

CR90

Open Computer Systems

Christian Rovsing a.s af 1984

As a result of over two decades of systems experience, Christian Rovsing of Denmark today enjoys a world-wide presence in:

- Corporate DP networks
- Airlines networks
- Space technology
- Military systems
- Point-of-sale systems
- Consultancy.

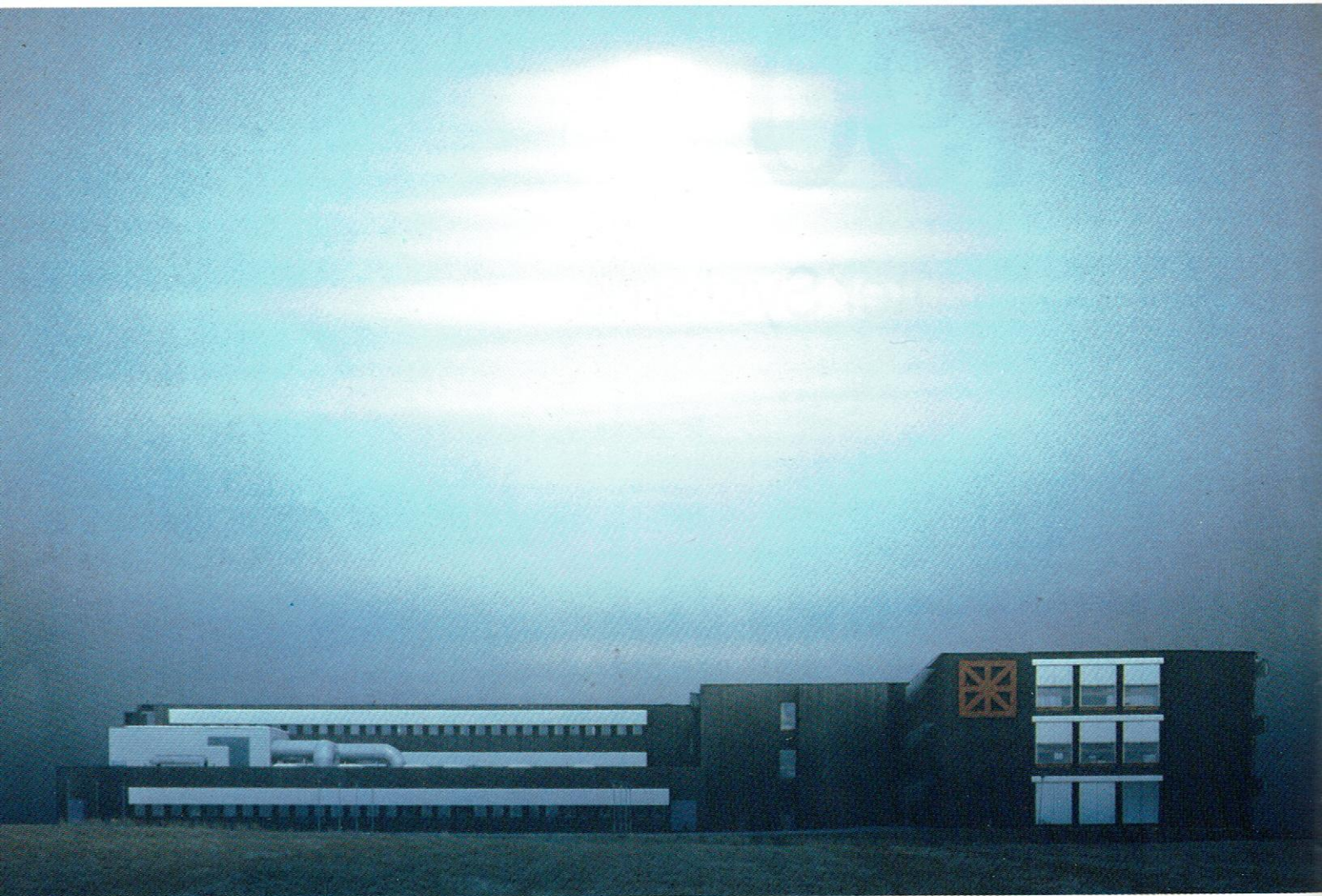
Its successes in all these fields have made Christian Rovsing a leading name in Data Communications.

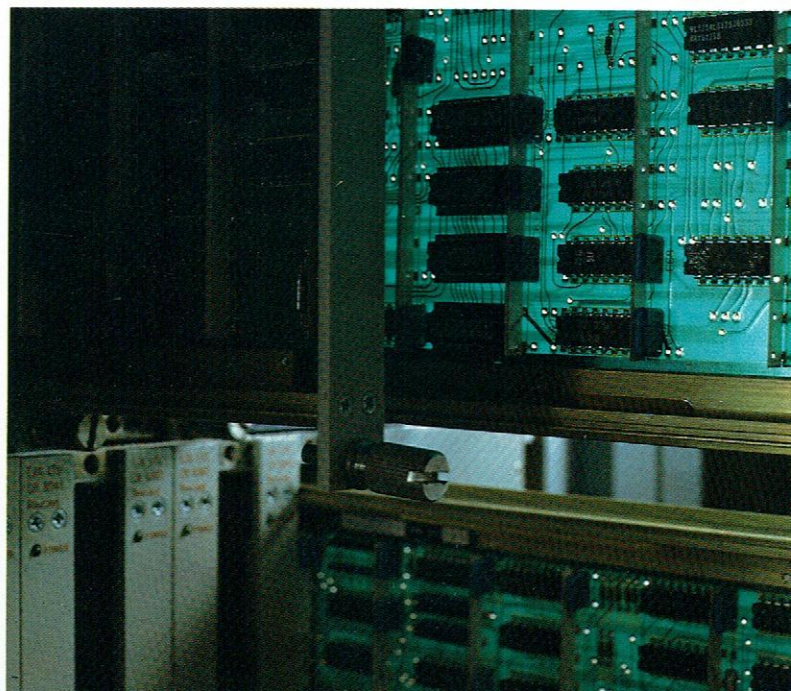
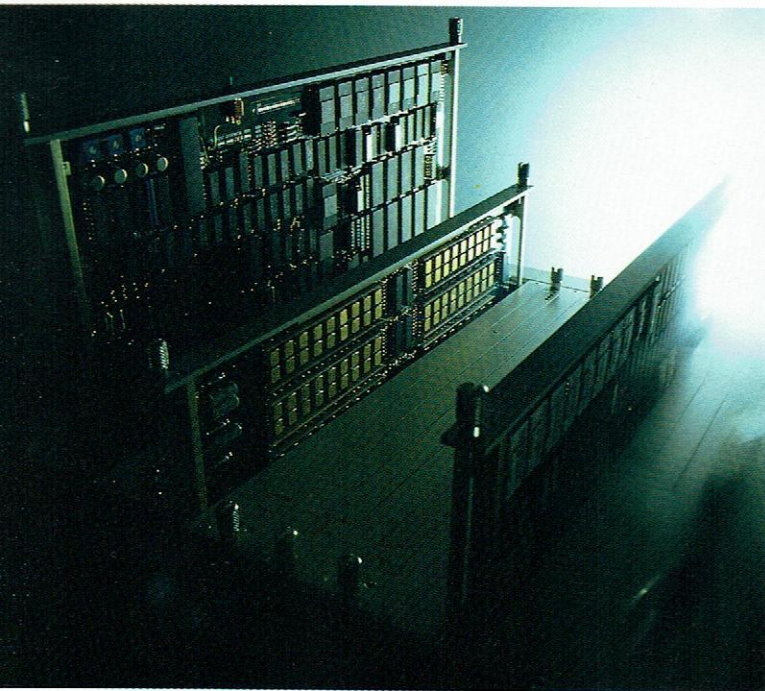
With a constant emphasis on technological excellence, the firm's resources, both in personnel and facilities, have achieved extremely high quality levels.

Always quick to capitalize on developments at technology's leading edge, Christian Rovsing introduced its first multiprocessor minicomputer several years before multiprocessor minis came into widespread use.

Christian Rovsing possesses a production line fully capable of manufacturing reliable, high quality systems, designed to meet even strict military and space agency specifications.

Coming from nearly a dozen countries, its highly adaptable personnel apply a top-down systems engineering approach, both to products as well as to turnkey projects designed to meet a customer's unique requirements.





Overview

The CR90 is a multiprocessor system specifically designed for data communications, with great potential as a general purpose computer as well.

The CR90 is a modular system which can be configured to fulfil virtually any combination of requirements for processing power, memory capacity, communication port connectivity, host channels, throughput and availability. High modularity makes the CR90 extremely adaptable.

The CR90 possesses:

- ultra-reliability
- fault tolerance
- architectural modularity
- linear modularity
- high speed
- high transaction volumes
- user programmability
- security.

System solutions are realized by combining the highly modular CR90 hardware with standard as well as customized communications software offerings.

CR90 architecture can meet almost any combination of connectivity and throughput requirements.

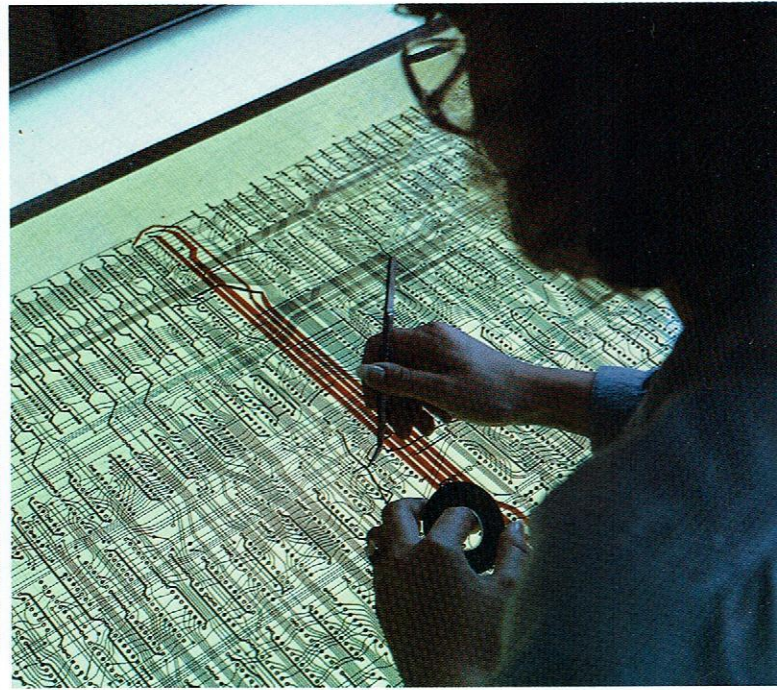
The CR90's ability to grow linearly allows for extensive system growth.

The CR90's capacity for absorbing new technology extends its lifetime – and the lifetime of the systems based upon it.

With the CR90, functional requirements are matched by standard software packages compatible with international standards, e.g. X.25 series, and de facto industry standards such as the SNA, UNIX® operating system and standard programming languages.

Programmability by users, portability, and use of standard software packages are ensured by the UNIX® operating system and a standard database management system. The real-time enhancements, the development tools, and the high-level languages Pascal and C provide efficient programming tools for adding end-user applications in the communication environment.

For military and financial applications, the CR90 contains security features, such as secure operating system for multi-level secure systems and integrated encryption modules for efficient and cost-effective solutions.



CR90 Architecture

The CR90 is a modular multiprocessor system based on standard 32-bit technology. The CR90 can be configured to meet virtually all reliability and availability requirements, ranging from a non-redundant configuration to a non-stop fully redundant configuration.

The CR90 open computer system differs from other computers (large, medium or small) because the unique distribution of its memory provides nearly unlimited processing power: 2000 Million instructions per second (MIPS). With minimum added hardware, the CR90 achieves its "self repair" features and 1024 MB maximum memory size

Extensive hardware checks have been incorporated throughout the CR90 architecture, supporting integrity and security in executing both application and system programs. This prevents erroneous interaction among users with the system software.

CR90 modularity exists on two levels: unit level (processor and channel unit) and component level (printed circuit boards).

The CR90 uses the same basic set of modules in both processor units and channel units. It also has a unique transfer bus architecture. This combination means that the CR90 is highly adaptable, i.e. its configuration can be changed to meet nearly any set of data communica-

tions requirements.

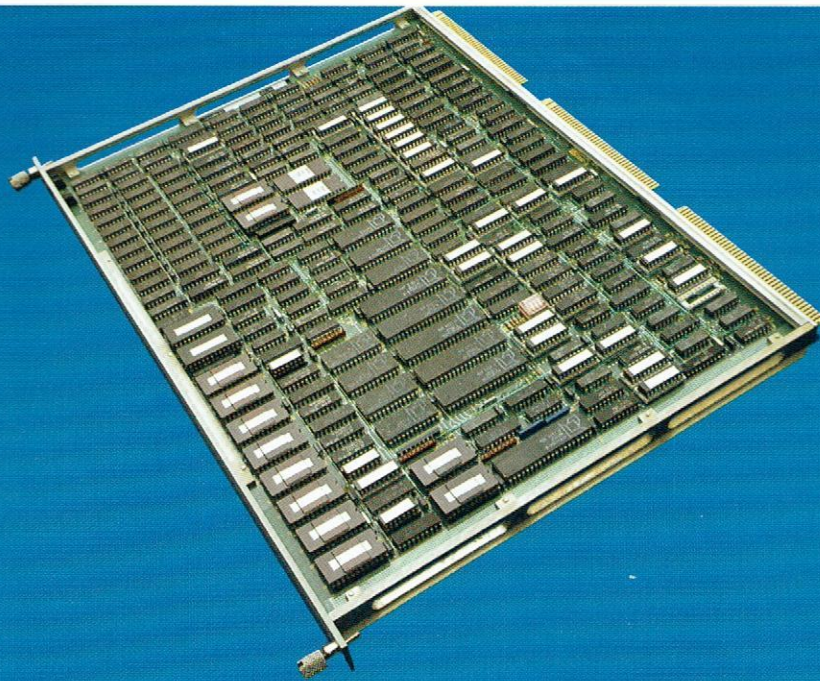
CR90 systems can range from a single non-redundant unit (with a single central processor module and few communication ports) all the way up to multiple, redundant processor units and multiple channel units, with more than 2000 central processor modules and an almost unlimited number of communication ports.

The distributed architecture of the CR90 enables implementation of functional submodules involving a combination of CPU, memory, peripheral controllers, and associated software, e.g.:

- Terminal Access subsystems with protocol conversion
- IBM host interface
- Dedicated end-user services processing.

A further level of distribution is present at the communication interface with a communication controller board, having the standard 32-bit CPU extended by a time-multiplexed serial bus connecting the different communication line adaptor modules.

This allows optimal use of processing power and memory capacity and ensures easy implementation of special interfaces, such as 1 Mbit lines and PABX interfaces.



CR90 Features

- Distributed multiprocessor system.
- Expandable from a single processor system to a system with more than 2000 processors.
- Standard 32-bit processor chips with standard instruction set.
- UNIX® operating system.
- Single processor execution higher than 1.5 mega-instructions per second; in multiprocessor configuration, execution higher than 2000 mega-instructions per second.
- Support for redundancy on more levels (unit level, transfer buses, printer circuit boards) ensures high availability.
- Same 32-bit microprocessor family used in central processor and communication controllers.
- Communication line connectivity gradually upgradable from a single line to more than 100,000 lines.
- Support for all standard communication interfaces and protocols, as well as several special protocols.

Security Aspects

The inherent logical separation of programs and data in CR90 architecture is well suited for:

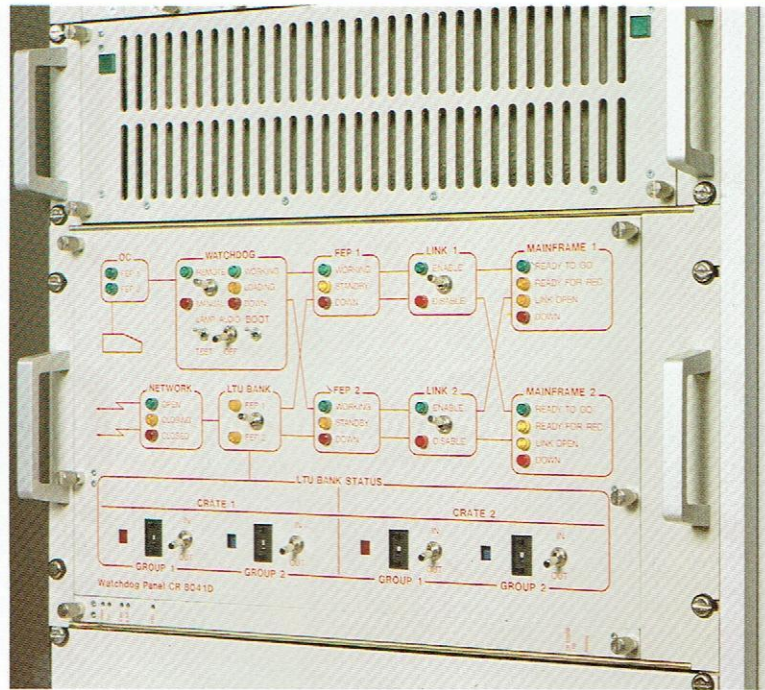
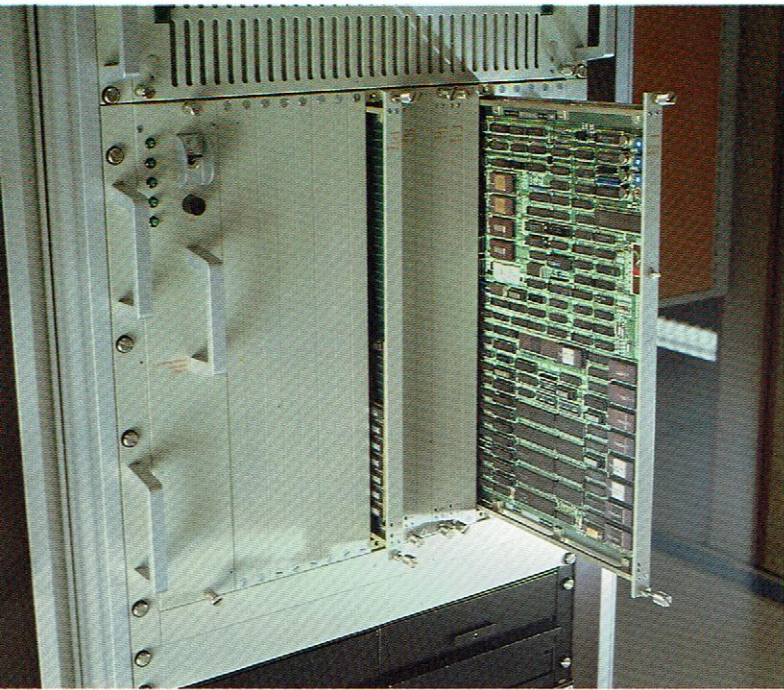
- Protecting data being processed from unintentional modification by other processes and from unauthorized reading.
- Protecting programs from unintentional modifications.
- Preventing processes from monopolizing the processor.

Security features are implemented in the processor with privileged instructions and memory protection.

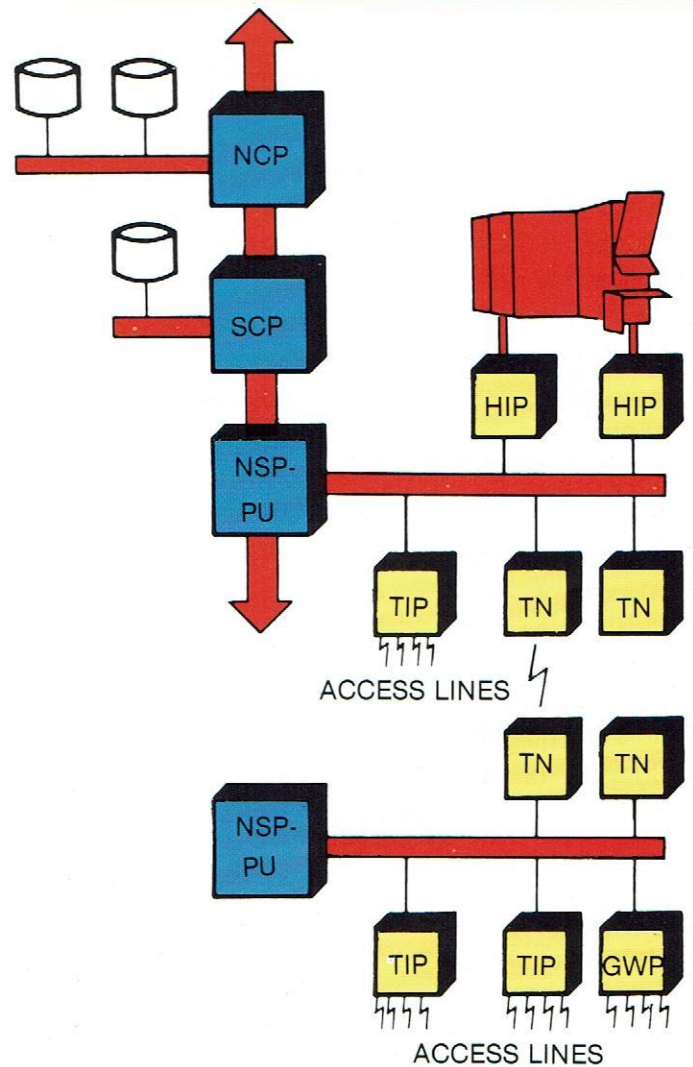
The protection mechanisms are implemented by introducing a processor state variable which can take two values:

- User State.
- System State (16 states)

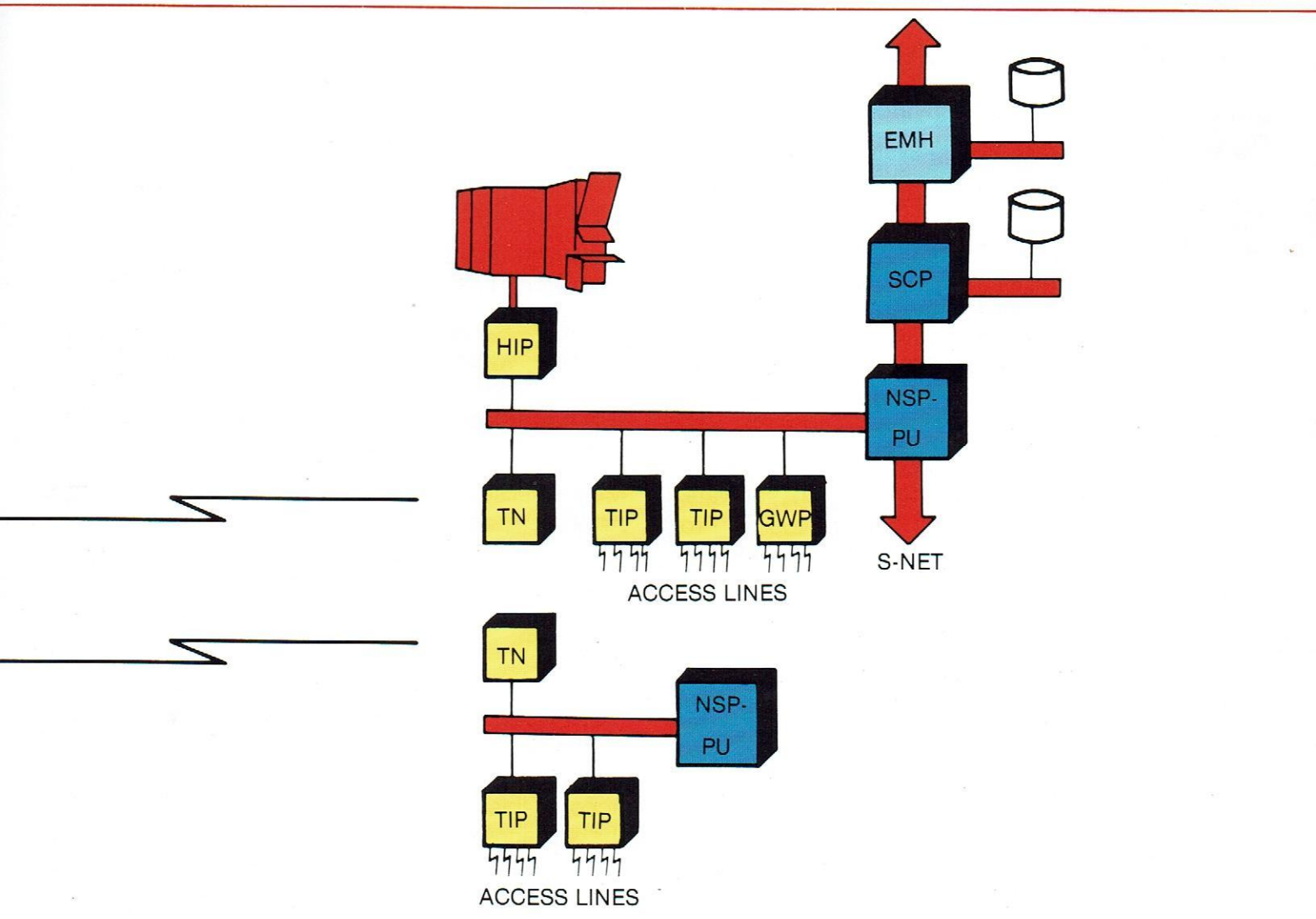
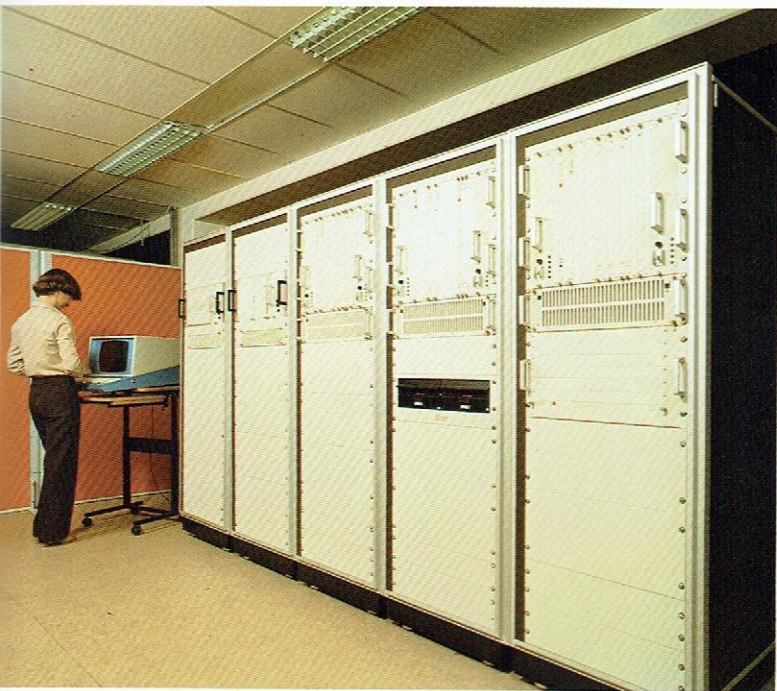
and by dividing the instruction set into privileged or non-privileged instructions. Attempted execution of privileged instructions in the User State generates a local interrupt upon which the CPU will automatically enter the System State. Privileged instructions can only be executed in the System State.

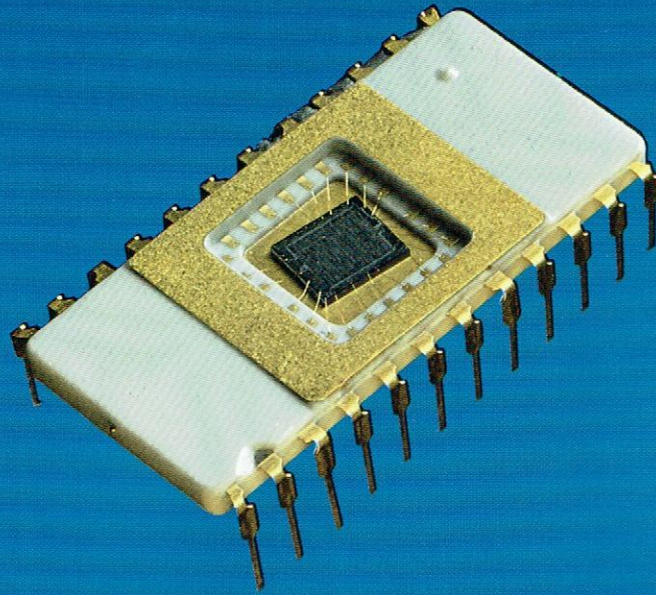


Network Example



- NCP - Network Control Processor
- SCP - System Control Processor
- NSP - Nodal Switch Processor
- HIP - Host Interface Processor
- TIP - Terminal Interface Processor
- GWP - Gateway Processor
- TN - Transport Nodes
- EMH - Electronic Mail Host





CR90 Software

UNIX® Standard Operating System

The standard UNIX® operating system provides standard tools for developing end-user applications.

With the CR90, the UNIX® operating system has been greatly enhanced by incorporating support of real-time multiprocessor applications, such as standardized communications software packages developed by Christian Rovsing. Combined with the standard database management system, this facilitates the creation and integration of, for example, common business applications.

UNIX® has a simple file structure, hierarchical file directories, multi-tasking facilities, a rich software-development environment, and a large toolkit. Programs written for UNIX® systems are inherently portable among computers that run the system.

UNIX® is good for handling high-speed, high-bandwidth links between a processor and high-resolution screens.

UNIX® is excellent for file sharing. Because UNIX® runs on every major computer, the potential exists for providing a homogeneous file system shared among many computers. This widely available operating system can be a basis for distributed information processing in commercial applications.

DAMOS Secure Operating System

The CR90 DAMOS is a secure operating system reflecting the Department of Defense Trusted Computer System Evaluation Criteria.

Integral to CR90 architecture, DAMOS facilitates fault-tolerant computing based on hardware redundancy.

DAMOS is particularly well-suited for real-time systems, while it also supports other environments, such as software development and batch processing. DAMOS offers high efficiency, flexibility, and secure processing.

Multi-level security is integrated in the DAMOS design. All objects, such as message segments, files, devices and terminals, are referenced indirectly by application and system processes, and each access is checked according to mandatory and discretionary access rules.

The kernel of DAMOS is the Trusted Computing Base (TCB) which satisfies the discretionary security requirements by providing total separation of user programs and data. The TCB also makes users individually accountable for their actions through logic procedures, the auditing of security-relevant events, and resource isolation.



Standard Communications Software

CR90 standard communications software implements the vital components of both private and public data networks:

- Front-End Processors
- PAD Concentrators
- Packet-Switched Exchanges
- Integrated Front-End/Packet-Switched Nodes
- Network Control Center.

Standard CR90 communications software enables operating staff to manage a network efficiently and to access host processors from a wide range of terminals and external networks.

The Christian Rovsing range of standard software includes:

- Network Management Software
- Transport Software
- Network Access Software
- Host Access Software
- Terminal Access Software
- Gateway Access Software.

Network Management

CR90 Network Management software provides a precise knowledge of the overall use of any application, thereby giving management an exact picture of the end-user's requirements for any particular application.

To ensure a user-friendly, efficient interface between the network and its operators, Network Management supplies multi-colored graphics, readily indicating the nature and location of failures and problems. Flashing displays and color changes draw attention to trouble conditions. Different levels of specified network detail may be "zoomed in" on to indicate network status and the usage of associated resources.

Transport Software

The standard Transport Software supports implementation of data communication as an integral part of a voice network, by allowing integration with PABX equipment consistent with the ISDN. Furthermore, it gives the freedom to implement a private leased line – terrestrial and/or satellite – backbone network, based on 9.6 to 64 kbps wideband or 2 Mbps PCM technology.



Network Access Software

The standard **Host Access Software** provides channel and/or remote connections to IBM processors operating VTAM or TPF2.

Because the CR90 will appear to the host as a host-specific front-end processor, the CR90 can relieve the host processor of all tasks associated with controlling the network and its attached resources. In fact, the CR90 can completely replace the IBM 37X5 communications processors.

The standard **Terminal Access Software (TAS)** supports the following types of devices:

- X.25 with X.3/X.28/X.29
- IBM 3270 BSC and SNA/SDLC
- IBM 3767 SNA/SDLC
- IBM 2780/3780 ND HASP work stations
- IBM 3770 SNA
- asynchronous terminals.

The standard TAS can convert the features of a wide variety of terminals into proper SNA terminal appearance in order to establish communication with applications resident on IBM host processors.

The standard Gateway Access Software supports;

- X.25 DCE
- X.75 gateway
- SNA networks.

Christian Rovsing has developed customized Network Access Software, such as support for:

- Sperry/Univac, ICL, DEC host/mini computers
- Sperry/Univac UTS terminals
- Burroughs TC500 terminals
- ICL CO2 and CO3 terminals
- IBM 1006 IPARS terminals.



Christian Rovsing a·S
af 1984

Unique Data Communications Expertise...

The Corporate Resource Sharing Network (CRSN) is a configuration of hardware and software that establishes a communications network integrating DP resources – including those previously unconnectable or incompatible.

CRSN is tailored to the special needs of airlines, insurance companies, banks and industrial groups whose activities are spread over a wide geographical area.

CRSN is designed for the ready incorporation of value-added functions. One example of such a function is electronic mail.

In solving the problems of separate networks for airlines, such as American Airlines and Air Canada, Christian Rovsing can offer an integrated ACP/VM/SNA and TELCON/VM/SNA front-end and network solution. The network will form the nucleus of an airlines' total data communications system. It will handle data for ticket reservations, air freight, passenger and aircraft traffic, and internal finance administration. The network is designed to meet the extremely exacting demands of this industry's security and reliability needs.

The most advanced electronic mail and transmission network in the world was supplied to the Danish

Ministry of Defence. The system will supersede data networks currently used by the individual armed services.

A high degree of reliability is one of the crucial features of this system. All vital components are dualized in order to ensure that faults in the system can be reduced to a total maximum stoppage of five minutes per annum with round-the-clock operation.

NATO has installed a message handling system that reduces message preparation and receipt time. The system is interoperable with other communications systems and increases the commonality of message-handling procedures in NATO.

Christian Rovsing also developed a protocol converter enabling NATO Headquarters to communicate with other networks, aided by automatic protocol translation and ACE-wide database access. The design prevents illegal access, corruption and compromise of data in transit.



Christian Roving a.s
af 1984

Lautrupvang 1, DK-2750 Ballerup, Denmark.

Phone: + 45-2-65 11 44. Telex 35111 cr dk. Telefax: + 45-2-65 43 73