Mid Semester Assignment
Course: - Distributed Computing

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Class and Section:_____MS CS 4TH SEMESTER

<u>Question1:</u> Provide an example of a modern Distributed System not discussed in the course; discuss how this system solves certain challenges by employing distributed architecture.   (5)

<u>ANS1:</u>

As a provision of good example of modern distributed system not discussed in the course can be National Database and Registration Authority(NADRA) which is commonly called Nadra. It is an independent and autonomous system which solves certain challenges such as regulating government database and statistically managing the sensitive registration database of all the national citizens of Pakistan. Employing distributed architecture of autonomous computers which communicate with each other through messages, Nadra has successful projects like the ID Card, Passports, Immigration Control, Motor Vehicle Registration (VIN), Law & Order enforcement, Credit Ratings, Authentications of all Transactions, Statistical data, Birth/ Marriage/ Death Registration, GIS, eGovernance, Disbursement of Grant, Planning at Federal, Provincial, District, Local Government etc, is based on the authenticity of the database.. It is one of the largest government database institution, employing more than 11,000 people in more than 800 domestic offices and five international offices. It also claims to hold the record for maintaining the largest biometric database of citizens in the world.

<u>Question2:</u> Among the trends of Distributed Systems discussed in C1-Lec2, which trend in your opinion will be most dominant in the future and why?   (4)

<u>ANS 2:</u>

In personally believe that the trend of "emergence of ubiquitous computing coupled with the desire   to support user mobility in distributed systems" will be most dominant in the future. There are several reasons I believe so. First of all, people have an increasing desire for ubiquitous access to information. They want the information to be available anytime and anywhere. Moreover, mobile devices in the shape of portable phones and notebook computers are now common places and we observe almost every one utilizing them. Hence technologies such as WAP, GSM, UMTS, and similar third generation cellular communication standards will be properly utilized and soon give rise to new mobile devices that provide fast and immediate access to internet. Thus I am of the opinion that the trend of ubiquitous computing will be dominant amongst other trends in the future.

Question3: **Among the challenges of Distributed Systems discussed in C1-Lec2, which problem in your opinion will accompany distributed systems into the future and why?** **(3)**

ANS 3:

In my opinion and understanding after studying the lecture and researching further, I think Performance is the problem which will accompany distributed systems into the future. Performance is always important issue and challenge of such systems. It is because distributed systems consist of different task scheduling algorithms. Proper solutions need to be provided to minimize this problem in the future.

Question4: **The design of distributed systems can be described and discussed in three ways i.e Physical Model, Architectural Model and Fundamental Model. Describe the example of distributed system in Question1 with respect to these three models.** **(5)**

ANS 4: To describe the example of NADRA of distributed in Question 1 with respect to models, lets first have a look of the system diagrammatically.

NADRA

PEOPLE

National Database

PROCESS

TECHNOLOGY
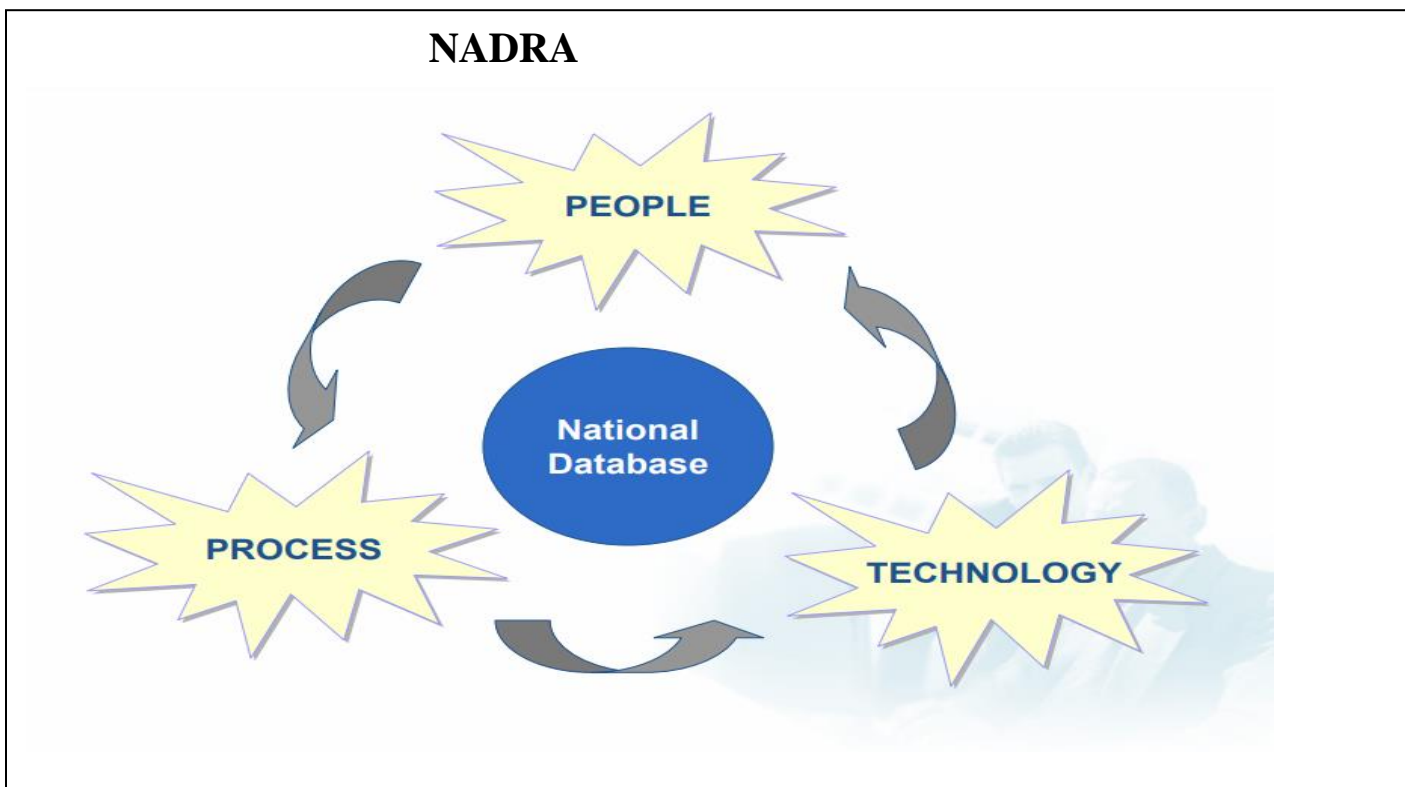
1. Physical Model:

It is probably the largest fully integrated database in the world. The various physical components of the above mentioned distributed system include both an Automatic Finger Identification System (AFIS) & a Facial Recognition System. It can be further divided into the physical components of National Data Warehouse, Storage Capacity of 60 Terabytes, Processing Speed of 18 Trillion Instructions/ Sec, Multilingual Support of English/ Urdu/ Sindhi , AFIS with a matching speed of 16 million/sec, World largest Facial Library of 47 million images (ICAO) , Network Infrastructure, Highly redundant, scalable and mission critical. It is connected with more than 8000 computers and Equipped Terrestrial, VSAT, and DVB RCS/2 WAN. It has

above 7906 Number of Computers, 613 number of servers, 354 NCRCs, above 36 Mbps of Bandwidth and above 4 Mb of internet bandwidth, 13 MHZ Satellite Bandwidth and more than 189 Mobile vans.

2. Links Architectural model:

The communication between the processes and the computation are the main concerns. In order to improve civil registration system, CRMS was introduced by NADRA at Union Council Level. Under this system event of Birth, Marriage, Divorce and Death are captured, which very vital in nature. NADRA has provided software, certificate paper and also imparting training to UCs Secretaries. 480 computer touch screen kiosks have been installed all over Pakistan to facilitate the citizens providing them Utility bills payment, Cell phone scratch cards, CNIC verifications. All the regional offices are connected with main offices and they are further linked with the head office in Islamabad which offers services of a main database and fetching facilities.

3. Fundamental model:

The KIOSKs are linked with the regional offices. In case the request for fetching the data from one center fails, the requested is forwarded to the other nearest center for the retrieval of data. The security of each system is maintained through the administrators of each site. The objective is to enhance the speed, provide accurate data retrieval and storage. in case of failure of an operation, it is sometimes omitted, arbitrated or timed out depending on the nature of the action performed. Each component in a distributed system is generally constructed from a collection of other components. It is possible to construct reliable services from components that exhibit failures. For example, multiple servers that hold replicas of data can continue to provide a service when one of them crashes. A knowledge of the failure characteristics of a component can enable a new service to be designed to mask the failure of the components on which it depends. A service masks a failure either by hiding it altogether or by converting it into a more acceptable type of failure.

Question5: **What is the purpose of Inter Process Communication (IPC) in distributed systems? Given the choice which protocol out of UDP and TCP will you use for your own distributed system and why?** **(5)**

ANS 5: The purpose of Inter Process Communication in distributed systems is to exchange the data between two or more independent processes. IPC is important to the design process for microkernels and nanokernels to reduce the number of functionalities provided by the kernel.

Given the choice, I would prefer using TCP for my own distributed system because it enables sending a stream of data and can automatically overcome packet loss, and delivers data in order. Furthermore, it does automatic flow control to match the sender rate with receiver rate. Such qualities are desirous in my own distributed system and hence I would opt for using TCP.

Question6: **The following are some of the threats and attacks on Distributed Systems. Provide potential solutions as how may be these threats and attacks be mitigated?** **(8)**

1. **Leakage :**
2. Tampering
3. **Vandalism**
4. **Eavesdropping.**

ANS 6:

For leakage, Firewalls may be used as they produce a local communication environment in which external communication is intercepted. Messages are forwarded to the intended local recipient only for communications that are explicitly authorized.

Vandalism can be mitigated by the security technique of Access Control. For any interference with the proper operation of a system, the server must first authenticate the request message and the principal's credentials and then apply access control, refusing any request for which the requesting principal does not have the necessary access rights to perform the requested operation on the specified resource.

The potential solution for mitigating Tempering and Eavesdropping is to use the security mechanism of Public-key and secret-key cryptography. Cryptographic algorithm scramble messages in a manner that can not be reversed without knowledge of decryption key. If two parties share a secret key, they can exchange encrypted information without risk of eavesdropping or tampering and with guarantees of authenticity.