

Distributed Databases Topic 10 - 10.5

Distributed Database Definition

- A database system that is split over more than one site
- This might involve *fragmentation*
- This might involve *replication*

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Why are Distributed Databases Needed?

- Increase in size of firms generally
- Growth of multi-nationals and globalisation
- Benefits of making data available across an organisation
- Diversification
- Performance issues

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Fragmentation and Transparency

Customers Table

London Customers Table

Birmingham Customers Table

Manchester Customers Table

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Replication

Customers Table

Site One

London Customers Table

Birmingham Customers Table

Manchester Customers Table

Site Two

London Customers Table

Birmingham Customers Table

Manchester Customers Table

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Transparency

- Location transparency
- Fragmentation transparency
- Replication transparency

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Visuals Handout – Page 3

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Foundation Rule

- A distributed database system should look exactly like a centralised database system.
- Local Autonomy
- No reliance on a central site


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Vertical Fragmentation



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CustomerID	Name	Area	PaymentType	Sex
6	Smith	London	Cash	M
5	Patel	London	Card	F
8	Singh	Manchester	Card	F
9	Kodogo	Birmingham	Card	F
2	Rice	Manchester	Cash	M

↓

CustomerID	Name	Sex
6	Smith	M
5	Patel	F
8	Singh	F
9	Kodogo	F
2	Rice	M

Vertical Fragmentation
CustomerID, Name, Sex

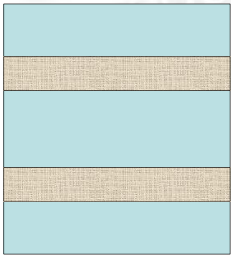
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Horizontal Fragmentation



→ Create fragment with RESTRICT

← Reconstruct original table with UNION

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CustomerID	Name	Area	PaymentType	Sex
6	Smith	London	Cash	M
5	Patel	London	Card	F
8	Singh	Manchester	Card	F
9	Kodogo	Birmingham	Card	F
2	Rice	Manchester	Cash	M

↓

CustomerID	Name	Area	PaymentType	Sex
8	Singh	Manchester	Card	F
2	Rice	Manchester	Cash	M

Horizontal Fragmentation

Customers in Manchester

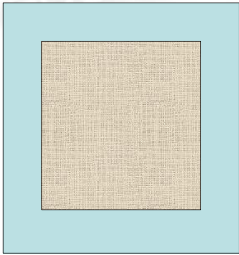
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Vertical and Horizontal Fragment



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CustomerID	Name	Area	PaymentType	Sex
6	Smith	London	Cash	M
5	Patel	London	Card	F
8	Singh	Manchester	Card	F
9	Kodogo	Birmingham	Card	F
2	Rice	Manchester	Cash	M

CustomerID	Name	PaymentType
8	Singh	Card
2	Rice	Cash

Vertical and Horizontal Fragmentation

Customers in Manchester and their Payment Type


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Advantages of Distributed Data

- Emulating organisational structure
- Greater Control
- Improved availability
- Greater reliability
- Better performance
- Easier growth


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Disadvantages of Distributed Databases

- Complexity
- Cost
- Security
- Integrity control more difficult
- Lack of standards
- Lack of experience
- Database design more complex


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Types of Distributed Database

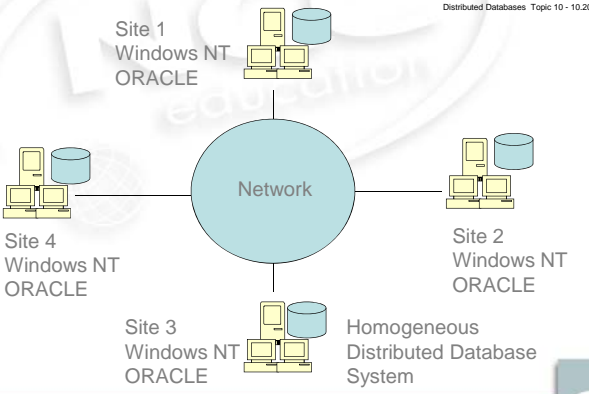
- Homogeneous
- Heterogeneous
- Federated (multi-database)

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Site 1
Windows NT
ORACLE


Site 2
Windows NT
ORACLE

Site 3
Windows NT
ORACLE

Site 4
Windows NT
ORACLE

Network

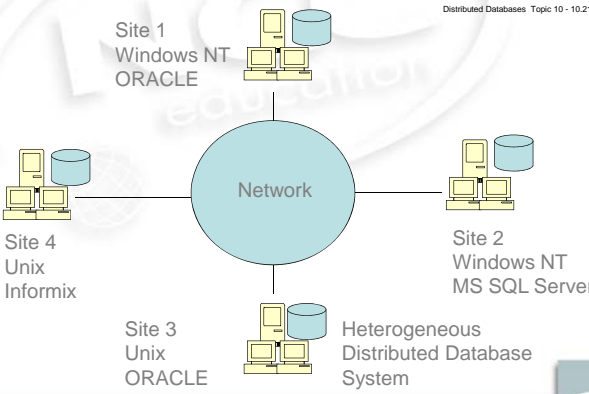
Homogeneous Distributed Database System

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Site 1
Windows NT
ORACLE


Site 2
Windows NT
MS SQL Server

Site 3
Unix
ORACLE

Site 4
Unix
Informix

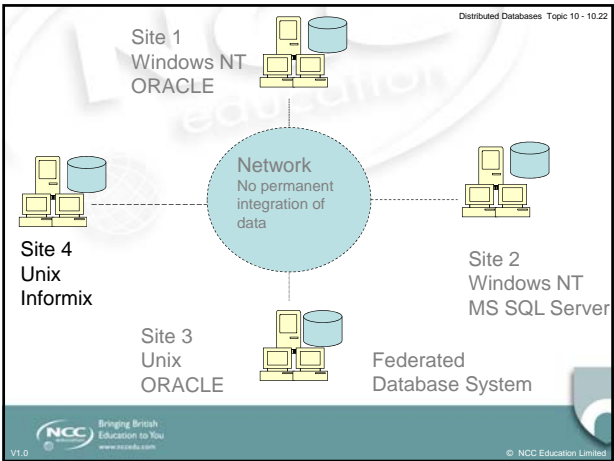
Network

Heterogeneous Distributed Database System

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Distributed DBMS

- More complex system catalogue
- Concurrency control needs to be more sophisticated
- Query optimiser needs to take account of distributed nature of data
- The DBMS itself must be distributed to ensure stability of systems

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Physical Design and Distributed Database Systems

- Follow normal process of physical design in designing base tables
- Investigate which data is used at which site
- Decide on fragmentation needed
- Consider topology of network and traffic on system to minimise traffic

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Learning Outcomes

By the end of this unit students will be able to:

- Recognise the need for distributed data
- Define the main features of a distributed database
- Define the different types of distributed databases

Have we met them?



References

- *Database Systems* Benyon-Davies, Paul. Palgrave Third Edition 2004 Chapter 37
- Connolly, Thomas M., and Begg, Carolyn E., *Database Systems: A Practical Approach to Design and Implementation* Addison-Wesley, Fourth Edition 2005 Chapter 22



Topic 10 – Distributed Databases

Any Questions?