X-pand into the Future

e u r e x *circular 086/01*

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⚠ **Action Required** ⚠ **High Priority**

Eurex Release 5.0: Common Front End Sizing Guidelines

Related circulars: 014/01, 062/01

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Content may be most important for:	**Attachments:**
➲ Front Office / Trading ➲ Middle + Back Office ➲ IT / System Administration	Common Front End Sizing Guidelines

You will find attached the updated Front End Sizing Guidelines relating to Eurex Release 5.0.

Due to the sharply higher Broadcast frequency resulting from the more active market this year, in comparison to the sizing recommendations for Release 4.1 the recommendations for Release 5.0 have been based on an increased Broadcast rate of 66% for the Architecture segment. The sizing recommendations for the Eurex Applications are also based on a higher Broadcast rate.

The increased processing load caused by the higher broadcast rate has been counteracted by software optimization in the Architecture and in the NT versions of the @X-ceed and @X-tract applications. The sizing requirements for these software components are similar to, and in some cases slightly lower than, those for Eurex Release 4.1.

For the Sun Solaris-based graphical user interface the sizing recommendations in comparison to Release 4.1 need to be significantly increased. The reason is essentially due to an extension of the load testing from which the hardware requirements are derived. These have revealed that the response to user actions on the Sun Solaris platform was unacceptably slow when the workstation was tested under conditions which simulated normal processor loading.

The newly introduced Section 3.5.2.1 of the Sizing Guidelines includes some recommendations for an efficient management of Broadcast load when using the Eurex GUIs.

Please note that the Sizing Guidelines now refer to processing power in SpecInt2000. For a rough translation of SpecInt95 into SpecInt2000 a conversion factor of 10 can be used.

Please take the new sizing requirements into account when planning for Eurex Release 5.0.

We would also like to inform you that we will support upcoming hardware revisions of the operating system Sun Solaris 8 in addition to hardware revision 04/01 announced in circular 062/01.

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Common Front-End Sizing Guidelines

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1 INTRODUCTION

1.1 Purpose

This document explains the sizing guidelines for users of the MISS (Member Integration System Server) based front-end and of front-end installations using Internet workstations. These guidelines were developed based on test installations for the listed Applications. The document is based on Eurex® Release 5.0, Xetra® and Xetra Vienna® Release 6.0.

The sizing guidelines are preliminary recommendations only for members. They are not binding.

The document is intended to support the network and system administrators of members in planning their network, hardware and software configuration.

1.2 Scope

For the MISS based front-end installations, these guidelines are focused on a single MISS group installation. A MISS group consists of one or two MISSes and optionally connected workstations. The guidelines do not cover Eurex UD-based front-ends.

Members are strongly urged to test their own configurations as differences in hardware, software and settings can have a material impact on the system's performance and capacity behavior.

This document is not intended to give information about the general technical concepts with GATE. GATE (Generic Access To Exchanges) is the name for the technical architecture and components of the MISS and workstation (see Figure 1). It also does not provide installation or operation procedures. Installation procedures are described in the documents “Front-End Installation Guide”. Operation procedures are described in “Front-End Operations Guide”.

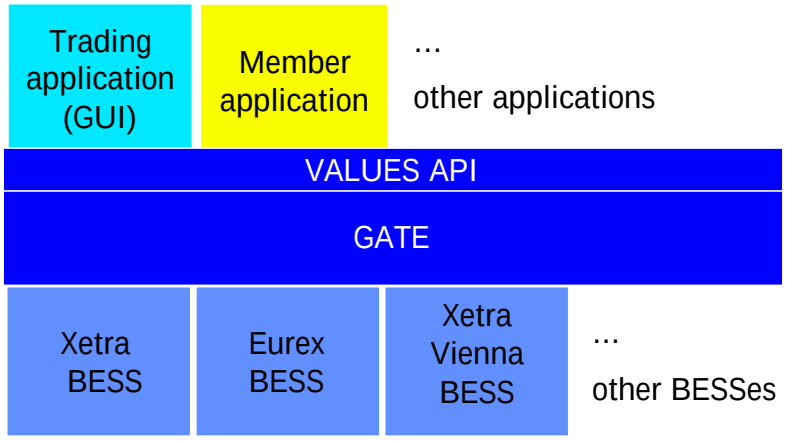


Figure 1 The GATE Layer

For installations using Internet workstations, these guidelines are focused on a single client installation, that is a single workstation with access to the Internet and coupled to a Smart Card Reader.

1.3 Contents

Section 2 TECHNICAL ENVIRONMENT contains short definitions of the hardware and software components used to build a front-end configuration. It describes the basic front-end configurations in relation to the member's requirements for availability and throughput. It is possible to set up other configurations using different components, but these other configurations have not been certified regarding their sizing and are not supported.

Section 3 SIZING GUIDELINES gives figures for sizing the supported front-end hardware components. The approach for determining the recommendations is focused on the number of processing requests and broadcasts. CPU, memory, disk and network recommendations are covered. The numbers given relate only to the systems having either Eurex, Xetra and Xetra Vienna software installed. Additional software installed on the front-end will affect sizing requirements and performance and is purely the members' responsibility.

The GATE software continues to support the ability to run multiple environments (e.g. parallel execution of the software in a production and simulation environment). The sizing guidelines provide recommendations for only one environment.

Section 4 APPENDIX describes the required operating system software versions.

2 TECHNICAL ENVIRONMENT

2.1 Overview

This section describes the hardware, software and network configuration to be used to access the Eurex, Xetra and Xetra Vienna systems.

The front-end must be able to run the software components necessary to establish and maintain a connection with the back end applications. The configuration components of a front-end configuration are shown in Figure 2 and are defined in the following sections. Note that the configuration shown in Figure 2 is a high availability configuration provided through redundancy of MISSes, routers and WAN lines.

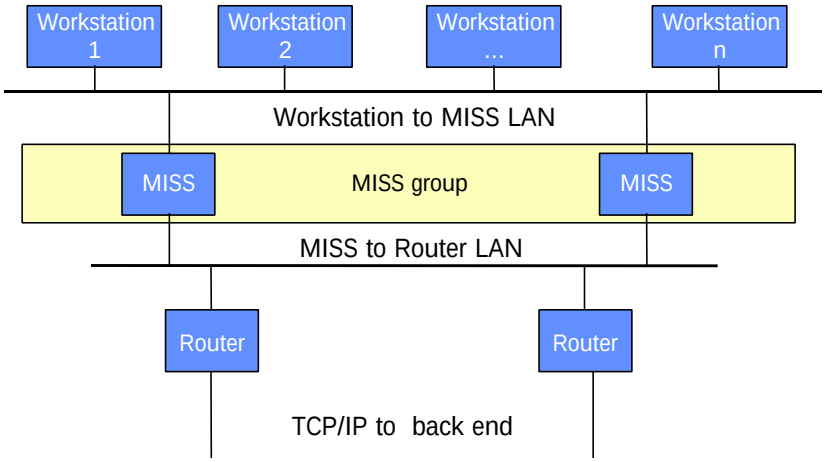


Figure 2 Front-end configuration

The different configurations for Internet workstations are not explained in this document. Therefore, chapter 2 is valid for MISS based front-end installations only.

2.2 Workstation

A workstation is a computer system, which is connected to a MISS via a local area network (LAN). The workstation has the Eurex, Xetra and Xetra Vienna workstation software or a combination of these installed.

The workstation is responsible for the presentation of market information and handling of member requests for the back end applications. Eurex, Xetra and Xetra Vienna provide Trading Applications which run on the workstation use the VALUES API (Virtual Access Link Using Exchange Services Application Programming Interface) and the front-end architecture services (GATE) that support the applications.

Member as well as third-party developed applications may also run on the workstation in addition to or instead of the provided Trading Application. However, this document provides no information about sizing for these types of applications, as they are the responsibility of the end-user organizations.

2.2.1 Workstation Platforms

The Eurex, Xetra and Xetra Vienna Software supports the following workstation platforms:

- IBM AIX 4.3.3 (not supported for Eurex)
- Microsoft Windows NT (Intel) Workstation 4.0 English Service Pack 5
- Sun Solaris 8 (for Xetra 6.0 Solaris 2.6)

Detailed information about required patch levels is contained in section 4.1.1 Detailed Requirement Specification.

Note: Homogeneous front-end configurations (MISSes and workstations of the same platform) were tested as well as the combination of AIX or Solaris based MISSes with Windows NT (Intel) workstations.

Note: The number of computers accessing and using services of the Windows NT Workstation software is limited from a license perspective on the Microsoft Windows NT Workstation 4.0 platform. In case that a specific installation exceeds the license regulation, Microsoft Windows NT Server (Intel) 4.0 English Service Pack 5 must be installed instead.

2.2.2 Workstation Software

The software that the members will be expected to run on a workstation consists of:

GATE software

- Architecture services

One or more exchange specific software components

- Electronic Trading Applications

System software:

- Window manager corresponding to the operating system (Solaris and AIX: CDE, Windows NT (Intel): Win32)
- Communication software (TCP/IP, UDP/IP)
- Operating system software (IBM AIX, Sun Solaris or Microsoft Windows NT (Intel))

2.2.3 Workstation to MISS LAN

Communication between the MISS and the workstation is done via a local area network (LAN). Communication protocols required within the communication architecture are TCP/IP and UDP/IP. The MISS and the workstations should be connected to the same LAN segment or to bridged LAN segments. Ethernet is the only LAN type, which has been tested.

2.2.4 Remote Workstations

The Remote Workstation Solution is an enhancement, that allows workstations to connect to a MISS (group) located in a different LAN segment from the workstations' segment where both segments are connected via low cost leased lines (e.g. 128 kbps).

With GATE broadcasts can be distributed using IP multicasting. In such a configuration the Remote Workstation Solution is not supported.

Sizing of remote workstation is not in the scope of this document.

2.3 MISS

A MISS is a computer system, which enables connection to the back end and has installed the MISS software.

The MISS can be used as a standalone machine running the front-end application for the presentation of market information and capture of the member requests for the back end applications. Additionally, it can serve connected workstations. In this case, the MISS coordinates workstation communications.

2.3.1 MISS Platforms

The following MISS platforms are supported:

- IBM AIX 4.3.3 (not supported for Eurex)
- Microsoft Windows NT Server (Intel) 4.0 English Service Pack 5
- Sun Solaris 8

Detailed information about required patch levels is contained in section 4.1.1 Detailed Requirement Specification.

Note: Homogeneous front-end configurations (MISSes and workstations of the same platform) were tested as well as the combination of AIX or Solaris based MISSes with Windows NT (Intel) workstations.

2.3.2 MISS Software

The software that the members will be expected to run on a MISS consists of:

GATE software:

- Architecture services

One or more exchange specific software parts

- Technical back end connection (BESS[1])
- Electronic Trading Applications (optional)

System software:

- Window manager corresponding to the operating system (Solaris and AIX: CDE, Windows NT (Intel): Win32)
- Communication software (TCP/IP, UDP/IP)
- Operating system software (IBM AIX, Sun Solaris or Microsoft Windows NT (Intel))

2.3.3 MISS to Router LAN

Communication between the MISS and the router is done via a local area network (LAN). The communication protocol required for the MISS to the router is TCP/IP.

Ethernet is the only LAN type, which has been tested.

[1] BESS: Back End Specific Subsystem

2.4 Router

Routers maintain the TCP/IP connections from the MISS to the back ends. Fault tolerance is achieved by providing multiple routing paths to back end applications.

The router platform approved for the use with Eurex, Xetra and Xetra Vienna is provided by CISCO. Details about model series and operating software is contained in section 4.1.1 Detailed Requirement Specification.

2.5 Basic MISS-based Front-End Configuration

Using a MISS-based front-end, there are many possible configurations, ranging from a standalone MISS to large configurations with several MISSes and workstations arranged in logical MISS groups. In a MISS group, all MISSes must be on the same LAN segment. If the active MISS fails then automatic fail-over takes place.

More than one MISS per member is supported. Two MISSes in one MISS group support dynamic failure recovery between them. For disaster recovery, an additional MISS or MISS group may be established. However, fail-over to the disaster recovery site must be managed by the member. Splitting of MISSes of a MISS group across different physical locations has not been tested.

There are several possibilities for front-end setup configurations. The drivers for choosing one of the described configurations are:

- Number of end users entering requests to the back end applications.
- Member's availability requirement.

Figure 3 Availability-Size-Relation shows four configuration alternatives that are a function of the number of end users and availability requirement. Configurations for normal availability contain single points of failure. High availability configurations have no single points of failure or have stand-by equipment available for recovery purposes.

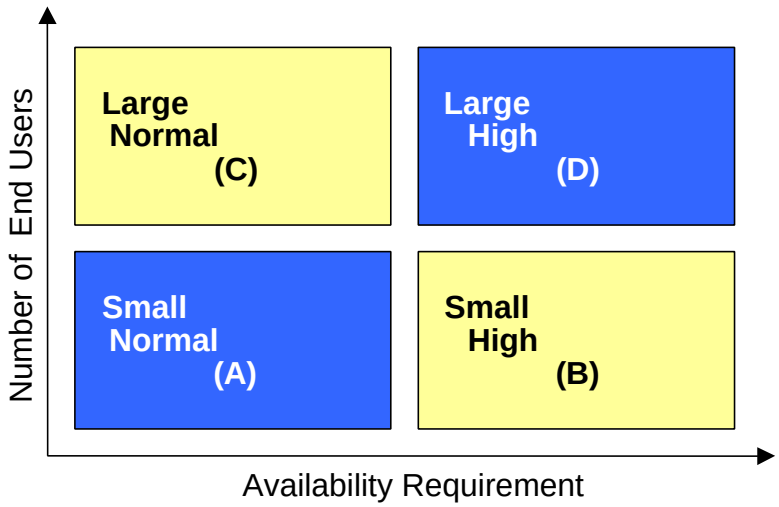


Figure 3 Availability-Size-Relation

Each of the next four sections depicts one of the proposed configurations.

2.5.1 Small Configuration, Normal Availability (A)

Figure 4 shows a front-end configuration that provides normal availability for one user. The user runs the Trading Application directly on the MISS.

Note that fail-over is not supported if any of the components fail.

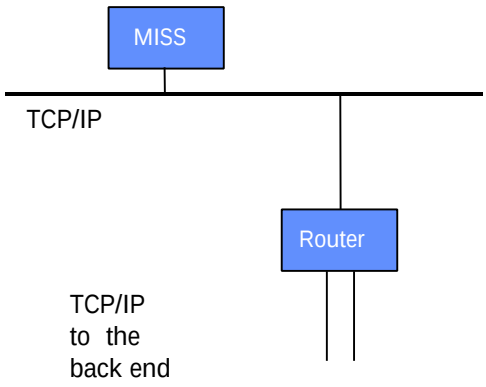


Figure 4 Small configuration for normal availability

2.5.2 Small Configuration, High Availability (B)

In Figure 5 a front-end configuration is shown that provides high availability (no single point of failure) for one or two users. The user runs the Trading Application directly on the MISS. If any individual component fails, the parallel component assumes control to support continuing operations.

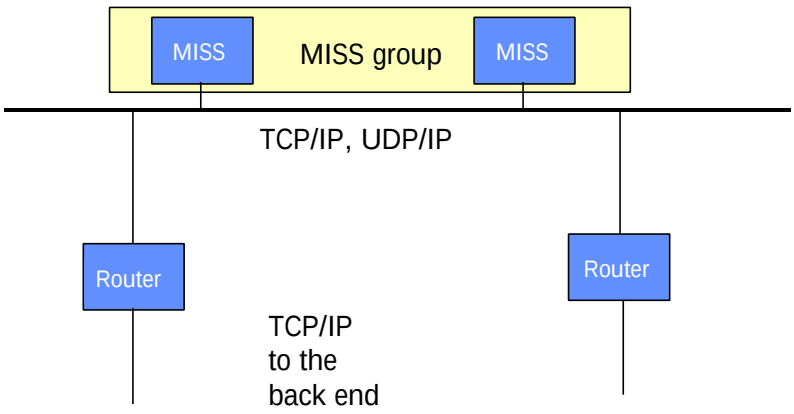


Figure 5 Small configuration for high availability

2.5.3 Large Configuration, Normal Availability (C)

Figure 6 shows a front-end configuration that provides normal availability for multiple users. Each user runs the Trading Application on his own workstation. Note that failure of any component other than a workstation will terminate all user access to the back end. Failure of any individual workstation will affect only the individual user of that workstation. The presented configuration supports a large number of workstations for multiple users. It is recommended to have the routers and MISSes in a separate LAN segment and the MISSes and workstations in another. In this type of front-end configuration, the workstation/MISS LAN network addressing can be unique.

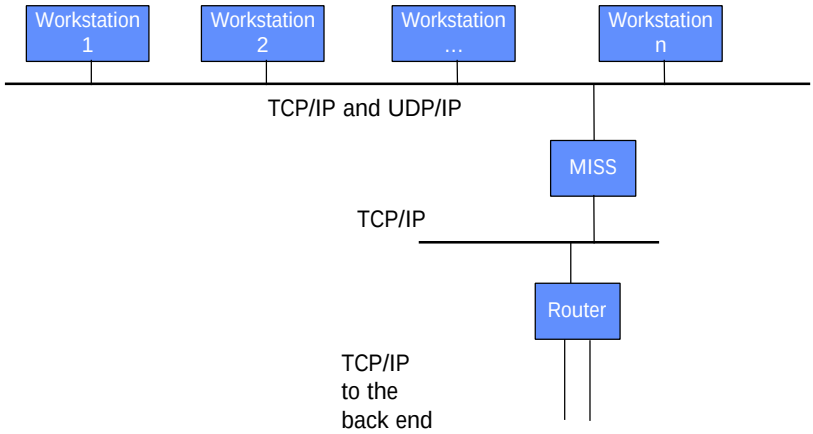


Figure 6 Large configuration for normal availability

2.5.4 Large Configuration, High Availability (D)

Figure 7 shows a front-end configuration that provides high availability for multiple users. Each user runs a Trading Application on its own workstation. Failure of any individual component other than a workstation is recovered via the remaining components. Failure of any individual workstation will affect only the individual user of that workstation.

If a MISS fails, requests from the workstations can be routed via the other MISS. Broadcasts and responses are sent from the other MISS to the workstations. If a router fails the request can be routed via the other router and the broadcasts and responses are sent from that router to the MISSes. Depending on the sizing of the configuration, operation following a failure may occur at degraded levels of performance.

It is recommended to have the routers and MISSes in one separate LAN segment and the MISSes and workstations in another. This type of front-end configuration allows to be independent from the network addressing in the workstation MISS LAN.

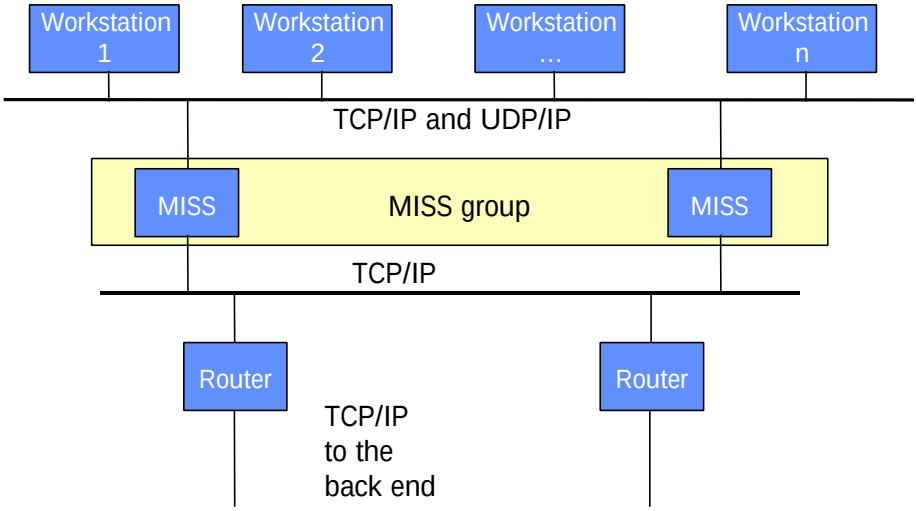


Figure 7 Large configuration for high availability

3 SIZING GUIDELINES

3.1 Introduction

This chapter provides guidelines to support members in sizing CPU, memory, disk and network resources of their MISS and workstation front-end installations.

MISS and workstation are designed to run several services (i.e. Eurex, Xetra and Xetra Vienna) in parallel. Installations running combinations of Eurex, Xetra and Xetra Vienna on a single system are classified as supported configuration with the introduction of Eurex Release 5.0. It should be considered, that in installations with only one MISS running several services, all services will be unavailable after the failure of the MISS.

The capability of a MISS or a workstation to run several services in parallel is also reflected in these sizing guidelines. Sizing figures for a MISS or workstation consist of a general part, which is required for all MISSes or workstations, independent of the installed services. For each service installed on the device, additional sizing requirements have to be added to the figures of the general part. For example, for a MISS running the Xetra and the Eurex software, the total sizing requirements have to be determined by adding the general sizing figures with the Xetra and the Eurex sizing requirements.

The sizing parameters of the service specific part are separated into base resource recommendations and incremental recommendations. The base resource recommendations are necessary to run the software without entering requests but processing the data generated by the general market activity (broadcasts). The incremental recommendations depend on the number of requests entered by the users of a MISS group.

The following sizing guidelines cover only the MISS and workstation software recommendations. They do not include requirements caused by the operating system, layered products (e.g. NFS or NIS) or other application software.

All sizing figures are given as SpecInt2000 values.

3.2 Assumptions

The guidelines are based on the following assumptions:

1. For Xetra and Xetra Vienna each workstation will run only one instance of the Trading Application per service (using the VALUES API) and one instance of the architecture services.
2. There are no remote workstations connected to the LAN. No processes to support remote workstations (e.g. broadcast bridge forwarder) run on either the workstations or the MISSes.
3. No third party products using VALUES are running on either the workstations or the MISSes; e.g. quote machines etc.

3.3 Sizing Drivers

Front-end sizing recommendations are driven by the level of activity to be supported. The front-end key activities are the processing of requests and responses (order entry, inquiries, etc.), and the general level of activity in the market (broadcast data processed by the front-end).

The aggregated number of orders, inquiries, etc. entered by a user on the front-end determines the level of processing on a MISS that is directly under control of the member. Additional processing by a MISS is driven by the total activity in the market as market activity generates broadcasts, which are delivered to front-ends.

The number of users drives the sizing of the front-end only in terms of the number of workstations required and the total number of orders that may be entered into the system.

One slow workstation or one slow MISS can slow down the performance of all devices of a MISS group.

3.4 Sizing Information – General Load

Workstations and MISSes have to manage a “General Load” that is independent from the installed services. This “General Load” has to be considered only once for each MISS and workstation independent from the number or type of installed services. As there is no “General Load” for disk usage and LAN utilization, only the service specific values have to be added for these sizing parameters.

3.4.1 CPU

The specified SPECint2000 values in the table below have to be added to the service specific values for the services installed:

IBM AIX [SPECint2000]	Microsoft Windows NT (Intel) [SPECint2000]	SUN Solaris [SPECint2000]
20	30	20

3.4.2 Physical Memory

Like the General Load of the CPU, 32 Mbyte of physical memory have to be added to the service specific memory requirements for the services installed. This value is valid for all platforms.

3.5 Sizing Information – Eurex

The following sections show the requirements of Eurex applications (Trading and Clearing GUI), the internet workstation software and the architecture processes (GATE and BESS) and include CPU usage, memory requirements and used disk space.

The architecture processes running on a MISS consume more resources (CPU load, memory per running instance and disk space per installation) than on a workstation. This is caused by the BESS software which is not running on a workstation. Therefore the requirements for the architecture processes are listed in two sections, one for MISSes and one for Workstations.

The requirements for applications do not differ between MISS and Workstation. The values are listed once for each application as they are valid for MISSes **and** Workstations.

The total reqirements for a MISS which is **only** running an architecture environment and **no** application can be taken from section 3.5.1.1 and its subsections. For every instance of an application that is running on a MISS the respective values for CPU load and physical memory usage have to be added.

The total values for a Workstation are computed from the values that are listed in section 3.5.1.2 (i.e. its subsections) and for each running instance of an application the values for CPU load and physical memory usage, taken from the respective section.

The disk space requirements listed in the MISS and Workstation sections are totals including the space required for all installed software (architecture, trading and clearing GUI) and for generating log files and report data files.

Note: The general load described is section 3.4 must be added, in order to get the final result.

Note: One badly sized MISS on a front-end can slow down the performance of all devices of a MISS group.

3.5.1 Architecture Processes

3.5.1.1 MISS

3.5.1.1.1 CPU Load consumed by Architecture Processes on a MISS

CPU load is caused by running BESS processes and GATE processes. The load is mainly caused by market activity (orders, quotes etc.).

Statistical data gathered from current Eurex operations shows that at peak times there are approximately 250 broadcasts per second sent out to the front-ends by the Eurex back end. The duration of the peak can be more than one minute. This peak is assumed as being generated by market makers entering mass quote entries (e.g. via quote machines). In addition to the public broadcasts, each MISS needs to handle the traffic generated by orders/quotes entered by the traders connected to it. One order/quote generates approximately 2.5 broadcasts on average. In the case of 10 orders/quotes per second this results in a total of 25 additional broadcasts per second.

When no broadcasts are subscribed (empty eurexsublist.dat), CPU load is caused by orders/quotes or other requests only. In such a case and when a single clearing application is running which is used for equity clearing only a minimum CPU requirement of 20 SPECint2000 for the architecture processes has to be considered.

The following table shows the CPU recommendations for the architecture processes for each platform:

Broadcasts per second to this machine (market activity)	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
150	29	19
200	38	26
250	48	33
300	57	40
350	67	47

It is recommended to choose at least a CPU size in the light gray area. Eurex members should account for their private orders/quotes rates in addition.

3.5.1.1.2 Physical Memory for Architecture Processes on a MISS

The main memory required for GATE and BESS processes, which is provided in the next table, should be used as minimum recommendation. It is important that paging should be avoided for maximum performance.

Microsoft Windows NT (Intel) [MByte]	**SUN Solaris [MByte]**
96	128

3.5.1.1.3 Disk Space required for Installation and Logging on a MISS

Local disk space is required for each environment (production/simulation) of a MISS including architecture and all applications. The space must be provided on the disk where the corresponding MISS file tree is located. The following table shows the disk space recommendations for one environment (production or simulation). The Eurex member can select which reports he wants to be delivered via the network to the MISS, therefore the space requirements for the reports depend on the trading volume and the reports selected by the Eurex member. These are estimates for one trading day.

	Microsoft Windows NT (Intel) [MByte]	**SUN Solaris [Mbyte]**
MISS software	350	350
Swap area	500	500
Report files and internal files [per day]	200	200
Static data files	500	500

3.5.1.2 Workstation

3.5.1.2.1 CPU Load consumed by Architecture Processes on a Workstation

CPU load is caused from running the architecture processes. The load is mainly caused by market activity (orders, quotes etc.)

Statistical data gathered from current Eurex operations shows that at peak times there are approximately 250 broadcasts per second sent out to the front-ends by the Eurex back end. The duration of the peak can be more than one minute. This peak is assumed as be generated by market makers entering mass quote entries (e.g. via quote machines).

In addition to the public broadcasts, each workstation needs to handle the traffic generated by orders/quotes entered by the traders in the same group. One order/quote generates approximately 2.5 broadcasts on average. In the case of 10 orders/quotes per second this results in a total of 25 additional broadcasts per second.

When no broadcasts are subscribed (empty eurexsublist.dat), CPU load is caused by orders/quotes or other requests only. In such a case and when a single clearing application is running which is used for equity clearing only a minimum CPU requirement of 20 SPECint2000 for the architecture processes has to be considered.

Broadcasts per second to this machine (market activity)	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
150	18	18
200	24	20
250	30	23
300	36	25
350	42	28

3.5.1.2.2 Physical Memory consumed for running architecture processes on a Workstation

The main memory required for GATE, which is provided in the next table, should be used as minimum recommendation. It is important that paging should be avoided as much as possible for maximum performance.

Microsoft Windows NT (Intel) [MByte]	**SUN Solaris [MByte]**
32	32

3.5.1.2.3 Disk Space used for Installation and Logging on a Workstation

Local disk space is required for each environment (production/simulation) of a workstation. The space must be provided on the disk where the corresponding workstation file tree is located. The following table shows the disk space recommendations for one environment (production or simulation).

	Microsoft Windows NT (Intel) [MByte]	**SUN Solaris [Mbyte]**
Workstation software	300	300
Swap area	500	500
Internal data files [per day]	50	50

3.5.2 Applications

3.5.2.1 General Remarks for GUI Sizing

The consumed CPU load and physical memory depends strongly on the number of visualized broadcast updates and the number of active windows. Nevertheless, also broadcast updates on iconized windows or broadcasts on not visible parts of a window generate an additional load which has to be considered. Therefore it is recommended not to iconize unsued windows or to use unnecesary large profiles.

The following values are valid for average usage of the application. More extensive usage will require additional resources.

3.5.2.1.1 Display

A screen resolution of 1280 x 1024 pixels with 65536 colors is recommended. In general higher resolutions or extremely small font sizes lead to higher CPU requirements.

All testing has been done using single head graphic adapters. Minor issues with multi head graphic adapters have been observed.

3.5.2.2 JAVA Trading GUI (@Xceed)

Statistical data gathered from current Eurex operations shows that at peak times there are approximately 250 broadcasts per second sent out to the front-ends by the Eurex back end. The duration of the peak can be more than one minute. This peak is assumed as being generated by market makers entering mass quote entries (e.g. via quote machines). It is assumed that 40% of these broadcasts are displayed.

3.5.2.2.1 CPU Load consumed by running one Instance of an Application

Visualized broadcasts per second to this machine (market activity)	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
50	57	107
100	114	213
150	171	320

200	228	426
250	285	533

3.5.2.2.2 Physical Memory consumed by running one Instance of an Application

Microsoft Windows NT (Intel) [MByte]	SUN Solaris [MByte]
150	150

3.5.2.3 JAVA Clearing GUI (@X-tract)

A Workstation or MISS that is running the JAVA Eurex Clearing GUI (@X-tract) requires CPU and memory resources in addition to those listed in the other sections of chapter 3.5. @X-tract takes advantage of multiprocessor machines.

3.5.2.3.1 CPU Load

Running the Clearing GUI on MISS or Workstation requires 80 (100 on Solaris) additional SPECint2000 on machines of Direct Clearing Members (DCMs) and Non Clearing Members (NCMs) and 120 (140 on Solaris) additional SPECint2000 on machines of General Clearing Members (GCMs).

For equity clearing only members having no broadcasts subscribed (empty eurexsublist.dat), 70 additional SPECint2000 are required. These are minimum requirements.

	Microsoft Windows NT (Intel) [SPECint2000]	SUN Solaris [SPECint2000]
DCMs and NCMs	80	100
GCMs	120	140

These figures are only valid if no ticker window is used. Otherwise the sizing of the trading GUI @X-ceed has to be considered.

3.5.2.3.2 Physical Memory consumed by running one Instance of an Application

Machines of NCMs, DCMs and GCMs require 128 MBytes of additional physical memory to run the Clearing GUI. These are minimum requirements.

Microsoft Windows NT (Intel) [Mbyte]	SUN Solaris [MByte]
128	128

3.5.3 Internet Workstation (@Eurex)

3.5.3.1 CPU Load

Concerning the Java applications (@Xceed or X-tract the internet workstation has the same CPU requirements than a standard workstation (refer to section 3.5.2.2.1 and 3.5.2.3.1). Concerning the architecture the sizing of the internet workstation requires to add the CPU requirements for the architecture processes on a standard workstation not only once, but one time for each running application (refer to section 3.5.1.2.1).

3.5.3.2 Physical Memory

Concerning the Java applications (@Xceed or X-tract the internet workstation has the same memory requirements than a standard workstation (refer to section 3.5.2.2.2 and 3.5.2.3.2). Concerning the architecture the sizing of the internet workstation requires to add the memory requirements for the architecture processes on a standard workstation not only once, but one time for each running application (refer to section 3.5.1.2.2).

3.5.3.3 Disk Space required for Installation and login on a Workstation

A certain amount of local disk space is required for an @Eurex installation. This space must be provided on the disk where the corresponding workstation file tree is located. These are the local disk requirements:

	Microsoft Windows NT (Intel) [MByte]
Workstation software	20
Internal data files [per day]	1
Java Runtime Environment	20

3.5.4 LAN

The following table shows the usage of the workstations to MISS LAN. The left column displays the maximum broadcast rate received by the workstations that are connected to a MISS group.

Broadcasts per second (market activity)	**Usage of 10 Mbps Ethernet [%]**
50	1.5
100	3.0
150	4.5
200	6.0
250	7.5
300	9.0

The load on the MISS to Router LAN is less than the one on the workstation as the traffic is less and compressed. The usage of a 10 Mbps Ethernet is recommended to connect MISSes with their routers.

3.6 Sizing Information – Xetra

3.6.1 Workstation

3.6.1.1 CPU – Workstation

CPU load is caused by running the Xetra Trading Application and architecture services (GATE). The majority of the load on the workstations is generated by market activity (e.g. order market overview updates).

Statistical data gathered from current Xetra operations shows that at peak times there are approximately 40 to 50 broadcasts per second sent out to the front-ends by the Xetra back end. The duration of the peak can be more than one minute.

In addition to the public broadcasts, each workstation needs to handle the traffic generated by orders/quotes entered by the traders in the same group. One order/quote generates approximately 1.5 broadcasts on average. In the case of 5 orders/quotes per second this results in a total of 7.5 additional broadcasts per second.

The following table shows the CPU recommendations of the Xetra workstation software for each platform:

Visualized broadcasts per second to this machine (market activity)	**IBM AIX [SPECint2000]**	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
10	11	16	11
20	19	26	19
25	25	32	25
30	30	38	30
40	40	50	40
50	51	63	51
60	61	74	61

If 30-50% of the market activity is visualized in the trading application, it is recommended to choose at least a CPU size in the light gray area. Xetra members should account for their private orders/quotes rates in addition.

Note: One slow workstation on a front-end can slow down the performance of the whole front-end connected to the same MISS group.

3.6.1.2 Physical Memory – Workstation

The main memory required for Xetra, which is provided in the next table, should be used as minimum recommendation. It is important that on workstations paging should be avoided as much as possible for maximum performance.

IBM AIX [MByte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [MByte]
96	96	96

3.6.1.3 Disk Space – Workstation

Local disk space is required for each environment (production/simulation) of a workstation. The space must be provided on the disk where the corresponding workstation file tree is located. The following table shows the disk space recommendations for one environment (production or simulation).

	IBM AIX [Mbyte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [MByte]
Workstation software	150	150	150
Swap area	500	500	500
Internal data files [per day]	50	50	50

3.6.1.4 Workstation to MISS LAN

The following table shows the usage of the workstations to MISS LAN. The left column displays the maximum broadcast rate received by the workstations that are connected to a MISS group.

Broadcasts per second to this machine (market activity)	Usage of 10 Mbps Ethernet [%]
10	1.2
20	2.4
25	3.0
30	3.6
40	4.8
50	6

3.6.2 MISS

The recommendations for CPU, memory and network depend on the activity on the machine. No instance of the Xetra Trading Application is running on the MISS. The tables present the sizing recommendations for Xetra Release 6.0.

3.6.2.1 CPU – MISS

CPU load is caused by running the BESS processes and the architecture services (GATE). The majority of the load on the MISSes is generated by market activity (orders, quotes etc.).

Statistical data gathered from current Xetra operations shows that at peak times there are approximately 40 to 50 broadcasts per second sent out to the front-ends by the Xetra back end. The duration of the peak can be more than one minute. In addition to the public broadcasts, each MISS needs to handle the traffic generated by orders/quotes entered by the traders connected to it. One order/quote generates approximately 1.5 broadcasts on average. In the case of 5 orders/quotes per second this results in a total of 7.5 additional broadcasts per second.

The following table shows the CPU recommendations of the Xetra MISS software for each platform:

Broadcasts per second to this machine (market activity)	**IBM AIX [SPECint2000]**	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
20	11	17	11
40	25	33	25
50	32	41	32
60	38	49	38
80	50	65	50

It is recommended to choose at least a CPU size in the light gray area. Xetra members should account for their private orders/quotes rates in addition.

Note: One slow MISS on a front-end can slow down the performance of the whole front-end connected to the same MISS group.

3.6.2.2 Physical Memory – MISS

The main memory required, which is provided in the next table, should be used as minimum recommendation. It is important that on excessive MISSes paging should be avoided in order to achieve maximum performance.

IBM AIX [MByte]	**Microsoft Windows NT (Intel) [MByte]**	**SUN Solaris [Mbyte]**
96	96	96

3.6.2.3 Disk Space – MISS

Local disk space is required for each environment (production/simulation) of a MISS. The space must be provided on the disk where the corresponding MISS file tree is located. The following table shows the disk space recommendations for one environment (production or simulation). The Xetra member can select which reports he wants to be delivered via the network to the MISS, therefore the space requirements for the reports depend on the trading volume and the reports selected by the Xetra member. These are estimates for one trading day.

	IBM AIX [Mbyte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [Mbyte]
MISS software	350	350	350
Swap area	500	500	500
Report files and internal files [per day]	200	200	200
Static data files	500	500	500

3.6.2.4 MISS to router LAN

The usage of a 10 Mbps Ethernet is recommended to connect the MISSes with their routers. Its load is less than the one on the workstation to MISS LAN as the traffic is less and compressed.

3.6.3 MISS running the Xetra Trading Application

The recommendations for CPU, memory and network are dependent on the activity on the machine. One instance of the Xetra Trading Application is running on the MISS. There are no workstations connected to the MISS. The configuration corresponds to the ones described in 2.5.1 Small Configuration, Normal Availability (A) and 2.5.2 Small Configuration, High Availability (B). The tables present the sizing recommendations for Xetra Release 5.

3.6.3.1 CPU

CPU load is caused by running the BESS processes, the Xetra Trading Application and the architecture services (GATE). The majority of the load on the MISS is generated by market activity (orders, quotes etc.).

The following table shows the CPU recommendations of the Xetra MISS software for each platform:

IBM AIX [SPECint2000]	Microsoft Windows NT (Intel) [SPECint2000]	SUN Solaris [SPECint2000]
36	44	36

The table assumes that of a total market activity of 50 broadcasts per second the user visualizes only 30-50% in the trading application and enters no more than 3 orders/quotes per second.

3.6.3.2 Physical Memory

The main memory required, which is provided in the next table, should be used as minimum recommendation. It is important that on MISSes paging should be avoided as much as possible for maximum performance.

IBM AIX [MByte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [Mbyte]
144	144	144

3.6.3.3 Disk Space

Local disk space is required for each MISS environment (production/simulation). The space must be provided on the disk where the corresponding MISS file tree is located. The following table shows the disk space recommendations for one environment (production or simulation). The Xetra member can select which reports he wants to be delivered via the network to the MISS, therefore the space requirements for the reports depend on the trading volume and the reports selected by the Xetra member. These are estimates for one trading day.

	IBM AIX [Mbyte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [Mbyte]
MISS software	350	350	350
Swap area	750	750	750
Report files and internal files [per day]	200	200	200
Static data files	500	500	500
Internal data files [per day]	50	50	50

3.6.3.4 MISS to router LAN

See 3.6.2.4 MISS to router LAN.

3.6.3.5 Warrant Trading (CAQ) – Sizing for Issuers MISS

With the introduction of Release 4.0, the continuous auction trading model has been realized for electronic warrant trading on Xetra. The functionality required for the limit surveillance is integrated in the Xetra MISS software. The limit surveillance functionality checks the public quotes and auction quotes entered by the issuers for potential executability through a query of the order book situation (cf. Market Model Warrants).

This chapter provides sizing recommendations on the basis of the Xetra Release 6.0 software version. We reserve the right to adjust these recommendations on the grounds of future test results. From these sizing guidelines, necessary technical capacities (SPECint2000, memory, necessary hard disk space) of MISS computers are derived from a given information load (quotes per second).

The stated figures only apply for the issuers limit control requirements. For determination of the necessary hardware sizing the following factors which influence the utilization of the system have to be considered:

- Quoting rate on issuer´s MISS
- Other activities (e.g. order entries)
- In-house applications and/or third-party applications

The recommended figures need to be considered in conjunction with the figures of the general sizing guideline recommendations which can be evaluated using this document.

3.6.3.5.1 CPU requirements

Quotes per second	**IBM AIX [SPECint2000]**	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
50	32	24	14
100	57	52	32
150	81	80	50
200	107	109	67

Please note that the hard disk subsystem used under the respective system and the network interface may influence the obtainable quoting rate.

3.6.3.5.2 Memory usage

Surveillance control on the issuers MISS requires approx. 60 byte memory per traded warrant.

Example: Active quoting for approx. 1000 warrants requires approx. 64 k memory.

3.6.3.5.3 Hard Disk Space

Each public quote, which is written in a file on the issuers MISS requires approx. 45 byte, each auction quote requires approx. 70 byte.

Example: the issuer quotes for the duration of 8 hours with a frequency of 50 quotes/second (public quotes), and each of these quotes is written in the file:

50 Quotes/sec * 45 bytes = 2250 bytes/sec = 8,1 MB/h = 64,8 MB/d,

i. e. a daily disk space of 70 MB should be available.

Additional space for auction quotes is required.

3.6.4 Internet Workstation (@Xetra)

3.6.4.1 CPU Load

The @Xetra internet workstation has the following CPU requirements:

Microsoft Windows NT (Intel) [SPECint2000]	SUN Solaris (Sparc) [SPECint2000]
175	141

3.6.4.2 Physical Memory

The main memory requirements for @Xetra, which are provided in the following table, should be gauged as the absolute minimum. It is important that on an @Xetra Client Workstation paging should be avoided as much as possible for maximum performance. For this reason that 256 Mbytes of memory is required as the standard configuration.

Microsoft Windows NT (Intel)	SUN Solaris (Sparc)
256 Mbytes (recommended 512 Mbytes)	256 Mbytes (recommended 512 Mbytes)

3.6.4.3 Disk Space required for Installation and login on a Workstation

A certain amount of local disk space is required for an @Xetra installation. This space must be provided on the disk where the corresponding workstation file tree is located. These are the local disk requirements:

	Microsoft Windows NT (Intel) [MByte]
Workstation software	20
Internal data files [per day]	1
Java Runtime Environment	20

3.7 Sizing Information – Xetra Vienna

3.7.1 Workstation

3.7.1.1 CPU – Workstation

CPU load is caused by running the Xetra Vienna Trading Application and architecture services (GATE). The majority of the load on the workstations is generated by market activity (e.g. order market overview updates).

Statistical data gathered from current Xetra Vienna operations shows that at peak times there are approximately 10 to 15 broadcasts per second sent out to the front-ends by the Xetra Vienna back end. The duration of the peak can be more than one minute.

In addition to the public broadcasts, each workstation needs to handle the traffic generated by orders/quotes entered by the traders in the same group. One order/quote generates approximately 1.5 broadcasts on average. In the case of 5 orders/quotes per second this results in a total of 7.5 additional broadcasts per second.

The following table shows the CPU recommendations of the Xetra Vienna workstation software for each platform:

Visualized broadcasts per second to this machine (market activity)	**IBM AIX [SPECint2000]**	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
5	9	11	9
7.5	10	14	10
10	11	16	11
15	14	21	14
20	19	26	19
25	25	29	25

If 30-50% of the market activity is visualized in the trading application, it is recommended to choose at least a CPU size in the light gray area. Xetra Vienna members should account for their private orders/quotes rates in addition.

Note: One slow workstation on a front-end can slow down the performance of the whole front-end connected to the same MISS group.

3.7.1.2 Physical Memory – Workstation

The main memory required for Xetra Vienna, which is provided in the next table, should be used as minimum recommendation. It is important that on workstations paging should be avoided as much as possible for maximum performance.

IBM AIX [MByte]	**Microsoft Windows NT (Intel) [MByte]**	**SUN Solaris [MByte]**
96	96	96

3.7.1.3 Disk Space – Workstation

Local disk space is required for each environment (production/simulation) of a workstation. The space must be provided on the disk where the corresponding workstation file tree is located. The following table shows the disk space recommendations for one environment (production or simulation).

	IBM AIX [Mbyte]	**Microsoft Windows NT (Intel) [MByte]**	**SUN Solaris [MByte]**
Workstation software	150	150	150
Swap area	500	500	500
Internal data files [per day]	50	50	50

3.7.1.4 Workstation to MISS LAN

The following table shows the usage of the workstations to MISS LAN. The left column displays the maximum broadcast rate received by the workstations that are connected to a MISS group.

Broadcasts per second to this machine (market activity)	**Usage of 10 Mbps Ethernet [%]**
5	0.6
10	1.2
15	1.8
20	2.4
25	3

3.7.2 MISS

The recommendations for CPU, memory and network depend on the activity on the machine. No instance of the Xetra Vienna Trading Application is running on the MISS. The tables present the sizing recommendations for Xetra Vienna Release 6.0.

3.7.2.1 CPU – MISS

CPU load is caused by running the BESS processes and the architecture services (GATE). The majority of the load on the MISSes is generated by market activity (orders, quotes etc.).

Statistical data gathered from current Xetra Vienna operations shows that at peak times there are approximately 10 to 15 broadcasts per second sent out to the front-ends by the Xetra Vienna back end. The duration of the peak can be more than one minute.). In addition to the public broadcasts, each MISS needs to handle the traffic generated by orders/quotes entered by the traders connected to it. One order/quote generates approximately 1.5 broadcasts on average. In the case of 5 orders/quotes per second this results in a total of 7.5 additional broadcasts per second.

The following table shows the CPU recommendations of the Xetra Vienna MISS software for each platform:

Broadcasts per second to this machine (market activity)	**IBM AIX [SPECint2000]**	**Microsoft Windows NT (Intel) [SPECint2000]**	**SUN Solaris [SPECint2000]**
5	4	5	4
10	6	9	6
15	8	13	8
20	11	17	11
25	14	21	14

It is recommended to choose at least a CPU size in the light gray area. Xetra Vienna members should account for their private orders/quotes rates in addition.

Note: One slow MISS on a front-end can slow down the performance of the whole front-end connected to the same MISS group.

3.7.2.2 Physical Memory – MISS

The main memory required, which is provided in the next table, should be used as minimum recommendation. It is important that on MISSes paging should be avoided as much as possible for maximum performance.

IBM AIX [MByte]	**Microsoft Windows NT (Intel) [MByte]**	**SUN Solaris [Mbyte]**
96	96	96

3.7.2.3 Disk Space – MISS

Local disk space is required for each environment (production/simulation) of a MISS. The space must be provided on the disk where the corresponding MISS file tree is located. The following table shows the disk space recommendations for one environment (production or simulation). The Xetra Vienna member can select which reports he wants to be delivered via the network to the MISS, therefore the space requirements for the reports depend on the trading volume and the reports selected by the Xetra Vienna member. These are estimates for one trading day.

	IBM AIX [Mbyte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [Mbyte]
MISS software	350	350	350
Swap area	500	500	500
Report files and internal files [per day]	200	200	200
Static data files	500	500	500

3.7.2.4 MISS to router LAN

The usage of a 10 Mbps Ethernet is recommended to connect the MISSes with their routers. Its load is less than the one on the workstation to MISS LAN as the traffic is less and compressed.

3.7.3 MISS running the Xetra Trading Application

The recommendations for CPU, memory and network depend on the activity on the machine. One instance of the Xetra Vienna Trading Application is running on the MISS. There are no workstations connected to the MISS. The configuration corresponds to the ones described in 2.5.1 Small Configuration, Normal Availability (A) and 2.5.2 Small Configuration, High Availability (B). The tables present the sizing recommendations for Xetra Vienna.

3.7.3.1 CPU

CPU load is caused by running the BESS processes, the Xetra Vienna Trading Application and the architecture services (GATE). The majority of the load on the MISS is generated by market activity (orders, quotes etc.).

The following table shows the CPU recommendations of the Xetra Vienna MISS software for each platform:

IBM AIX [SPECint2000]	Microsoft Windows NT (Intel) [SPECint2000]	SUN Solaris [SPECint2000]
12	16	12

The table assumes that of a total market activity of 15 broadcast per second the user visualizes only 30-50% in the trading application and enters no more than 3 orders/quotes per second.

3.7.3.2 Physical Memory

The main memory required, which is provided in the next table, should be used as minimum recommendation. It is important that excessive MISSes paging should be avoided in order to achieve maximum performance.

IBM AIX [MByte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [Mbyte]
144	144	144

3.7.3.3 Disk Space

Local disk space is required for each MISS environment (production/simulation). The space must be provided on the disk where the corresponding MISS file tree is located. The following table shows the disk space recommendations for one environment (production or simulation). The Xetra Vienna member can select which reports he wants to be delivered via the network to the MISS, therefore the space requirements for the reports depend on the trading volume and the reports selected by the Xetra Vienna member. These are estimates for one trading day.

	IBM AIX [Mbyte]	Microsoft Windows NT (Intel) [MByte]	SUN Solaris [Mbyte]
MISS software	350	350	350
Swap area	750	750	750
Report files and internal files [per day]	200	200	200
Static data files	500	500	500
Internal data files [per day]	50	50	50

3.7.3.4 MISS to router LAN

See 3.6.2.4 MISS to router LAN.

3.8 Sizing Examples

This section contains examples, how to size the platforms for various combinations of trading software. Only a few of all possible combinations of services are listed.

3.8.1 Eurex only

Workstation running GATE with 250 broadcasts per second and the Java Eurex Trading Application (@Xceed). The Member generates 10 own orders per second (=25 additional broadcasts). The value 275 broadcasts per second is not contained in the tables. We have to interpolate between 250 and 300 broadcasts per second to obtain the values for GATE.

The Eurex trading application visualizes only 40% as assumed. (100 broadcasts per second visualized + 25 broadcasts per second as a result of own orders = 125 broadcasts)

Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Eurex requirement	850
GATE	24	GATE	32		
@Xceed	266,5	@Xceed	150		
Total	310,5	Total	214	Total	850

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Eurex requirement	850
GATE	33	GATE	32		
@Xceed	142,5	@Xceed	64		
Total	205,5	Total	128	Total	850

Workstation running X-tract (only NCM or DCM). The X-tract software is included in the Eurex installation. Disk space requirement is therefore the same as for Eurex.

Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Eurex requirement	850
GATE (250 bc/sec)	23	GATE	32		
X-tract	100	Eurex requirement	128		
Total	143	Total	192	Total	850

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Eurex requirement	850
GATE (250 bc/sec)	30	GATE	32		
X-tract	80	Eurex requirement	128		
Total	140	Total	192	Total	850

MISS running Eurex- Market (Production) with 250 broadcasts per second (No instance of the Eurex trading application is running). The Member generates of 10 own orders per second wich causes the MISS to transport aproximately 25 additional broadcasts per second. The value of 275 broadcasts per second is not contained in the table. We have to interpolate between 250 and 300 broadcasts per second.

Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Eurex requirement	1550
GATE + BESS	36,5	GATE + BESS	128		
Total	56,5	Total	160	Total	1550

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Eurex requirement	1550
GATE + BESS	52,5	GATE + BESS	96		
Total	82,5	Total	128	Total	1550

3.8.2 Xetra only

Workstation running Xetra-Market (Production) visualize 50% of a supposed total market activity of 50 broadcasts per second (= 25 broadcasts per second) + 3 orders per second from all workstations in the same group (= 5 broadcasts per second) = 30 broadcasts per second.

IBM AIX and Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	700
Market Activity + own orders	30	Xetra requirement	96		
Total	50	Total	128	Total	700

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	700
Market Activity + own orders	38	Xetra requirement	96		
Total	68	Total	128	Total	700

Workstation running Xetra-Market (Production) visualize 100% of a supposed total market activity of 50 broadcasts per second + 3 orders per second from all workstations in the same group (= 5 broadcasts per second) = 55 broadcasts per second. Since the value of 55 broadcasts is not included in the table, we have to interpolate between 50 and 60 broadcasts.

IBM AIX and Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	700
Market Activity + own orders	56	Xetra requirement	96		
Total	76	Total	128	Total	700

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	700
Market Activity + own orders	69	Xetra requirement	96		
Total	99	Total	128	Total	700

MISS running Xetra- Market (Production) with 50 broadcasts per second (No instance of the Xetra trading application is running). The Member generates 3 own orders per second wich causes the MISS to transport aproximately 5 additional broadcasts per second. (total = 55 broadcasts per second). Since the value of 55 broadcasts is not included in the table, we have to interpolate between 50 and 60 broadcasts.

IBM AIX and Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	1550
Market Activity + own orders	35	Xetra requirement	96		
Total	55	Total	128	Total	1550

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	1550
Market Activity + own orders	45	Xetra requirement	96		
Total	75	Total	128	Total	1550

3.8.3 Xetra and Xetra Vienna

Workstation running Xetra-Market (Production) visualize 50% of a supposed total market activity of 50 broadcasts per second (= 25 broadcasts per second) + 3 orders per second from all workstations in the same group (= 5 broadcasts per second) = 30 broadcasts per second.

Workstation running also Xetra Vienna-Market (Production) visualize 50% of a supposed total market activity of 15 broadcasts per second (= 7.5 broadcasts per second) + 3 orders per second from all workstations in the same group (= 5 broadcasts per second) = 12.5 broadcasts per second. Since the value of 12.5 broadcasts per second is not contained in the table, we have to interpolate between 10 and 15 broadcasts per second.

IBM AIX and Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	700
Market Activity + own orders Xetra	30	Xetra requirement	96	Xetra Vienna requirement	700
Market Activity + own orders Xetra Vienna	12,5	Xetra Vienna requirement	96		
Total	62,5	Total	224	Total	1400

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	700
Market Activity + own orders Xetra	38	Xetra requirement	96	Xetra Vienna requirement	700
Market Activity + own orders Xetra Vienna	18,5	Xetra Vienna requirement	96		
Total	86,5	Total	224	Total	1400

MISS running Xetra-Market (Production) with 50 broadcasts per second (No instance of the Xetra trading application is running). The Member generates 3 own orders per second wich causes the MISS to transport aproximately 5 additional broadcasts per second. (total = 55 Broadcasts per second) Since the value of 55 broadcasts per second is not contained in the table, we have to interpolate between 50 and 60 broadcasts per second

MISS running also Xetra Vienna-Market (Production) with 15 broadcasts per second (No instance of the Xetra trading application is running). The Member generates 3 own orders per second wich causes the MISS to transport aproximately 5 additional broadcasts per second. (total = 20 Broadcasts per second)

IBM AIX and Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	1550
Market Activity + own orders Xetra	35	Xetra requirement	96	Xetra Vienna requirement	1550
Market Activity + own orders Xetra Vienna	11	Xetra Vienna requirement	96		
Total	66	Total	224	Total	3100

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	1550
Market Activity + own orders Xetra	45	Xetra requirement	96	Xetra Vienna requirement	1550
Market Activity + own orders Xetra Vienna	17	Xetra Vienna requirement	96		
Total	92	Total	224	Total	3100

3.8.4 Xetra and Eurex

Workstation running Xetra-Market (Production) visualize 50% of a supposed total market activity of 50 broadcasts per second (= 25 broadcasts per second) + 3 orders per second from all workstations in the same group (= 5 broadcasts per second) = 30 broadcasts per second.

Also running GATE with 250 broadcasts per second and the Eurex Trading Application (@Xceed). The Member generates 10 own orders per second (=25 additional broadcasts). The value 275 broadcasts per second is not contained in the tables. We have to interpolate between 250 and 300 broadcasts per second to obtain the values for GATE.

The Eurex trading application visualizes only 40% as assumed. (100 broadcasts per second visualized + 25 broadcasts per second as a result of own orders = 125 bc/sec)

The GATE part of physical memory is included in the Xetra value and must not be added for Eurex, because GATE is only used once.

Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	700
Market Activity + own orders Xetra	30	Xetra requirement, requirements for GATE are subtracted.	96	Eurex requirement	850
Market Activity + own orders Eurex (Sum of GATE and appl.)	290,5		150		
		Eurex requirement	32		
		GATE			
Total	340,5	Total	310	Total	1550

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	700
Market Activity + own orders Xetra	38	Xetra requirement, requirements for GATE are subtracted.	96	Eurex requirement	850
Market Activity + own orders Eurex	175,5		150		
		Eurex requirement	32		
		GATE			
Total	243,5	Total	192	Total	1550

MISS running Xetra-Market (Production) with 50 broadcasts per second (No instance of the Xetra trading application is running). The Member generates 3 own orders per second wich causes the MISS to transport aproximately 5 additional broadcasts per second. (total = 55 Broadcasts per second) Since the value of 55 broadcasts per second is not contained in the table, we have to interpolate between 50 and 60 broadcasts per second

MISS running also Eurex-Market (Production) with 250 broadcasts per second (No instance of the Eurex trading application is running). The Member generates 10 own orders per second wich causes the MISS to transport aproximately 25 additional broadcasts per second. (total = 275 Broadcasts per second)
The value of 275 broadcasts per second is not contained in the table. We have to interpolate between 250 and 300 broadcasts per second.

The Xetra value for physical memory can be used as it is, because the main part of this values is caused by the BESS. Two BESSes are running one for Xetra and and one for Eurex.

Sun Solaris

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	20	General Load	32	Xetra requirement	1550
Market Activity + own orders Xetra	35	Xetra requirement	96	Eurex requirement	1550
Market Activity + own orders Eurex	36,5	Eurex requirement	128		
Total	91,5	Total	256	Total	3100

Microsoft WindowsNT

CPU Load (SPECint2000)		Physical Memory (Mbyte)		Disk Space (Mbyte)	
General Load	30	General Load	32	Xetra requirement	1550
Market Activity + own orders Xetra	45	Xetra requirement	96	Eurex requirement	1550
Market Activity + own orders Eurex	52,5	Eurex requirement	96		
Total	127,5	Total	224	Total	3100

4 Appendix

4.1 Supported Software Configurations

4.1.1 Detailed Requirement Specification

4.1.1.1 Operating System Versions

The next tables show the software versions and patches supported for the front-end configuration. The PAL (Portable Abstraction Layer) run time library required by the front-end architecture or GUI as well as a Perl interpreter required for the operations procedures are contained in the installation kits for the MISS and workstation software. For Gate 3.0 and Solaris 8, the Solaris pre-installed Perl is used.

The Java GUIs (@X-tract, @Xceed) require a JAVA runtime Environment. For SUN Solaris and Microsoft Windows NT this environment is included in the installation kit.

Software	IBM AIX	Microsoft Windows NT (Intel)	SUN Solaris
Miss and Workstation	IBM AIX 4.3.3 (English version) not supported for Eurex	MS Windows NT (Intel) Workstation 4.0 (English version)	Sun Solaris 8 (English version) Sun Solaris 2.6 still supported for Xetra 6.0
Internet Workstation	-	MS Windows NT (Intel) Workstation 4.0 (English version)	Sun Solaris 2.6 (English version) @Xetra only

4.1.1.2 Patch levels for IBM AIX

Based on the IBM AIX Release 4.3.3 no additional patches are required.

4.1.1.3 Patch levels for SUN Solaris 2.6 (Xetra 6.1 only)

The supported version of the Sun Solaris operating system is version 2.6 HW5/98 with the following patches (or higher versions) installed additionally:

Package	Patch ID#
SunOS 5.6: kernel update patch	105181-21
SunOS 5.6: libc & watchmalloc patch	105210-27
SunOS 5.6: /usr/sbin/rpcbind patch	105216-03
SunOS 5.6: sbus driver patch	105222-03
SunOS 5.6: pln/soc drivers & ssafirmware patch	105223-05

Package	Patch ID#
Motif 1.2.7: Runtime library patch	105284-34
SunOS 5.6: /kernel/drv/ssd patch	105356-07
SunOS 5.6: /kernel/drv/ses patch	105357-02
SunOS 5.6: BCP patch	105377-03
SunOS 5.6: /kernel/misc/nfssrv patch	105379-05
SunOS 5.6: SGML Manual Pages Patch	105390-02
SunOS 5.6: at & cron utility patch	105393-07
SunOS 5.6: /usr/lib/sendmail patch	105395-03
SunOS 5.6: /usr/sbin/passmgmt patch	105397-02
SunOS 5.6: Greek keyboard layout incorrect on Sparc	105400-02
SunOS 5.6: libnsl and NIS+ commands patch	105401-16
SunOS 5.6: ypbind/ypserv patch	105403-02
SunOS 5.6: libcurses.a & libcurses.so.1 patch	105405-02
SunOS 5.6: /usr/bin/volrmmount patch	105407-01
SunOS 5.6: /usr/lib/acct/acctdisk patch	105416-01
SunOS 5.6: /etc/init.d/asppp patch	105421-01
SunOS 5.6: /usr/lib/libtnfprobe.so.1 patch	105426-01
SunOS 5.6: /usr/lib/autofs/automountd patch	105472-06
SunOS 5.6: /kernel/fs/hsfs patch	105486-04
SunOS 5.6: linker patch	105490-07
SunOS 5.6: cgsix driver patch	105492-02
SunOS 5.6: /usr/lib/fs/ufs/fsck patch	105516-01
SunOS 5.6: /kernel/drv/be patch	105528-01
SunOS 5.6: /kernel/drv/tcp patch	105529-05
SunOS 5.6: /usr/sbin/rpc.nisd_resolv patch	105552-02
SunOS 5.6: chkey and keylogin patch	105562-03
SunOS 5.6: /kernel/misc/rpcsec patch	105564-03
SunOS 5.6: /usr/lib/libthread.so.1 patch	105568-17
SunOS 5.6: /kernel/fs/ufs patch	105572-07
SunOS 5.6: /kernel/drv/glm patch	105580-08
SunOS 5.6: Shared library patch for C++	105591-02
SunOS 5.6: /kernel/drv/isp patch	105600-07
SunOS 5.6: ebus/pci/rootnex driver patch	105604-05
SunOS 5.6: /usr/lib/nfs/mountd patch	105615-04
SunOS 5.6: libbsm patch	105621-09

Package	Patch ID#
SunOS 5.6: /usr/bin/fncreate_printer patch	105623-01
SunOS 5.6: OpenWindows 3.6:Xsun patch	105633-41
SunOS 5.6: /usr/lib/power/powerd patch	105637-01
SunOS 5.6: prtdiag patch	105642-05
SunOS 5.6: ac/environ/fhc/sysctrl driver patch	105651-08
SunOS 5.6: driver_aliases/driver_classes/name_to_major patch	105654-03
SunOS 5.6: /usr/bin/login patch	105665-03
SunOS 5.6: /usr/bin/rdist patch	105667-02
CDE 1.2: libDtSvc Patch	105669-10
SunOS 5.6: Cachefs patch	105693-05
SunOS 5.6: /usr/kernel/drv/audiocs patch	105705-02
SunOS 5.6: /usr/bin/su patch	105718-02
SunOS 5.6: /kernel/fs/nfs patch	105720-06
SunOS 5.6: /usr/lib/fs/ufs/ufsdump patch	105722-01
SunOS 5.6: /usr/lib/fs/ufs/ufsrestore patch	105724-01
SunOS 5.6: /kernel/drv/ecpp patch	105741-05
SunOS 5.6: /kernel/drv/le patch	105742-03
SunOS 5.6: /usr/lib/libxfn.so.2 patch	105743-01
SunOS 5.6: /usr/bin/cpio patch	105746-01
SunOS 5.6: libresolv, in.named, named-xfer, nslookup, nstest patch	105755-07
SunOS 5.6: /usr/bin/echo patch	105757-01
SunOS 5.6: /kernel/fs/specfs patch	105778-01
SunOS 5.6: /kernel/fs/fifofs patch	105780-01
SunOS 5.6: /kernel/drv/ip patch	105786-07
SunOS 5.6: /usr/sbin/tar patch	105792-03
SunOS 5.6: /kernel/drv/hme patch	105795-05
SunOS 5.6: /kernel/drv/sd patch	105797-05
SunOS 5.6: sun4m, sun4u & sun4u1 cprboot patch	105798-03
SunOS 5.6: /usr/bin/admintool, y2000 patch	105800-05
SunOS 5.6: /kernel/drv/qe patch	105836-03
SunOS 5.6: /kernel/drv/st.conf patch	105847-01
SunOS 5.6: /usr/sbin/tapes patch	105867-01
SunOS 5.6: libspmisoft.so.1 patch for upgrade	105874-01
SunOS 5.6: devlink.tab/iu.ap/minor_perm & se driver patch	105924-05
SunOS 5.6: /usr/sbin/static/tar patch	105926-01

Package	Patch ID#
SunOS 5.6: /usr/bin/xargs patch	105953-01
SunOS 5.6: /usr/kernel/strmod/ppp patch	105959-01
SunOS 5.6: /usr/sbin/rwall patch	105988-01
SunOS 5.6: vi/ex/edit/view/vedit patch	105990-01
SunOS 5.6: POINT PATCH: 4074114 - bugfix for /kernel/strmod/ms	106017-01
SunOS 5.6: /usr/ccs/bin/make patch	106029-01
SunOS 5.6: /usr/bin/getopt patch	106035-01
SunOS 5.6: X Input & Output Method patch	106040-13
SunOS 5.6: /usr/lib/nss_nisplus.so.1 patch	106044-01
SunOS 5.6: /usr/sbin/in.telnetd patch	106049-01
SunOS 5.6: sgml patch	106123-02
SunOS 5.6: Patch for patchadd and patchrm	106125-05
SunOS 5.6: /usr/bin/mkdir patch	106141-01
SunOS 5.6: in.dhcpd and pntadm patch	106150-02
SunOS 5.6: Jumpstart install fails searching for profile()	106152-01
SunOS 5.6 HW398: Jumpstart install fails searching for profile()	106154-01
SunOS 5.6: dma driver patch	106168-02
SunOS 5.6: sbusmem driver patch	106169-02
SunOS 5.6: /kernel/drv/esp patch	106170-03
SunOS 5.6: /kernel/drv/lebuffer patch	106171-01
SunOS 5.6: /kernel/drv/fas patch	106172-04
SunOS 5.6: /kernel/misc/scsi patch	106173-03
SunOS 5.6: cfgadm utility & libraries	106183-04
SunOS 5.6: y2000 sysid unzip patch	106193-03
SunOS 5.6: /platform/sun4u/kernel/drv/envctrl patch	106216-02
SunOS 5.6: luxadm.1m Manual Page Patch	106219-02
SunOS 5.6: /usr/sbin/format patch	106226-01
SunOS 5.6: lp patch	106235-02
SunOS 5.6: /usr/lib/libpam.so.1 patch	106257-04
SunOS 5.6: Manual Pages Patch for ffbconfig.1m	106260-01
SunOS 5.6: Manual Pages Patch cfgadm.1m config_admin.3x libcfgadm.4	106261-01
SunOS 5.6: Manual Pages Patch for qfe.7d	106262-01
SunOS 5.6: /usr/lib/security/pam_unix.so.1 patch	106271-04
SunOS 5.6: /kernel/sys/msgsys patch	106285-01
SunOS 5.6: pkgadd/pkginstall & related utilities	106292-02

Package	Patch ID#
SunOS 5.6: /usr/sbin/in.ftpd patch	106301-01
SunOS 5.6: /usr/lib/netsvc/yp/rpc.yppasswdd patch	106303-01
SunOS 5.6: upgrade_script terminated abnormally during upgrade	106317-01
SunOS 5.6: /etc/inet/services patch	106323-01
SunOS 5.6: csh/jsh/ksh/rksh/rsh/sh patch	106361-04
SunOS 5.6: /platform/sun4u1/kernel/drv/cvc patch	106381-03
SunOS 5.6: /usr/bin/localedef patch	106388-01
SunOS 5.6: patch for ide and atapi misc. fixes	106407-03
SunOS 5.6: Fixes the Chinese True Type fonts	106409-01
SunOS 5.6: /kernel/drv/mm patch	106429-01
SunOS 5.6: /usr/kernel/drv/pm patch	106435-01
SunOS 5.6: /usr/sbin/syslogd patch	106439-02
SunOS 5.6: /usr/sbin/ping patch	106448-01
SunOS 5.6: /usr/sbin/df & /usr/xpg4/bin/df patch	106466-01
SunOS 5.6: /kernel/fs/autofs patch	106471-01
SunOS 5.6: truss & truss support library patch	106495-01
SunOS 5.6: Manual Pages Patch for ldap	106497-01
SunOS 5.6: /platform/SUNW,Ultra-250/kernel/drv/envctrltwo patch	106504-01
SunOS 5.6: /usr/bin/cat patch	106507-01
SunOS 5.6: /usr/bin/ftp patch	106522-01
SunOS 5.6: bad iso-2022-cn string cause crash in iconv problem	106556-01
SunOS 5.6: /usr/sbin/aspppd patch	106561-01
SunOS 5.6: libauth.a & libauth.so.1 patch	106569-01
SunOS 5.6: /usr/lib/nfs/statd patch	106592-01
SunOS 5.6: Japanese UTF-8 iconv patch	106613-01
SunOS 5.6: bad iso-2022-cn string cause crash in iconv problem	106618-01
SunOS 5.6: /kernel/strmod/rpcmod patch	106639-02
SunOS 5.6: /usr/lib/fs/nfs/mount patch	106641-01
SunOS 5.x: rpc.pcnfsd accepting "." as printer name fix	106646-01
SunOS 5.6: /usr/lib/netsvc/rstat/rpc.rstatd patch	106651-01
SunOS 5.6: /usr/lib/sa/sadc patch	106653-01
SunOS 5.6: iostat/mpstat/vmstat patch	106655-01
SunOS 5.6: /usr/lib/libposix4.so.1 patch	106797-01
SunOS 5.6: /usr/bin/dc patch	106808-01
SunOS 5.6: /usr/sbin/sar patch	106818-01

Package	Patch ID#
SunOS 5.6: /usr/bin/date patch	106828-01
SunOS 5.6: Feature patch for Euro currency support	106842-03
SunOS 5.6: /etc/cron.d/logchecker patch	106863-01
SunOS 5.6: /usr/lib/nfs/nfsd patch	106882-01
The PC Card are not recognized in Ultra5_10	106901-01
SunOS 5.6: /usr/sbin/uadmin patch	106929-01
SunOS 5.6: /usr/ucb/ucblinks patch	106994-01
SunOS 5.6: Ejecting a cdrom when still accessing causes panics	107068-01
SunOS 5.6: /usr/lib/fs/ufs/quota patch	107099-01
SunOS 5.6: Linker Patch	107733-08
SunOS 5.6: ssJDK1.2.1_03 fails with fatal error in ISO8859-01 Locales	108091-03
SunOS 5.6: multiple xterm fixes	105464-01
OpenWindows 3.6: printtool patch	105497-01
OpenWindows 3.6: Xcms patch	105618-01
OpenWindows 3.6: Xsun patch	105633-14
OpenWindows 3.6: ToolTalk patch	105802-07
OpenWindows 3.6: mp fails to set correct A4 paper size information	106138-01
OpenWindows 3.6: filemgr (ff.core) fixes	106222-01
OpenWindows 3.6: Xview Patch	106331-03
OpenWindows 3.6: libXext patch	106404-01
OpenWindows 3.6: w returns wrong login user number in xdm	106415-01
OpenWindows 3.6: libce suid/sgid security fix	106648-01
OpenWindows 3.6: libdesksetpatch	106649-01
OpenWindows 3.6: mailtool attachment security patch	106650-03
OpenWindows 3.6: Keytables patch	106841-01
OpenWindows 3.6: fstobdf core dumps with 2-byte fonts	106957-01
CDE 1.2: dtterm libDtTerm.so.1 patch	105160-07
CDE 1.2: dtmail patch	105338-14
CDE 1.2: dtpad patch	105558-03
CDE 1.2: calendar manager patch	105566-05
CDE 1.2: libDtWidget patch	105630-01
CDE 1.2: dtwm patch	105634-05
CDE 1.2: dtlogin patch	105703-07
CDE 1.2: dtappgather Patch	105837-02
CDE 1.2 sdtfprop: patch for group permissions	106025-01

Package	Patch ID#
CDE 1.2 dtsession: patch for screenlock	106027-02
CDE 1.2: dtfile patch	106112-02
CDE 1.2: libDtHelp.so.1 fixes	106242-01
CDE 1.2: sdtimage fixes	106267-02
CDE 1.2: Print Manager Patch	106437-01
CDE 1.2: Actions patch	106660-02
Creator 2.6: FFB Graphics Patch	105360-20
VIS/XIL 2.6: Graphics Patch	105361-07
PGX 2.6: M64 Graphics Patch	105362-16

4.1.1.4 Patch levels for SUN Solaris 8

The supported version of the Sun Solaris operating system is version 8 HW10/00, 04/01 or higher with the following patches (or higher versions) installed additionally:

Patch ID#
108652-31
108921-07
108940-12

4.1.1.5 Patch levels for Windows NT (Intel)

The supported version of the Microsoft Windows NT (Intel platform) operating system is Version 4 Service Pack 5 with no additional patches installed.

4.2 Requirements for Internet Workstations

4.2.1 Network Specifications

If a connection is to be made over the LAN via a proxy server or a firewall then the following settings need to be adhered to:

Port to be open for: • Proxy Server • Firewall • Internet Service Provider's Proxy Server and Firewall	443 Please ensure that the ports are CHECKED and TESTED THOROUGHLY before installation.
Deutsche Börse IP address Simulation SSL Server	 193.29.78.41
Deutsche Börse IP address Production SSL Server 1 SSL Server 2	 193.29.78.40 193.29.78.41

Helpful Hints

Below are sugestions which will assist in verifying a successful proxy server connection:

- If the connection through a firewall uses only Network Address Translation (NAT), then the routing within the client's network must be configured with default settings or the host route needs to be set to one of the specified IP addresses.
- If SSL proxy is being used on the firewall, it can be assumed that the encrypted packet's handover is transparent, resulting behind the firewall not being able to see the destination. If this is the case, then the installer / network engineer will need to modify the proxy's and firewall's configurations as above.
- In both of the cases above, connection verification can be checked by executing the "trace route" (TRACERT) command from one of the SSL IP addresses referenced above.
- If access is done via an internal proxy server (Netscape, Squid etc.), the SSL server connection must be verified either by pinging or using the "TRACERT" command from the client's PC.
- It is also possible to test the connection by using the Internet sites - "https:www.fileservice.de". If this does not work then the network engineer will need to trace the connection from the Client Workstation to the proxy server and/or to the firewall. The proxy server needs to be configured as explained above. Authorized members should already have the appropriate User Login and Password (If not, please follow the registration instructions on the web page).

4.2.2 Display

A screen resolution of 1024 x 768 pixels with 65536 colors is required, however a resolution of 1280 x 1024 pixels with 65536 color is recommended.

4.2.3 Internet Access Requirements

The Internet Workstation must be connected to the internet (e.g. via modem, ISDN or Proxy) with a minimum bandwidth of 33.6 kbit/s.

However, the exclusive use of a single 64 kbit/s ISDN line or better is highly recommended.

For @Eurex the minimum bandwidth requirement is 64 kbit/s.

4.2.4 Smart Card Reader (Serial Interface)

The Smart Card Reader (delivered with the client package) will be connected to a free RS232 serial port and the PS2 (keyboard) interface of the Workstation. For the SUN Microsystems Kit a separate power adapter is supplied along with the Smart Card Reader.

Description:
Pure Java Smart Card Reader with numeric pin pad from SCM Microsystems.
Model: RSR P Java plus numeric pin pad.

4.3 Router

The table shows the recommended router.

Router Recommendations	Product Number	Product Name
Router for IP protocol support	Cisco2610 S26C-12.1.1a or higher WIC-1T CAB-X21MT For internet connection only: S26CK2-12.0.7T MEM2600-24U40D MEM2600-U816FS	1 Ethernet Modular Router Cisco 2600 Series IOS IP 1-Port Serial WAN Interface Card X.21 Cable, DTE, Male, 10 Feet Cisco 2600 Series IOS IP PLUS IPSEC 3DES, Firewall optional 24 to 40 MB DRAM Factory Upgrade 8 to 16 MB Flash Factory Upgrade

The router CISCO 2610 is the recommended router type because of its improved fail over functionality (HSRP, Hot Standby Routing Protocol). IOS Version 12.1(1) should not be used because of a bug that affects the transfer of files using FTP. The problem in IOS Version 12.1(1) is resolved with release 12.1(1)a and above.

The formerly recommended router CISCO Series 36nn is also fully supported. CISCO Series 25nn will still be supported.

Router also supported for connections via leased lines	Product Number	Product Name
Router for IP protocol support	Cisco3620 S362C-11.3(6) *or higher* NM-1E2W WIC-1T CAB-X21MT For internet connection only: S362CK2-12.0.7T S364AK2-12.0.7T S366CK2-12.0.7T MEM3620-32U48D MEM3640-32U48D MEM3660-32U64D MEM3600-8U16FS	2-Slot Modular Router-AC Cisco 3620 Series IOS IP only Feature Set 1 Ethernet 2 WAN Card Slot Network Module 1-Port Serial WAN Interface Card X.21 Cable, Male, 10 Feet Cisco 3600 Series IOS IP PLUS IPSEC 3DES, Firewall optional 24 to 48/64 MB DRAM Factory Upgrade 8 to 16 MB Flash Factory Upgrade

CISCO Systems routers greater than Series 36nn are oversized (but allowed).

The following table shows new router models which are supported for all access methods:

Router Recommendations	Product Number	Product Name
Router for IP protocol support	CISCO1720 S17C-1215T5 WIC-1T CAB-X21MT For access via internet (iAccess or Combined / Premium 2): S17CHK2-1215T5 Alternatively the following bundle can be used: CISCO1720-VPN-M/K9 WIC-1T CAB-X21MT	CISCO1720 10/100BaseT Modular Router w/2 WAN slots, 8M Flash/32M DRAM CISCO 1700 IOS 12.1.(5)T5 IP ONLY 1-Port Serial WAN Interface Card X.21 Cable, DTE, Male, 10 Feet Cisco 1700 IOS IP/FW/IDS PLUS IPSEC 3DES 1720 VPN Bundle, Dual Ethernet, VPN Module, IOS FW/IPSec3DES 1-Port Serial WAN Interface Card X.21 Cable, DTE, Male, 10 Feet