DATA DISTRIBUTION

- **Problem:**

  Choose a unit of the logical database to use for assignment to datamodules.

- **Possibilities:**

  Relations -Distribution issues will influence logical database design.

  Columns -Distribution issues will influence logical database design.

  Rows -Too many; directories become too large

  Data items -Too many; directories become too large

Advantages of fragments as units of distribution

- **Very flexible in size and definition**
- **Distribution choices are largely independent of logical design**

SYSTEM CONSIDERATIONS

- RELIABLE NETWORK

- PIPELINING

LOGICAL DATA ITEMS

DATABASE OPERATIONS: READ
WRITE

TRANSACTIONS: READ SET
WRITE SET
ATOMIC- “ALL OR NOTHING” EFFECT

EACH SITE IN THE DDBMS HAS ONE OR BOTH OF THE FOLLOWING SOFTWARE MODULES:

- TRANSACTION MANAGER (TM)
- DATA MANAGER (DM)

TRANSACTION EXECUTION

TRANSACTION	TM'S ACTION
BEGIN	SET UP TEMPORARY WORKSPACE
READ (X)	SELECT A DM WHICH STORES X, SEND A MESSAGE TO THIS DM REQUESTING X, PLACE X IN WORKSPACE
READ (X)	NO ACTION NECESSARY X IS ALREADY IN WORKSPACE
WRITE (X)	CHANGE THE VALUE OF X
READ (X)	NO ACTION NECESSARY
END	SEND A PRE-COMMIT TO EACH DM THAT STORES A COPY OF X AWAIT ACKNOWLEDGEMENTS SEND COMMIT MESSAGE

OPTIMAL FILE ALLOCATION IN A DISTRIBUTED DATABASE SYSTEM

GIVEN A NUMBER OF COMPUTERS THAT PROCESS COMMON INFORMATION FILES, HOW CAN WE ALLOCATE THE FILES OPTIMALLY SO THAT THE ALLOCATIONYEILDS MINIMUM OVERALL OPERATING COSTS (STORAGE AND COMMUNI-CATION) AND MEET ACCESS TIME REQUIREMENTS FOR EACH FILE; AND DOES NOT EXCEED THE STORAGE CAPACITY OF EACH COMPUTER.

Note: A File may be viewed as a segment

SYSTEM PARAMETERS

- n Computers

- m Files
  - Size of Each File
  - Usage Distribution For Each File at Each Computer
  - Frequency of Modification of Each File at Each Computer During Usage
  - Access Time Requirement For Each File at Each Computer

  Storage Capacity of Each Computer

  Cost of Storage Per Unit File Length Per Computer

  Cost of Transmission Per Unit File Length Per Second Per Pair of Computers

CONTENT OF DIRECTORY

- **Global description**
- **Fragmentation description**
- **Allocation description**
- **Mappings to local names**
- **Access method description**
- **Statistics on the database**
- **Consistency information**

POSSIBLE DATA TYPES IN IDD

- **Data names, definitions, formats and sizes**
- **Integrity constraints, authorization tables, and usage statistics for transaction management**
- **Schemas and subschemas**
- **Description of standardized transactions and reports**
- **Characteristics of hardware, such as processors, lines, and terminals**
- **Description of users**

- **The IDD must support the maintenance of relationship between various entities**
  - **Associations between**
    - authorization tables and data,
    - users and transactions
    - reports
  - **The supplies version control**

CLASSES OF DIRECTORY

- **Centralized Directory**
  - **-Single Master Directory**
  - **-Extended Centralized Directory**
  - **-Multiple Master Directory**
- **Local Directory**
- **Distributed Directory**

CAUSES FOR DIRECTORY UPDATE

- CHANGING THE DESCRIPTION OR STRUCTURE OF THE USER DATABASE
- MOVING USER DATABASE ENTITIES FROM ONE NODE TO ANOTHER
- CHANGING THE DESCRIPTION OF A USER OR NODE
- CHANGING A USER VIEW
- CHANGING A NETWORK NODE’S STATUS

SPECIFIC DRAWBACKS WITH GLOBALLY REPLICATED DIRECTORIES

1) ADDITIONAL REMOTE ACTIVITY TO MAINTAIN DIRECTORY COHERENCE
2) DIFFICULTY OF POSTING DIRECTORY CHANGES TO A DOWN SITE
3) DIFFICULTY OF INTEGRATING A NEW SITE
4) STORAGE OF DIRECTORY ENTRIES WHERE THEY ARE NOT REFERENCED
5) BLURRED RESPONSIBILITY FOR MAINTAINING THE DIRECTORY

PERFORMANCE MEASURE

- Operating Cost/Unit Time = Communication Cost (Query+Update)
  +Storage Cost + Code Translation Cost (Query+Update)
- Response Time

DISTRIBUTED INGRES DICTIONARY/DIRECTORY CONTAIN FOUR TYPES OF DATA:

- RELATION NAME AND LOCATION
- INFORMATION FOR PARSING QUERIES (DOMAIN NAMES, FORMATS, ETC.)
- PERFORMANCE INFORMATION

  (NUMBER OF TUPLES, STORAGE STRUCTURES, ETC.)
- CONSISTENCY INFORMATION

  (PROTECTION, INTEGRITY CONSTRAINTS, ETC. DOES NOT INCLUDE CONTROL DATA FOR CONCURRENCY CONTROL AND SYNCHRONIZATION)

SDD-1 DICTIONARY/DIRECTORY

THE DIRECTORY ITSELF IS DEFINED AND MAINTAINED LIKE ANY OTHER USER DATA. IT CAN BE LOGICALLY FRAGMENTED, DISTRIBUTED, AND REPLICATED ACROSS THE DISTRIBUTED DBMS'S.

A DIRECTORY LOCATOR (A SMALL HIGHLY STATIC FILE OF DIRECTORY FRAGMENT LOCATIONS) OS KEPT AT EVERY SITE AND IS USED BY THE TMs AND DMs TO PLAN AND CONTROL TRANSACTIONS AND TO HELP ENSURE DB INTEGRITY AND CONSISTENCY ACROSS CONCURRENT ACCESSES OF DATA ELEMENTS.

THE TRANSACTION MODULES ARE CAPABLE OF *CACHING* REMOTELY ACCESSED DIRECTORY DATA FOR SUBSEQUENT USAGE. THIS FACILITY IS PROVIDED ON THE PRESUMPTION THAT DB OPERATIONS WILL EXHIBIT THE LOCALITY-OF-REFERENCE CHARACTERISTIC.