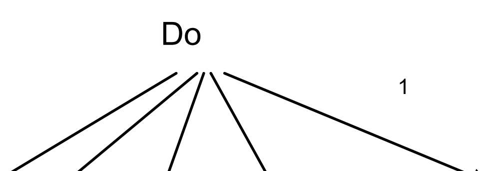
- The most important characteristic of a multimedia information system is the variety of data it must be able to support.
- Multimedia systems must have the capability to store, retrieve, transport and present data with very heterogeneous characteristics such as text, images (both still and moving), graphs and sound.Multimedia Information Retrieval Systems specifically for handling multimedia data.
- Multimedia IR systems must be able to deal with different kinds of media and with semi-structured data.Multimedia IR systems must be able to deal with different kinds of media and with semi-structured data
- The main goal of a multimedia IR system is to efficiently perform retrieval, based on user requests, exploiting not only data attributes, as in traditional DBMSs, but also the content of multimedia objects.
- Data retrieval relies on the following basic steps:
  1.Query specification
  2.Query processing and optimization
  3.Query answer
  4.Query iteration

  Multimedia IR systems should therefore combine both the DBMS and the IR technology, to integrate the data modelling capabilities of DBMSs with the advanced and similarity based query capabilities of IR systems

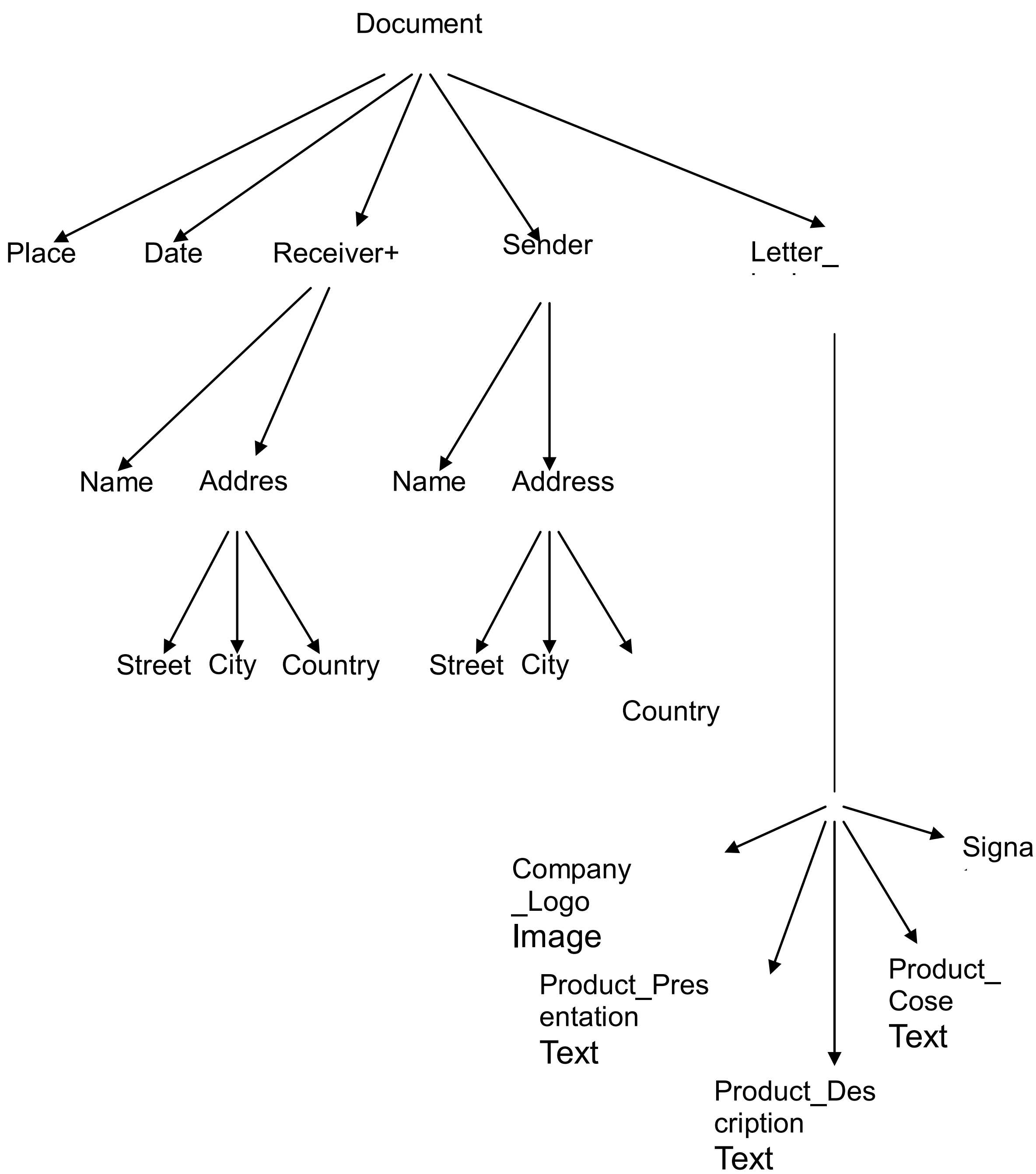
  Data Modelling
- The complex nature of multimedia data may benefit from the use of DBMS functions for data representation and querying. Multimedia data is inherently different from conventional data. The main difference is that information about the content of multimedia data are usually not encoded into attributes provided by the data schema (structured). Rather, text, image, video and audio data are typically unstructured.
- Addressing data modelling issues in the framework of multimedia IR systems entails two main tasks.
- A data model should be defined by which the user can specify the data to be stored into the system.
- The system should provide a model for the internal representation of multimedia data.

  MULTOS data model : Multimedia Office Server is a multimedia document server with advanced document retrieval capabilities, developed in the context of an ESPRIT project in the area of Office Systems.
- MULTOS is based on a client/ server architecture. Three different types of document servers are supported:
  1.Current servers
  2.Dynamic servers
  3.Archive servers
- These three servers differ in storage capacity and document retrieval speed
- Two types of index are constructed:
  1. Object Index
  2.Cluster Index



Conceptual structure of the type **Generic_Letter**

Complete conceptual structure of the type **Business_Product_Letter**



Query languages

Relational/object-oriented database system

- Exact match of the values of attributes

Multimedia IR system

- Similarity-based approach
- Considers the structure and the content of the objects
- Content-based query

- Retrieve multimedia objects depending on their globe content

In designing a multimedia query language, three main aspects require attention

- How the user enters their request to the system
- Which conditions on multimedia objects can be specified in the user request
- How uncertainty, proximity, and weights impact the design of the query language

Request specification

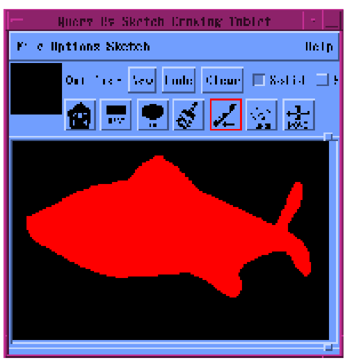
Interfaces

- Browsing and navigation
- Specifying the conditions the objects of interest must satisfy, by means of queries

Queries can be specified in two different ways

- Using a specific query language
- Query by example
- Using actual data (object example)

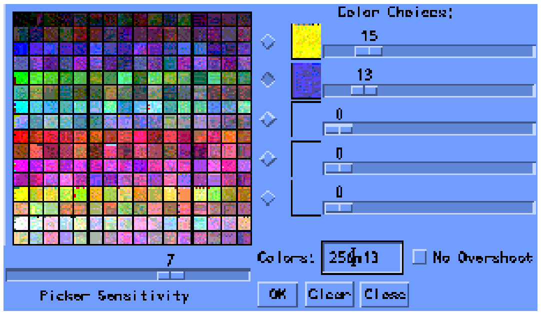
Search Using Sketch in QBIC



- **Sketch entry**

Results of search

Search by Color in QBIC



- **Color selection**
- **15% yellow and 13% blue**

- **Results of search**

Conditions on multimedia data

1. Attribute predicates

- Concern the attributes for which an exact value is supplied for each object
- Exact-match retrieval

2. Structural predicates

- Concern the structure of multimedia objects
- Can be answered by metadata and information about the database schema
- “Find all multimedia objects containing at least one image and a video clip”

3. Semantic predicates

- Concern the semantic content of the required data, depending on the features that have been extracted and stored for each multimedia object
- "Find all the red houses"
- Exact match cannot be applied

Indexing and Searching

→Given two objects O1and O2the distance (=dissimilarity) of the two objects is denoted by D(O1, O2).

→Similarity queries can be classified into two categories: Whole match : given a collection of N objects O1, O2, . .. , ON and a query object Q, we want to find those data objects that are within distance €from Q.

Sub-pattern match: Given N data objects O1, O2, . . . , ON, a

query (sub-) object Q and a tolerance €, we want to identify the parts of the data objects that match the query

Ideal method which required by all categories of queries should ful fill the following requirements:

o It should be fast.

o It should be "correct"

o It must have a small space overhead It should be dynamic

Algorithm-1 Search:

- Map the query object Q into a point F(Q) in feature space
- Using a spatial access method, retrieve all points within the desired tolerance €from F(Q).
- Retrieve the corresponding objects, compute their actual distance from Q and discard the false alarms.
- Lemma(Lower Bounding): to guarantee no false dismissals for whole match queries, the feature extraction function F() should satisfy the following formula:

$$D_{feature}(\mathcal{F}(O_1), \mathcal{F}(O_2)) \leq D(O_1, O_2)$$

Algorithm-2 (GEMINI) Generic Multimedia object Indexing approach:

- Determine the distance function D() between two objects o Find one or more numerical feature-extraction functions, to provide a 'quick-and-dirty' test
- Prove that the distance in feature space lower-bounds the actual distance D(), to guarantee correctness. Use a SAM, to store and retrieve the f-D feature vectors.
- Feature extracting question: If we are allowed to
- use only one numerical feature to describe each data object, what should this feature be?