

WHITE PAPER

BS2000/OSD - The successful mainframe platform in data center

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Abstract

The BS2000/OSD business servers, the BS2000/OSD operating system and a comprehensive software configuration that is optimally attuned to the operating system form an entire, highly competitive and innovative server platform that meets the highest requirements of cost efficiency, flexibility and reliability. The mainframe architecture plays a decisive role in this regard. It ensures that the performances of the application can still be easily scaled even with a very high number of users, processes and transactions. The virtualization of all server resources and the self-regulation of the system components enable stable full automation of the everyday procedures in the data center. BS2000/OSD permits the implementation of changes, the migration of resources, backup and many more maintenance activities in ongoing operation and thus enables trouble-free 24-hour operation. The BS2000/OSD operating system has been decoupled from the underlying processor hardware for many years now and currently runs not only on traditional /390 processors, but also on Intel-x86 processors. Consequently, optimal server hardware is available to BS2000 customers throughout the entire performance range. At the same time the BS2000 applications can be put into operation on each of these hardware platforms without any porting outlay (on an object-compatible basis!) and thus enjoy high investment protection.

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The correct IT infrastructure is tailor-made

The tasks performed by IT in companies today are as different as the business processes it supports, implements or controls. This is why there is no correct IT infrastructure for every requirement, but only the appropriate solution for specific tasks. This white paper facilitates orientation in a broad-based offering of IT solution technologies and shows with which requirements and general conditions BS2000/OSD mainframes can contribute toward implementing the optimal solution.

Standard software or individual software?

Nowadays there is standard software available for the jobs that occur in almost every enterprise, e.g. Office packages, Enterprise Resource Planning packages or databases. Such software is usually optimized for a certain platform, which means that the choice of platform is already made when the application is implemented.

Therefore, with standard software the software manufacturer is responsible for the choice of platform. With one feature in particular being critical here: the widest possible distribution of this platform.

As this ensures that the potential market for this software is the largest. At the same time unit costs are reduced, because the price of the software is basically determined by development costs and with a high number of licenses sold these can be spread over many customers.

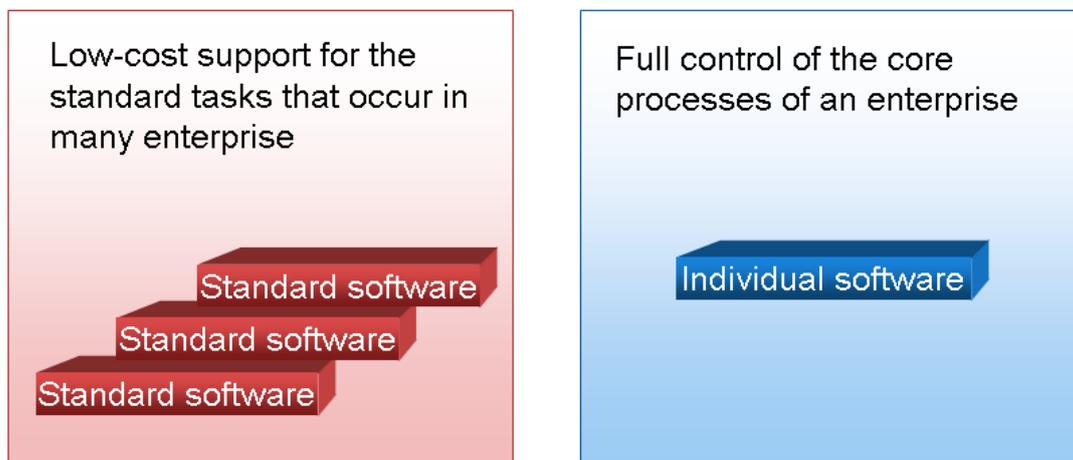


Figure 1: Standard task or core process?

Individual software is the right alternative for the business processes that involve the specific core competence of companies and whose optimal organization is a substantial deciding factor when it comes to gaining an advantage over the competition.

Individual software is tailored to suit one or a few companies. In this case it is not possible to apportion the development costs to a great many users.

For individual software it is therefore particularly important that the development costs can be kept low. And since the customer for individual software is at the same time also the user, the long-term basis of its use and the anticipated operating costs play a decisive role in the choice of the platform.

Therefore, the low operating costs and long-term compatibility guarantees of mainframes make them particularly attractive as a platform for individual software.

On account of the limited market segment and greater focus on specific conditions the decision criteria for the choice of platform for industry-specific software more frequently resemble those of individual applications than those for standard software.

Which IT tasks are run in-house and which ones are better purchased as a service?

In addition to the decision for which tasks in the company ready-made standard software and for which ones optimally tailored individual software is the best, you also have to clarify which IT tasks are done by the IT user himself and which ones are better purchased from external providers.

Wherever the core competence of the company can contribute to the IT, where the initiative to change business processes emanates from the company and therefore swift, flexible adaptation of the supporting IT is most reliably ensured when it can be controlled by the company itself, these IT tasks should then be performed in-house by the company.

In all the other cases these tasks should be taken on by professional providers of such services. This helps companies to concentrate on their core business.

Fujitsu supports such solutions that are tailored to the particular situation of a company by providing a modular and comprehensive service concept for the IT operations in a company. Each company can then purchase precisely and solely those services it cannot present as efficiently itself or does not want to pursue itself for strategic reasons.

Whether you need proactive services, such as our System Health Check, or support with database administration – our Managed Services cover every operative process and are deployed according to your requirements. We assume responsibility for the IT – you remain in control.

Integration Services from Fujitsu comprise adaptive solution components to optimally meet your requirements from the very outset. Our qualified staff accompanies you along the entire value chain of a solution - from comprehensive consulting and concept planning right through to implementation. In this process we deploy consultants, planners and integrators in the most varied roles in order to be able to transform your requirements into the IT infrastructure at any time and on a comprehensive basis.

Unique features of mainframes

Mainframes have already had a long history, in which they have been confronted by many alternative architecture concepts and new technologies.

Many of these new concepts and technologies have in the course of time been adapted by the mainframes.

Thus for many years, mainframes have also seen themselves as central servers in a client/server architecture. And today TCP/IP is also the most important communication technology for mainframes. At present web technology is just as integrated in mainframes as in all other platforms.

Conversely, central mainframe concepts, such as the sharing of server resources (main memory, CPUs, I/O ports) for many of the applications that run in parallel on a processor, have also become accepted in non-mainframe servers.

Technologies for the parallel operation of several applications on one processor, such as multi-core processors, and the use of virtual machines have even become standard on client computers.

Despite this long list of examples for the convergence of system platforms, a number of essential differences still remain in existence between mainframes and non-mainframes:

- Free combination of all IT components available on the market on open standard systems versus attuned pre-tested hardware and software configuration for mainframes
- Separation of the applications into an own operating system instance*for standard systems versus the unrestricted parallel running of several applications within a mainframe operating system instance.

The following is to clarify why these two differences in particular between standard systems and mainframes have not disappeared and why this will not change in the foreseeable future.

Free component combination versus guaranteed trouble-free interaction of all components of an IT infrastructure

With mainframes the platform manufacturer defines the possible hardware and software configurations for this platform. In return mainframe manufacturers ensure that the components of these IT configurations fit together optimally.

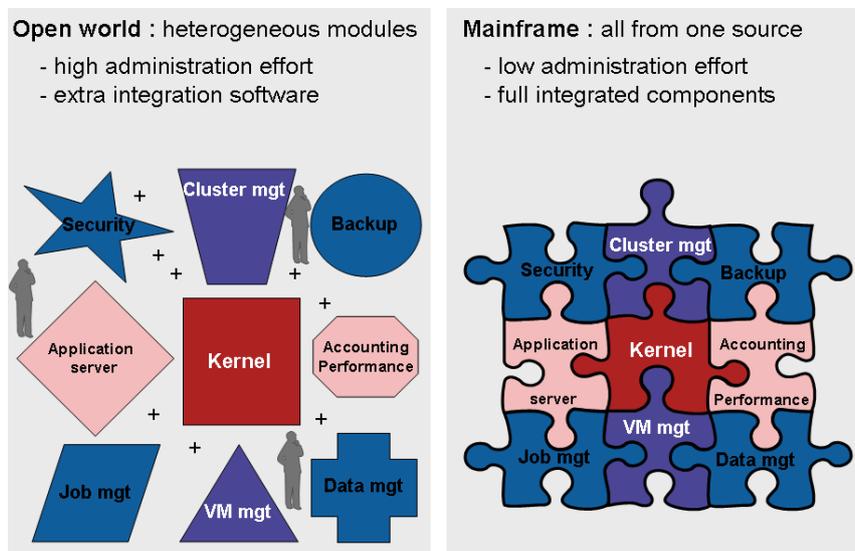


Figure 2: Free configuration or optimal reliability?

This means e.g. that all

- components can be combined without any additional integration costs
- components work together in such an efficient way that the overall performance is right
- IT infrastructure functions are available as system commands and can thus be automated by scripts
- IT infrastructure components observe centrally adjustable process and job priorities
- IT infrastructure components comply with centrally adjustable security requirements
- IT infrastructure components behave in an agreed way in the event of an error
- components are coordinated in terms of time in the event of release changes

Furthermore, it is expected of mainframes that the advantages of all fundamental technological innovations are passed on to the customers as soon as possible, this means:

- support for the most powerful processor technology and server architecture
- support for the most powerful peripherals and network technology
- optimal integration of the mainframe platform in heterogeneous IT landscapes

Thus, one principal difference in the product philosophy between mainframe and non-mainframe systems is that with mainframes the freedom to put together individual IT infrastructures from all the components readily available on the market is restricted in order to be able to offer on the other hand ready-made, functionally pre-integrated IT configurations of optimally attuned components whose interaction has been tested.

This difference has an impact on the IT cost structure. With mainframes the costs for the optimal integration of all IT infrastructure components and the costs for testing all the approved combination versions of the manufacturer are apportioned to the price for the hardware and software. With standard platforms these costs must be borne by the customer. This is why they do not appear in the investment costs for hardware and software, but in the operating costs.

The different product philosophy of mainframe and non-mainframe systems entails various advantages and disadvantages.

However, this does not mean that the advantages of various platform architectures could not be utilized simultaneously. Whatever cannot be achieved with one platform is very much possible with the specific use of various platforms.

Services, which are not able to benefit at all from the freer configuration option of standard platforms, but urgently need the long-term compatibility and reliability that mainframe systems offer, run optimally on mainframes. However, the interface compatibility of mainframe systems, which are guaranteed on a long-term basis, is of no significance for services with a short lifecycle. The option of being able to fully use every service available on the market can on the other hand be very important. Testing which platform is the best for which service should always be done in detail.

Unlimited parallel operation of several applications in a system and/or distributed applications

The second, remaining important difference between mainframe and non-mainframe systems concerns the **parallel operability of applications in an operating system instance**.

As a matter of principle, parallel operability within an operating system instance is at present possible on every server platform. The difference is to be found in the possible unnecessary effects that the parallel installation and running of applications can entail.

The most important aspects here are:

- Does the new installation of an application possibly disturb the integrity of already installed applications?
- Does the malfunctioning or the crash of an application impair other applications?
- Do bottleneck situations in a server cause deadlocks or violation to specified process priorities when accessing the resources?

With the aid of their process and user management mainframes isolate the various applications in an operating system instance from each other in every respect. Non-mainframes only do this with certain restrictions. In practice this has resulted e.g. on Windows platforms in every application running in most cases on an exclusive server or in a separate guest system. Even this difference between mainframes and non-mainframe systems originates from a different product philosophy, i.e. the alignment to the IT paradigms scale-up and scale-out.

Scale-Up

Mainframes are designed as host computers that offer IT service for many users at the same time. This is only possible with a system architecture, in which the hardware and operating system resources can be withdrawn from and re-issued to every user or process at any time, at short notice and without any appreciable costs as well as without having to involve the resource users. This requires an operating system with very intelligent resource and user management and hardware that can manage a great many users in parallel, securely isolated exclusive process and user resources and optimally supports a swift context change both between the processes as well as between I/O and processing.

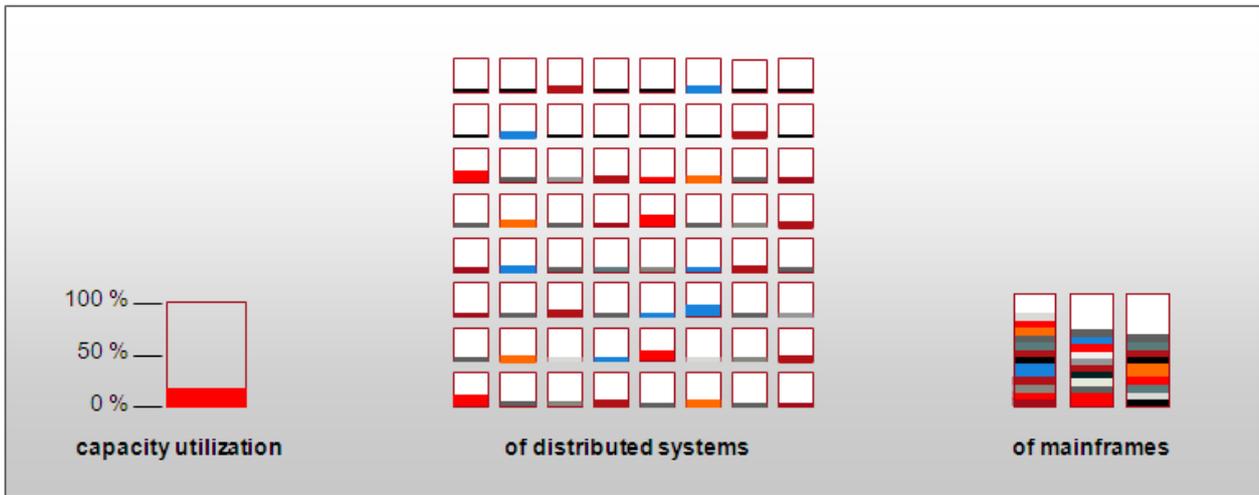


Figure 3: Capacity utilization in Scale-Out and Scale Up szenarios

The advantage of the scale-up architecture:

Optimal resource utilization and high flexibility with a changing load, a few large servers with low operating and maintenance costs as well as low location, energy and air-conditioning costs.

Scale-Out

All non-mainframe systems pursued an alternative concept at their time of design. They countered the scale-up concept of the mainframes with the scale-out concept. Instead of the complex host computer, this IT infrastructure architecture comes down on the side of a network of low-cost standard computers with distributed processing.

The advantage of the scale-out architecture:

Low cost standard hardware, no complex program logic for the mutual isolation of applications within an operating system instance and for complex resource management.

Convergence with the server architecture - long-term differences in operating system architecture

However, scale-up and scale-out is today no longer seen as mutually exclusive IT paradigms, but as necessary architecture concepts that can easily coexist and be sensibly used on all platforms.

The performance of today's processors is much higher than the performance that average applications can generally accept. Multi-core processor technology, which is becoming more accepted, can only be sensibly used if the processing can be handled on a processor with a high level of parallelism.

A reasonable utilization level for today's computers and processors can only be achieved under these circumstances if more than one application runs in parallel on a computer. Since this is only possible to a certain extent on standard systems within an operating system instance, the necessary parallel operation of applications on standard systems is achieved by using virtual machines.

The high operating, maintenance, energy and location costs that each individual server causes are a second reason for scale-up scenarios. In order to manage with a lower number of servers and thus reduce costs, the previous native applications are consolidated onto a few servers with numerous guest systems with the help of virtual machines.

On the other hand, distributed systems and distributed applications are currently a means on all platforms of improving the fail-safety of services. When a system fails, the instances of the application running on other systems can simply take on the tasks of the part that has failed.

The implementation of the two architecture concepts scale-up and scale-out on all normal system platforms resulted in the present use of virtual machine technology on the one hand and cluster & server pool technologies on the other hand for all platforms.

However, the operating system architecture of the mainframe and non-mainframe systems remained for the most part unchanged, this means scale-up is solely possible for non-mainframe systems with the help of virtual machine technology; for mainframe systems both with virtual machine technology as well as with the help of several applications operating in parallel within an operating system instance.

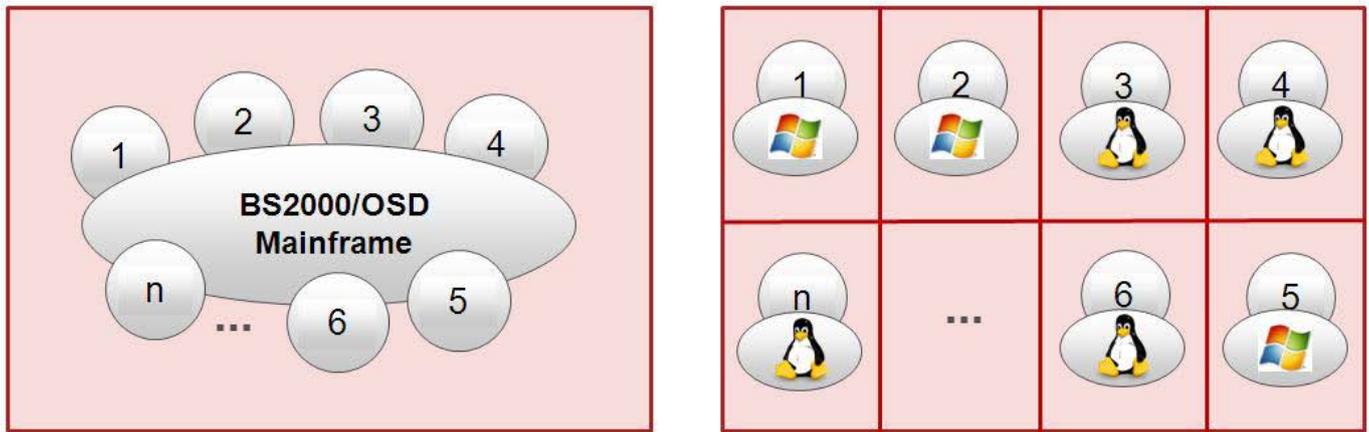


Figure 4: Unlimited parallelism in an operating system instance for mainframes

What does this difference mean for us today?

- A lower number of system instances is necessary for the same number of applications. This saves resources and maintenance costs.
- Since applications running under the same system instance can communicate via the main memory, the coordination of cooperating applications is considerably easier and quicker there.
- For the same reason the exchange of data between cooperating applications is also faster.
- Isolation between applications that are to run under the same operating system instance requires particularly good isolation between processes and between the users of a system.
As a great many of today's applications are multi-process applications, the processes within an application are also optimally isolated from each other for mainframe applications. That means less error spread and less performance impact between the individual jobs within an application.
- Within an operating system instance there are more effective and further-reaching opportunities to set different priorities for applications than is possible when the applications run under different system instances.
- It is easier to implement cross-application automation within an operating system instance than is possible for applications that run under various system instances.
- Services that are based on the interaction of several applications have a higher level of availability when the applications depend on fewer servers.

The role of BS2000/OSD mainframes in data centers

With its business servers BS2000/OSD covers a broad-based range of services and provides - together with the comprehensive system software - an entire IT infrastructure for the optimal running of business-critical applications.

On account of their specific strengths mainframes can make an important contribution to

- greatly reducing complexity in the data center,
- considerably increasing the security and availability of the IT infrastructure
- significantly improving the efficiency of a company's core applications

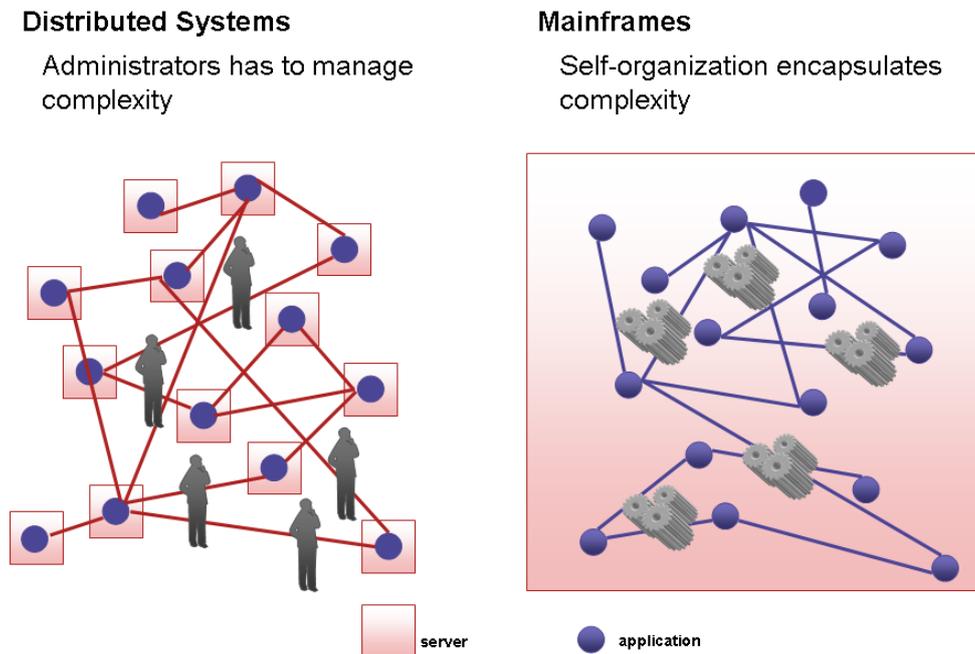


Figure 5: Different handling of complexity

The right platform for individual applications

Core application is the name of applications that support and automate those business processes, in which the **core competence of a company** is to be found. Whether a company can achieve competitive advantages or not depends quite decisively on how freely and efficiently the core business processes can be designed.

This is why the core applications of a company are mostly individual applications. Whereas standard applications compel a company to adapt its business processes to the procedures stipulated by its applications, this is completely the opposite with individual applications. Here the IT is adapted to suit company-specific business processes. Only in this way can the company-specific business processes be made into an instrument of competition.

The strengths of BS2000/OSD mainframes are brought fully to bear with individual applications in particular.

- The standardized software environment that BS2000/OSD provides for the applications (since operating system software and system-related software are from a single source and not put together from components of various manufacturers) requires less investment in product-specific know-how and simplifies implementation. That makes this software at the same time both less complex and error-prone.
- Due to the fact that all the IT infrastructure components come from a single source, the function extensions and release dates of all the components are coordinated. This facilitates modernization and maintains the operability of the procedures that the customer has developed to automate his operating processes.
- The joint use of the system functions and features that make the BS2000/OSD mainframes highly available, secure, reliable and easy to automate saves implementing the appropriate functionality in the application. (to maintain platform independence standard applications frequently do without the use of platform-specific features)
- The long-term interface compatibility that is typical of BS2000/OSD saves frequent and complex software adaptations to new system versions
- The high virtualization of all resources that is typical of BS2000/OSD saves the constant adaptation of the application software to that of rapidly changing technical implementations.

BS2000/OSD facilitates the development of economical individual applications and thus extends the options of securing competitive advantages through an IT that is optimally adapted to the company-specific core processes.

The right platform for business-critical services

Business-critical IT services are the services, on whose permanent, error-free and highly efficient functioning business processes depend, which should neither fail nor go wrong, nor be delayed because considerable damage would otherwise occur.

Mainframes were developed as a platform for business-critical IT services from the very outset and have until now pioneered both for hardware and system software the further development of the RAS features required for business-critical IT services. (RAS stands for Reliability, Availability and Serviceability)

It is not unheard of for BS2000/OSD mainframe systems not to have to be powered down for a year or even longer. This not only shows the extreme stability of these systems, but also that interruptions planned on this platform only become necessary in extremely rare cases.

Such interruptions can be avoided, because periodical maintenance actions, e.g. data backup, file reorganization, data migration, software updates and upgrades, HW upgrades, etc., can mostly be performed on BS2000/OSD platforms during ongoing operations. Without the option of parallelizing productive operation and maintenance actions the necessary maintenance actions would interrupt productive operation time and again. Under these prerequisites 24-hour operation would not be possible at all.

BS2000/OSD mainframe systems are optimally prepared to resolve these tasks:

- The architecture of process management is geared to enabling many processes to run in parallel on one server without mutually impairing each other
- Central resource management and the high degree of resource virtualization make it possible for the replacement and dynamic reorganization of resources to remain transparent for applications
- Redundant data storage on the disk storage systems creates fail-safety and the option of consistently copying large quantities of data without having to temporarily freeze them and consequently interrupt productive operation
- Tailor-made role and encryption concepts protect business-critical data against unauthorized access - both internally and externally
- A largely automatable operation minimizes the probability of operating errors, optimizes service performance and makes service availability independent of the presence of administrators.

The platform that knows no hidden costs

In contrast to **purchase or rental costs for hardware and software**, the costs that are also incurred in the course of the **IT lifecycle**, are often not transparent. Many analyses show that the proportion of these costs of the total costs is on the increase and that they currently already represent the largest pool of costs for standard platforms. It is assumed today that 80% of the available budget is required for the ongoing operation.

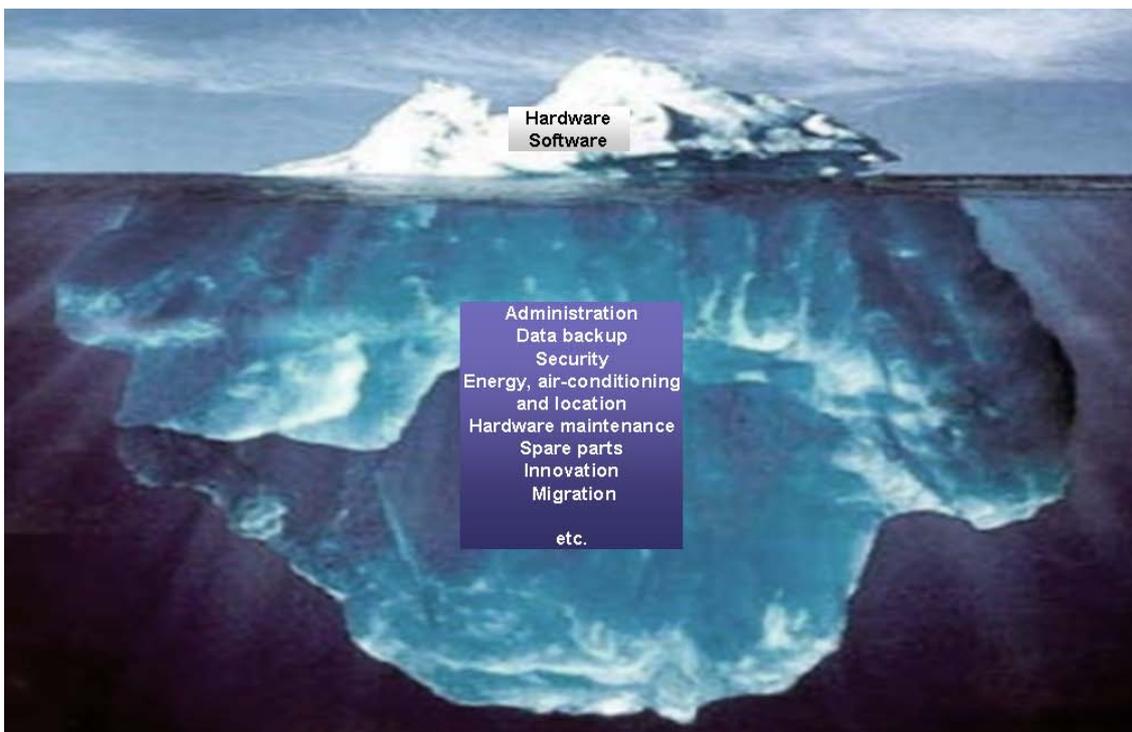


Figure 6: Which costs are of more consequence?

Considerably less administration costs

As BS2000/OSD mainframe systems manage with considerably less administration costs than standard platforms, they are especially economical when it comes to performing these tasks. Thus, mainframe systems with thousands of users can be managed with one or a few administrators.

This is above all due to the optimal prerequisites that these mainframe systems have for the automation of data center operation and that BS2000/OSD systems optimize themselves and automatically adapt themselves to changing loads so that manual intervention is superfluous.

Due to the fact that the BS2000/OSD infrastructure comes from a single source and that the manufacturer already ensures that its components interact efficiently and compatibly over the course of numerous innovation cycles and versions, no costs are incurred for the customer, which would otherwise become necessary during the modernization of open IT infrastructures every time new components are integrated.

Unequaled reliability saves expensive resources

Experience shows that the typical mainframe reliability of BS2000/OSD and the concept of preventive maintenance make system failures so rare that for many BS2000 customers the increase in availability through failover scenarios is not necessary at all.

Consequently, the redundancy of expensive resources (e.g. standby servers, data duplicates, complex testing methods) is no longer applicable.

Long-term security of the IT investment

If the IT infrastructure comes from a single source, there are no disagreeable surprises, such as unexpected incompatibilities or hidden dependencies, which only become visible after migrating to new hardware or software versions and which can seriously impair the functioning of the IT infrastructure.

If the IT infrastructure comes from a single source, it makes the evolutionary further development of the data center infrastructure reliably determinable and protects any IT investments in the long term.

The BS2000 operating system has not been exclusively coupled to the /390 server hardware for more than a dozen years. This hardware independence gives you a free hand to select the most suitable server hardware as a platform for the BS2000 throughout the performance range.

Optimal service and fast support

A large number of the services that support data center operations, which are in part available for mainframe customers on a 24-hour basis, supplement the product offering and thus ensure the typical mainframe reliability.

Favorable economies of scale

Due to central resource management it is possible for mainframes to utilize IT resources better than is possible on distributed platforms. Scaling (upgrading) on mainframes is frequently a mere administrative act and can in many cases be done during ongoing operation. In this way, it is only possible to add e.g. additional CPUs or additional storage to the system when they are actually required.

Without options such as these resources would have to be kept in reserve for a lengthier period of time. Any that would enforce expensive surplus capacities.

Summary

There is no best platform for everything. However, for each specific task there is always a platform that best suits the task.

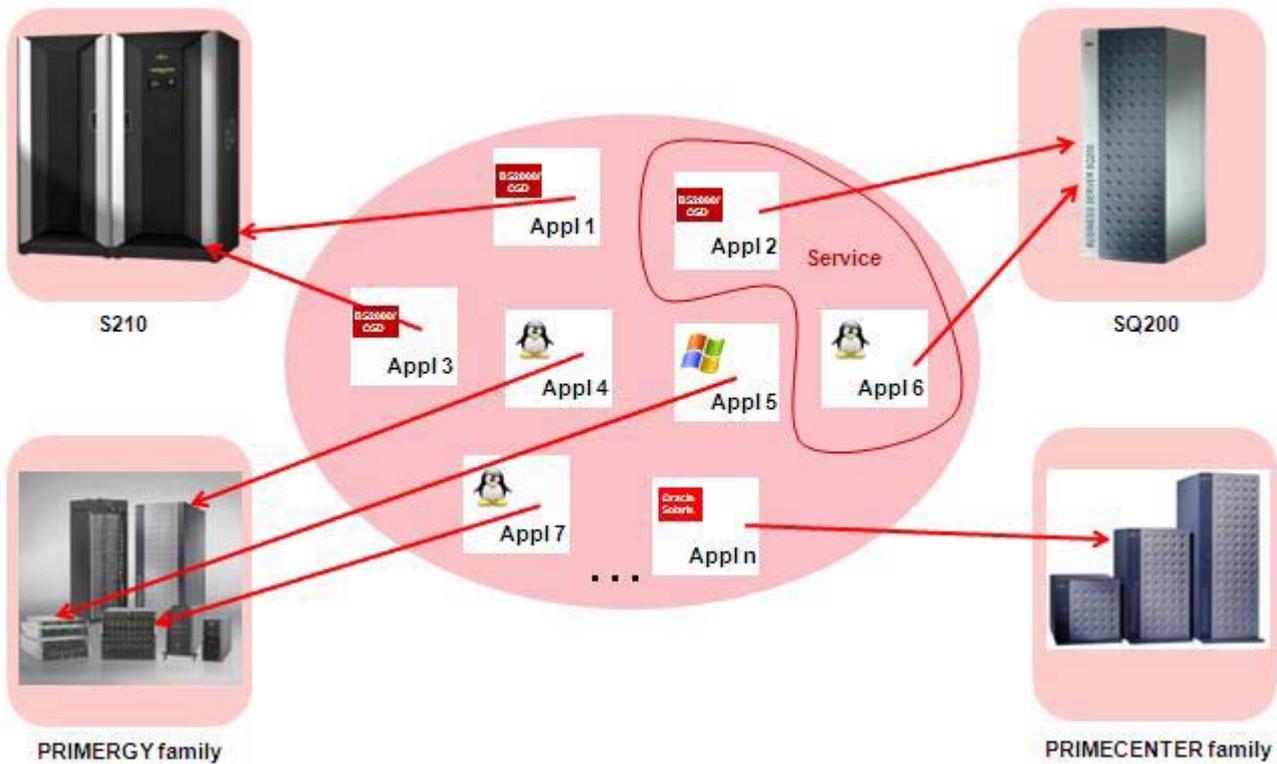


Figure 7: Which application suits which platform?

The specific strengths of the mainframe system BS2000/OSD are low operating costs, high efficiency of resource usage and absolute reliability in ongoing operation and in investment maintenance.

This is why BS2000/OSD is the ideal platform for individual core applications in companies. The fully automated and uninterrupted operation that is possible with this mainframe system not only ensures maximum availability and the necessary core process reliability, it also minimizes the expensive administration and maintenance costs - caused by a high degree of personnel - for the IT infrastructure.

In this way, the low operating costs of the BS2000/OSD mainframe systems more than compensate for the high costs for hardware and software licenses in comparison with standard systems.

This positive effect is all the more explicit the higher the user numbers and the transaction volume. For companies' business-critical core applications BS2000/OSD mainframes prove to be the most economical servers with the lowest total cost of ownership (TCO).