جامعة طرابلس

كلية تقنية المعلومات

قواعد البيانات النقالة والغير متجانسة

Heterogeneous and Mobile Databases

ITMC322

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المحاضرة الثالثة

Review of topics

- *Database Systems classification*
  - *Centralized Databases*
  - *Parallel Databases*
  - *Client/Server Topology*
  - *Peer-to-Peer Topology*
  - *Distributed Databases*
  - ***Multidatabases***
  - ***Mobile Computing***

Database Systems classification

Multidatabases

Adding control distribution to the definition of distributed databases as discussed in previews section results in an environment with the following characteristics:

- Data is distributed and stored in several locations,
- Processes are more distinguished,
- Underlying platforms could be parallel, and
- Processing nodes are autonomous.

Multidatabase systems (MDBS) represent the case where individual DBMSs (whether distributed or not) are fully autonomous and have no concept of cooperation; they may not even “know” of each other’s existence or how to talk to each other.

Database Systems classification

Multidatabases

This brings out a new computational paradigm that is referred to as multidatabase or heterogeneous distributed database.
Due to the autonomy, local databases can join or leave the global information infrastructure at will.
Note that , the autonomy comes in the form of design autonomy, communication autonomy, execution autonomy, and association autonomy.
Then, autonomy implies heterogeneity. Therefore, autonomy and heterogeneity are the major features that distinguish a multidatabase system from a traditional distributed database system.

Database Systems classification

Multidatabases

The differences in the level of autonomy between the distributed multi-DBMSs and distributed DBMSs are also reflected in their architectural models.
The fundamental difference relates to the definition of the global conceptual schema. In the case of logically integrated distributed DBMSs, the global conceptual schema defines the conceptual view of the entire database, while in the case of distributed multi-DBMSs, it represents only the collection of some of the local databases that each local DBMS wants to share.
The individual DBMSs may choose to make some of their data available for access by others (i.e., federated database architectures)

Database Systems classification

Multidatabases

the definition of a global database is different in MDBSs than in distributed DBMSs. In the latter, the global database is equal to the union of local databases, whereas in the former it is only a (possibly proper) subset of the same union.
In a MDBS, the GCS (which is also called a mediated schema) is defined by integrating either the external schemas of local autonomous databases or (possibly parts of their) local conceptual schemas.
Furthermore, users of a local DBMS define their own views on the local database and do not need to change their applications if they do not want to access data from another database. This is an issue of autonomy.

Database Systems classification

Multidatabases

Designing the global conceptual schema in multidatabase systems involves the integration of either the local conceptual schemas or the local external schemas (Figure 4.1). A major difference between the design of the GCS in multi-DBMSs and in logically integra
the mapping is from lo
schema.

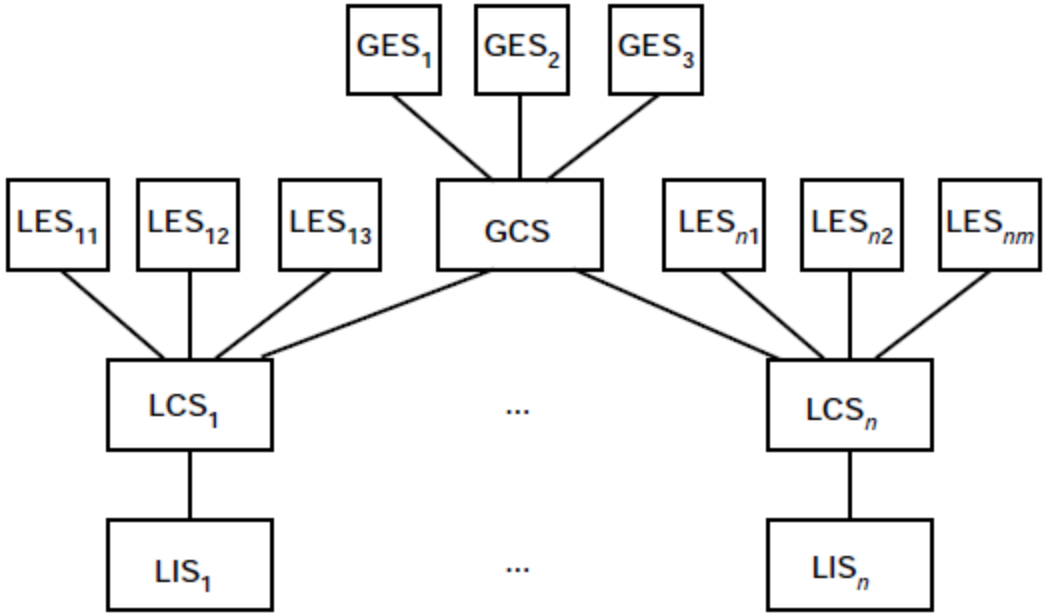

Fig. 4.1 MDBS Architecture with a GCS

Database Systems classification

Multidatabases

To conclude, multidatabases are more dynamic and robust than distributed databases - i.e., system expands and shrinks more rapidly. The design of multidatabase is a bottom up approach - i.e., integration and interoperability of pre-existing databases. Consequently, while data distribution is a major concern in the design of distributed databases, data integration is the major concern in the design of multidatabases

Database Systems classification

Multidatabases

The component-based architectural model of a multi-DBMS is significantly different from a distributed DBMS. The fundamental difference is the existence of full-fledged DBMSs, each of which manages a different database.
The MDBS provides a layer of software that runs on top of these individual DBMSs and provides users with the facilities of accessing various databases (Figure 4.2). Note that in a distributed MDBS, the multi-DBMS layer may run on multiple sites or there may be central site where those services are offered. Also note that as far as the individual DBMSs are concerned, the MDBS layer is simply another application that submits requests and receives answers.

Database Systems classification

Multidatabases

The component-based architectural model of a multi-DBMS

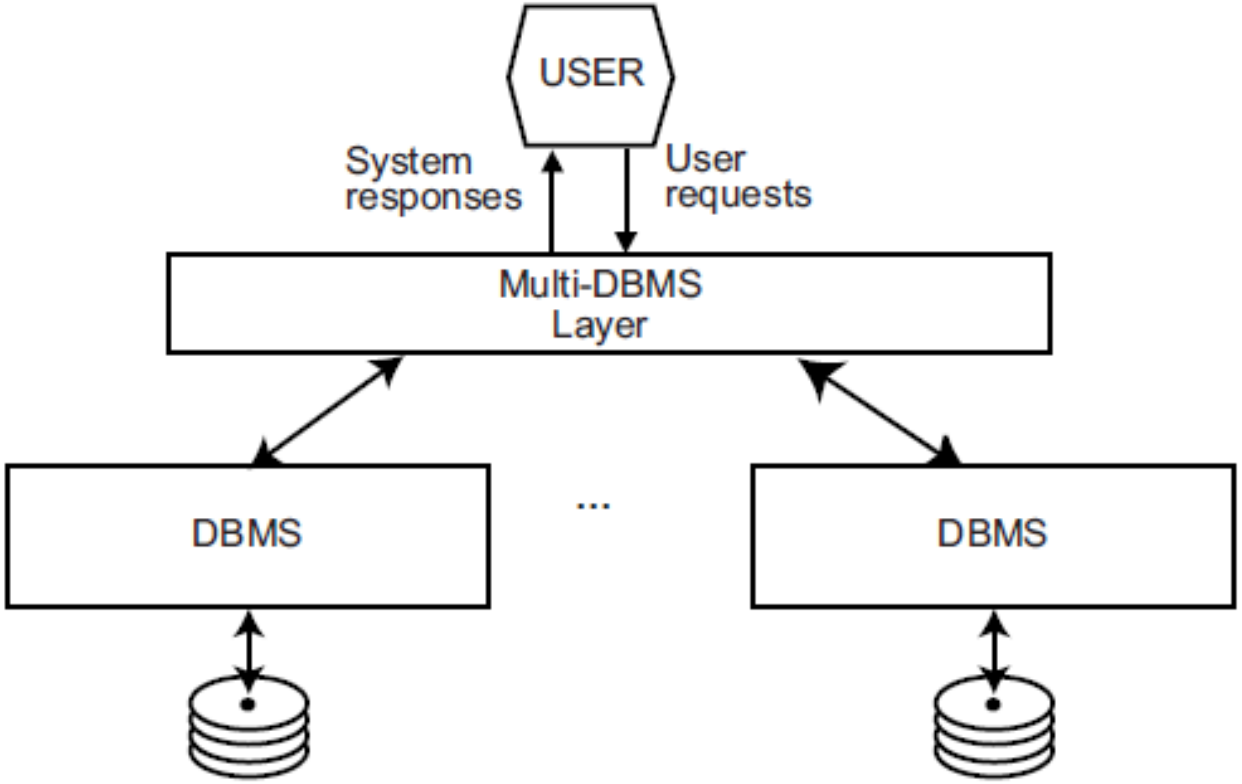

Fig. 4.2 Components of an MDBS

Database Systems classification

Mobile computing is human–computer interaction by which a computer is expected to be transported during normal usage, which allows for transmission of data, voice and video. Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc networks and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile devices or device components. Mobile software deals with the characteristics and requirements of mobile applications.[1]

[1] : https://en.wikipedia.org/wiki/Mobile_computing

Database Systems classification

Mobile Computing

Remote access to various types of data is not a new concept. Traditional distributed databases and multidatabases relying on fixed network connectivity have addressed many of the issues involved in accessing remote data. However, the concept of mobility, where a user accesses data through a remote connection with a portable device, has introduced several disadvantages for traditional database management systems.

These include:

•Reduced network connectivity,

•Processing and resource restrictions, and

•Effectively locating and accessing information from a multitude of sources.

Database Systems classification

Mobile Computing

The mobile computing environment is based on wireless communication that allows the user to access information anywhere at anytime without direct physical link to the network. The wireless network (Figure 4.3) is mainly composed of the following:

- A number of network servers enhanced by wireless transceivers, called mobile support stations (MSS), scattered along a geographical area and
- A varying number of mobile hosts (MHs) free to move at will.

Database Systems classification

Mobile Computing

The mobile computing environment

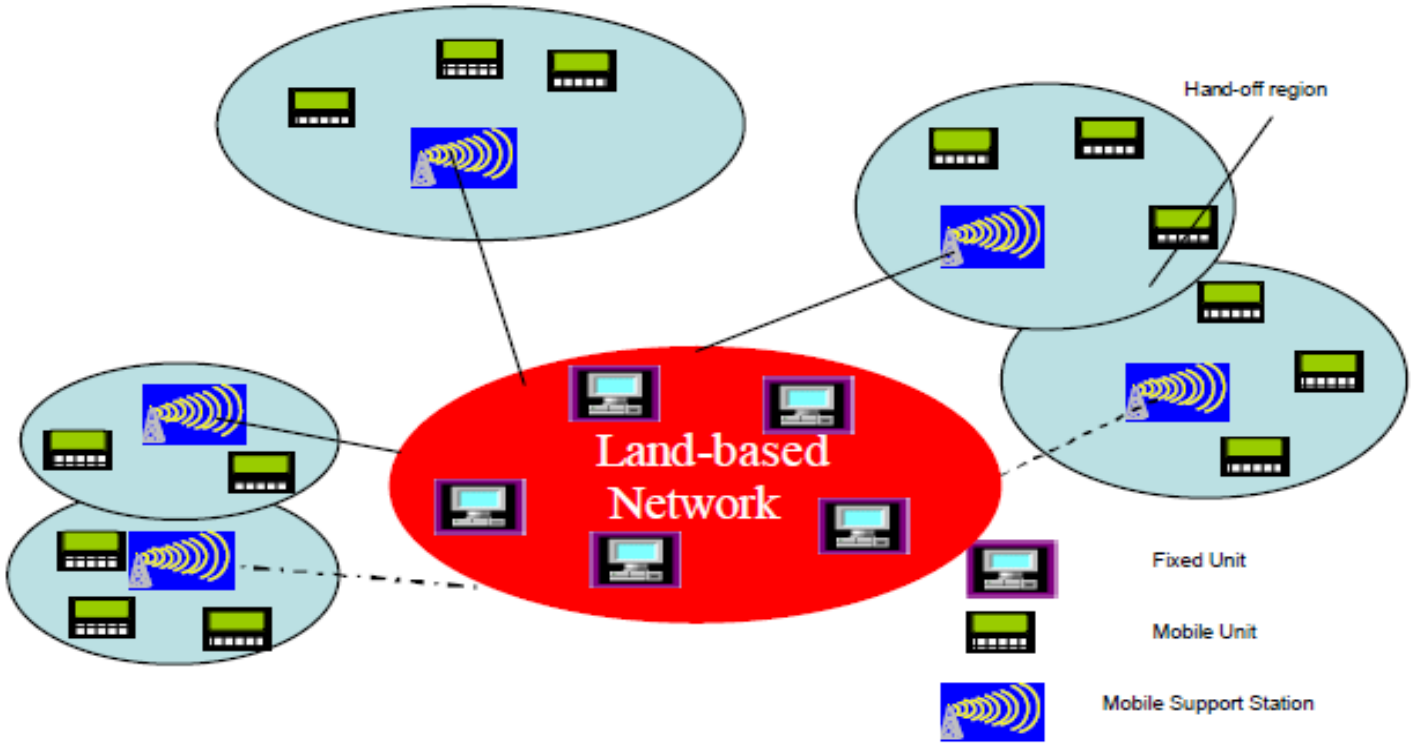

Fig.4.3 Architecture of the mobile computing environment

Database Systems classification

The MSS provides a link between the wireless network and the wired network. The link between a MSS and the wired network could be either wireless (shown as dashed line) or wire based. The area covered by the individual transceiver is referred to as a cell. The size of the area covered by each cell varies widely, depending on the technology being used. The MH is relatively small, light weight, and portable. It is designed to preserve space and energy, and it usually has limited amount of resources (memory, processing power, etc.). Most of the time, the MH relies on temporary power sources such as batteries as its main power source.

To save energy, the MH is design to operate in different operational modes (i.e. active doze,sleep, nap) that consume different amount of power.

Database Systems classification

Performance metrics

Response Time (Execution time, Latency) ─ The time elapse between the start and the completion of an event.
Throughput ─ The number of tasks that can be completed during a given time interval.

Database Systems classification

Performance metrics

Scaleup – Handling large task by increasing the degree of parallelism. It is the ability to process larger tasks in the same amount of time by providing more resources.

Speedup – Running a task in less time by increasing the degree of parallelism.

$$S = \frac{\text{Execution time on Original Machine}}{\text{Execution time on Larger Machine}}$$

Database Systems classification

Performance metrics

Power Consumption – Becomes an important performance metric when we use mobile wireless access devices.

Network Connectivity – Becomes of interest when connectivity is through wireless medium.

Data reliability and integrity – Becomes even more of concern at the presence of mobility and wireless communication.

The End

Thanks for listening ..

Any questions ?