CAD *versus* GIS
Which is better for Automated Mapping?

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What is the difference between Automated Mapping Systems and Geographic Information Systems (GIS) technologies?

Is there really a difference, and if so, why do users select one technology over the other?

CAD Technology Automates Drafting Functions (1 of 3)

- Nearly all early approaches for automating, organizing, and drafting map data used computerized aided drafting (CAD) technology
  - With particular emphasis on interactive graphics system functionality
- Initially designed to serve the generic need for automating the drafting function
- Early on, used as a tool for increasing worker and organizational productivity in map generation & maintenance

CAD Technology Automates Drafting Functions (2 of 3)

- Database model treats spatial information as electronic drawings made-up of graphic features organized into “layers”
- In early graphics systems, the data model was simple and consisted almost entirely of symbolized graphic features
  - Features were represented by a graphic symbol
  - In later versions, data became more intelligent
- In graphic system software, map files (i.e., layers) can be edited, manipulated, displayed, & generally managed

CAD Technology Automates Drafting Functions (3 of 3)

- Has evolved into more general-purpose map data management tools
  - These tools have become particularly popular in the automated mapping/facilities management (AM/FM)
- Although automated map drafting & general management of map information has delivered significant benefits to government & private organizations, general-purpose, spatial data management requires a database structure & software technology beyond the graphic functionality offered by CAD solutions

CAD SOFTWARE TOOLS

INPUT

- Digitizing
- Graphic Definition
- Existing Data Interface
- Application Software Interface

MANIPULATION

- Feature Layering
- Feature Complexing
- Attribute Linking
- DBMS Functions
- Edgematching

ANALYSIS

- Boolean Operations
- Solid Modeling
- Measurements

INTERACTIVE GRAPHICS

- Feature Manipulation
  - Add, Move, Copy, Rotate, Scale, Mirror, Split, Delete, Curvefit, Smooth
- Dimensions
- Menu Design
- Symbol Design

DISPLAY/OUTPUT

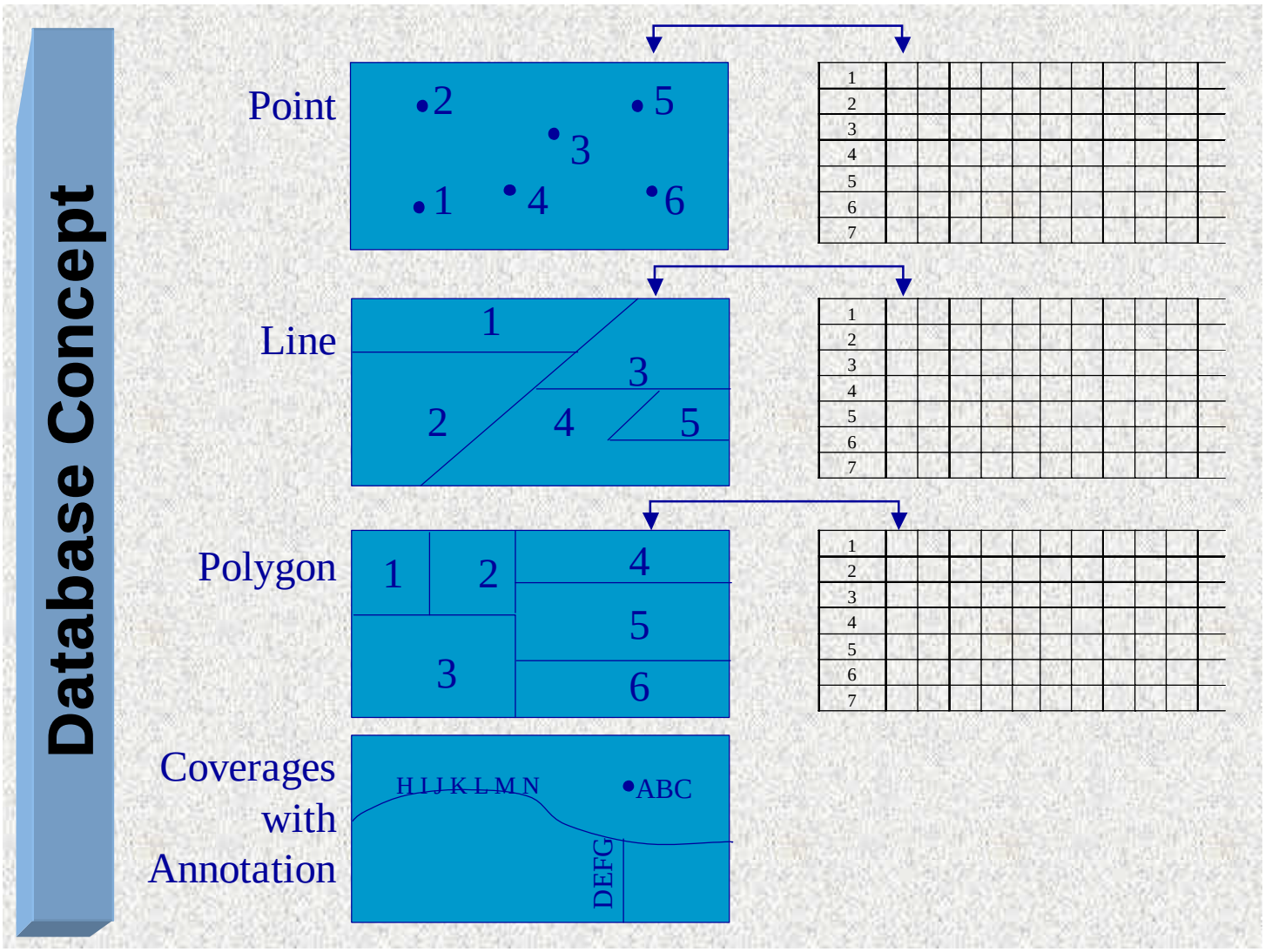
- Feature Symbolization
- Full View Manipulation
- Hidden Line Viewing
- Query
- Reports of Features

GIS Technology Fills Gap Left by CAD Systems (1 of 2)

- A GIS data model involves storage of tabular data (attributes) in association with very simple cartographic features (points, lines, and polygons)
- Notice, cartographic data is stored as a table in non-symbolized form and in “relation” to other attributes
- Purpose & use of these systems were primarily focused on the entry, management, manipulation, analysis, query and display of large collections of spatial data

GIS Technology Fills Gap Left by CAD Systems (2 of 2)

- GIS data model, while similar to CAD approach in that it uses coordinates, is fundamentally different in its simplicity & approach
- Common to the GIS is the use of topology (networks) to store relationships among various spatial objects
  - Topology involves the use of graph theory to abstract & relate cartographic objects using a series of arcs and nodes
- This represents a different and superior structure for geographic data management
  - as compared with the "graphics model"


Database Concept
Point
2
5
3
1
4
6
1
2
3
4
5
6
7
Line
1
3
2
4
5
1
2
3
4
5
6
7
Polygon
1
2
4
5
3
6
1
2
3
4
5
6
7
Coverages
with
Annotation
H I J K L M N
ABC
DEFG

GIS SOFTWARE TOOLS

DATA ENTRY

- Digitizing
- Scanning
- Automated Data Capture
- Interface to Existing Intersect

MANIPULATION

- Map merge
- Projection
- Clip/Window
- Update
- Generalize
- Aggregate

QUERY

- Spatial
- Attribute

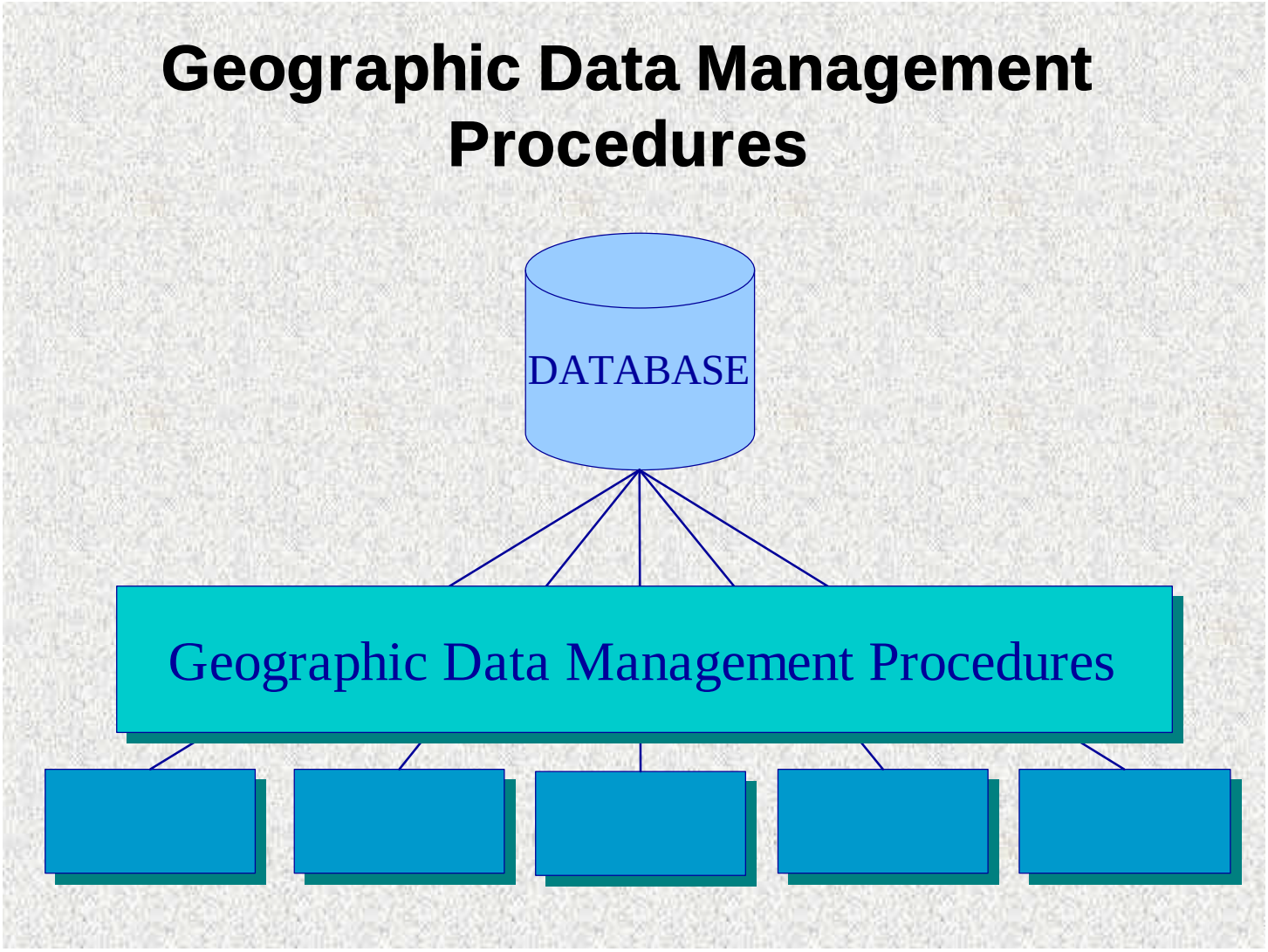
ANALYSIS

- Map Overlay/Intersect
- Nearness Analysis
- Diffusion
- Network Analysis
- Diffusion
- Network Analysis
- Enclosure
- Measurement
- Attribute Analysis
- Interpolation

DISPLAY/REPORT

- Tabular List
- Map Display
- Chart Display

Geographic Data Management Procedures



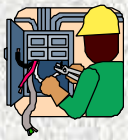
GIS Offers Greater Flexibility

- Can be used as an automated drafting tool
- More than simple storage & regeneration of graphics, rather involves plotting of all displays based on information maintained in a database format
- Does not store map features as graphic symbols, rather organizes features with descriptive characteristics
- Allows user flexibility to associate the symbology of choice with the cartographic objects based on attributes in the database

GIS Offers Greater Flexibility

An Example





- In a municipality, a planning department may wish to create a map that colors land ownership parcels according to the land use attributes
- Using the same database, the tax assessor can display the dimensions, book, page, and parcel numbers to a parcel polygon
- Finally, the public works department can see the same parcels with dimensions automatically plotted for each of the parcel boundaries
- In a GIS system, all of these views can be very simply generated from a single parcel boundary associated with a list of appropriate attributes

GIS Manages Large Collections of Spatial Information

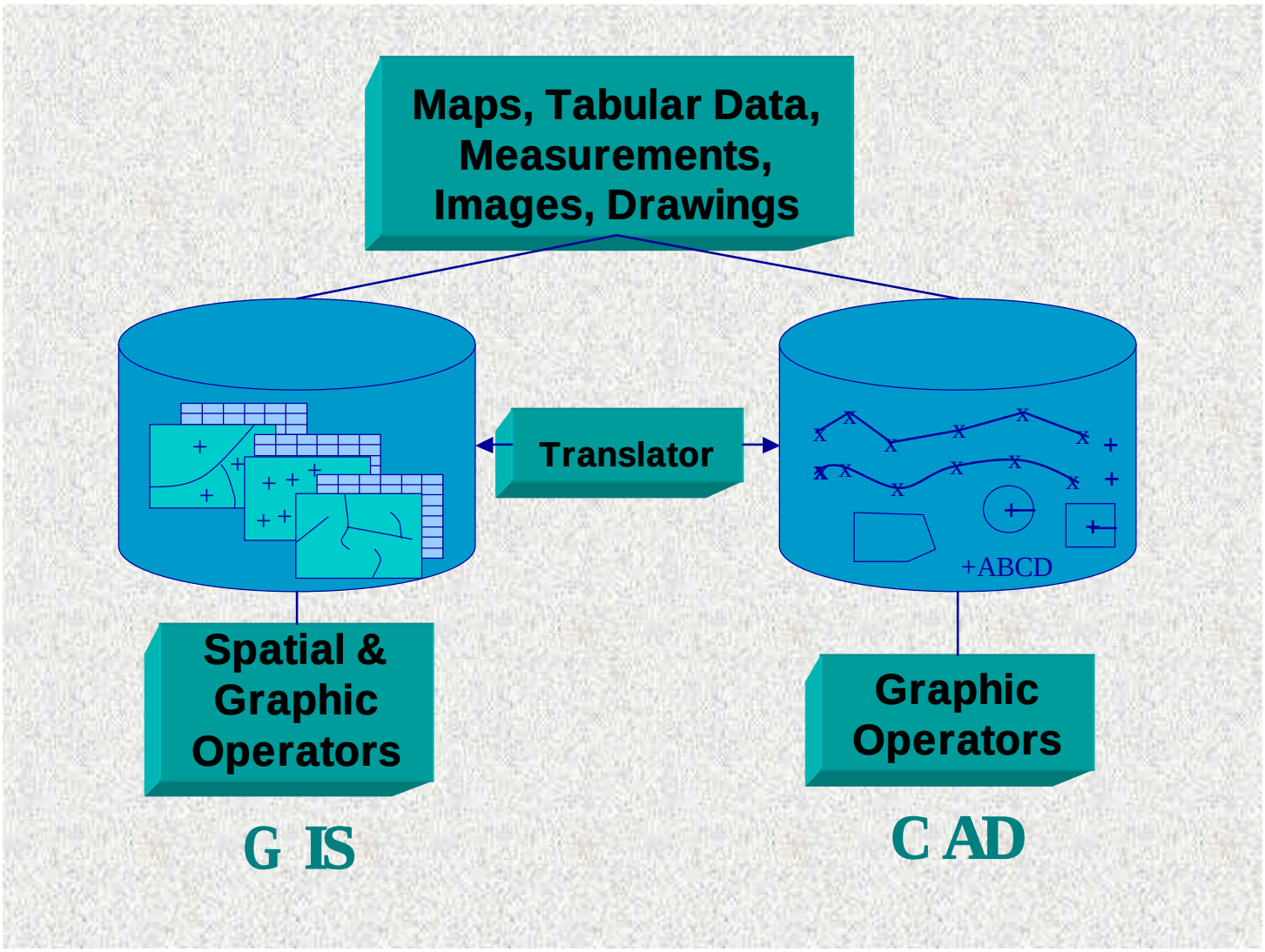
- Beyond flexible graphic tools, a GIS is primarily focused on managing large collections of spatial information
- Software tools
- Analytic and manipulative tools
- Common to all of these applications is the integrated spatial information base that is required and the analytic software tools necessary to support them

GIS Provides Special User Interface

Other Vendors Provide Inadequate Solutions

Interface Between GIS and CAD needed

- At present, there are major investments in both GIS and CAD based digital mapping systems
- While we see a shift toward the GIS approach, we also see the need to build interfaces between the two database systems


Maps, Tabular Data,
Measurements,
Images, Drawings
Translator
+ABCD
Spatial &
Graphic
Operators
Graphic
Operators
GIS
CAD