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# THE CONCEPTION STRUCTURE MODEL FOR CROATIAN GLOBAL COMMUNICATION SYSTEM

# KONCEPCIJSKA STRUKTURA HRVATSKOG MODELA GLOBALNOG KOMUNIKACIJSKOG SUSTAVA

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*Abstract*
Information systems (IS) users in all sizes and types of organizations are moving toward a new synthesis of centralized and distributed computing. A new paradigm, defining the role of the mainframe within an enterprise model, is emerging. It combines the performance, flexibility and user-friendliness of small systems with the inherent economies of scale of central IS operations. The advantages of organization-wide consistency in data management, information distribution, system architectures and networking environments are creating new values for IS in this scenario. In this context, new roles can be clearly seen for the mainframe toward new millennium. Mainframes will remain viable in applications which represent genuine, organization-wide economies of scale. Similarly, mainframes will continue to play a vital role as platforms for large, mission-critical applications which leverage unique strengths of mainframe-based hardware and software architecture. Mainframes are also moving into a new role in strategies for distributed computing in open, heterogeneous networks. The core mainframes strengths are in data management. This involves the management of large databases and storage volumes, along with the movement of large data volumes. High bandwidth input/output facilities enable mainframes to act as hubs in enterprise-wide backbone networks. As database servers, mainframes maintain, protect and ensure the accessibility of critical data for all users within organizations. As enterprise resource managers, mainframes increase the cost-effectiveness and availability of distributed computing solutions by providing new services for the management of large, dispersed bases of midrange systems, personal computers, workstations and local area networks. These synergistic strengths in data management, resource management and resource integrity define new value for mainframes within multiplatform IS portfolios. Users who employ them effectively will be more able to achieve the gains of distributed computing without corresponding increases in complexities and support costs. They will also be able to leverage the mainframe role as enterprise

*Sažetak*
Korisnički info sustavi u organizacijama raznih vrsta i veličina transformiraju svoje računarske resurse iz pretežno centraliziranog u distribuirani komunikacijski sustav gotovo na svim razinama. Ova nova paradigma, u biti definira ulogu velikih kompjutora unutar velikih poslovnih asocijacija kao i njihovu integraciju na nacionalnoj razini. To je, zapravo kombinacija performansi, fleksibilnost i korisničko-prijateljski odnos s malim autonomnim korisnicima od osnovnih operacija/obrada do usluga vezanih za središnji komunikacijski sustav glavnog računala. Prednost ovakve organizacije komunikacijskih resursa leži u širokoj dosljednosti u upravljanju podacima, distribuciji informacija, sustavnoj arhitekturi, načinu umrežavanja okruženja i stvaranju novih vrijednosti koji proizlaze iz ovakvog organizacijskog modela upravljanja informacijskim i komunikacijskim resursima na razini Hrvatske Države. Gledano u tom kontekstu, promjenjene/nove uloge brojnih sudionika mogu biti samo jasnije vidljive u koncepciji glavnog kompjutora na početku novog tistljeća. Na taj način glavni kompjutori se premještaju u središte zbivanja i imaju novu ulogu u strategiji distribuiranog računarstva u jednoj otvorenoj i heterogenoj komunikacijskoj mreži. U biti, temeljna snage koncepcije glavnog kompjutora je u upravljanju podacima/informacijama. To uključuje upravljanje velikim bazama podataka i pohranjivanje datoteka podataka, u kontrolu komunikacija velikih količina podataka/informacija. Uz navedeno, velike širokopojasne mreže koje opslužuju razne institucije, omogućiti će glavnim kompjutorima djelovanje kao komunikacijskim čvorištima u novom poduzetništvu širom komunikacijske infrastrukture tj. komunikacijske mreže. Kao tehnička podrška baza podataka brojnih korisnika, poslužitelji - glavni kompjutori postaju, tehnička osnovica i garancija su sigurne zaštite informacijsko/podatkovnih resursa za sve korisnike i poslovne asocijacije, širom komunikacijske mreže. Kao upravljačka tehnička komponenta poslovnih asocoijacija, glavni kompjutori poboljšavaju rentabilnost poslovnih asocijacija, obavlja raspodjelu sustavnih

data manager in new, high-impact applications for the collections, distribution and exploitation of important business information. The mainframe is an enterprise system. It will play a vital part in creating new business values through IS-driven improvements in organizational competitiveness efficiency and dynamism toward new millennium.

resursa, pružanjem novih usluga, te daje sistemsku podršku midi i osobnim kompjutorima na cjelokupnom fizičkom komunikacijskom prostoru. Korisnici koji ih upotrebljavaju učinkovito biti će u mogućnosti ostvariti i razne dobiti za svoje poslovne asocijacije korištenjem ovakvog modela distribuiranog kompjutinga, bez većih troškova i ulaganja u kompjutorsko/komunikacijske resurse. Oni će također moći koristiti glavne kompjutore za potrebe svojih poslovnih asocijacija u smislu upravljanja podacima i važnim poslovnim informacijama. Na ovakav način, glavni kompjutori u poslovnim korporacijama postaje stavnicom organizacijskog sustava. i kao takovi igraju važnu ulogu u stvaranju novih poslovnih vrijednosti kroz koncepciju komunikacijskog sustava upravljanjem raspoloživim resursima poslovnih asocijacija, što će u biti poboljšati konkurentnost, organizacijsku učinkovitost i dinamičnost svih poslovnih asocijacija na cjelokupnom nacionalnom hrvatskom komunikacijskom prostoru na početku novog tisućljeća.

## 1. Introduction

Information systems (IS) have entered upon an era of unprecedented change. Traditional centrali-zed IS is no longer adequate to deal with the changing business imperatives of the 1990s. IS resources must support new and more flexible corporate strategies. Resources must be capable of dynamic response to increasingly volatile and competitive market and economic environments. Moves toward a different paradigm of IS deployment has begun in many organizations. Increasing power and sophistication of distributed computing systems provide one of the elements of this paradigm. PCs are bringing more powerful, user-friendly IS tools to the individual. Adoption of the client/server model illustrates that desktop computers will become the primary vehicle through which users obtain access to computing and communications resources within their organizations. At the same time, small systems and servers, as well as networking developments make it possible to offer new types of distributed solutions. These allow IS to be more closely mapped to business processes at all organizational levels in order to provide more flexible and responsive tools as business needs change. Even as users gain more experience in distributed IS, decentralization of IS does not in itself provi-de all the answers. There is obvious logic to moving computing tools closer to users. However, it has not been proven that significant business gains occur when the entire IS infrastructure, with all of its attendant complexities and overheads, is pushed out into end-user organizations. All too often, flexibility is accompanied by escalating support costs, increased software complexities and fragmentation of critical system, data and network resources. A balance must be struck between the economies of scale and inherent consistencies of organization-wide IS with the dynamic potential of distributed computing.

### *1.1 The Emerging Paradigm*

Many users are adopting heterogeneous, multi-platform IS strategies. IS is moving toward a synthesis of organizational and technological approaches that leverage the inherent strengths of centralized and distributed computing, while minimizing the respective disadvantages. In leading-edge organizations worldwide, a new paradigm is emerging that realizes this synthesis. Using concepts and techniques that have been successfully employed by a wide range of users, the model that emerges from their experiences:

- Exploits the full potential of desktop systems and distributed computing environments,
- Provides modular concepts and methodologies that accommodate multiple types of architectures and systems in the realization of IS solutions,
- Leverages organization-wide economies of scale in the implementation and management of IS resources,
- Achieves significant gains in the efficiency, flexibility, productivity and dynamism of the organization using the IS infrastructure,
- Defines new paradigms for the application of emerging IS technologies that facilitate the performance of business tasks.

This is the Enterprise Model. The term 'enterprise' is commonly associated with large corporate commercial users. However, the issues addressed by the model concern basics relationship involving IS environments and technologies with organizational cost structures and productivity. The model is not specific to any particular business size, organization activity or form of IS infrastructure. Similarly, the enterprise model is not a 'centralized' IS scheme. It combines elements normally associated with centralization and decentralization of IS resources. It can be more accurately characterized as a 'distributed' IS environment. The term enterprise is widely used, not only among mainframe users, but also in referring to wide and local area networks, in midrange system application, as well as by PC vendors and open systems supporters. Among all of these sectors, 'enterprise' stands for new approaches to organization-wide integration of IS resources.

### *1.2 The Mainframe Role*

Although the enterprise model is not specific to mainframe-based computing, it has a special relevance to this type of system. In most organizations, mainframe usage offers primary benefits in terms of economies of scale. Mainframes also possess unique, architecturally-optimized capabilities that qualify them to act as core or backbone hubs within the enterprise model. As hubs, mainframes process applications in which economies of scale area significant factor and-or which leverage particular strengths of mainframe architecture. Over time the mainframe role will shift toward data management services. These will be supplied via organization-wide information infrastructures to new groups of distributed users. As this occurs, traditional mainframe-based computing and the central IS role will give way to new approaches. These will emphasize a more marketing-driven approach to the IS-user relationship. New techniques for the definition, implementation and pricing of central IS services deliverables will also evolve.

## 2. The Enterprise Model

The enterprise computing model is a general scheme for the organization of IS resources that is based on the following(see: Figure 1):

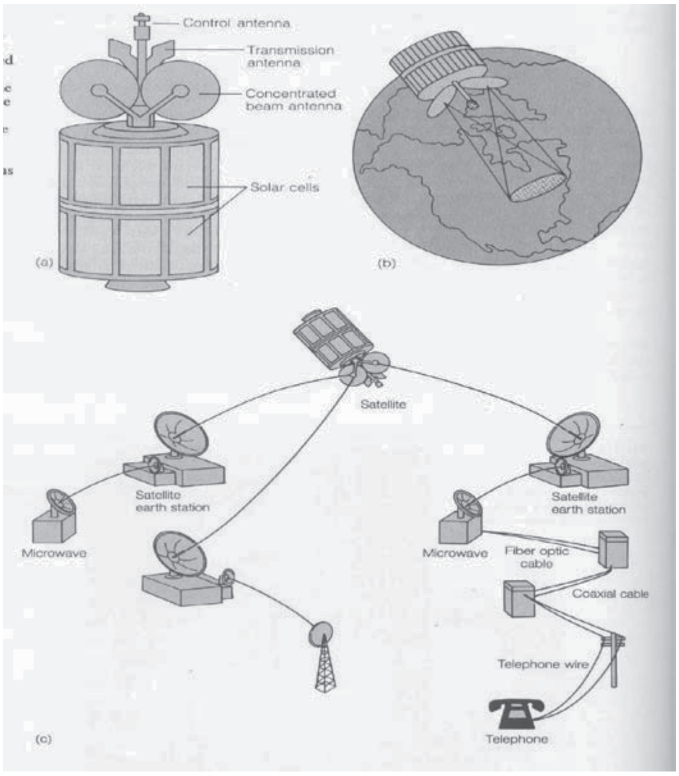


Figure 1. General scheme the Global Communication System

• ***IS infrastructures.*** These link all users in an organization with dynamic structures for access to and distribution of information. They also provide facilities, transparent to users, for the efficient management of system, data and network resources.

• ***Hub topologies.*** These improve the quality and reduce the costs of distributed computing solutions. They also allow for the integration of heterogeneous systems and networks while providing new flexibility in the organization and management of IS operations.

•*Rightsizing methodologies.* These are driven by applications and business requirements. They seek to define optimum solutions that leverage the unique strengths and minimize the weaknesses of different types of computer platforms.
• *New forms of business value.* These emerge through the interaction of organization-wide information infrastructures and high-performance workstations which deliver powerful new information resources to managers and individuals. Realization of infrastructures can also be combined with initiatives in business process redesign.

**2.1. Information infrastructure**

The information infrastructure is the collection of basic architectures, protocols, interfaces and supporting hardware, software and communications facilities that allow for the management and distribution of information within an organization.

**2.1.1. Components**

*Data Management Infrastructure.* This consists of software platforms for the logical organization, storage and protection of data, including:
• Database management systems (DBMS) and file systems.
• Facilities for data integrity, security and back-up.
*Network Infrastructure.* This includes:
• Basic communications facilities,
• Wide and local area network.
*Information Distribution Infrastructure.* This consists of facilities for movement of and access to information within an organization, including:
• Database access mechanisms (such as SQL),
• Electronic mail and document distribution facilities,
• Graphical user interfaces (GUIs).
*Resource Management Infrastructure.* This consists of facilities that ensure the optimum performance and availability of IS resources, including:
• System administration tools,
• Network management tools,
• Business management tools.
*Computer Systems.* These are divided into two types:
•End-user systems which include PCs, workstations, local peripherals, associated subsystems and other end-user computing devices,
• Infrastructure systems which include all other systems and servers.
The general principle is that infrastructure systems provide computing resources for data management, backbone communications, networking environments, resource management and other functions supplied as support services to end-user systems.

End-user systems are in principle recipients of services, rather than part of the infrastructure. The 'Information Infrastructure' concept is similar to the infrastructure term understood within the electrical utility industry. In this industry, the infrastructure extends to the business or home outlet, but the devices that attach to it are the customers property and the way in which the devices are used is determined by the customer. The information infrastructure approach can also be referred to as the 'Information Utility'.

**2.1.2. Issues**

*Organization.* The infrastructure is organization-wide. Centralized control of IS resources is not implicit, so the infrastructure may be managed in a number of different ways. Analogies from other fields are useful. For example, telecommunications networks may be managed nationally as in Europe or through multiple national and regional carriers as in the United States. Electricity, gas, water and their related infrastructures are commonly run by regional and-or municipal utilities. Highways and roads are also typically maintained by regional and/or local authorities. Basic organizational requirements for the information infrastructure areFigure(Figure2.):

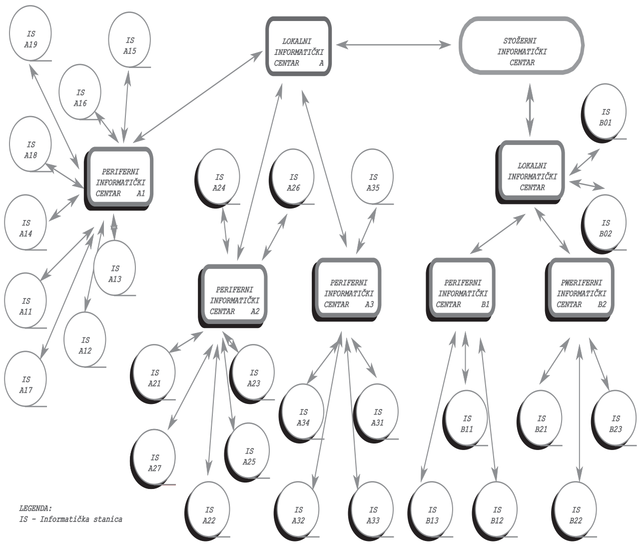


Figure 2. Organizational topological scheme the information infrastructure

• A general body to define infrastructure contents and standards,
• A scheme that defines the responsibilities of multiple organizational units for infrastructure investment, management and maintenance.

***Realization.*** A useful technique is the 'lowest common denominator'. The focus is on realizing the basic level of capability necessary for the infrastructure to perform its task. This allows infrastructures to be defined and constructed progressively, moving toward more sophisticated architectural levels as and when it is feasible to do so.

***Benefits.*** The key principle of the infrastructure is consistency, which facilitates:

- Transparent distribution of information throughout an organization,
- User access to all computing, database and communications resources,
- Economies of scale for implementation, maintenance and support,
- Consolidation of procurements to obtain improved service and terms from suppliers.

### 2.2. Information Hub

The information hub is the key organizing principle for infrastructure resources. It defines a concentration of IS hardware, software and personnel at a specific location in order to provide cost-effective service to given sets of end users.

#### 2.2.1.Types of Hub

Client/Server Hub. This concentrates server resources supporting PCs and work-station clients. Hubs may include large specialized servers, multiple departmental servers and/or conventional system modified to conform to the client/server model. IS staff handling system administration and network management tasks for PC/LAN users would normally be based at the hub. Optionally, end user support personnel, help desk functions, as well as IS management and administrative staff may also be centered here. Systems Hub. This is a consistent organizing structure for IS resources such as main-frame-based data centers, midrange systems located at remote sites or in specialized facilities and hierarchies of data collection devices, programmable controllers, process control systems and the like used in industrial, engineering/scientific and related applications.

#### 2.2.2. Realization

Consistent, but flexible methodologies should be applied to determine the optimum degree of concentration and locations hubs. These are likely to include such criteria as:

• Type and number of applications supported
• Type and volume of services required
• Size and geographic distribution of end users
• Optimum logical and physicalsize of networks
• Qualifications, availability and cost of IS staff
• Organizational ownership of IS resources

Hub sizing and planning for server resources can draw upon techniques and experience from data center operations. However, there may be differences in network size and technology as well as in requirements for physical proximity of support personnel to end users.

#### 2.2.3. Hub Topologies

In small organizations, a single hub may be appropriate. In larger organizations, a multiple-hub topology is more likely. Hubs will typically be interconnected by 'backbone' networks and communications facilities handling relatively high-volume data traffic between major concentrations of computing resources and/or geographic locations within the organization. Local data traffic, typically landed by LANs, is not affected by this scenario.

In the largest organizations, a mullet-tiered hub structure may be appropriate. In this structure hub structure, backbone hubs, group systems and servers typically handle, the highest levels of data management, resource management and centralized processing tasks. Smaller hubs can be mapped to divisional or department levels within the organization and/or specific geographic locations.

#### 2.2.4. Hubs Functions

***Data Management.*** Hubs contain organizational databases (individual databases may be resident on PCs or workstations), along with facilities for maintaining data integrity and security. Concentration of important organizational data in hubs can yield major integrity and security benefits. It can also facilitate decision support and related applications by making it easier to access continuously update information on key business operations.

***Resources Management.*** The lowest tier of hubs in multiple-tier topologies and singe hubs in smaller organizations will normally handle system, network and business management tasks for end user systems interconnected by LANs. Thus, end users are not required to become involved with IS operational tasks and LAN management may be more efficiently handled. These tasks can be combined with normal resource management functions for hub systems and servers. In intermediate and large organizations, larger hubs would also normally handle management tasks for backbone networks. In multiple-tier topologies, a number of approaches are possible. For example, local system/network management flexibility can be provided into lower-level hubs while operational information is forwarded to backbone hubs for global resource management and accounting tasks. Backbone hubs may also concentrate basic network management tasks at physical and data link levels, while management tasks for higher software levels are decentralized. These hubs may also act as default managers in the event of local hub outage.

***Network/Information Distribution Hub.*** Where peer-to-peer network architecture are employed, the hub structure will be logically transparent to the network. Hubs concentrate communications facilities within the network and provide a location for system administration and network management facilities requiring operator invention. Similarly, the hub is transparent to distributed information distribution facilities such as electronic mail and database access tools. Although hub databases may be used to store information, the architecture remains per-to-per. In lager organizations, high-level hub structures will normally map to existing backbone network topologies. These hubs may also be used as focal points of major nodes for hierarchical networks such as SNA coexisting with peer-to-per networks. Hubs functions can be defined in a variety of different ways, depending on size and topology.

**2.2.5. Benefits**

***Modularity.*** The information hub approach is highly modular. Implementations range from local facilities supporting relatively small workgroup clusters to large data centers used to handle central processing and server functions for corporate-wide mission-critical applications and strategic databases. The methodologies can be applied to any type of platform. Hubs may be built around mainframes, midrange systems, large servers or server clusters or , in hierarchical networks, around controllers or data concentrators. Similarly, like the basic information infrastructure concept, hubs do not imply any specific form of IS organization. Management and ownership of hubs may be shared among multiple units.

***More Effective Client/Server Solutions.*** The client/server model defines a relationship between systems in which one (the server) provides a resource or service for another (the client). In normal usage, the client/server model addresses the general structure of IS resources and defines PCs and workstations as primary clients. However, the model does not propose any specific scheme for the logical and physical organization of server resources. As a result, the client/server concept has often been interpreted as moving all IS operations onto highly decentralized PC/LAN systems. In practice, user experience raise questions about the viability of this approach. PCs and LANs, when used in relatively simple applications, are inexpensive and can be easily installed and user. However, one these are used to host more complex, mainstream IS applications, the equation undergoes a fundamental change. Facilities for system administration , database administration, network management, information integrity, data security and similar functions become increasingly important. The related hardware, software and personnel overheads add up rapidly, particularly when these must be replicated across a large number of distributed systems. Similarly, in highly decentralized approaches, personnel-intensive support infrastructures are typically adopted with support staff dispersed to local user bases. Support requirements tend to increase over time as distributed applications become more complex. These overheads are not properly planned for when implementing client/server strategies. If adequate communications facilities are available to link clients and servers, the location of servers should be transparent to the user. Server resources, including IS personnel responsible for managing these, can thus be concentrated to achieve improvements in efficiency and realize economies of scale and maximum cost-effectiveness. A trend in this direction is emerging among IS users. After initially placing servers close to end users, many organizations are now concentrating these in single locations for the purpose of more cost-effective management. Servers are also growing progressively larger as developments in local networking technology make it possible to construct larger, interconnected cluster. Streamlined client/server structures built around consistent platforms will also facilitate the development, implementation and support of client/server software. The key benefits may be summarized as:

- Reduced support overheads for PC/LAN-based client/server systems,
- More effective system administration and network management for PC/LAN cluster,

- Improved data availability, integrity and security through reduced points of failure,
- Faster 'roll-out' of client/server applications.

***Consistent Management Structure for Heterogeneous IS resources.*** The information hub approach allows for consistent organization of computing and client/server resources that do not conform to this model. Major benefits include:

- Management and operational approaches are more consistent between traditional IS and client/server organizations to facilitate staff and skill transfer,
- Consistent business management and accounting techniques may be adopted for all IS operations and sites.

***Increased Cost-Effectiveness of Conventional IS.*** This can be achieved by concentrating IS operations as much as possible on obtaining maximum economies of scale in hardware, software and personnel utilization. Data center consolidation is yielding major savings and productivity improvements in many organizations. This approach can also be extended to midrange systems and is applicable to any organization with multiple-site IS operations. Economy of scale also applies to standard network installations. Technical support costs and personnel overheads of managing a 1000-user network are substantially less than managing ten 100-user networks.

### 2.3. Rightsizing Methodology

Enterprise rightsizing methodology assists in identifying the appropriate platform(s) for user applications. It also assists in defining strategies for the realization of business values that leverage the unique strengths and minimize the weaknesses of specific types of platforms.

#### 2.3.1. General Methodology

***Spectrum Approach.*** Centralized and distributed IS approaches are plotted against a spectrum of strengths and weaknesses. The mix of centralized and/or distributed capability that is appropriate for a particular application of IS installation may thus be determined according to the user's specific requirements.

Computing Models. These analytical tools, designed to highlight the extent to which applications are sensitive to the unique capabilities of specific types of platforms, include:

- *Centralized.* Major economies of scale along with high levels of data availability, integrity and security through concentration of processor resources.
- *Intermediate.* Ability to provide flexible and-or local multi-user capability in large networked applications.
- *Desktop.* User-friendliness, interactive, graphics-intensive performance and individualized computing capability.

The models are not mutually exclusive and in practice most user implementations will involve a combination of two or all three computing models. These do not imply any specific system or architecture. For example, the centralized model applies equally well to mainframes, midrange systems and large servers used in a centralized role. Similarly, the intermediate model may apply to networked midrange systems, multi-user microcomputers and PC/LAN configurations. The desktop model applies to both PC and workstation environments.

#### 2.3.2. Applications Methodology

Applications in the enterprise model are the primary sources of IS business value. The manner of their implementation should be that which is most effective in achieving business goals. Rightsizing decision, which may be influenced by other factors, are primarily applications-driven. Although there will inevitably be wide variations among users and industries, three general categories of applications are defined.

***Basic Business Accounting.*** This includes accounting software, financial management, human resources and related applications. Although these may be linked to other systems, they are relatively consistent across and among companies. They typically conform to legal requirements or business norms over which the organization has limited control. These are, in most cases, not particularly sensitive to the strengths of the intermediate and desktop models. There are some advantages to providing more user friendly access to the data contained in these applications and PCs may be employed in many organizations to achieve this. The logic for client/server or departmental capability is weaker. Data integrity and security, which are major requirements for this type of applications, can typically be standardized, major economies of scale will also apply. Benefits are more likely to come from consolidation than from distributed approaches.

**Business Process Automation.** This broad category of applications that automate structured, organizational work processes in businesses or public sector agencies can be divided into two main groups:

- Applications specific to a particular industry or

type of business,
- Applications that automate functional work processes.

These applications are likely to benefit more from an intermediate approach. PCs or workstations may again be employed to provide user-friendly interfaces to systems and applications. However, key benefits come more from building flexibility and intelligence into networks, than from the unique strengths of desktop computing.

Information-Driven Applications. These automate the collection, manipulation and/or dissemination of information rather than work processes and include:
- Application for numerical and graphical requirements. Executive information and decision support systems, spread-sheets, project managers.
- Applications for handling document creation, editing and distribution. Text-processing, office automation, report generators, electronic mail, document management systems.

These applications are candidates for a strong desktop emphasis. They automate predominantly individualized processes such as data analysis, decision support and information communication. PC and workstation capabilities involving interactive and graphics-intensive processing are also applicable to data analysis and interpretation.

**Benefits**

***Compatibility with Hub Topologies.*** The applications methodology may be combined with that used for determining optimum hub concentration. In practice, this will assist both in rightsizing platforms and in building hub topologies around them.

***Prioritization of Resources.*** There may be benefits to 'downsizing' and/or moves to client/server computing in many applications. However, the claim that such moves will invariably save costs is at best unclear. In many cases, the expected increase in flexibility is annulled by delays in implementing relatively complex applications on distributed, heterogeneous platforms. Broad-based 'downsizing' attempts commonly result in a dissipation of resources that satisfies neither end users nor management. The enterprise methodology focuses on 'downsizing' applications where distributed and/or desktop computing offer significant advantages over centralized platforms. This approach can result in significantly better utilization of IS resources by prioritizing their deployment in areas of maximum realizable benefit.

***Economies of Scale.*** These can yield significant bottom-line gains. A recent study of the practices of leading-edge corporations in the United States and Japan showed that cost reductions of between 5 and 80 percent were achieved by consolidating and re-engineering accounting, finance, human resources and related applications that were previously dispersed within organizations. Company-wide accounting and finance costs were reduced, for example, from between 2.5 and 4 percent of revenues to around 1 percent. This approach can be extended to other business applications that are relatively consistent across organizations. The key is to identify duplications and redundancies, and to quantify economies of scale from their removal. If consolidation is properly landled, users should experience no loss of flexibility and will experiences reduced costs, improved service levels and higher-quality applications.

New Business Value. Automation of basic business accounting applications were the first main source of IS business value during the 1960s and 1970s. Business process automation applications formed a second wave. But only a fraction of the bottom-line impact of information-driven applications has been realized to date. In the future, corporations will compete increasingly on the effectiveness with which they handle information. Information-driven applications are potentially the main source of new IS business value in the 1990s. Realization of this potential requires an enterprise approach. The power of the desktop to interpret and communicate information is irrelevant if data is not available, and if mechanisms for information access and distribution are not in place. Realizing the potential of the PC or workstation for information-driven applications requires major attention to the organization and availability of databases and to the creation of information infrastructures.

### 2.4. New Sources of Business Value

There are numerous ways in which IS can create business value, most of which can be realized within the context of the enterprise model. There are also major new forms of business value that can be realized through the synthesis of technologies proposed by the model. Identification and realization of these opportunities is still at an early stage, although a few have already begun to emerge.

#### 2.4.1. Infrastructure-Driven Process Redesigns

Creation of IS infrastructures brings numerous gains from improved availability and distribution of information, software and networks consistency and IS personnel deployment. It can also play a more dynamic role in the realization of business value. The enterprise approach involves the creation of transparent flows of information within organizations. Where these cross-functional integration and business process redesigns may be more effectively realized. These reduce the number of stages in business processes, typically by using IS technology to eliminate personnel-intensive tasks. Costs are reduced and business process cycles are speeded up. This results in improved competitiveness and flexibility. In practice, fewer people almost invariably equates to greater efficiency and faster job throughput. Infrastructure programs can thus be usefully coupled with business process redesigns, using the infrastructure itself to generate bottom-line gains. Infrastructure investments can be cost-justified on the basis of these gains.

### 2.4.2. Information Empowerment

During the 1908s, PCs empowered individuals with computing tools while distributed systems had the same effect on business units, departments and divisions. The next phase of this process is information empowerment. This combines user computing power with access to organization-wide databases and information distribution systems, supported by underlying network and resource management facilities within the IS infrastructure. A wide range of new information-driven application are emerging.

***Decision Automation Systems.*** An extension of decision support systems, these incorporate more powerful tools, real-time data and closer integration with ongoing management, planning and budgeting processes. They allow decision-making authority and accountability to be more effectively decentralized to lower organizational levels. Decision-making processes are also speeded up. Companies may now compete more effectively on a stream of ongoing, well-informed tactical decisions geared to localized competitive, market and environmental conditions. They can also respond more effectively to time-sensitive competitive actions and market opportunities.

***Front-Line Systems.*** These extend the enterprise approach to employees who interface with customers and/or who are engaged in manufacturing, distribution and similar activities. Low-cost workstations, new mobile computing devices and the latest communications systems are employed. Front-line employees may now be more effectively integrated into an organization's information infrastructure and receive access to critical information resources. They can respond more effectively to customer needs while exercising more initiative in rapidly identifying and responding to business opportunities.

***Command and Control Systems.*** These allow executives and staff specialists to more effectively monitor business operations. Granular variations in business performance, potential cost savings, productivity improvements and new business opportunities may be rapidly identified and acted on. By improving the speed and comprehensives of problem identification, the potential risks of management decentralization may also be more effectively contained.

### 2.4.3. Rapid Deployments Systems

This is an emerging methodology that combines business process redesigns, information empowerment techniques and other components.

Rapid deployment systems define new business techniques for realizing the advantages of decentralization without sacrificing the advantages of size. In practice, these also reduce management layers and administrative overheads while generating significant, measurable productivity improvements.

## 3. Mainframe as Enterprise Systems

### 3.1. Positioning the Mainframe

Much of the confusion that surrounds mainframe positioning comes from the coexistence of two different paradigms. One is the traditional paradigm that the mainframe is a centralized processing system. The other is that the mainframe is a specialized system for the performance of certain high value-added computing functions. The traditional paradigm of the mainframe as a general-purpose processing system developed in the 1950s and 1960s. At that time, CPU power was relatively expensive and highly concentrated. Mainframes were the predominant or the only computing resource available in most organizations. Batch processing dominated date from this period and have not been substantially modified since then. Popular perceptions of the mainframe also commonly draw on this paradigm. The mainframe role has, however, evolved substantially over time. Batch processing has become a minor component of most mainframe workloads. Growth in mainframe -based computing has been driven primarily by networking along with database intensive and transaction-processing applications. Distributed computing, initially in the form of minicomputers started in the 1970s. In the 1980s, growth of PC and LAN usage continued this process. As the balance of computing power has shifted downward in organizations, a certain process of 'natural selections' has occurred. The mainframe, in short, has evolved in a specialized direction. It is this pattern of evolution that can position it to play a major new role in organizational computing strategies toward new millennium.

#### 3.1.1.Mainframe Strengths

In most organizations where it is employed, the mainframe has come to embody three primary strengths. All of these are potentially significant for organizations moving to distributed computing.

***Economy of Scale.*** This is inherent to any centralized or concentrated IS resource. The mainframe, being more concentrated than most computing resources, tends to benefit more from this principle. This explains why most large organizations still typically run their basic business accounting applications on mainframes. Similarly, economies of scale are a major contributor to the continued mainframe role as a host for large mission-critical OLTP applications. Economy of scale is relevant to certain types of applications processing. It also applies more generally to such capabilities as resource and data management.

***Resource Integrity.*** Any centralized system, because it represents fewer points of failure, has the potential to achieve high levels of integrity. This applies to processor resource, database and networks. In the case of the mainframe, inherent centralization strengths are reinforced by the embedded stability of mainframe hardware, operating systems and applications. Integrity has been a major design parameter for mainframe vendors as well as for independent suppliers of mainframe software. Integrity of system, data and network resources is highly relevant to mission-critical applications. It is also significant for protecting and ensuring availability of critical organizational data resources. As organizations move to distributed computing, mainframe strengths also become relevant to maintaining the integrity of dispersed systems and databases as well as large, heterogeneous network infrastructures.

***Data Management.*** This has, over time, become the core strength of mainframe architecture. Mainframes are optimized for the management and movement of large volumes of data. This optimization extends to hardware, operation systems and basic software platforms (large DBMS, systems managed storage). The data management strengths of the mainframe contribute to its continued role as a centralized processor. Mainframe-based mission-critical OLTP applications commonly involve handling large volumes of data. Similarly, data management capability is central to resource management applications. Mainframe strengths should be highly applicable in organizations where shifts to distributed computing will make it necessary to maintain large databases of dispersed devices, configurations and operational information. Mainframe data management strengths are also potentially relevant to another major 1990s trend involving the growth of data volumes. Use of graphical user interfaces (GUIs) and workstation graphics, along with new IS technologies for relational databases, image-processing requirements, high-quality document-processing applications, expert systems and object-based architectures, will all radically expand the volumes of electronic information circulating within organizations.

#### 3.1.2. Trends and Futures

There are strong arguments that mainframes, in their present from, may be deployed in the 1990s in new ways that are synergistic with the growth of distributed computing. There are also indications that current trends in mainframe-based computing and the future evolution of the mainframe environment will reinforce these synergies.

***Economy of Scale.*** Consolidation of data centers, which has yielded significant reductions in cost and improvements in throughput, highlights the importance of this factor in mainframe economics. Similarly, mainframes are getting fewer but bigger, as users consolidate processors into larger system complexes. In the future, it can be expected that mainframes will evolve toward radically larger configurations. New techniques are expected to emerge for interconnecting multiple processors within single system images. The competitiveness of mainframes in leveraging economies of scale is thus likely to increase.

***Data Management.*** In this area, there are clear signs that significant enhancements will occur in the future. All of the major mainframe hardware vendors are working in this direction. For example, it is expected that IBM's Enterprise Systems Architecture (ESA) will evolve from its present level of 18 terabyte addressabillty to at least 128,000 terabytes. Significant improvements are also expected in efficiency of data addressing, data-base capability, I/O bandwidth, disk storage and other data management parameters. The general evolution of IBM-compatible mainframe systems will be toward a 'data-base-optimized' mode of performance. Hardware, software and I/O components of mainframe architecture will be increasingly geared to the management and movement of large data volumes. Mainframe databases are also making a transition to the relational model. As this occurs, new possibilities are opened up for the mainframe to support distributed information-driven applications. Users in environments such as DB2 have seen growth not only in established applications, but also in such areas as decision support and executive information systems. PCs are typically used to access mainframe databases.

***Resource Management.*** There is a clear trend among mainframe users as well as mainframe hardware and software vendors to merge systems, network and business management functions. Existing platforms for such functions as performance management, system management storage, database administration operations management and network management are converging toward integrated, multifunction resource management systems. An increasing number of enables are also becoming available to link mainframe management applications to distributed midrange systems and PC/LAN networks including UNIX-and open systems-based environments.

### 3.1.3. Mainframe as Enterprise Hub

In organizations adopting the enterprise model, the mainframe role is clearly that of a hub. Because mainframes are and will probably remain the premier centralized computing resource in most organizations, they are likely to be primary hubs. In very large organizations with multiple mainframe installations, they are becoming the basis of a backbone level of the hub topology. In positioning the mainframe in this role, it is important to distinguish between core mainframe strengths that are specific to centralized processing and those that are more widely applicable to distributed and client/server computing. In the 1990s, it can be expected that economies of scale and other aspects of mainframe architecture will maintain a role for the mainframe as a central processor. Mainframes will typically become the basis of dual hubs providing both conventional and client/server computing services. However, the main growth will come from repositioning the mainframe as an enterprise hub providing new support services for distributed applications an users.

### 3.1.4. Enterprise Hub Functions

***Data Management Hub.*** The mainframe focal point is database management systems (DBMS), such as a high-performance relational platform. This is supported by facilities for maintaining the availability, integrity and security of data resources. The DBMS is underpinned by hardware and software facilities that allow for the construction and efficient addressing of large memories, databases and files concentrated in the hub. It is also supported by high-bandwidth access to large volumes of active data. These also provide secure storage of archival and back-up data. As a data management hub, the mainframe is used to house and protect important organizational data. In additional to supporting centralized mainframe-based applications, it acts as a database server for distributed applications and users while maintaining back-up copies of critical data resident on decentralized systems. The DBMS also acts as the focal point for the mainframe role as a resource management hub. This enables on-line databases of distributed devices and configurations including assets and operational data to be efficiently and comprehensively maintained as the basis of enterprise resource management strategies. The mainframe may also host hierarchical database managers dedicated to specific applications. Where this is the case, mechanisms are put in place to ensure transparent access to applications data by users regardless of the DBMS' location. It is particularly important that hierarchical databases and files used for core business accounting and mission-critical applications be accessible to information-driven requirements for such purposes as analysis and decision automation.

***Network Hub.*** The mainframe plays three different, but complementary roles (see Figure 3.).

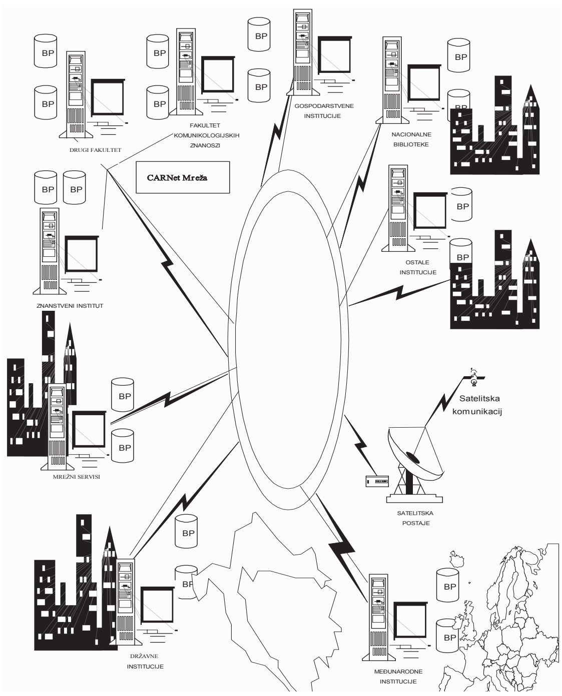


Figure 3. Organizational show the Croatian Model the Global Comunnication System

***System Network Architecture (SNA) Networks.*** Hierarchical networks used in hierarchical applications will typically continue to function as before. The mainframe will act as a classical SNA host handling controller and device networks. However, the mainframe role as an SNA hub major also evolve in other directions. IBM appears to be moving SNA more toward a hub topology. Growing use of gateways and routers to carry LAN traffic over SNA backbone also suggests that, in practice, the SNA role in future enterprise networking environments will continue to be substantial.

***Open Networks.*** As a hub in networks using such architectures as TCP/IP, the mainframe does not possess the same control functions as in hierarchical SNA networks. Logically, it is simply another node on the network. It does, however, act as a focal point for communications switching. It also servers as a primary resource for system, network and business management tasks that benefit from economy of scale and/or require operator intervention.

***'Enterprise Router'.*** In a network hub role, mainframe data management strengths are significant. High-bandwidth I/O facilities, interconnected to the organization's communications infrastructure, allow for efficient movement or large volumes of data within and between hubs as well as between hubs and distributed systems. The growth of distributed computing will, in most organizations, result in major increases in the volume and complexity of network traffic in the 1990s. Mainframes will increasingly evolve into enterprise routers, to direct high-volume data traffic along network backbones.

***Information Distribution Hub.*** The mainframe has no direct role as a hub for this component of IS infrastructures. Software environments will typically be implemented in peer-to-peer form to support informations communications between PC and workstation users. In practice, it is likely to have a substantial indirect role. It can be expected that mainframe databases will be used to house numerical and graphical information and to maintain copies of more important documents and messages.

***Resource Management Hub.*** The mainframe role is built around three components.

System Management. This capability is initially focused on the mainframe environment itself. Different facilities are progressively automated and integrated. This maximizes cost-effectiveness and performance of all hardware, software and communications components. The eventual goal is to implement highly automated operations in which complex local and/or remote host installations can be managed by small cadre of IS professionals using common interfaces and tools.

***Network Management.*** The mainframe hub role initially focuses on the management of large, backbone networks. Mixed-mode facilities are implemented for major protocol stacks such as SNA, TSP/IP and OSI including vendor-specific network management architectures and platforms. The objective is to create an environment capable of supplying a common suite of management services for heterogeneous, multi-vendor wide-area networks. Managements of local area networks can then be integrated at two levels, consisting of basic physical infrastructure management and management of LAN operating environment such as NetWare. The goal of this exercise should be to consolidate LAN management functions to achieve greater efficiencies and cost-effectiveness. Local flexibility in applications and configurations at higher software levels should be preserved if this required by the user.

***Enterprise Resource Management.*** This is a broader goal. The objective is to progressively automate and integrate system and network management functions for both mainframes and distributed systems. This provides greater overall efficiencies for IS installations and allows for the performance of system and network management tasks by a common set of operators.

## 4. Realization

There is no inherent technological reason why the mainframe role as an enterprise hub should not start to be realized now. Tools to achieve the different hub functions and implement interpretability with distributed midrange systems, UNIX-based platforms and PC/LAN clusters are available. In many cases, the obstacles to realization are more organizational than technological. It is necessary to establish new paradigms both of the IS-user relationship and of the role of central IS systems and organizations. In achieving this, the following techniques have proved effective. If can be expected that these will be more widely adopted in the future.

***Economy of Scale.*** The financial principles of economy of scale are not well understood. However, once adopted, they can yield significant cost savings through consolidation and re-engineering of applications.

***Information-Driven Applications.*** Consolidation of mainframe databases for basic business accounting and mission-critical applications can be combined with new desktop systems and tools in realizing new, high-productivity applications such as decision automation systems.

Core Competence. The mainframe role and that of the IS organization are highly synergistic with this business model. It proposes methodologies for leveraging key strengths and skills that can be used to define new organization-wide roles for centralized IS and staff. Alternative Development Approaches. To respond to changing business demands on IS, it is necessary to develop new approaches to mainframe applications development. If properly employed, CASE strategies can meet user needs more effectively and reduce the need for later changes by mapping applications to underlying business processes. Re-engineering can similarly improve the flexibility and performance of legacy applications. Changes in project management procedures, programmer organization and other parameters can also yield major benefits.

***Service Business Model.*** In many organizations, the central is function operators as a 'utility'. This is an excellent approach, if there is sufficient support for it among management and users. However, the development of new, higher value-added services supporting distributed users requires adoption of the 'service business' model for the central IS role. This proposes greater flexibility in the content of user services and changes in pricing, packaging and delivery mechanisms. It also involves the creation of a proactive IS marketing capability to interface with and sell new services to internal and/or external customers.

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