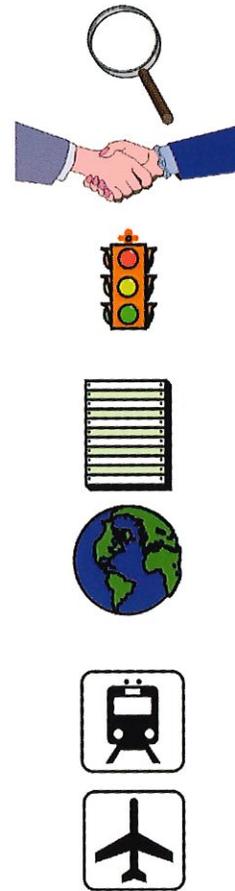


Fig. 5
CLASS as an OSI model.



VCE's Lars Åhlin (seated) and Börje Länn regard CLASS as an invaluable tool.

Working group functions:

- File sharing
- Office applications
- Local applications
- Document management
- Mail/fax
- Mobile clients

Operations:

- Installation
- User/security administration
- Systems management
- Backup
- Support
- Help desk

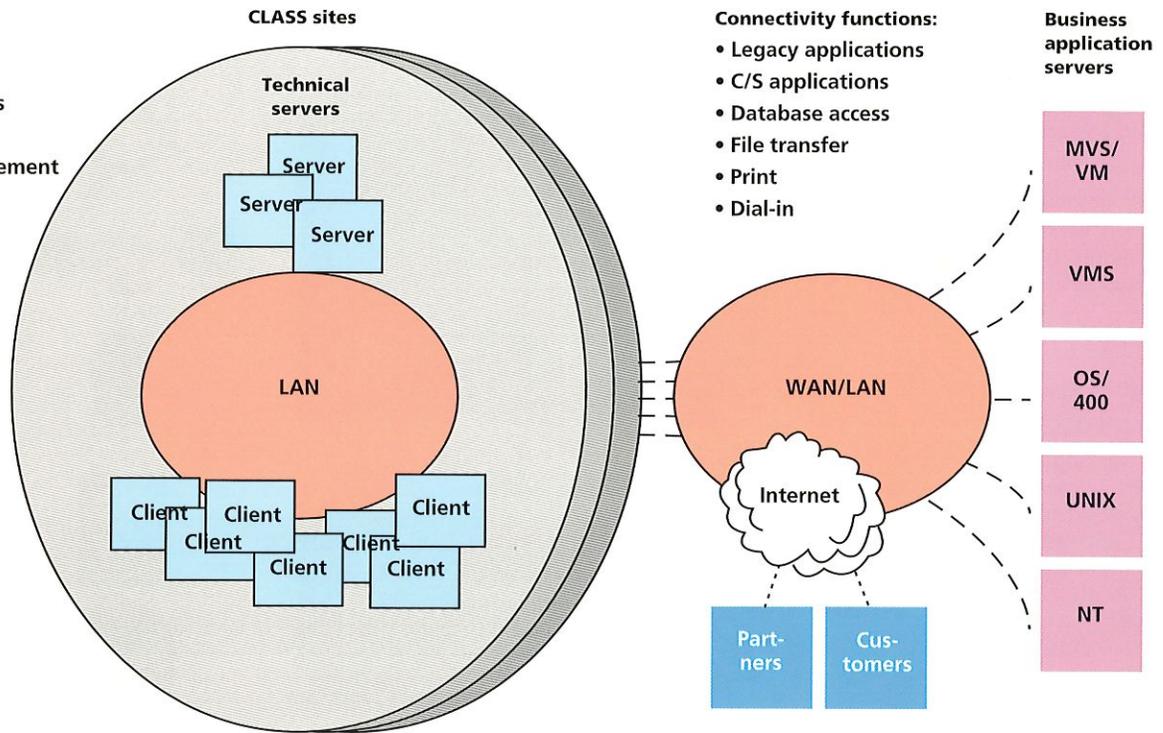


Fig. 6
The common client/server concept.

Volvo Data Corporation is responsible for training personnel in the CLASS concept

developed to comply with the overall conditions of the security policy.

Verification consists of a validity check and acknowledgement carried out before a user or application is permitted access to a system. Conventional verification is based on the user's identity and a password. However, since the password may not be transmitted over the network in plain text, a one-off password, password generator or similar method may be used.

Since CLASS does not transmit passwords in plain text, it employs a logic which obliges the user to fulfil certain minimum requirements concerning the form of the password and the frequency with which it is changed. Volvo's security regulations stipulate that the environment must be protected against viruses, trojan horses and similar undesirable program corruption. In CLASS, this is achieved by virus-checking both servers and clients.

Current regulations specify that the security administration must be decentralised.

Each user must be administered by a user administrator who knows the user, while the resources (objects) are administered by an object owner or by his or her representative. NDS complies with all of these requirements.

In CLASS, backup is provided both by connection to ADSM (ADSTAR Distributed Storage Manager) in an MVS environment and by means of the Palindrom utility (CLASS incorporates backup and restore routines for both variants). However, each site is individually responsible for establishing backup procedures based on its own specific requirements.

Supervision of workstations and networks

A function which permits remote control of any random workstation is included to facilitate operation and support. This function, which is available to all defined administrators, enables the support and administrative organisation to assume control of the

workstation in question from another terminal, and to solve any user problems which may have occurred. Remote control can be implemented only with the positive consent of the user on each individual occasion.

ManageWise is one of the tools used to monitor and supervise the servers and other equipment. Supervision implies that the status of servers, particularly those whose condition is updated continuously on line, can be read out.

The purpose of supervision is to obtain information sufficiently early to initiate preventive measures before problems arise. Among other features, Version 2 of CLASS will include enhanced facilities for supervising PCs on the network.

Training in CLASS concept

Volvo Data Corporation is responsible for training personnel in the CLASS concept. CNA (Certified NetWare Administrator) and CNE (Certified NetWare Engineer) training courses standardised by Novell are available in many

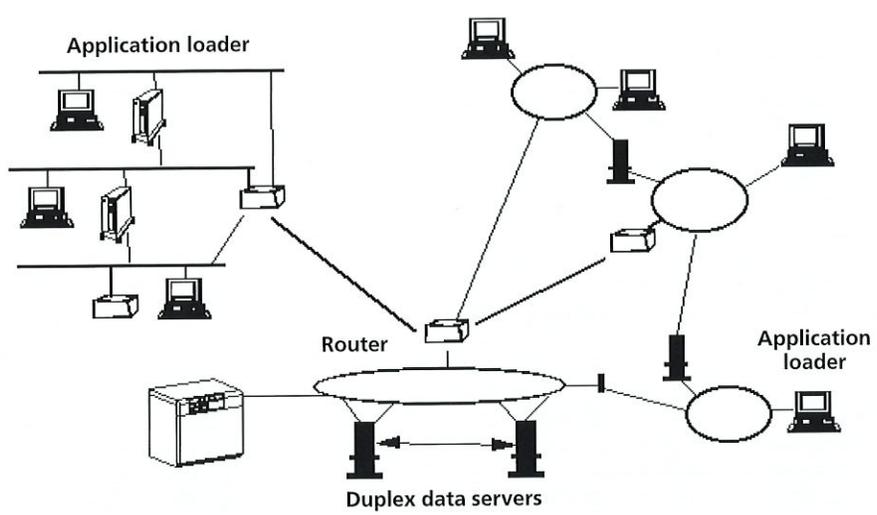


Fig. 7
Server topology for optimised fault tolerance and performance.

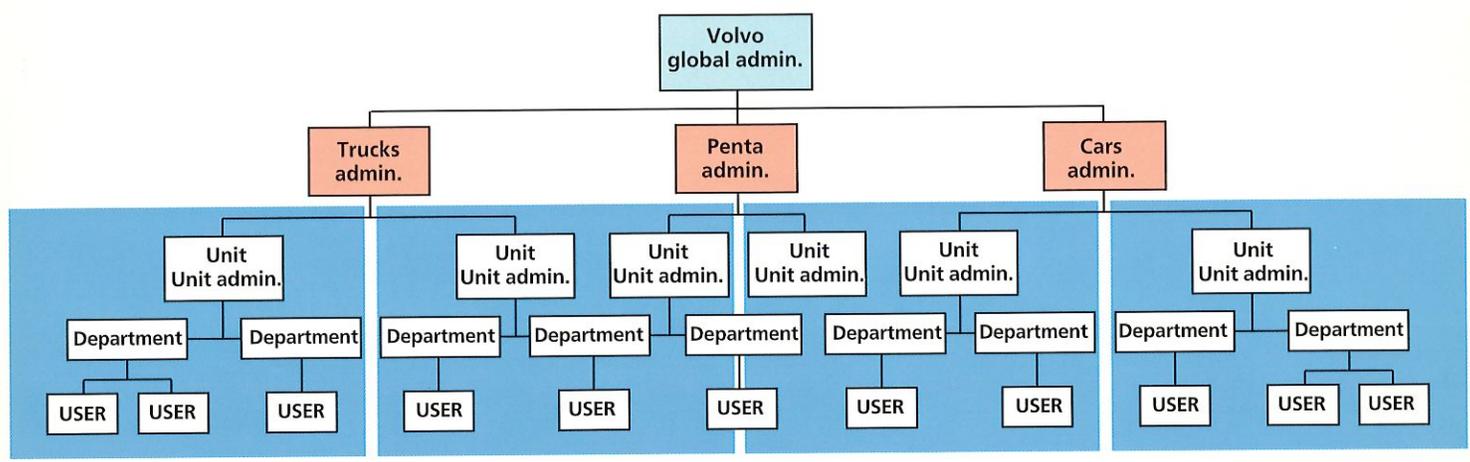


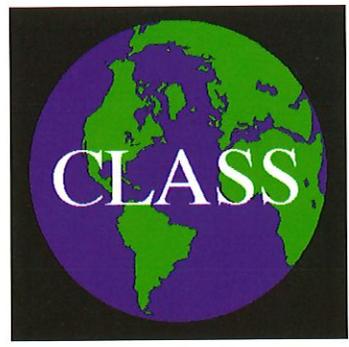
Fig. 8
Administration and user support organisation.

parts of the world. The CLASS site manager's organisation should include resources with Novell CNE certification.

It is recommended that administrators in the support and administrative organisation should possess at least Novell CNA certification initially. A satisfactory knowledge of TCP/IP, as well as network and hardware management, is required at operating level.

Organisation

Since CLASS is a practical implementation of a common Volvo standard, responsibility for central control rests with a personnel group known as the Product Board. For the same reason, development and global support responsibility is also exercised at central level, while responsibility for operation and administration is divided between Volvo Data Corporation and the local sites.



CLASS and the office of the future

One of the basic purposes of CLASS is to enable users to log on from any PC on the Volvo network. The effectiveness of this concept in creating a versatile 'office of the future' has been demonstrated by the success of the system installed by Volvo Data Corp. for Volvo Construction Equipment in Eskilstuna in conjunction with VCE's move to new premises in

December 1995, when the existing PC environment was replaced by a CLASS network of interactive terminals.

The system provides all users with access to the Microsoft Office range of word processing, spreadsheet and presentation software, and with a mobile Freetel phone for office use.

Novell NetWare was chosen as the network operating system and the local network is based on the EtherNet standard. Data communication with the AS/400 minicomputer and mainframe environments is based on the TCP/IP protocol. In other words, the complete installation complies with the CLASS standard.

Advantages of CLASS

The main advantage of the system to VCE has been the elimination of the communi-

One of the basic purposes of CLASS is to enable users to log on from any PC on the Volvo network

Glossary

Note: Many of the following definitions are taken from the Free On-line Dictionary of Computing on the Internet (<http://wagner.Princeton.EDU/foldoc>). Copyright by Denis Howe 1993, 1996.

3270

A class of terminals known as display devices, normally used to talk to IBM mainframes.

ADSM (ADSTAR Distributed Storage Manager)

A network-based backup and archive utility.

Application

A complete, self-contained program which performs a specific function directly for the user, unlike system software, such as the operating system kernel, server processes and libraries, which exist to support application programs.

AS/400

An IBM minicomputer for small business and departmental users.

Client

A computer system or process which requests a service from another computer system or process (referred to as a server). For example, a workstation which requests the contents of a file from a file server is a client of that server.

CNA

Certified NetWare Administrator (Novell)

CNE

Certified NetWare Engineer (Novell)

Client/server

A software partitioning paradigm in which a distributed system is split either between a single centralised server or several distributed servers. This model allows clients and servers to be located independently on nodes in a network.

Emulator

One system is said to emulate another when it performs in exactly the same manner, although not necessarily at the same speed.

EtherNet

A coaxial-cable, local area network first described by Metcalfe & Boggs of Xerox PARC in 1976.

Specified by DEC, Intel and Xerox (DIX) and now recognised as the IEEE 802.3 industry standard. Data is broken down into packets, which are transmitted using the CSMA/CD algorithm until they arrive at their destination without colliding with other packages.

Memo

The electronic mail system developed by Volvo Data Corporation in collaboration with the member companies of the Volvo Group.

MS-DOS

A single-user operating system which runs one program at a time and is limited to working with 1 MB of memory, 640 kB of which is available for the application program.

MVS (Multiple Virtual Storage)

An IBM operating system for mainframes.

Netscape

A World-Wide Web browser from Netscape Communications Corporation.

Novell NetWare

Novell's proprietary networking operating system. NetWare uses IPX/SPX, NetBIOS or TCP/IP network protocols. It supports MS-DOS, Microsoft Windows, OS/2, Macintosh and Unix clients. NetWare for Unix enables users to access Unix hosts. NetWare 2.2 is a 16-bit operating system, while versions 4.x and 3.x are 32-bit systems.

Operating system

The low-level software which schedules tasks, allocates storage, handles the interface with peripheral hardware and presents a default interface to the user when no application program is running.

OS/400

An operating system for the AS/400.

OSI (Open Systems Interconnection)

A reference model of network architecture and a suite (or stack) of protocols for its implementation. Developed by ISO in 1978, OSI was conceived as a framework for coordinating the development of international standards in heterogeneous computer network architecture. Each layer in the seven-layer architec-

ture uses the layer immediately below and provides a service to the layer immediately above.

PC/LAN

A data communication network which is geographically limited (typically to a 1-km radius), allowing easy interconnection of terminals, microprocessors and computers within adjacent buildings.

Product Board

The Volvo steering group responsible for CLASS development.

Rumba

A terminal emulation product.

Server

A program which provides a service to another program (or client). The connection between client and server is normally achieved by message passing, often over a network, using a protocol to encode the client's requests and the server's responses.

Site

A defined geographical area in which computer users are connected by means of a high-speed data communication network.

TCP/IP

Transmission Control Protocol/Internet Protocol. The de facto standard Ethernet protocols incorporated in 4.2BSD Unix. Developed by DARPA for Internet working, TCP/IP encompasses both network layer and transport layer protocols.

TN3270

A program, similar to Telenet, used to connect users to remote IBM mainframe hosts, many of which do not understand Telenet. The program emulates a 3270-type terminal to support application programs.

Token ring

A computer local area network arbitration scheme in which collisions in data transmission are avoided by the use of 'tokens' which confer permission to send. A station keeps the token while transmitting a message and passes it to the next station on completion of transmission. The term often refers to the IEEE 802.5 Token Ring standard, the commonest type in use today.

Tool

A program used primarily to create, manipulate, modify or analyse other programs, such as a compiler, an editor or a cross-referencing program.

Topology

The physical arrangement of the nodes and links in a network.

UNIX

By 1991, Unix had become the most widely used general-purpose, multi-user operating system in the world. Unix is now offered by many manufacturers and is the subject of an international standardisation effort. Versions include OSF, Version 7, BSD, USG Unix, Xenix, Ultrix and GNU.

UPS

Uninterruptible Power Supply.

VCN

Volvo Corporate Network.

VM (Virtual Machine)

An IBM program which has been ported to several large IBM mainframes over the last two decades. Formerly known as VM/SP and VM/XA, and currently as VM/ESA.

VMS (Virtual Memory System)

DEC's proprietary operating system for its VAX minicomputer.

Windows NT (Windows New Technology)

The 32-bit operating system developed by Microsoft from what was originally intended to be OS/2 3.0, before Microsoft and IBM ceased joint development of OS/2. NT is targeted at the workstation and corporate network market.

X-emulation

X uses a client-server protocol known as the X protocol, the server being the computer or X terminal, complete with monitor, keyboard, mouse and server program, and the clients being application programs. X is used on many UNIX systems.

cations problems which it encountered before the standardised PC network environment was introduced. Except for one incident, no availability problems have been encountered.

Further benefits include the valuable synergies made possible by the adoption of a global Volvo standard and the version-based software approach. CLASS is also seen as a living concept which can be developed in step with the company's needs.

Information, training and user support

Following an introductory presentation of CLASS for senior VCE management, training courses were conducted for all personnel involved in the new system. Lasting four days, these included a grounding in the basic functions of Word, Excel and PowerPoint. In time, these courses will be followed by further sessions dealing with the future implications of CLASS.

Despite the fact that using a PC can involve a 'generation gap' and that people of different ages react differently to new technology, the CLASS network has been generally well received. At management level, the consensus is that the system has contributed to a significant improvement in skills in both VCE and Volvo Data Corporation.

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Minimum PC specifications

Since the workstation is composed of a number of different sub-functions, it is extremely important that the CLASS architecture is implemented to ensure that the defined performance and functionality are achieved. The following minimum specifications are required for connection of an existing workstation to the system:

- Processor: 486/66 Hz
- Hard disk: min. 250 MB
- RAM: 16 MB
- Standard network interface card: EtherNet (3Com)
- Standard network interface card: Token Ring (Madge)
- Monitor: Standard 15"

A new workstation should comply with the following:

- Processor: Pentium 5/90
- Hard disk: min. 500 MB or higher
- RAM: min. 16 MB
- 2 MB PCI video memory
- Standard network interface card: EtherNet (3Com)
- Standard network interface card: Token Ring (Madge)
- Monitor: Standard 17"

Network interface cards for workstations

- A 3Com card (10 MB) must be used to connect workstations on EtherNet networks.
- A Madge token-ring card (16/4 MB) must be used to connect workstations on Token Ring networks.

CONCLUSION

Derived from Volvo's common IS/IT strategies, CLASS is based on the premise that all information on the network must be readily available to users anywhere on the company's global network, subject only to authorisation. This means that the mixed PC/LAN environments which exist at present must be integrated into a common, global infrastructure of local PC networks.

Because of its global nature, CLASS enables PC users connected to the network to interact over long distances, share files and printers, communicate, exchange information and run common corporate client/server applications.

A standard package of network systems, operating systems, tools and applications, which is included in all versions of CLASS, is provided at the common Volvo Group level, with supplementary applications designed to individual company standards at company level. Local customisation – an extremely important aspect of CLASS – can be carried out easily by trained personnel at the particular site.



Hans Orrheim received his BSc in mathematics and information

technology from the University of Uppsala in 1973, and joined the Gränges Group as an applied mathematician and statistician. In 1980, he moved to Volvo Data Corp., working initially at the company's information centre and personal computing department. Since then, he has since held a series of management positions, mainly in data communication, and is currently responsible for the development of infrastructural client/server services, mainly in the CLASS environment.



Anders Wilhelmsson took his MA in media and communication studies at the

University of Gothenburg in 1994, having begun his career on the shop floor at Volvo Truck Corporation in 1988. On completion of his studies, his interest in marketing and computers resulted in his appointment to Volvo Data Corporation's marketing department. He now works in marketing communication at Volvo Data Corp. in Gothenburg.

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