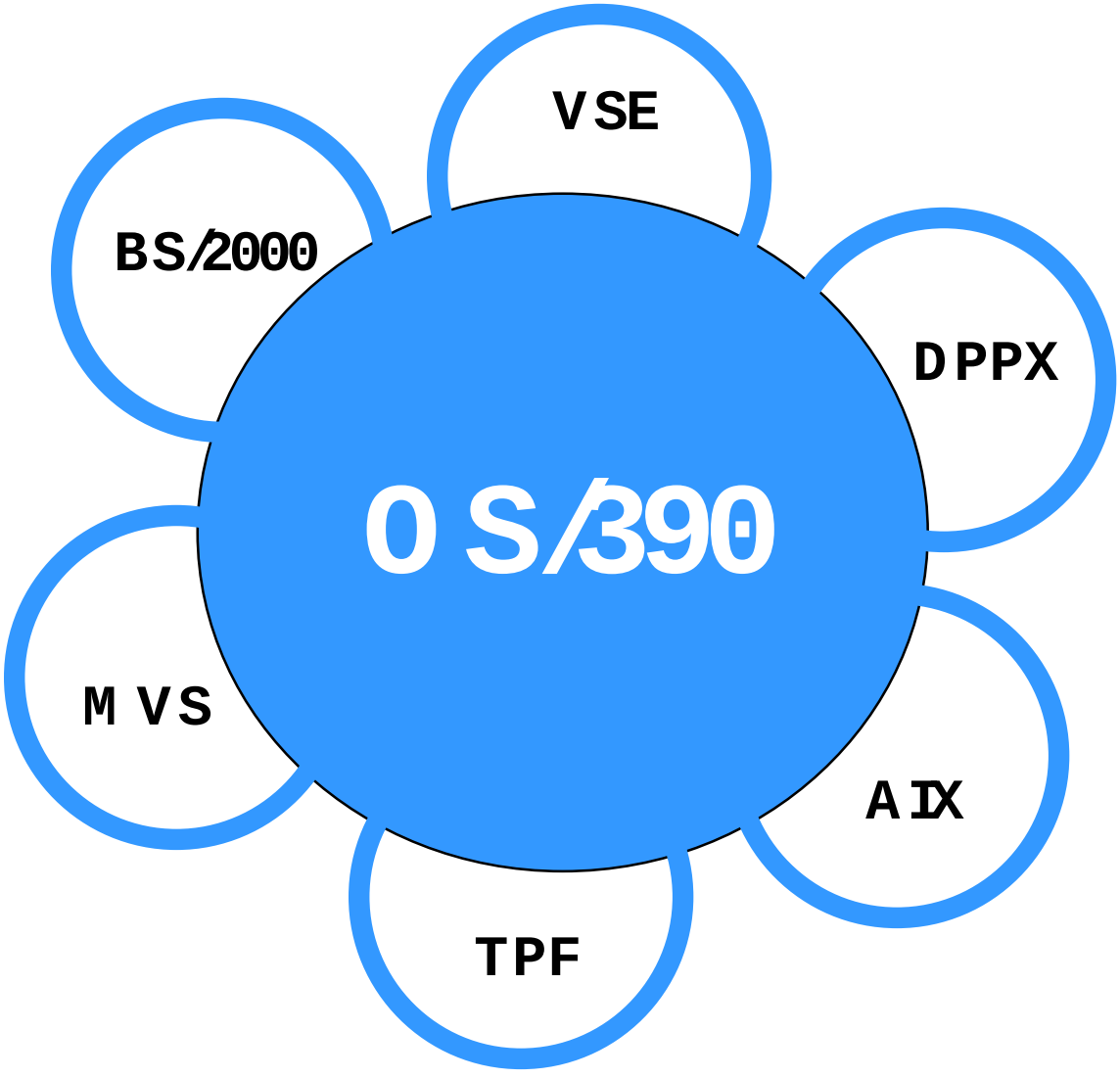
# VIRTUAL MACHINES IN OS/390 FOR EXECUTION OF ANY GUEST SYSTEM

**NEW ABILITIES FOR THE CONSOLIDATION OF INFORMATION TECHNOLOGIES ON THE S/390 PLATFORM**

**FAST (one day) MIGRATION OF THE APPLICATIONS TO OS/390 FROM ANY 370-390 OPERATING SYSTEM**



## Section 1. INTRODUCTION

This document gives a short description of a new software product for OS/390 that will enable the execution of any 370/390 operating system as a guest of OS/390. This virtual execution facility provides the technology for consolidating enterprise information processing.

The material is intended for managers of information technology departments, system software engineers, system project developers and system integrators.

The consolidation of other 370/390 operating systems and their applications into an OS/390 environment typically takes one to two days.

If you are currently using OS/390 in addition to other 370/390 operating systems within your enterprise, the consolidation of the other operating systems onto a single machine under OS/390 can dramatically improve the reliability, throughput, and cost of computing.

If your enterprise provides business recovery or outsourcing services (or plan to), and you currently use OS/390, adding the virtual execution facility could allow you to reduce costs, simplify your processes, and expand the business.

The installation and setup for executing other 370/390 operating systems in a guest mode takes one to two days, and is considered to be:

- a fast migration path for moving applications and operating systems to an OS/390 environment (Fig.1.1.);
- a consolidation process for enterprise information technologies. A single OS/390 system would provide and control the dynamic allocation of computing resources to the applications (Fig. 1.2).

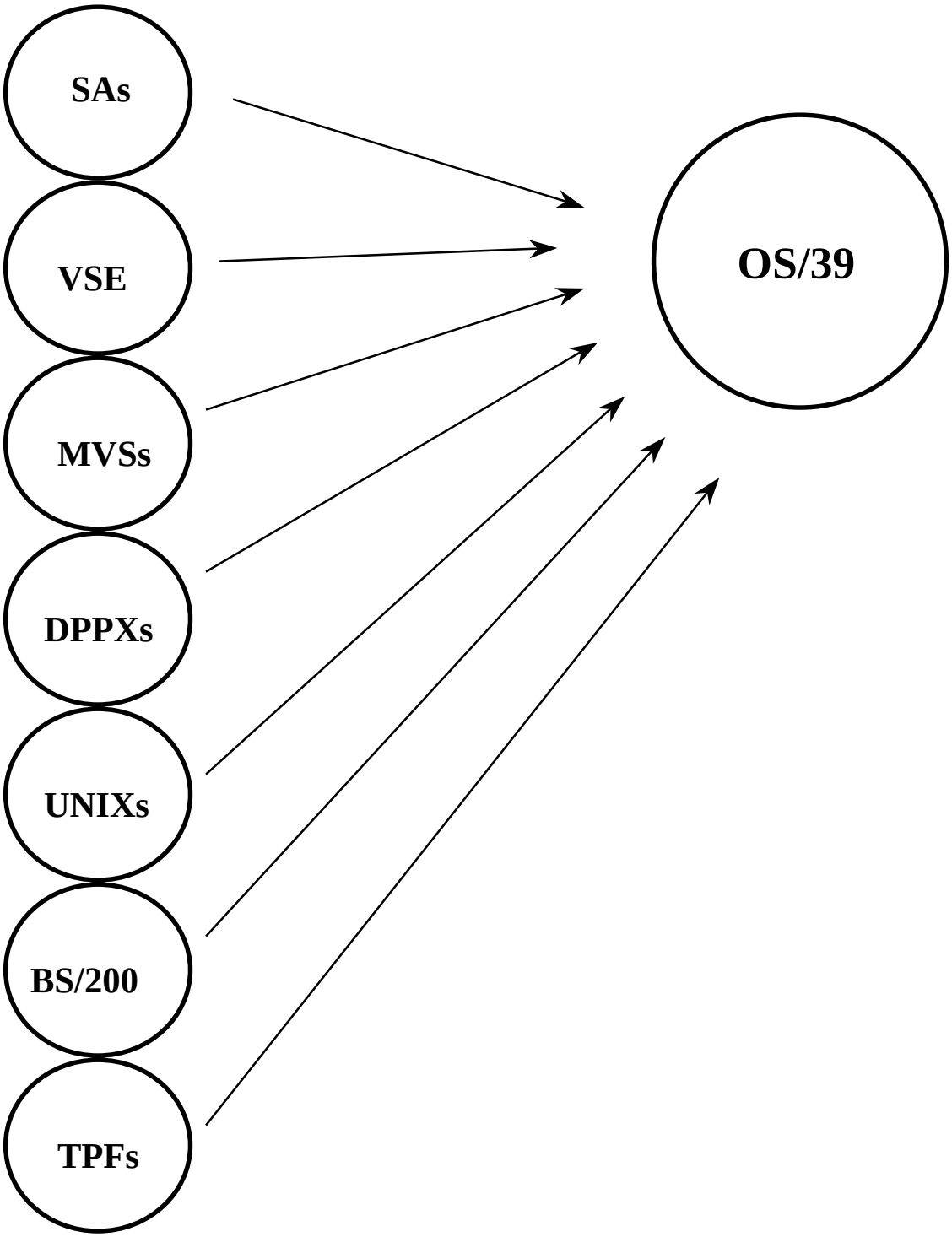
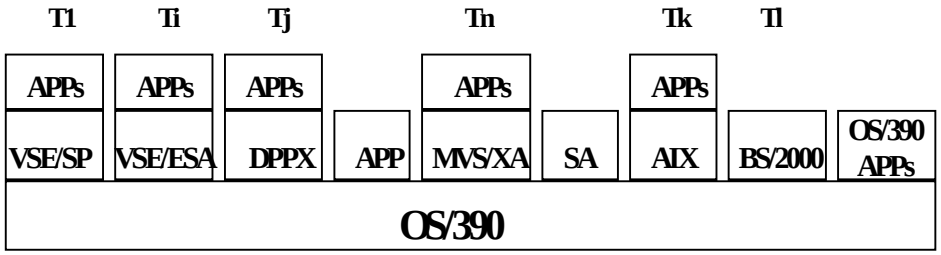



**Fig.1.1. Fast (one day) migration of the applications from any operating system to OS/390**




**T1-Tl - OS/390 tasks**

**VSE/SP - TPF any 370-390 guest system with its native applications (excluding VM/ESA).**

**APP - native OS/390 applications tasks**

**1-L - as many as number of OS/390 tasks**

**OS/390 - host system (possible to use VSE/ESA)**

**SA - Stand Alone software (DDR, for example)**

**Fig. 1. 2.**

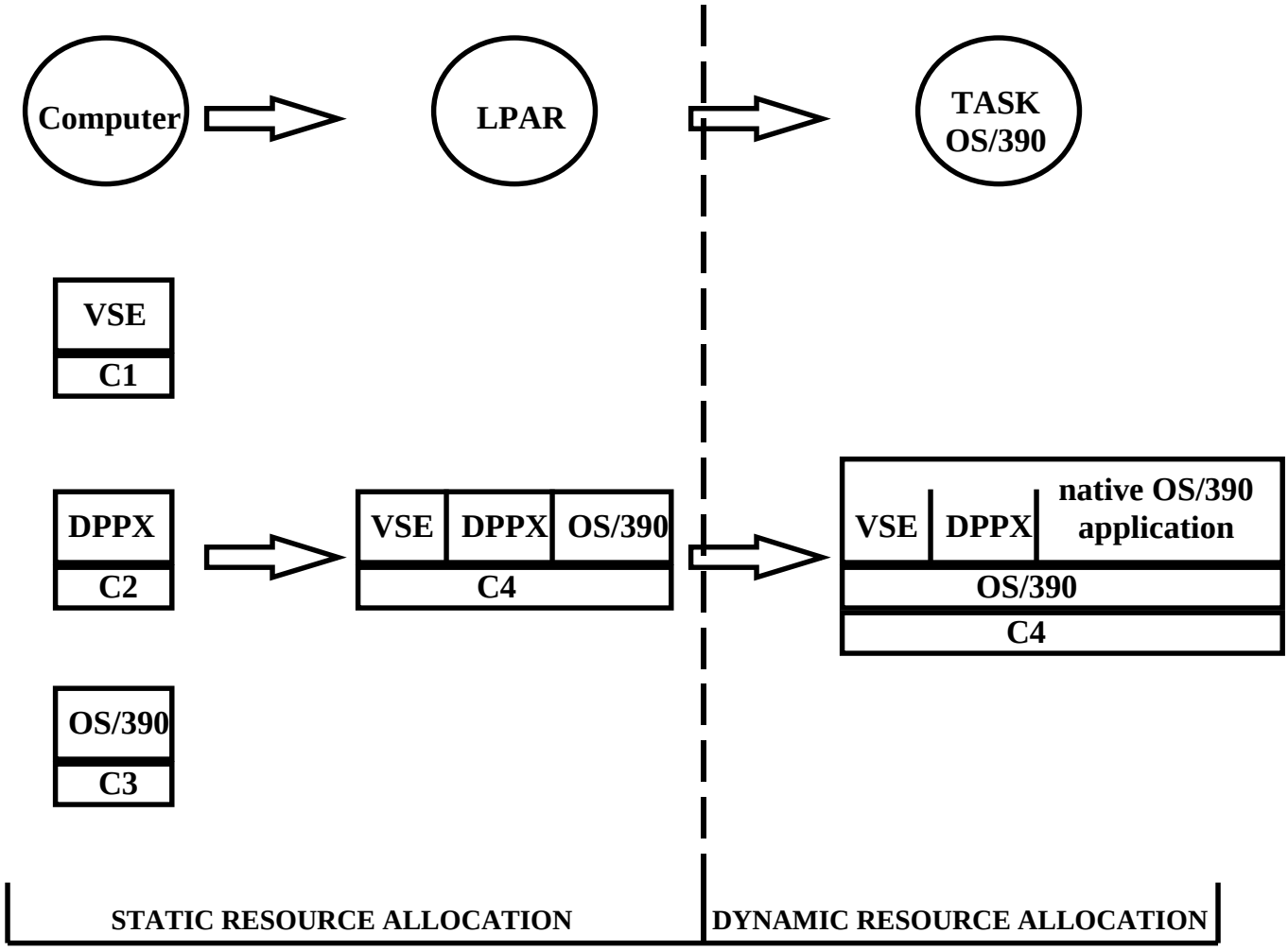
Applications that were executed in 370 mode are now executed in S/390 mode (incl. new processor models), which results in the:

- reduction of the average system response time and batch elapsed time on the same equipment (improved networking, I/O processing, and processor utilization);
- ability to use S/390 equipment for 370 applications (for instance, ESCON, FICON, RVA).

The applications executing in the guest operating systems under OS/390 gain access to OS/390 system facilities.

The consolidation path of enterprise data processing is directly related to the ability to switch from static (pre-allocation of Computer centre's resources) to dynamic (assignment during execution). This is illustrated by Fig 1.3.: multiple computers → multiple LPARs → TASKS.




**C1-C4 = Computer 1, ..... , Computer4**

**Fig. 1.3. Way for processing consolidation at the enterprise**

Sections 2 and 3 give an overview of the ISX (INTERPRETIVE SPACE EXECUTIVE) program facilities for building a virtual machine in OS/390. The ISX Users Guide and Reference for OS/390 covers all aspects of the ISX product from installation and customisation to error messages.

Section 4 gives an overview of the migration and start-up process for moving any 370 or 390 operating system, along with its applications, to run as an OS/390 guest.

Section 5 discusses the advantages of using ISX to consolidate operating systems instead of using logical processor partitioning (LPAR) mode. A primary advantage is the ability to switch from static to dynamic resource allocation.

After the initial ISX installation has been completed, the new system facilities offer potential improvements in the areas of cost, reliability, security and resource allocation within the enterprise.

Sections 6 through 15 discuss the facilities that have been tested at the User sites.

## Section 2. ISX - A PROGRAM TO BUILD A VIRTUAL MACHINE IN OS/390

The objective in ISX development was to enable the guest execution of 370/390 operating systems (either IBM or non-IBM) as tasks in OS/390. ISX will run on any computer which implements the S/390 Principles of Operations in full. Among these computers are all IBM 9672, MULTIPRISE 2000, P/390 and R/390.

The imperative requirement was freedom from changes in IBM HOST systems and GUEST systems of any vendor.

To achieve this freedom, the ISX program structure is three layers, as shown in figure 2.1. At the bottom there is a USER INTERFACE of the HOST operating system. At the top there is a virtual machine, implementing 370 or 390 principles of operations. In the centre there is an ISX executive core. ISX is started as a user TASK of the HOST system, where ISX facilities allow the initial program load (IPL) of the guest system on top of ISX..

ISX, the guest system, and the applications, as shown in Fig.2.1, are considered to be a single task of the OS/390 system. As a task of OS/390, all OS/390 task rules and restrictions apply.

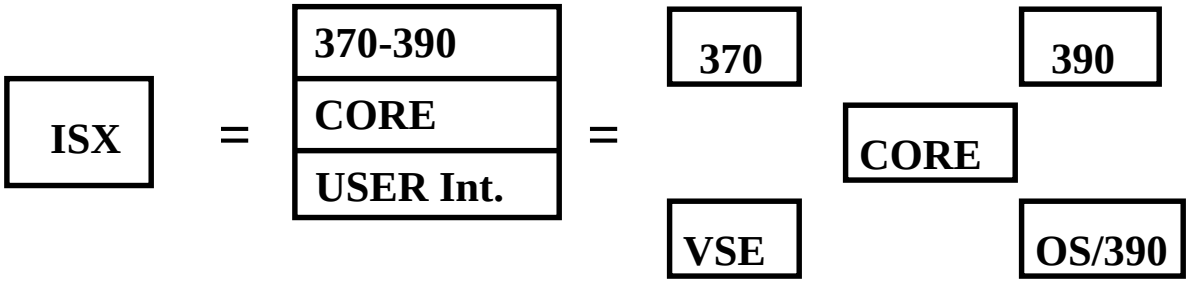
OS/390 supports the concurrent execution of multiple tasks. Therefore, each ISX task could execute a different operating system.

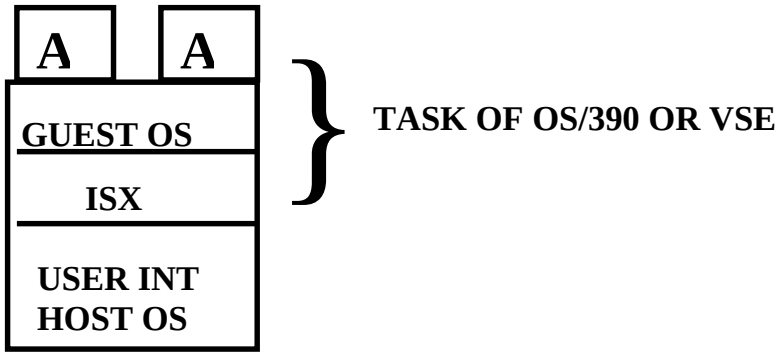
As a matter of fact, ISX is a small VM, executing only one guest operating system. Therefore, it does not suffer from the main disadvantages of VM, such as performance loss of the host operating system, for VM resource consumption, purchasing and maintenance costs.

Some primary data about the ISX product is given in Fig. 2.1:

- the product has been tested within IBM;
- main storage and DASD space requirements are minimal;
- overhead costs for each guest are approximately equal to V=R (real storage) guest execution in VM mode. The overhead costs have been confirmed for each guest in a multiple guest environment;
- lack of overhead costs on the HOST level (HOST TASK);
- the product is easy to install and configure, and does not require in-depth training.

# WHAT IS ISX?




- **Tested by IBM**
- **Few tracks of DASD Memory**
- **Main memory, few segments**
- **V = R (VM) overhead for GUEST**
- **No overhead for HOST**
- **Reliable, 2 hour training**

**Fig. 2.1.**

## Section 3. ISX - ADDITIONAL FACILITIES

The following additional ISX system facilities are presented:

- communication support between guest and native applications; and
- FBA disk emulation on CKD devices for the guest operating systems.

**Communications Support**

Fig. 3.1 shows the ability to use virtual (VCTC) and real (CTC) channel-to-channel adapters as a mechanism to establish a communications link between guest and host systems.

The communications link between guest systems G1 and G2 running in the same HOST system could be established with a physical CTC (ESCON) or through the ISX system facility - virtual CTC (VCTC). When using the VCTC facility, data exchange occurs without using physical I/O operations.

The communication link between guest systems running in different HOST systems, or between the native applications of the host system, can be established with a physical CTC (ESCON).

Once the communications links are established (CTC and/or VCTC), application access can be provided to all users of any system by using standard network cross-domain resource definitions. The native OS/390 applications of the host operating system (A1 and A2), can be accessed from other systems (G1, G2, other OS/390).

So any applications of any guest operating system can be accessed using OS/390 networking facilities.

## FBA Device Emulation Support

The Fig. 3.2 shows the structural diagram for executing the operating systems and the applications dependent on FBA - DASD (DPPX, VSE). The FBA device emulation is accomplished using VSAM files stored on CKD DASD.

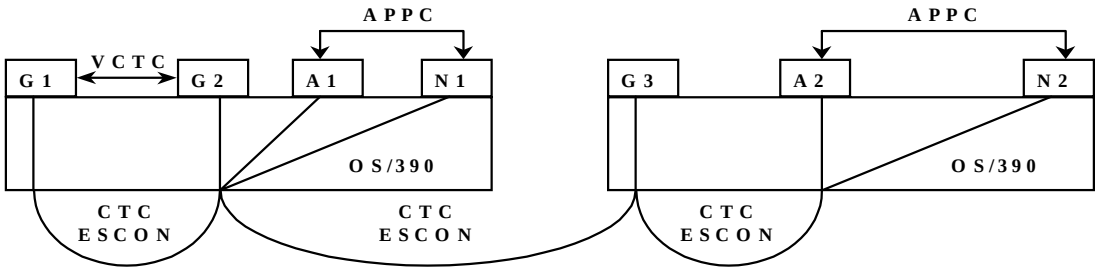
The FBA emulation feature is contained within ISX, which means that no changes are in either the guest or the host operating systems.

The general approach within the ISX product is to provide a method for introducing new system facilities, without effecting the guest or host operating systems.

It is worth mentioning that OS/390 has no access to VSE and DPPX files stored directly on FBA, and instead accesses them through VSAM files. As a result, the VSE and DPPX files are protected by OS/390 RACF.

CTC - connections

Aim: to communicate between GUEST and HOST tasks
in NEW environment
(OLD NETWORKs maintained in GUEST are valid)

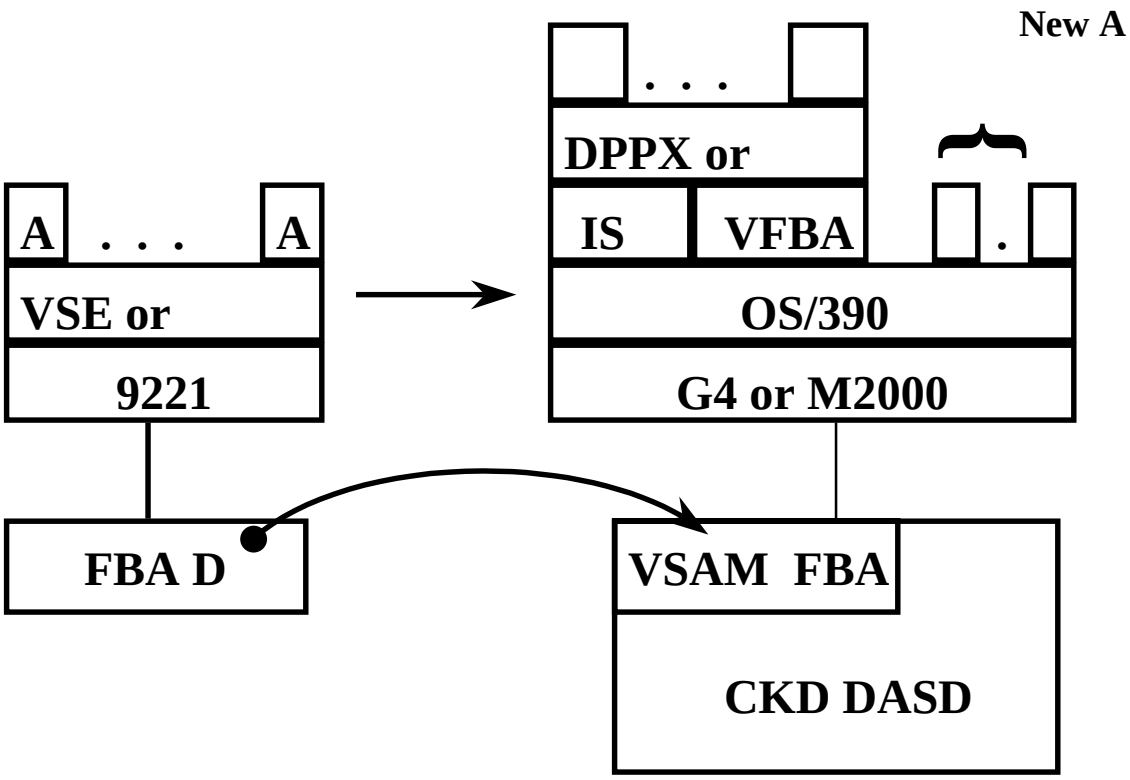



A1-A2 - agents - native tasks, developed to communicate
between GUEST and HOST TASKs
CTC - channel to channel
VCTC - virtual CTC
N1-N2 - native applications
G1-G3 - applications in ANY GUEST SYSTEM with CTC maintained

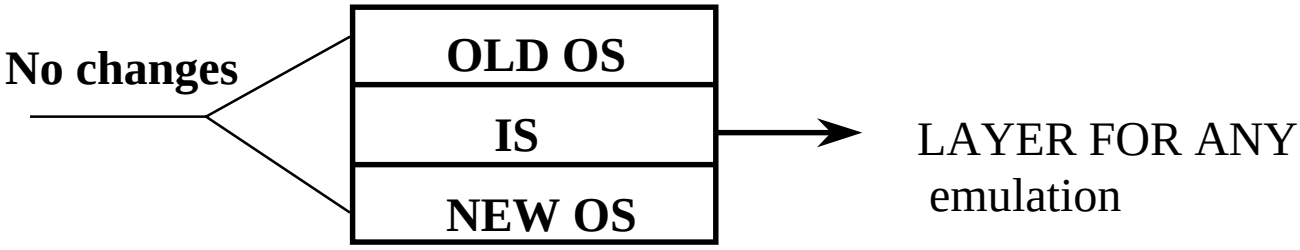
Fig. 3.1.

# FBA - DASD emulation on CKD




**VFBA - virtual FBA DASD on VSAM**




**Performance dramatically increases on the same CPU**
**(number of virtual FBA I/Os > number of**

**Fig. 3.2.**

## Section 4. FAST CONSOLIDATION OF VSE/ESA SYSTEMS WITH OS/390

Fig. 4.1 illustrates the consolidation procedure.

The initial processor configuration occurs when enterprise activities are supported by any operating system (OS 1), and OS/390 is planned to be the future enterprise operating system.

As the enterprise moves to the OS/390 environment, there will be a transition period where both systems will operate simultaneously.

During this transition period, the old operating system and its applications can be consolidated into the OS/390 environment within a matter of hours. Once consolidation is complete, the old operating system and applications now have access to OS/390 system facilities.

The procedure consists of four simple steps, none of which require any physical configuration changes. Since no physical changes are required, downtime is kept at a minimum

- ISX is installed and customized;
- ISX is started as an OS/390 user task;
- OS1 is initially loaded in ISX (IPL) by ISX facilities,
- the application A1 is started up in the guest operating system (OS 1) parallel to application A1 in LPAR 1.

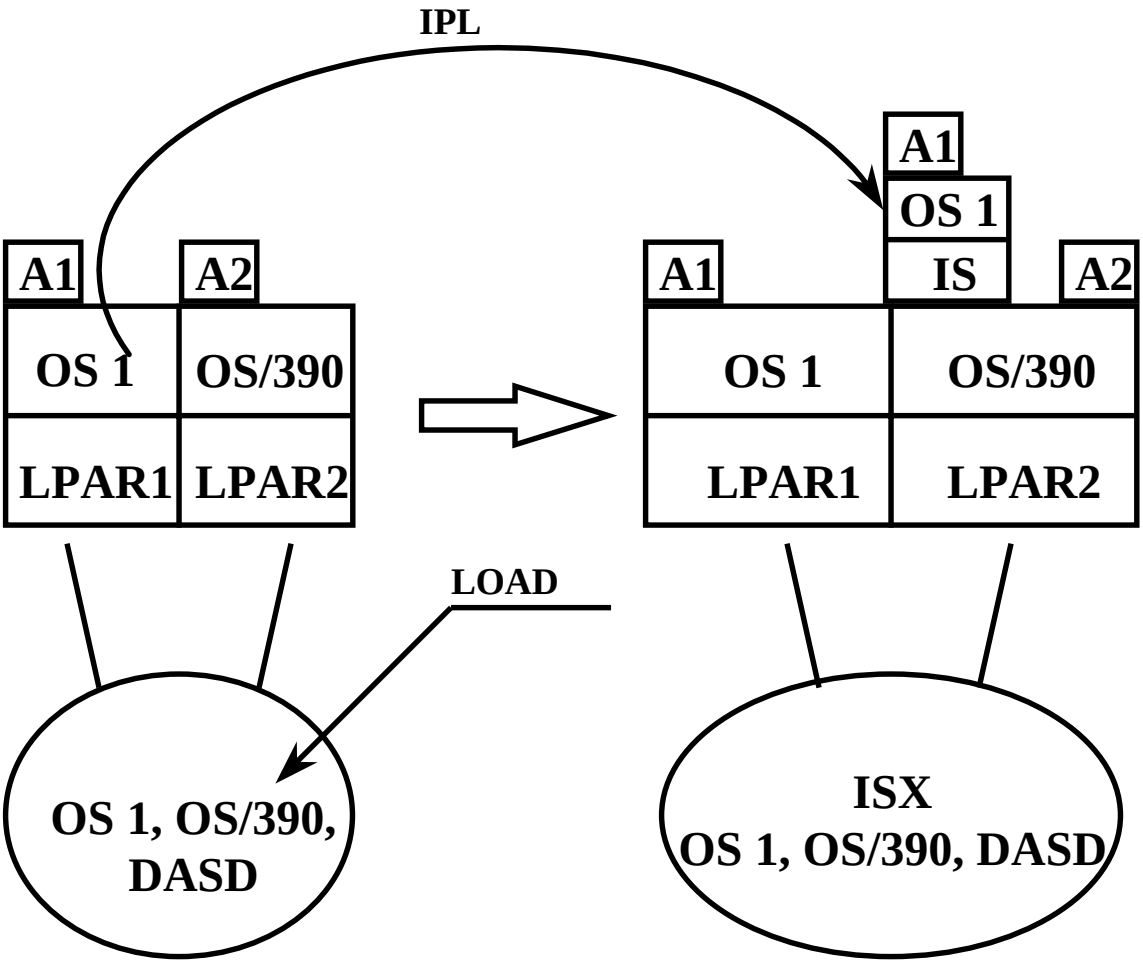
Given the fact that training for ISX usually takes 2 - 3 hours, any application could be started up as an OS/390 guest within one calendar day.

Your staff can run the system using the same processes and controls that were in place before the consolidation with minimal changes. A deep knowledge of OS/390 is not required.

Consolidation of guest operating systems into the OS/390 environment using ISX is a fast and easy process.

# HOW TO START THE OS/390 GUEST




**OS - ANY 370-390 OS.**

1. **LOAD ISX on DASD (1 cylinder)**
2. **START ISX as OS/390 user task**
3. **IPL OS1 as ISX GUEST**
4. **Use A1 as OS/390 application in LPAR2 concurrently with A1 in LPAR1.**

**Fig. 4.1.**

## Section 5. SWITCHING FROM STATIC TO DYNAMIC RESOURCE ALLOCATION - IMPROVEMENT OF RESOURCE UTILIZATION

Fig. 5.1 shows a typical LPAR configuration used to support multiple, and sometimes diverse, operating systems on a single machine.

Each of the LPARs are assigned hardware resources (channels, memory, DASD, network equipment, terminals, printers A, B, C, D) to support the operating system that will be running in the LPAR.

It is possible to improve the resource utilization of the same equipment by changing the LPAR configuration and using OS/390-ISX virtual facilities. This logical configuration change does not require any operating system configuration changes.

In this case the processor is configured in BASIC mode (without LPARs). OS/390 is IPLed in the new processor configuration, while the other 3 operating systems are IPLed as guest systems of OS/390-ISX. This is illustrated in Fig. 5.1.

It is reasonable to compare important system measurements between the left (initial) and the right (final) configurations in Fig. 5.1

In the final configuration processor resources such as storage and DASD paths are allocated dynamically. For example, resources are not statically pre-assigned to one of the operating systems before execution, but are allocated as required according to resource allocation rules for OS/390 tasks.

Consequently, it might be expected that the final configuration will show improved throughput relative to the initial configuration due to improved utilisation of the available computing resources.

In the final configuration, each of the guest operating systems has four logical paths to DASD devices, instead of one path in the initial configuration. Reliability is increased because there is no single point of failure for accessing DASD devices. For example, in the final configuration, for an operating system to fail, all four paths to the DASD devices would have to be lost, whereas in the initial configuration, the loss of the single path would cause the operating system to fail.

Since the peripherals A, B, C, and D are accessible by all guest operating systems, the number of peripherals and channels required could be reduced. This reduction in hardware results in lower total configuration costs. Another possibility would be to use the identical peripherals (B, C and D) as backups.

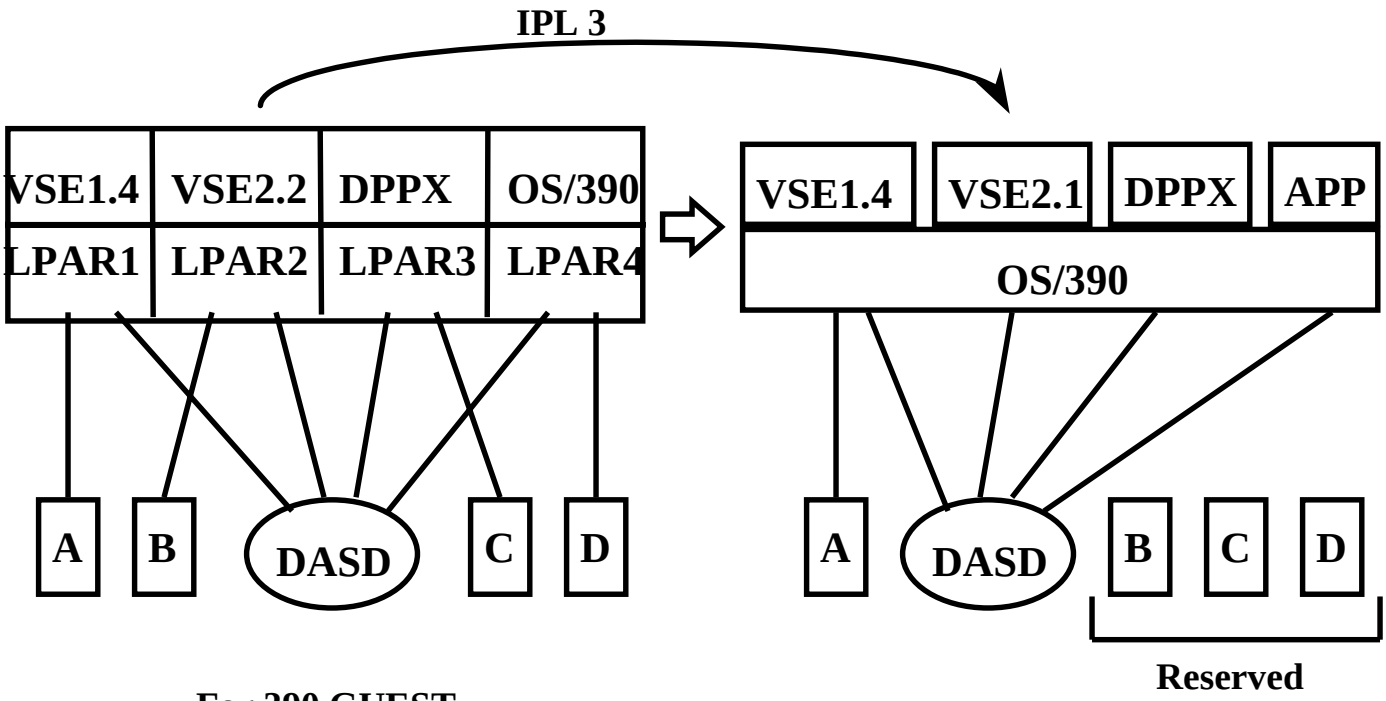
The final configuration (without LPARs) requires less management effort than the 4 LPARs in the initial configuration.

Switching to dynamic resources allocation using the OS/390-ISX virtual facilities results in the following:

- an increase in configuration throughput;
- an improvement of configuration reliability;
- a reduction in hardware resources;
- a reduction in the complexity of system administration.

# FROM LPAR TO TASK

**Static allocation** ⇒ **Dynamic allocation**




**For 390 GUEST**

- **CPU main memory ways to periferial dynamic allocation;**
- **From 1 way TASK-DASD to 4 ways TASK-DASD;**
- **From A+B+C+D+ many CHANNEL cards on CPU and**
- **Periferials to A and few Channel cards;**
- **From 4 administrarting enteties to 1**

**Add. for 370 GUEST**

- **From 370 to 390 mode (G4, 390 periferials, protocols)**

- **Performance ⬆**
- **Reliability ⬆**
- **Hardware price ⬇**
- **Maintenance ⬇**

**Fig. 5.1.**

## Section 6. OVERCOMING THE RESTRICTIONS OF THE OLD OPERATING SYSTEMS - NEW SYSTEM FACILITIES FOR OLD APPLICATIONS.

The major types of OLD Operating System restrictions are:

- lack of new device support (for example, any device through ESCON for 370 mode, CKD disks for DPPX, tape libraries for VSE);
- lack of access to new OS/390 system facilities (for example, access to RACF or to the most recent protocols);
- shortage of internal operating system resources.

Fig. 6.1 illustrates the method to overcome these restrictions.

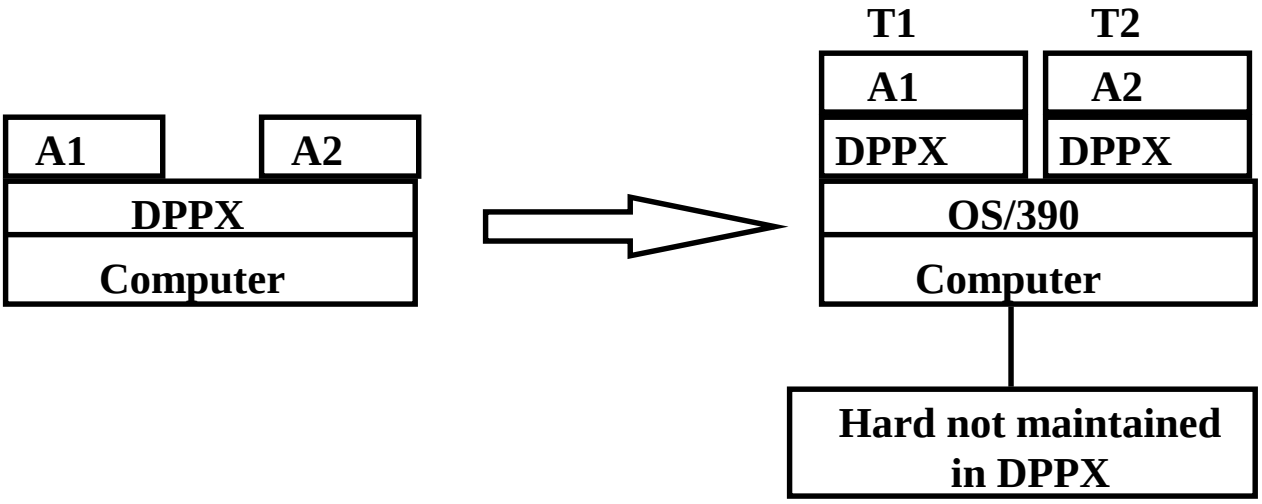
When the old operating system runs as an OS/390 guest, many of these restrictions may be overcome.

The 370 operating systems and their associated applications can be run on a 9672 G4 computer, which has no 370 mode, and has the capability to use devices connected with ESCON channels.

The OLD applications can have access to new OS/390 system facilities. Some of these facilities have been already tested by Users, and are illustrated in Sections 8 through 15 that follow.

# OVERCOMING THE RESTRICTIONS OF THE OLD OS




- **Any A gets OLD OS resourses in monopoly**
- **Any A together with GUEST OS turns to be OS/390 task and can reach Hard and Soft OS/390 resourses, facilities and protocols**
- **Any A can get separate virtual time (from OS/390 and other GUESTS) to built timing windows or to test Year 2000 dependence.**

**T1-T2 - OS/390 user tasks (A + DPPX + ISX).**

**Fig. 6.1.**

## Section 7. OVERCOMING THE RESTRICTIONS OF THE NEW OPERATING SYSTEMS - OLD SYSTEM FACILITIES FOR THE OLD AND NEW APPLICATIONS.

If the User creates a new system from scratch, or purchases a canned system, it is very difficult to understand the restrictions that OS/390 may impose for running OLD applications. However, upon review of the IBM information, such creation from "tabula rasa" appears to be about 6% of the cases. The most frequent occurrence is when the new operating system is delivered to the computer centre instead of the old operating system, which has the currently deployed technology.

The system restrictions may appear in the following areas:

- Equipment;
- API;
- MIDDLEWARE;
- Network solutions.

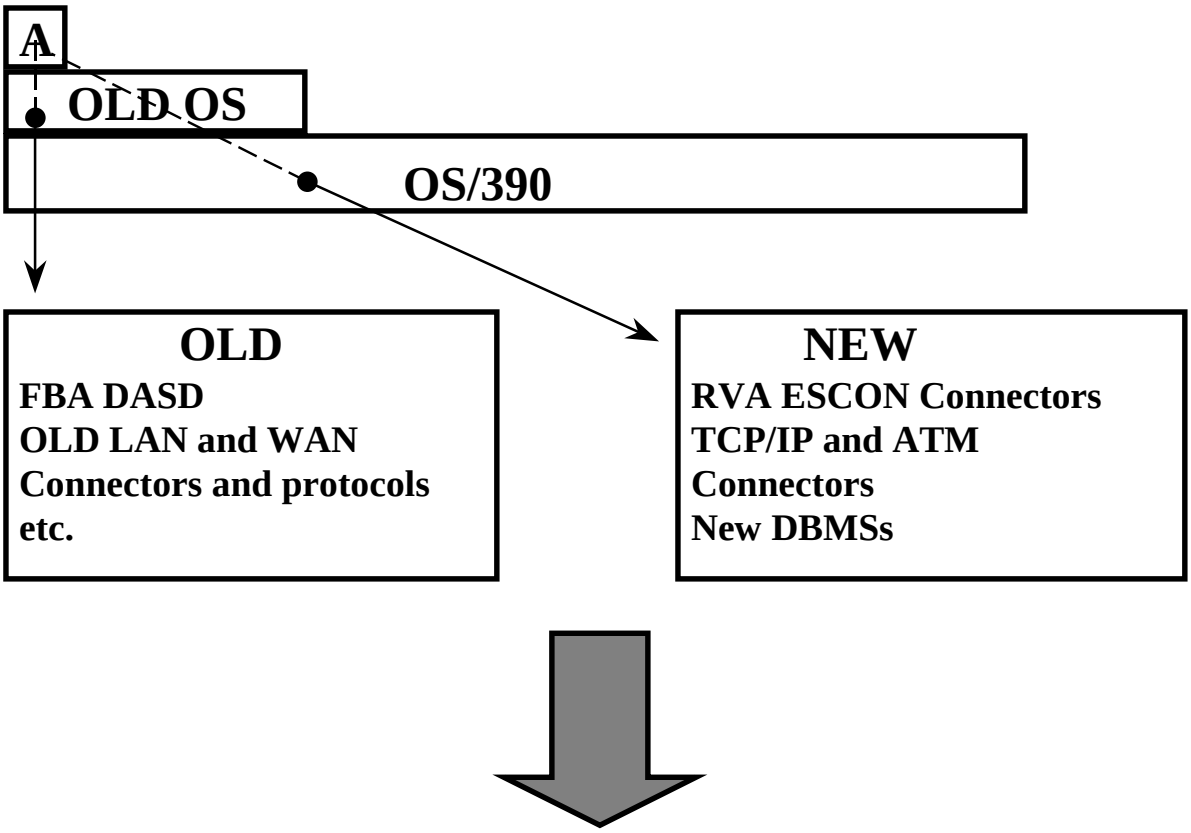
Many of these restrictions could be avoided by executing the old operating system and applications as OS/390 guests, as shown in Fig. 7.1.

In this case, the combined responsibility of the old and new operating systems is to provide applications with the proper system facilities for execution. This results in a shared system environment as shown in Fig. 7.1. This shared environment allows the computer centre to start utilizing the benefits of the new operating system to support the current technology during the transition period to the new operating system.

Since the deployed technology in each computer centre is unique to that centre, there is not a common solution that is available during the transition period.

The possibilities for using the joint environment are similar in nature, as described in Section 9 (Coexistence of the Old and New Data Base Management Systems During Transient Period) and Section 10 (Coexistence of the Old and New Networks During Transient period). Each enterprise should build its own individual, optimal method for switching to OS/390 in the shortest timeframe possible, which results in the maximum savings of resources (hardware, software, and personnel).

# OVERCOMING THE RESTRICTIONS OF NEW OS.




**Joint A environment**
**OLD OS: responsible for OLD**
**OS/390: responsible for NEW**

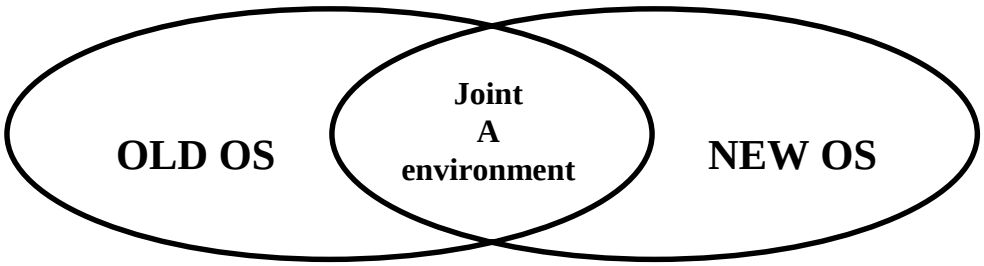



**Fig. 7.1**

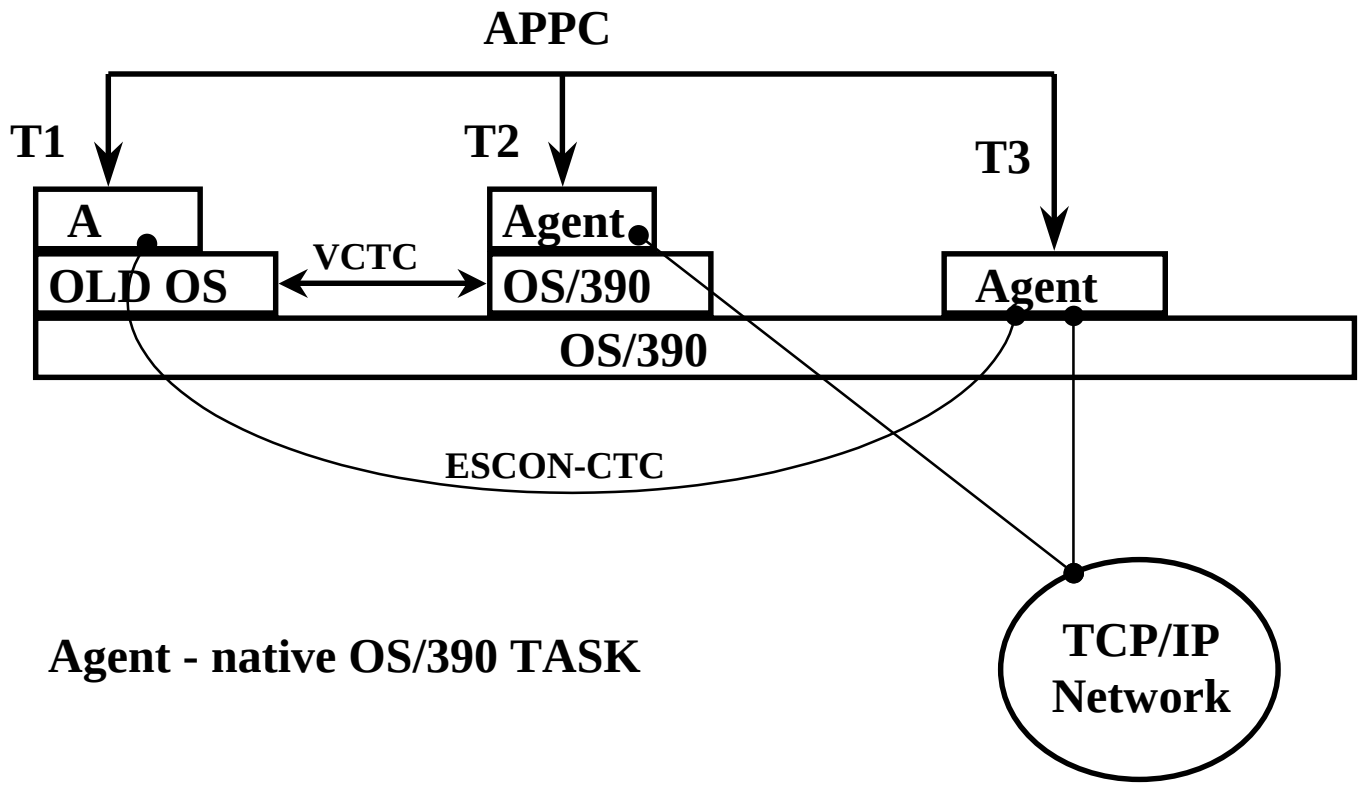
## Section 8. TCP/IP NETWORK CONNECTION TO THE OLD APPLICATIONS.

The applications executing in the old operating systems (VSE/SP, DPPX, VSE/ESA etc., which have no connection facilities to TCP/IP) may use OS/390 facilities for such connections while executing in GUEST mode. Fig. 8.1 illustrates these connections.

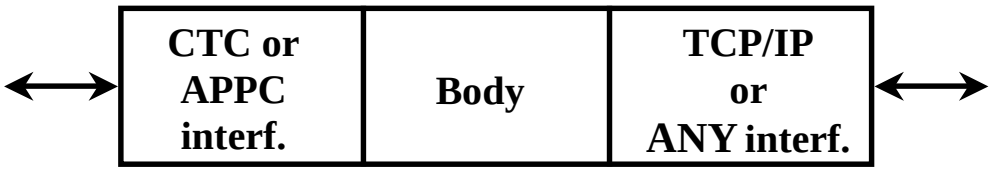
An agent is used as the basis in establishing these connections - an OS/390 task specifically designed for these connections. The agent has the simplest structure and consists of three layers, as shown on Fig. 8.1, application interface, agent body and TCP/IP interface. The interface to the application from the agent can be established either with virtual CTC, real CTC, or APPC (assuming APPC is available in the GUEST) or by using other access facilities that are supported in the same manner in both HOST and GUEST operating systems (for example, through any network).

Once connections are in place, other agent connections can be made available, such as CICS versions, OS/390 DB2, and others.

## TCP/IP connections to OLD applications




**Agent - native OS/390 TASK**




**VCTC - virtual CTC**

**T1 = A + OLD OS + ISX - OS/390 TASK**
**T2 = Agent + OS/390 + ISX - OS/390 TASK**
**T3 = Agent - OS/390 native TASK**

**Fig. 8.1**

## Section 9. COEXISTENCE OF THE OLD AND NEW DATA BASE MANAGEMENT SYSTEMS DURING TRANSIENT PERIOD

As soon as the old operating system becomes a GUEST of the new OS/390, the need to synchronize the data between DBMS systems becomes an immediate concern as shown in Fig. 9.1. The problem that needs to be solved at this level is separating the data flow transmitted to the old DBMS into two directions: to the old DBMS and the new DBMS.

The goal of this separation is to support DBMS synchronisation for the transition period. This ensures the newly developed OS/390 applications and the old applications work with identical data during this period.

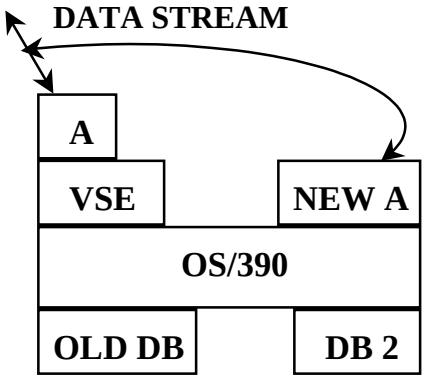
One possible approach is to separate the old application into two parts: the executive PART (EPART) and the telecommunication PART (TPART), as shown on Fig. 9.1.

The exchange between TPART and EPART is carried out at the agent level in the HOST operating system, where the data flow is divided into the NEW and OLD DBMS for all functions (comparison of the acknowledgement from the old and new DBMS before their transmission to network, for example, automation of the old and new applications joint debugging).

The same parallel work can be performed not only for the DBMS, but also for other old and new operating system facilities. (For example, network coexistence, as shown in the next section).

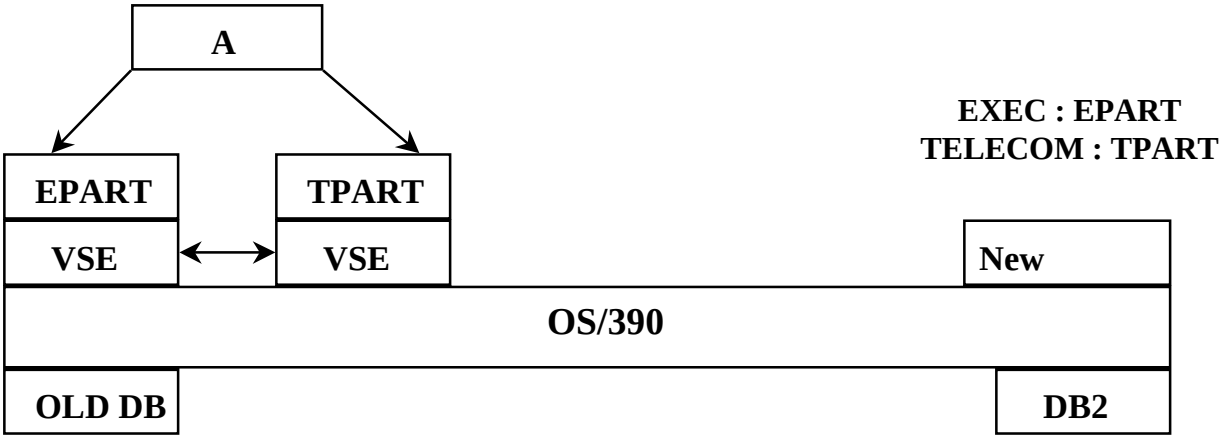
 

## DB COEXISTENCE

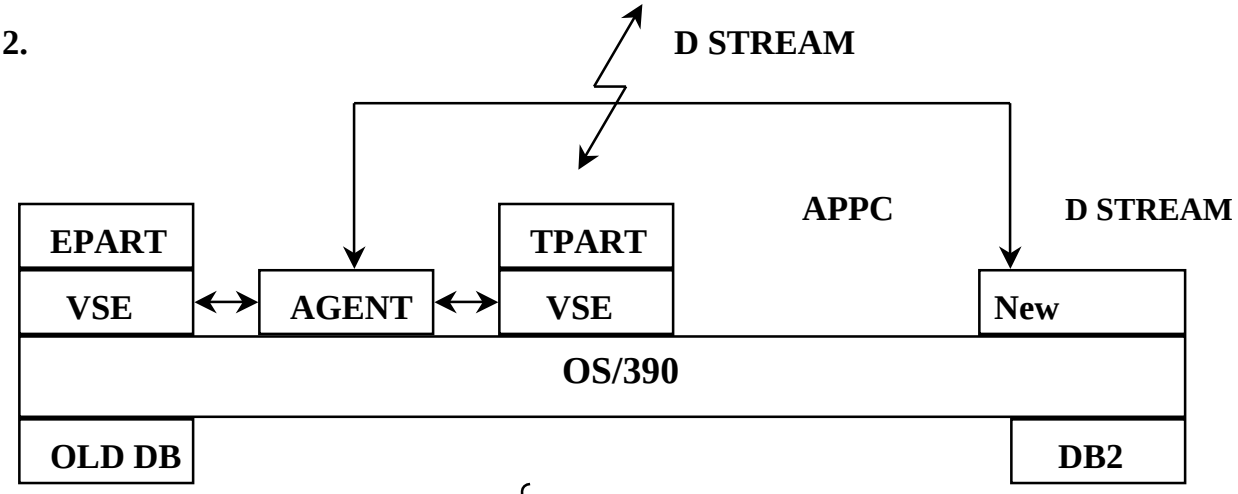



**AIM: TO SHARE D STREAM BETWEEN A AND NEW A**

**1. To extract parts of OLD**




**2.**




**AGENT = { SHARE STREAM, SWITCH and COMPARE**

**Fig. 9.1**

## Section 10. COEXISTENCE OF THE OLD AND NEW NETWORKS DURING THE TRANSITION PERIOD

After the migration of the guest operating system and applications has been performed, it may be required to switch to a new terminal network that utilizes new network facilities supported by OS/390.

This situation is illustrated in Fig. 10.1.

At the initial point of the transition period, application A operates with the old terminals across the old network. At the final point of the transition period, application A and the newly developed OS/390 application AN should jointly work with the new terminals across the new network. During the transition period, both the old and new applications should work with both the old terminals and old network as well as the new terminals and new network.

The transition to the new network needs to be gradual. The logistics of performing an instantaneous switch from the old terminal network to the new one are often complex, especially in networks that have a large number of terminals. The potential for network outages during a switchover also increases with the complexity of the network.

The problem in organising the joint operation of the old and new terminal systems is that the new terminals and protocols might not be supported in the old operating system, and the old terminals and protocols might not be supported in the new operating system.

Using OS/390 guest facilities as indicated in Fig. 10.1 can solve this problem.

To implement the solution, an AGENT (a 4-way switch supporting the joint operation of two guest and two NATIVE applications) is being developed.

EPART - executive part of the old application
TPART - network part of the old application to run with the old terminal network
NEW EPART - executive part of the new application
NEW TPART - network part of the new application to operate with new terminal net. The exchange between the allocated parts of the old and the new applications could be organised by system facilities accessible for the guest system in a manner shown in Fig. 10.1.

## NETWORKS COEXISTENCE

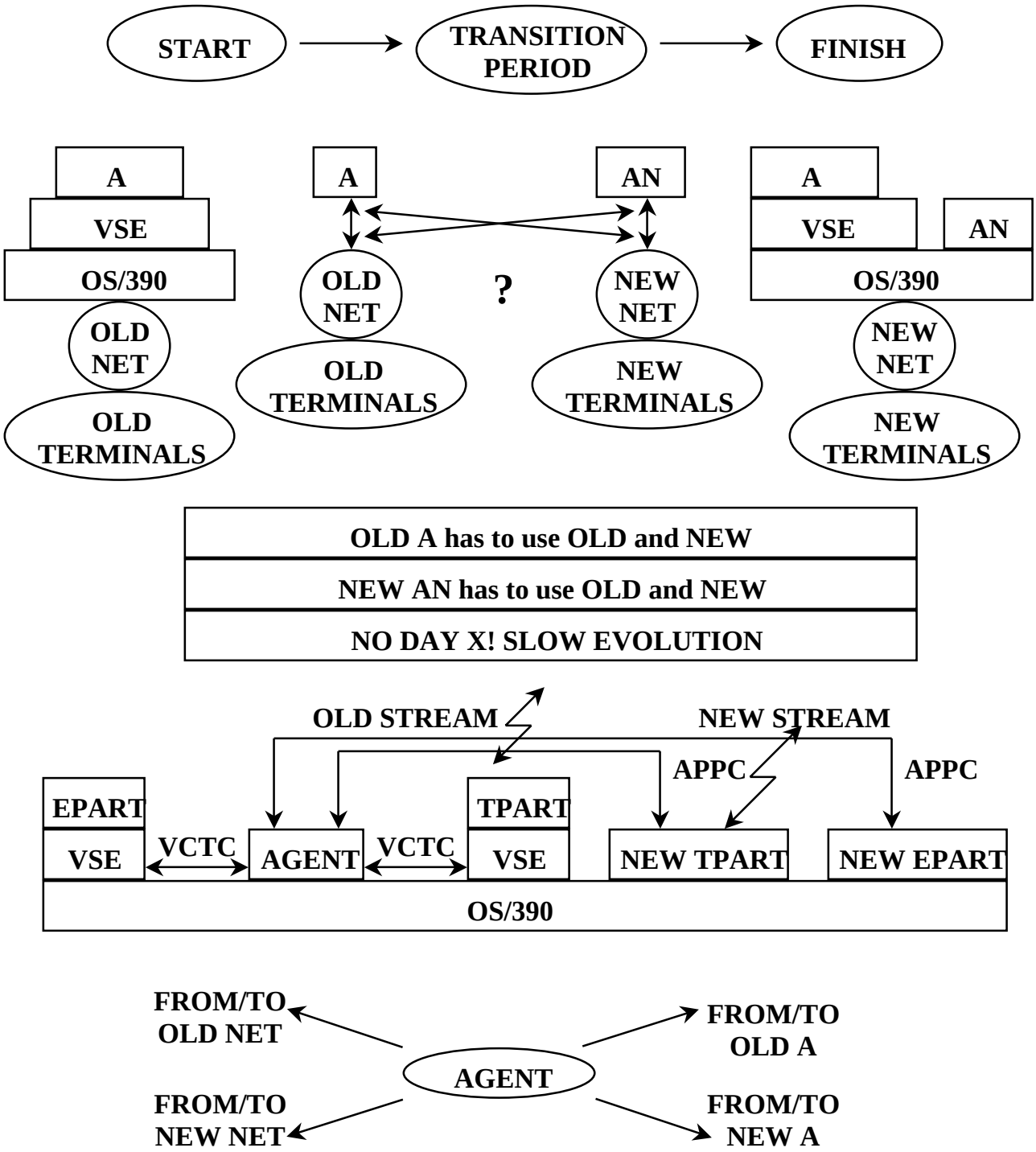



**Fig. 10.1**

## Section 11. MIGRATION OF MULTI-MACHINE SYSTEMS - ENTERPRISE PROCESSING CONSOLIDATION

The steady existing trend to increase the performance of lower 9672 models concurrently with an increase in the throughput of the intercomputer communication networks leads to the consideration of consolidating enterprise processing on a lesser number of machines that have higher performance.

The existing diversity of the applicable operating systems considered for consolidation complicates the consolidation strategy of installing newer, higher performing computers.

Fig. 11.1 shows the situation which requires a switch from using a higher number (N) of the previously installed machines, to installing and using a lesser number (K) of new computers. The resulting configuration overcomes the diversity of the previously existing operating environment.

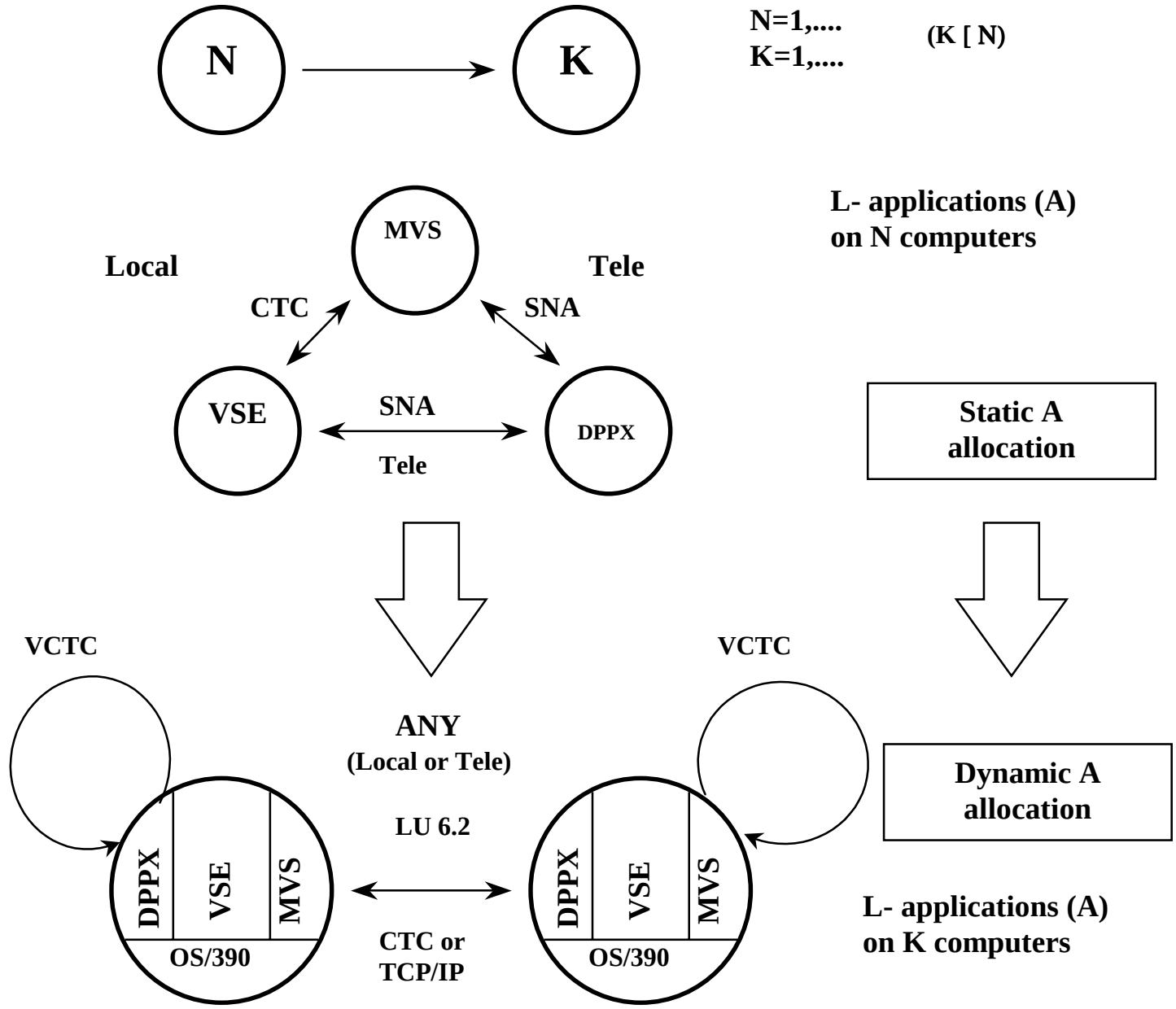
The goal of consolidation is to improve the overall economic characteristics by achieving better use of the computer resources and a reduction in the hardware required. Computing resources are used more efficiently as a result of the switch to dynamic resource allocation from the previous method of static resource allocation.

In the previous solution not all tasks (L) could be executed on all computers (N) due to the diversity of their operating environment.

After consolidation to computers (K) of higher performance, configured as illustrated in Fig. 11.1, each task could be executed on any machine with free resources. This enables the switch-over to dynamic resources management at the network level.

It is evident that certain task features supporting their mobility are required to achieve this goal. These requirements could be met by the methods discussed in prior sections and shown in Fig. 11.2.

# Multi-machine system migration to Dynamic Networking




- **Dynamic resources allocation on the network level**
- **Multiple distributed back up (ANY on ANY)**

**OS/390 based HETEROGENIOUS S/390 distributed dynamic Network (DN)**

**Fig. 11.1**

# Mobile S/390 GUEST application

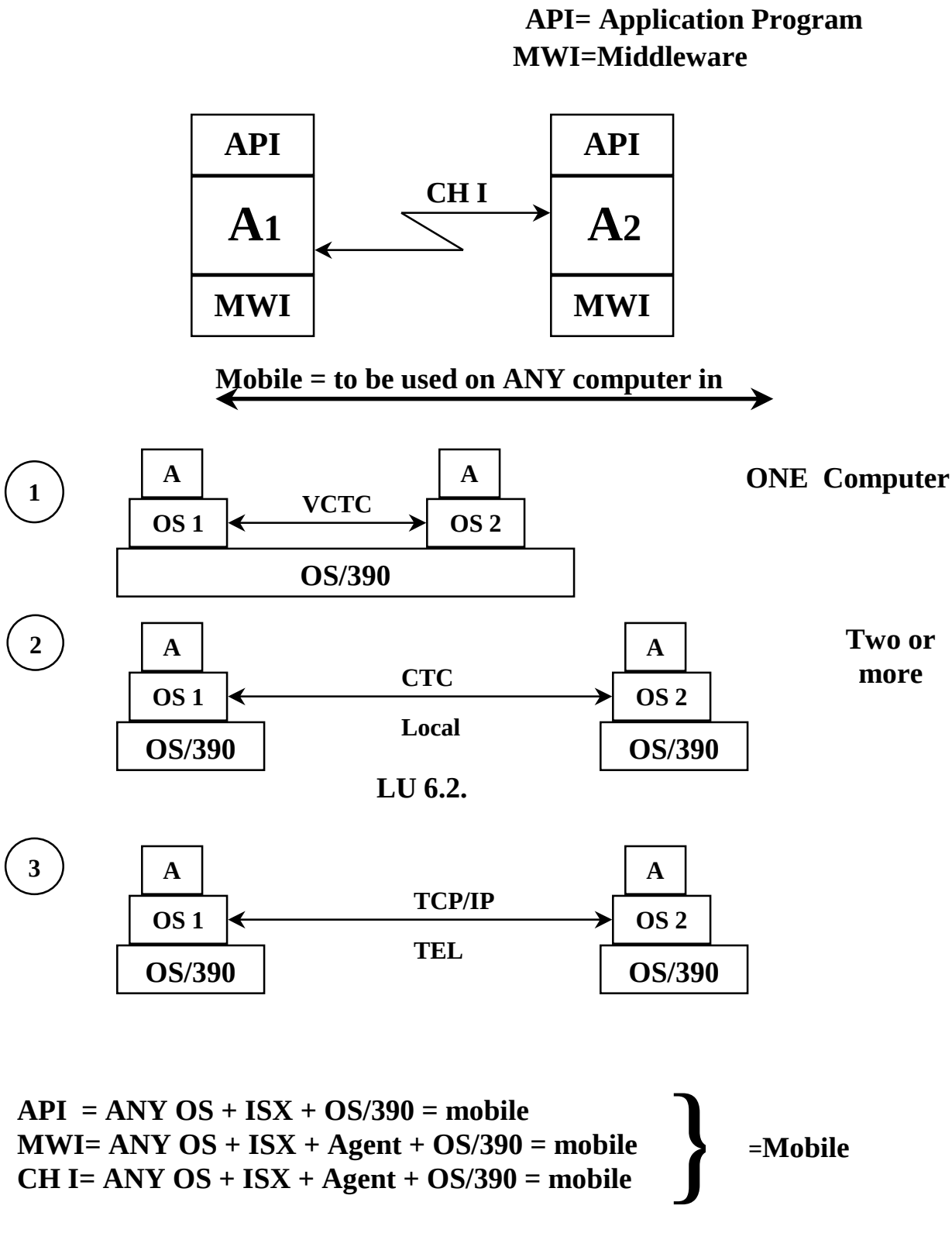



**Fig. 11.2**

## Section 12. OS/390 COMMON SECURITY FOR THE OLD AND NEW APPLICATIONS (RACF)

Fig 12.1 presents the logical structure of RACF interacting with the guest applications A1 and A2.

When the migration process has been finished, the guest applications combined with the guest operating systems under ISX form OS/390 tasks, and like any OS/390 task could be controlled by RACF.

If you need deeper control over the access to OS/390 network resources, the message flow between the guest tasks and OS/390 network resources could be transferred to an OS/390 proper task – AGENT. For an example, see Section 8 - TCP/IP Network Connection to the Old Applications.

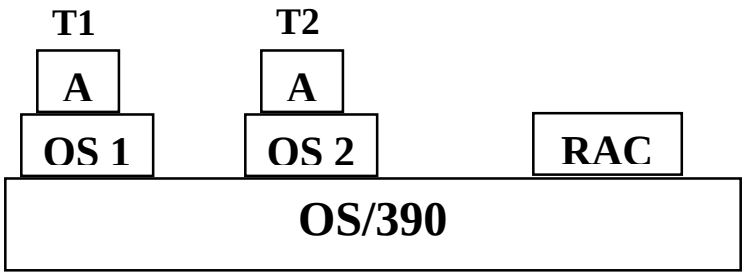
In case it is necessary to control access to resources (that are not normally protected by RACF) for applications not designed to interact with the security system, it might be possible to use the additional OS/390 system facility SAF (System Authorisation Facility).

With the use of SAF, the access control policies can be centralized and oriented to the existing enterprise security policy.

The SAF and RACF interaction mechanism is presented in Fig. 12.1. This checks the security policy for the individual access rights to the user program entry.

# OS/390 RACF for DPPX, VSE




**T1, T2 - OS/390 TASKs - RACF resources**

# OS/390 SAF (System Autorization Facility)

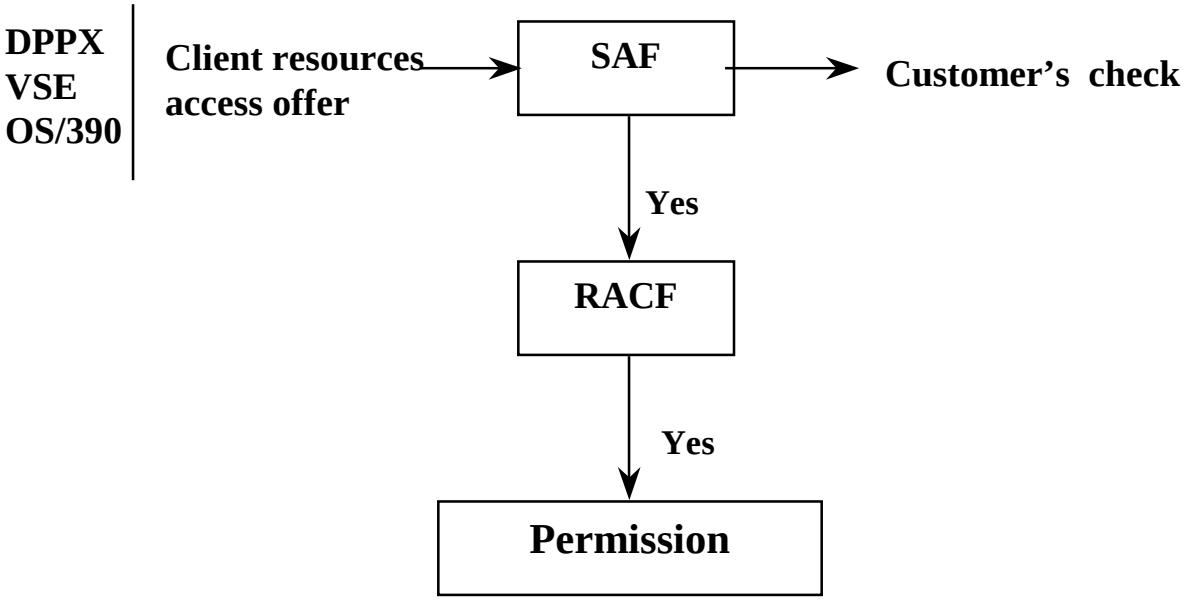



**Fig. 12.1**

## Section 13. DCE COMMON SECURITY FOR THE OLD AND NEW APPLICATIONS

In practice, it is often required to integrate independently developed TCP/IP networks (distributed computing system) and classic centralized systems implemented with SNA (including systems running in the operating systems without TCP/IP connection facilities, and, not supporting DCE).

With the help of some elements from ISX based system solutions, as discussed in previous sections, it may be possible to integrate the centralized (S/390) and distributed (UNIX. WINDOWS NT) systems under common security system (DCE SECURITY SERVER). The solution is based on using the standard OS/390 facilities. This is shown in Fig 13.1.

The problem is, how to use this construction for the applications in the operating systems not intended for its use, as well as how to use DCE facilities for the old applications, which are not developed to use these facilities.

This problem can be overcome in the three steps presented in Fig. 13.1.

In the first step, OS/390 applications combined with their operating systems will be UPGRADED to OS/390 guest mode (Section 4). Thereafter, the applications become OS/390 resources secured by RACF (Section 12).

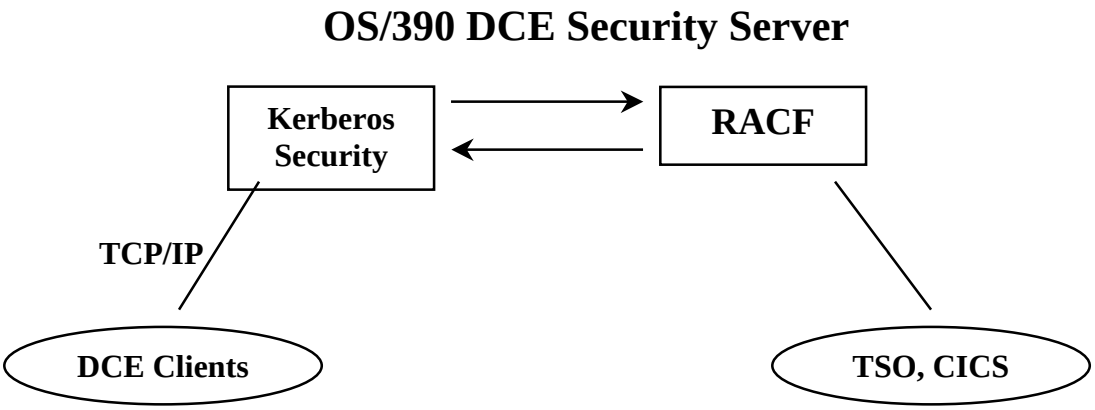
In the second step, the traffic between the applications will be UPGRADED to use TCP/IP. For the old applications it could be implemented according to the approach discussed in section 8.

In the third step, the traffic between the applications will be UPGRADED to use DCE. This UPGRADE is to be performed by intercepting the application traffic at the TCP/IP driver level and re-directing of the traffic to other address (to DCE infrastructure). There are some standard system products marketed by independent vendors to implement this procedure.

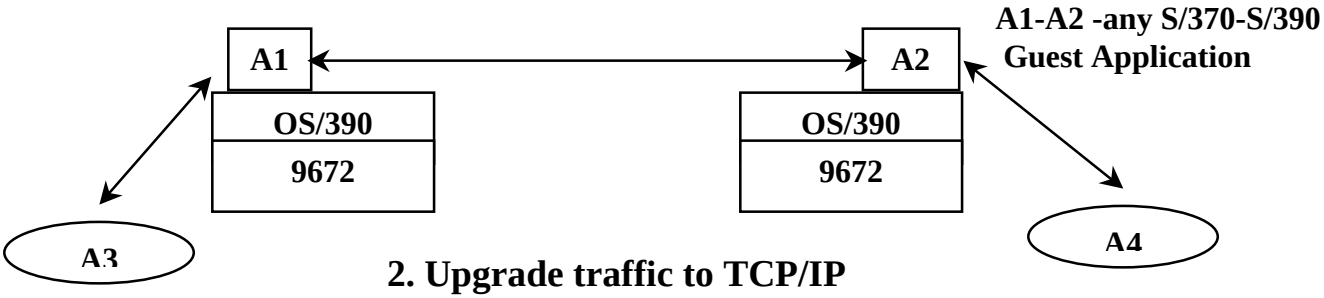
Optionally, in the fourth step, the confidentiality of the system can be improved with the introduction of an enterprise developed (proper, individual) crypto algorithm instead of using a purchased product. This procedure is performed according to OPEN GROUP standard GCS-API as shown in Fig. 13.1.

# DCE Security for any S370-S390

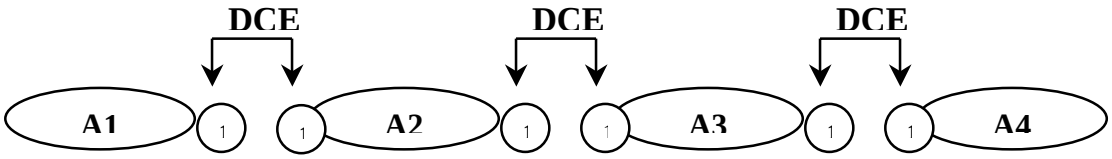



**1. Upgrade S370-S390 applications to OS/390 (OS/390**



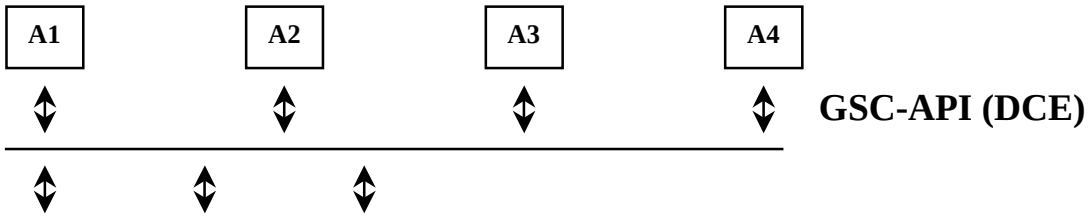

**2. Upgrade traffic to TCP/IP**


**3. Upgrade traffic to**




**1.Intercept TCP/IP on driver's level**

**4. Use GCS- API Standart to increase your**




**DES RSA Your own algorithm**

**Fig. 13.1**

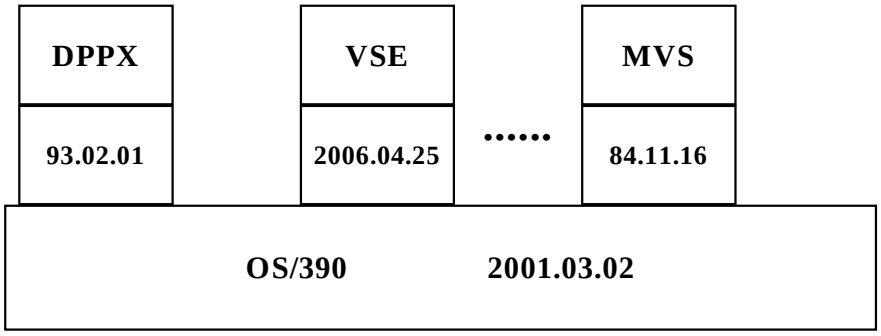
## Section 14. VIRTUAL DATES - TESTING THE YEAR 2000 DEPENDENCE

The possibilities for testing each system and its applications for Year 2000 readiness is shown in Fig. 14.1. Each of the guest systems along with its associated applications can have their date values altered for testing. Each date setting for all guests are independent of one another. This allows for concurrent testing of different applications or the testing of one application in different scenarios.

# Virtual dates

- **testing of dates dependences**
- **creating static and dynamic windows**




**Any GUEST can get separate date**

**Fig. 14.1.**

## Section. 15. VIRTUAL TIME - TESTING AND OVERCOMING DEPENDENCE UPON THE PROCESSOR PERFORMANCE WHILE SOLVING EQUATIONS

When solving differential and algebraic equations, it is typical to call the system timer for determining the number of the iterations for a fixed time.

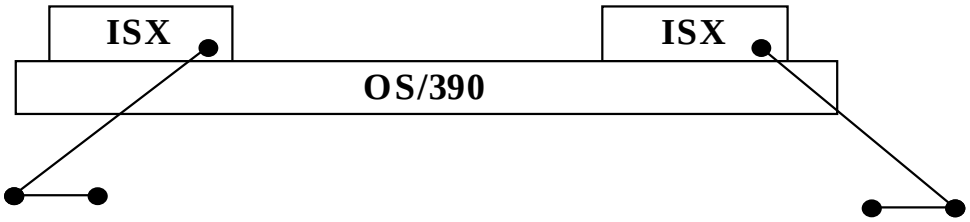
While changing the processor performance (migration to another computer with higher performance) more iterations can result in same time frame, and the execution process may run longer which could lead to a different result

This situation can be corrected by switching the computing process to a virtual time (the guest operating system and the application will be switched) which can run faster or slower than real system time, as shown on Fig. 15.1. By selecting an acceleration or delay time factor, it is possible to bring the computing process back to the old timings.

# Virtual times

- testing of performance dependences
- creating virtual times for overruning dependences




time runs N times
faster, than in OS/390

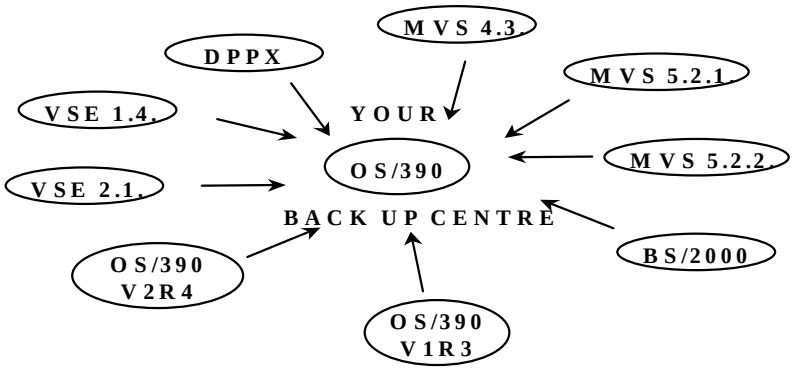
time runs L times
slower, than in OS/390

Fig. 15.1.

## Section 16. S/390 BACK UP FOR SALE

The need to share computing costs has forced some of the larger OS/390 Computer Centers to sell their resources to be used as a backup for other computer centers within the enterprise, or the computer centers of other companies.

To effectively market the resources, the computer center must have the ability to backup heterogeneous configurations differing in type, version, release, product set and operating system configuration. This presents complications in developing and maintaining the different backup configurations. This is illustrated in Fig. 16.1.




APPLICATION DEPENDENCE
API
MIDDLEWARE
NETWORKING

OS DEPENDENCE
•TYPE
•VERSION
•SET OF PRODUCTS (VERSIONS)
•TUNINGS

Fig. 16.1.

In THIS situation, a simple, easy-to-implement solution is offered by implementing new OS/390 virtual machine capabilities based on the Interpretive Space Executive (ISX) product for OS/390.

Without changing the existing operating system configuration at your computer center, ISX enables the execution of different backup configurations (with all of their setup “as is”) as guests of your OS/390 system, as shown in Fig.16.2

The stand-alone programs can also be executed as OS/390 guests, and do not require another OS/390 or use of the specific machine, LPAR or VM.

The preparations for back up require the following steps:

1. Back up the target operating machine configuration, for instance, by using the DDR utility;
2. Install and configure ISX at the back up computer center;
3. Restore the target operating system by means of DDR at the back up computer center;
4. Start ISX as an OS/390 task to IPL the backup operating system on top of ISX.

The backup operating system is ready to run the backup applications.

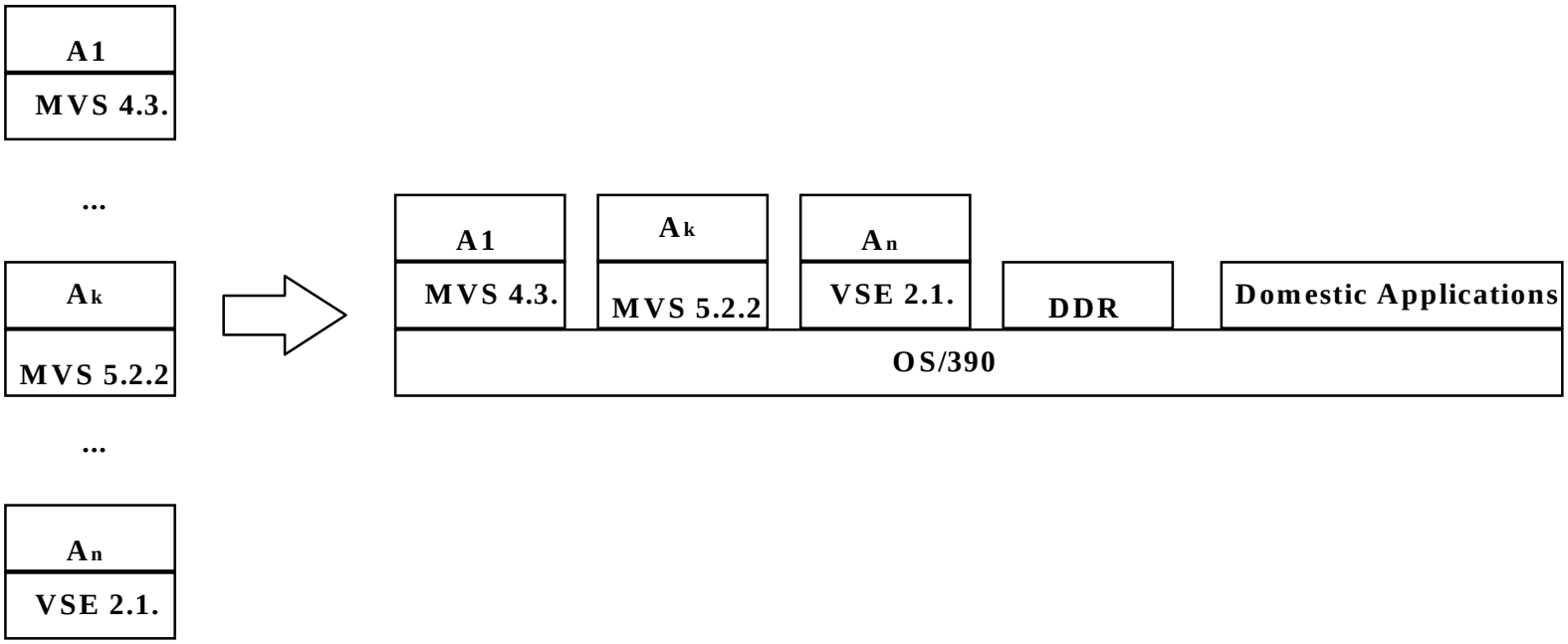



**Fig. 16.2.**

## Section 17. ISX FAMILY

| NAME | GUEST TYPE | HOST OS | DASD RESOURCES | MAIN MEMORY |
|---|---|---|---|---|
| ISX\VSE | ANY 370 | VSE 2.1 | Few tracks | Few segments |
| ISX/370 | ANY 370 or SA | OS/390 | | |
| ISX\SA | ANY 390 SA | OS\390 | - | - |
| ISX\DPPX | DPPX and SA | OS\390 | - | - |
| ISX\390 | ANY 390 GUEST without MVS | OS\390 | - | - |
| ISX\MVS | ANY 390 MVS | OS\390 | - | - |
| VFBA | FBA DASD emulation on CKD DASD for VSE and DPPX guests | OS\390 | In ISX resources | One additional segment |
| VCTC | VIRTUAL guest to guest CTC. | OS\390 | In ISX resources | One additional segment |
| LRTE | Local on remote terminal emulation for guest. | OS\390 | In ISX resources | One additional segment |
| VDATE | VIRTUAL DATE for guest | OS\390 | In ISX resources | One additional segment |
| VTIME | VIRTUAL TEMP of time for guest | OS\390 | In ISX resources | One additional segment |

## Section 18. SUMMARY

This document briefly discusses system solutions, which can be designed to concurrently manage and consolidate OS/390 and VSE operating systems. These solutions are based upon the virtual machine facilities of the Interpretative Space Executive (ISX). The range of possible solutions is far wider than what has been discussed here. Some solutions that have been covered are the result of actual user implementations of ISX.

As the number of enterprises applying ISX solutions increases, the variety and number of user solutions will also increase.

## FOR THE FURTHER INFORMATION, PLEASE, CONTACT:

**Prof. Doctor SHMID Alexandre,**
**Ph.D. NAUMOV Viatcheslav**
**Ms. Ludmilla VOLKOVA**

**Development Lab**
125, Varshavskoje shosse, Moscow, 113405, Russia
**Phone**: 007 - (095) - 319-1390
**Fax**: 007 - (095) - 319-6990, 319-1390
**E-mail**: leasin@dol.ru