

DATA SIG

DATA SPASIAL (SIG)



REAL WORLD



DATA SIG

(Geographical data)

Raster

Vektor

Grafis

(Geometric Data)

- Titik (Point)
- Garis (Arc/Line)
- Poligon (region/Polygon)
- Permukaan (Surface)

linking database to maps

Data Attribut
(Attribute Data)

mis.: *.dbf

Qualitative Data

Quantitative Data

- Ordinal
- Interval
- Ratio

Smart Map

(linking a database to the map)

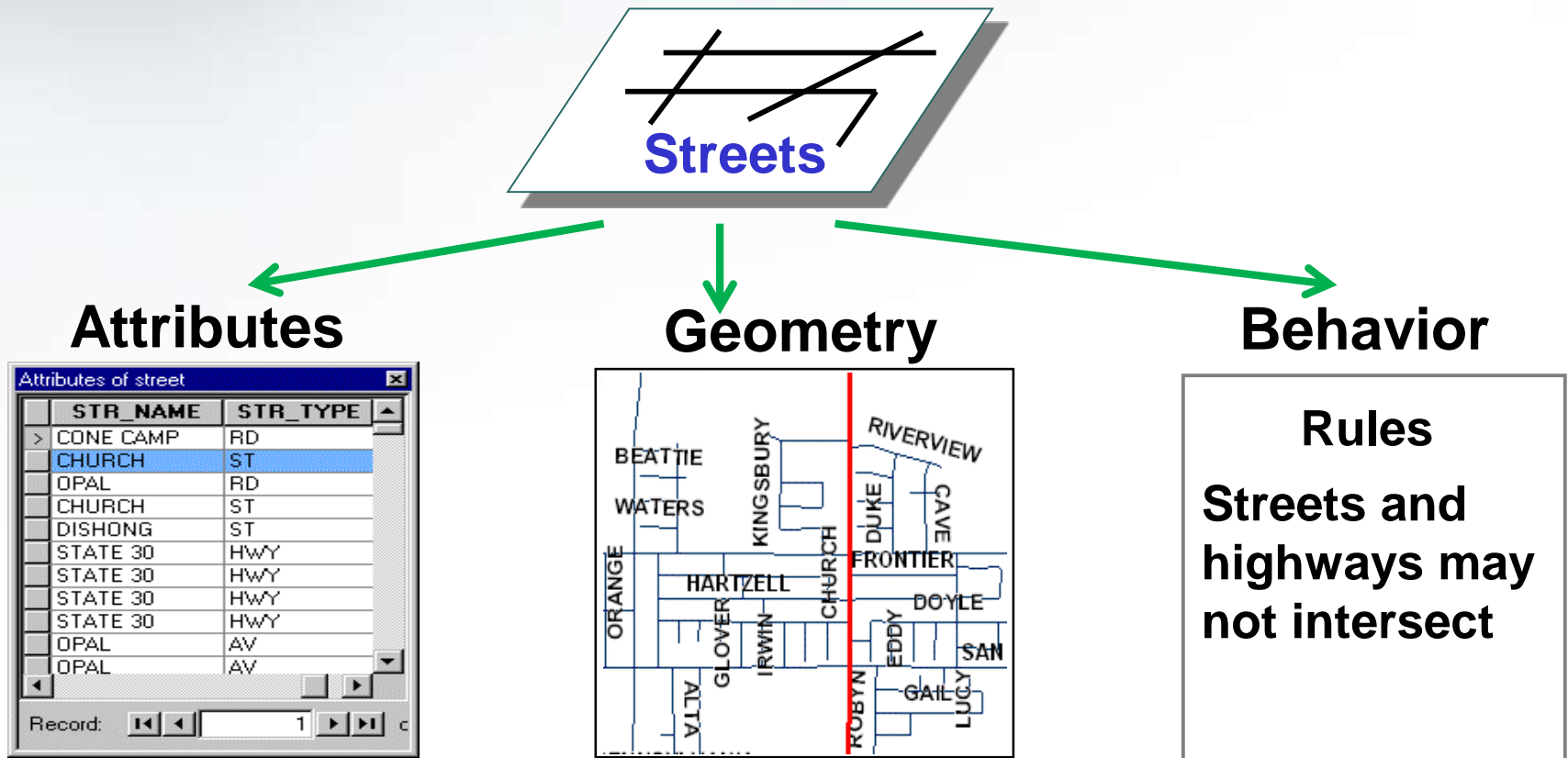
- Siapa/Apa ?
(What is at ?)
- Dimana ?
(Where is it ... ?)



Components of geographic data



- Three general components to geographic information



ArcGIS® Geodatabase Topology Rules

Topology is a set of rules that are used to ensure the accuracy and integrity of spatial data. Topology rules are used to ensure that the data is consistent and that the relationships between the data are correct. Topology rules are used to ensure that the data is accurate and that the relationships between the data are correct.



How to read these diagrams

Topology rule name

Severity

Rule description

Diagram

Map example

Polygon

All parts do not overlap

Each part of a polygon must be a single, continuous area. Overlapping parts are not allowed.

Severity: Error

Diagram: Shows two overlapping green polygons.

Map example: Shows a map with overlapping green polygons.

Polygon

Must not have gaps

There must be no gaps between adjacent polygons. Gaps are not allowed.

Severity: Error

Diagram: Shows two green polygons with a gap between them.

Map example: Shows a map with a gap between green polygons.

Line

Must not have dangles

Dangling lines (lines that do not connect to other lines) are not allowed.

Severity: Error

Diagram: Shows a green line with a red dot at its end, representing a dangle.

Map example: Shows a map with a dangle line.

Line

Must not have pseudo-nodes

Pseudo-nodes (nodes that do not represent a change in direction) are not allowed.

Severity: Error

Diagram: Shows a green line with a red dot at a sharp turn, representing a pseudo-node.

Map example: Shows a map with a pseudo-node.

Polygon

Contains point

Points must be contained within the boundaries of polygons. Points outside polygons are not allowed.

Severity: Error

Diagram: Shows a green polygon with a red point outside it.

Map example: Shows a map with a point outside a polygon.

Polygon

Boundary must be covered by

The boundary of a polygon must be covered by a line. Gaps in the boundary are not allowed.

Severity: Error

Diagram: Shows a green polygon with a gap in its boundary.

Map example: Shows a map with a gap in a polygon boundary.

Line

Must not overlap

Lines must not overlap. Overlapping lines are not allowed.

Severity: Error

Diagram: Shows two overlapping green lines.

Map example: Shows a map with overlapping lines.

Line

Must not self-overlap

Lines must not self-overlap. Self-overlapping lines are not allowed.

Severity: Error

Diagram: Shows a green line that overlaps itself.

Map example: Shows a map with a self-overlapping line.

Line

Must not intersect

Lines must not intersect. Intersecting lines are not allowed.

Severity: Error

Diagram: Shows two intersecting green lines.

Map example: Shows a map with intersecting lines.

Line

Must not self-intersect

Lines must not self-intersect. Self-intersecting lines are not allowed.

Severity: Error

Diagram: Shows a green line that intersects itself.

Map example: Shows a map with a self-intersecting line.

Polygon

Must be covered by feature class of

The area of a polygon must be covered by a specific feature class. Areas not covered are not allowed.

Severity: Error

Diagram: Shows a green polygon not covered by a red feature class.

Map example: Shows a map with a polygon not covered by a feature class.

Polygon

Must be covered by

The area of a polygon must be covered by a specific feature class. Areas not covered are not allowed.

Severity: Error

Diagram: Shows a green polygon not covered by a red feature class.

Map example: Shows a map with a polygon not covered by a feature class.

Line

Must not intersect on both interior

Lines must not intersect on both interior. Intersecting lines on both interior are not allowed.

Severity: Error

Diagram: Shows two intersecting green lines on both interior.

Map example: Shows a map with intersecting lines on both interior.

Line

Must be single part

Lines must be single parts. Multi-part lines are not allowed.

Severity: Error

Diagram: Shows a green line with two separate parts.

Map example: Shows a map with a multi-part line.

Polygon

Must not overlap with

Polygons must not overlap with a specific feature class. Overlapping polygons are not allowed.

Severity: Error

Diagram: Shows a green polygon overlapping with a red feature class.

Map example: Shows a map with overlapping polygons.

Polygon

Must cover each other

Polygons must cover each other. Gaps between polygons are not allowed.

Severity: Error

Diagram: Shows two green polygons with a gap between them.

Map example: Shows a map with a gap between polygons.

Line

Must not overlap with

Lines must not overlap with a specific feature class. Overlapping lines are not allowed.

Severity: Error

Diagram: Shows a green line overlapping with a red feature class.

Map example: Shows a map with overlapping lines.

Line

Must be covered by feature class of

The area of a line must be covered by a specific feature class. Areas not covered are not allowed.

Severity: Error

Diagram: Shows a green line not covered by a red feature class.

Map example: Shows a map with a line not covered by a feature class.

Polygon

Area boundary must be covered by boundary of

The area boundary of a polygon must be covered by the boundary of a specific feature class. Gaps in the boundary are not allowed.

Severity: Error

Diagram: Shows a green polygon with a gap in its boundary.

Map example: Shows a map with a gap in a polygon boundary.

Line on boundary

Must be larger than cluster tolerance

Lines on the boundary must be larger than the cluster tolerance. Small lines are not allowed.

Severity: Error

Diagram: Shows a small green line on a boundary.

Map example: Shows a map with a small line on a boundary.

Line

Endpoint must be covered by

The endpoint of a line must be covered by a specific feature class. Endpoints not covered are not allowed.

Severity: Error

Diagram: Shows a green line with an endpoint not covered by a red feature class.

Map example: Shows a map with an endpoint not covered by a feature class.

Line

Must be covered by boundary of

The area of a line must be covered by the boundary of a specific feature class. Areas not covered are not allowed.

Severity: Error

Diagram: Shows a green line not covered by a red feature class.

Map example: Shows a map with a line not covered by a feature class.

Point

Must be properly inside polygons

Points must be properly inside polygons. Points outside polygons are not allowed.

Severity: Error

Diagram: Shows a red point outside a green polygon.

Map example: Shows a map with a point outside a polygon.

Point

Must be covered by boundary of

Points must be covered by the boundary of a specific feature class. Points not covered are not allowed.

Severity: Error

Diagram: Shows a red point not covered by a green feature class boundary.

Map example: Shows a map with a point not covered by a feature class boundary.

Point

Must be covered by endpoint of

Points must be covered by the endpoint of a specific feature class. Points not covered are not allowed.

Severity: Error

Diagram: Shows a red point not covered by a green feature class endpoint.

Map example: Shows a map with a point not covered by a feature class endpoint.

Point

Point must be covered by line

Points must be covered by a line. Points not covered are not allowed.

Severity: Error

Diagram: Shows a red point not covered by a green line.

Map example: Shows a map with a point not covered by a line.

ArcGIS® Geodatabase Topology Rules

Topology in ArcGIS® allows you to control spatial relationships between the features in a feature class. Topology rules allow you to define these relationships between features in a feature class or within a geodatabase feature class or geodatabase. Topology rules allow you to define the spatial relationships that make the result of your data model. Topology rules are a combination of the rules that you can apply from your existing ArcGIS editing tools to topology.



How to read these diagrams

Topology rule name

Illustrates the spatial relationship that the rule enforces.

Polygon

Must not overlap

Illustrates the spatial relationship that the rule enforces. Two polygons overlap.

Polygon

Must not have gaps

Illustrates the spatial relationship that the rule enforces. Two polygons do not touch, leaving a gap.

Line or Polygon

Must be larger than cluster tolerance

Illustrates the spatial relationship that the rule enforces. A small polygon is shown next to a larger one.

Line

Must not have pseudonodes

Illustrates the spatial relationship that the rule enforces. A line has a node that does not connect to any other lines.

Polygon

Contains points

Illustrates the spatial relationship that the rule enforces. A point is located inside a polygon.

Polygon

Contains one point

Illustrates the spatial relationship that the rule enforces. Only one point is located inside a polygon.

Line

Must not have slantings

Illustrates the spatial relationship that the rule enforces. A line has a slanted segment.

Line

Must not self overlap

Illustrates the spatial relationship that the rule enforces. A line overlaps itself.

Polygon

Must be covered by feature class of

Illustrates the spatial relationship that the rule enforces. A polygon is covered by another polygon.

Polygon

Boundary must be covered by

Illustrates the spatial relationship that the rule enforces. A polygon's boundary is covered by a line.

Line

Must not overlap

Illustrates the spatial relationship that the rule enforces. Two lines overlap.

Line

Must not self intersect

Illustrates the spatial relationship that the rule enforces. A line intersects itself.

Polygon

Must not overlap with

Illustrates the spatial relationship that the rule enforces. Two polygons overlap.

Polygon

Must be covered by

Illustrates the spatial relationship that the rule enforces. A polygon is covered by another polygon.

Line

Must not intersect

Illustrates the spatial relationship that the rule enforces. Two lines intersect.

Line

Must be single part

Illustrates the spatial relationship that the rule enforces. A line is split into two parts.

Polygon

Area boundary must be covered by boundary of

Illustrates the spatial relationship that the rule enforces. A polygon's area boundary is covered by another polygon's boundary.

Polygon

Must cover each other

Illustrates the spatial relationship that the rule enforces. Two polygons cover each other.

Line

Must not intersect with

Illustrates the spatial relationship that the rule enforces. Two lines intersect.

Line

Must be covered by feature class of

Illustrates the spatial relationship that the rule enforces. A line is covered by another line.

Point

Must be coincident with

Illustrates the spatial relationship that the rule enforces. Two points are coincident.

Point

Must be disjoint

Illustrates the spatial relationship that the rule enforces. Two points are disjoint.

Line

Must not intersect or touch interior

Illustrates the spatial relationship that the rule enforces. Two lines do not intersect or touch interiorly.

Line

Must be covered by boundary of

Illustrates the spatial relationship that the rule enforces. A line is covered by another line.

Point

Must be covered by endpoint of

Illustrates the spatial relationship that the rule enforces. A point is covered by a line's endpoint.

Point

Point must be covered by line

Illustrates the spatial relationship that the rule enforces. A point is covered by a line.

Line

Must not intersect or touch interior with

Illustrates the spatial relationship that the rule enforces. Two lines do not intersect or touch interiorly.

Line

Must be inside

Illustrates the spatial relationship that the rule enforces. A line is inside a polygon.

Point

Must be properly inside polygons

Illustrates the spatial relationship that the rule enforces. A point is properly inside a polygon.

Point

Must be covered by boundary of

Illustrates the spatial relationship that the rule enforces. A point is covered by a line.

Line

Must not overlap with

Illustrates the spatial relationship that the rule enforces. Two lines overlap.

Line

Endpoint must be covered by

Illustrates the spatial relationship that the rule enforces. A line's endpoint is covered by another line.



DATA GRAFIS (*GRAPHIC DATA*) - Spatial data

Says *where* the feature is

- Co-ordinate based
- Vector data – discrete features:
 - Points
 - Lines
 - Polygons (zones or areas)
- Raster data:
 - A continuous surface

DATA GRAFIS (*GRAPHIC DATA*)

- *continuous*: elevasi, curah hujan, salinitas air laut
- *area*:
 - *unbounded*: penggunaan lahan, area pasar, jenis tanah, jenis batuan
 - *bounded*: batas kota/negara, persil
 - *moving*: massa udara, kumpulan binatang, kumpulan ikan
- *networks*: jalan, pipa/kabel transmisi, sungai
- *points*:
 - *fixed*: sumur, lampu jalan, alamat
 - *moving*: mobil, ikan, rusa



DATA ATTRIBUT (*ATTRIBUTE DATA*)

Says *what* a feature is

Eg. statistics, text, images, sound, etc.



Attribute Data



ATTRIBUTE DATA

Qualitative Data

Best



Qualitative Data



Ordinal Data



Interval Data

A 0-10 yrs B 10-25 yrs C more than 25

R.F. 1:500000

Ratio Data

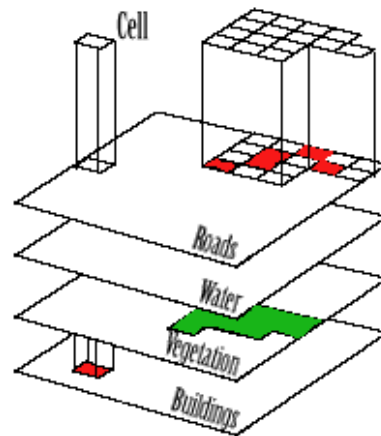
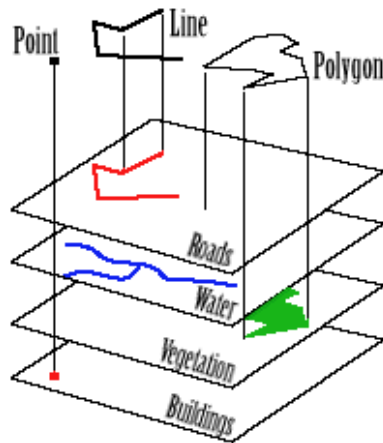


MODEL DATA SIG

(Spatial database models)

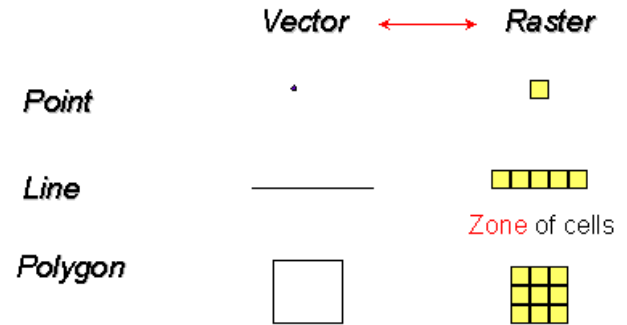
Spatial database models

- Vector – points, lines and polygons
- Raster – gridded, classified space



Raster and Vector Data

Raster data are described by a cell grid, one value per cell

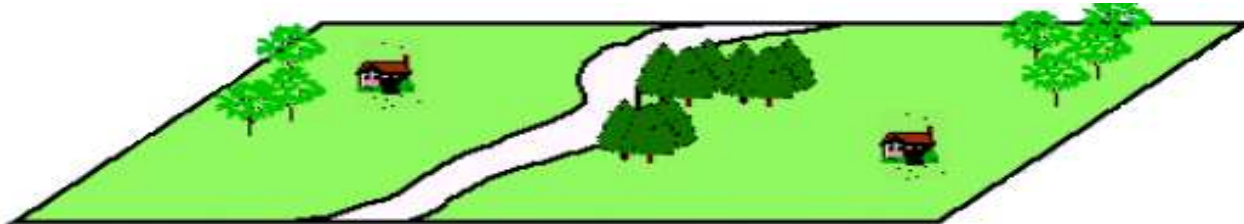


Data Layers in the Database

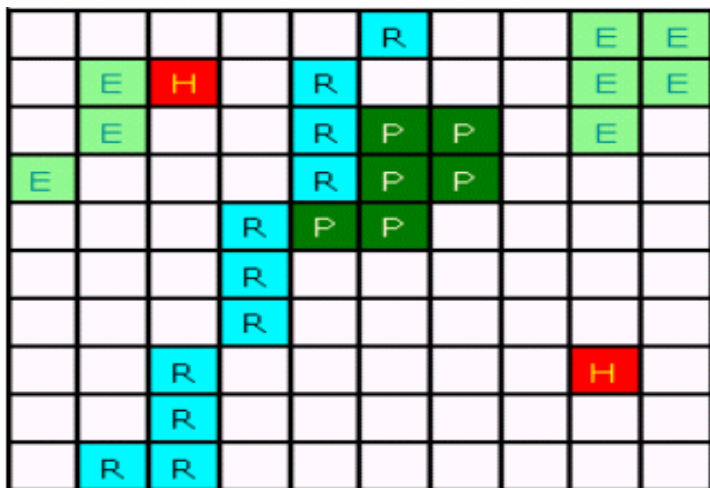


- Organize by **feature type**
 - point
 - line
 - polygon
- Organize by **thematic** grouping
 - roads (lines)
 - land use (polygons)
 - soils (polygons)
 - wells (points)

Spatial database models

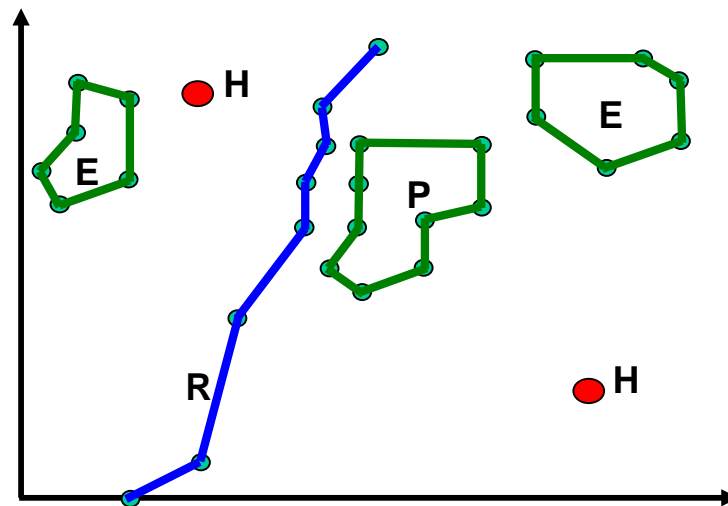


Real World



Raster Representation

R = River E = Eucalypts



Vector Representation

P = Pine Forest H = House R = River

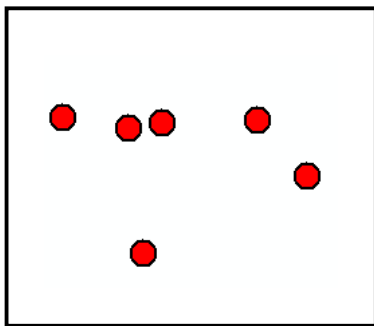


Table 8.1 Geographic data models used in GIS

Data model	Example applications
Computer-Aided Design (CAD)	Automating engineering design and drafting.
Graphical (non-topological)	Simple mapping.
Image	Image processing and simple grid analysis.
Raster/Grid	Spatial analysis and modeling especially in environmental and natural resources applications.
Vector/Georelational topological	Many operations on vector geometric features in cartography, socio-economic and resource analysis, and modeling.
Network	Network analysis in transportation, hydrology, and utilities.
Triangulated Irregular Network (TIN)	Surface/terrain visualization, analysis, and modeling.
Object	Many operations on all types of entities (raster/vector/TIN, etc.) in all types of applications.

Representing features in vector data

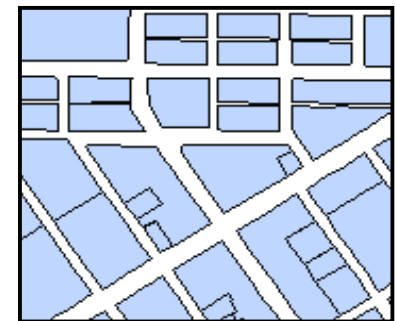
- Real-world entities are abstracted into three basic shapes



Points
(Fire hydrants)

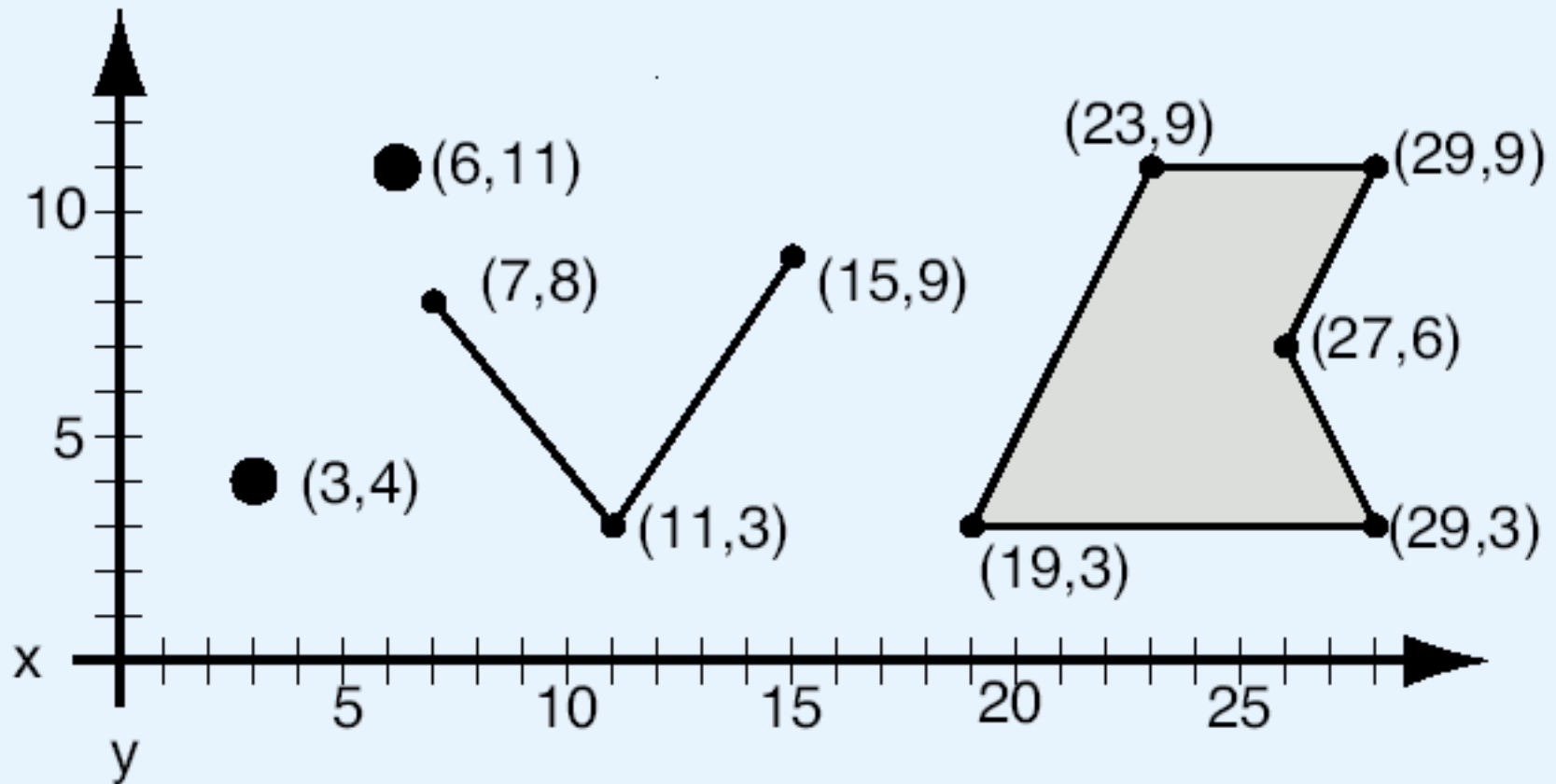


Lines
(Streets)



Polygons
(Parcels, Zoning)

STRUKTUR DATA VEKTOR



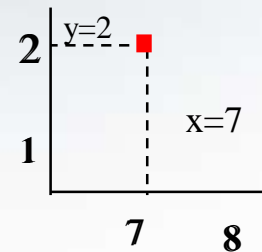
STRUKTUR DATA VEKTOR



* Titik (node/point): 0-dimension

- koordinat tunggal (x,y)
- area/luasan nol

contoh : pohon, sumur minyak, penempatan label

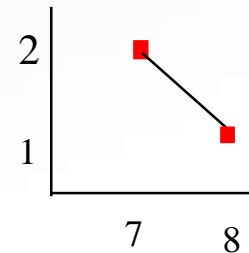


Point: 7,2

* Garis (arc/line): 1-dimension

- dua (atau lebih] koordinat x,y yang dihubungkan

contoh : jalan, sungai

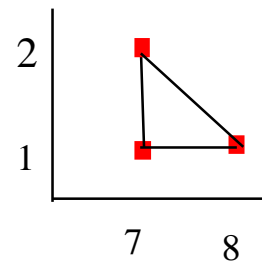


Line: 7,2 8,1

* Poligon (polygon/region) : 2-dimensions

- empat atau lebih koordinat x,y yang dihubungkan
- koordinat awal dan akhir sama
- area yang tertutup

Contoh : daerah/propinsi, danau



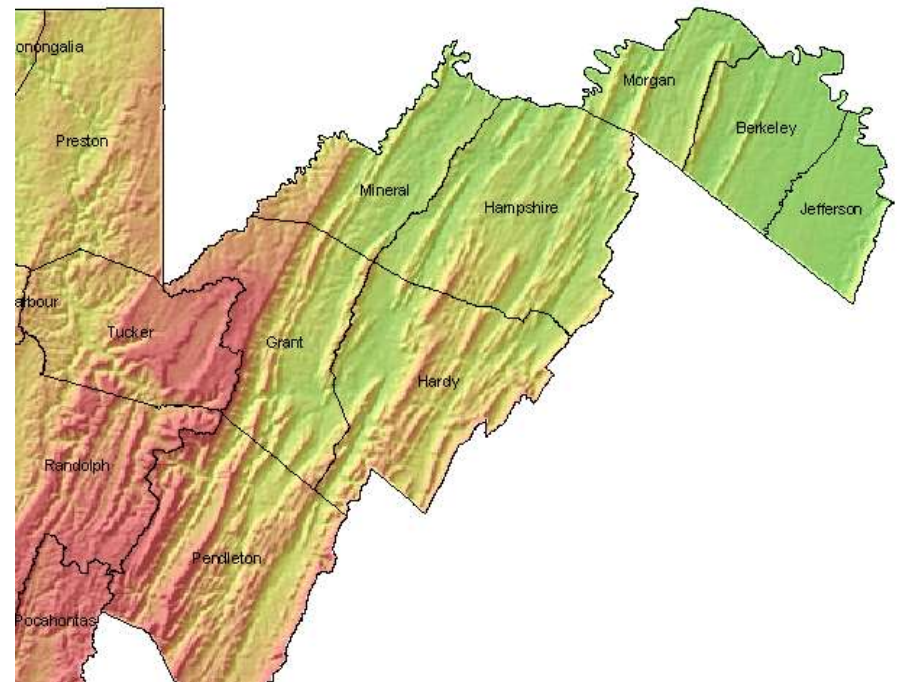
Polygon: 7,2 8,1 7,1 7,2



Raster datasets - GRIDs

Common GRID format datasets:

- Land use/land cover
- Elevation (DEM)
 - Slope
 - Aspect
 - Shaded relief
- Precipitation
- Temperature

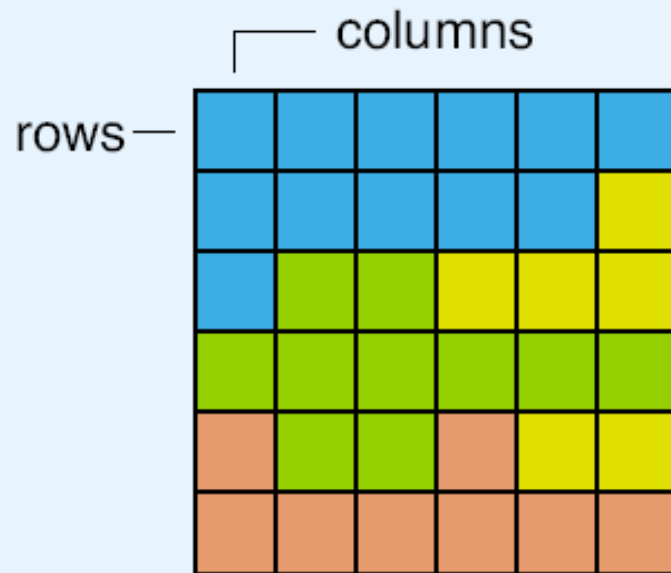


Representing features in the raster data model

- Square cells store values to represent reality
- Images
 - Aerial photos
 - Scanned photos or maps
 - Satellite imagery
- Grids
 - Values represent some measured quantity or classification (elevation, precipitation, land cover)

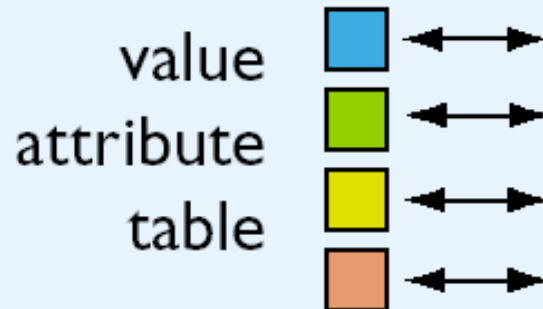
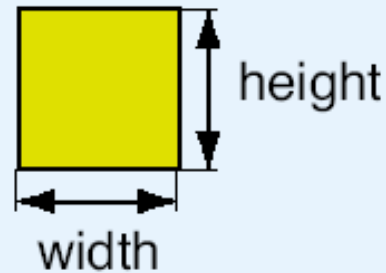


STRUKTUR DATA RASTER



raster dataset

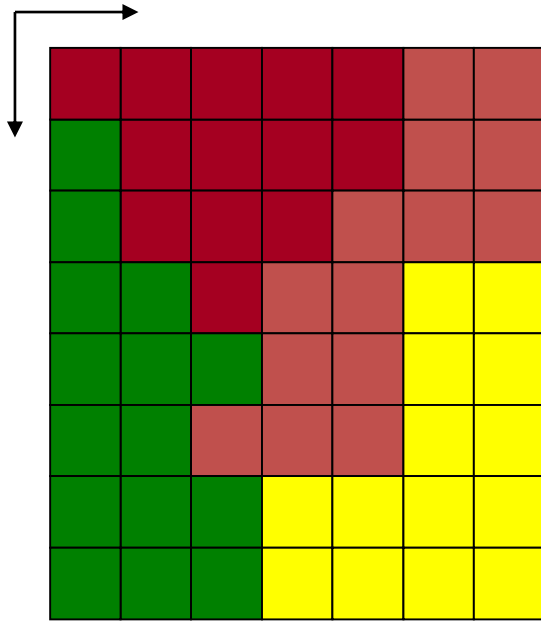
cell



Value	Count	Land use
1	12	Water
2	8	Agriculture
3	6	Residential
4	6	Industrial



RUN-LENGTH CODING







Row-by-row coding:

CCCCCBBDDCCCCBBDDCCCBDDDCBBAADD
DDBAADDDBBBBAADD DAAAADD DAAAA

Run-length coding:

5C 2B 1D 4C 2B 1D 3C 3B 2D 1C 2B 2A 4D 1B
2A 2D 3B 2A 3D 4A 3D 4A

-  A. Mixed Conifer
-  B. Douglas Fir
-  C. Oak Savannah
-  D. Grassland



56 entries for 7x8 array, or



22 pairs (44 entries) for 7x8 array

Perbandingan Struktur Data Vektor dan Raster

Parameter	Vektor	Raster
Akurasi	Akurat dan lebih presisi	Sangat bergantung dengan ukuran grid/sel
Atribut	Relasi langsung dengan DBMS (database)	Grid/sel merepresentasikan atribut. Relasi dengan DBMS tidak secara langsung
Kompleksitas	Tinggi. Memerlukan algoritma dan proses yang sangat kompleks	Mudah dalam mengorganisasi dan proses
Output	Kualitas tinggi sangat bergantung dengan plotter/printer dan kartografi	Bergantung terhadap output printer/plotter
Analisis	Spasial dan atribut terintegrasi. Kompleksitasnya sangat tinggi	Bergantung dengan algoritma dan mudah untuk dianalisis
Aplikasi dalam Remote Sensing	Tidak langsung, memerlukan konversi	Langsung, analisis dalam bentuk citra sangat dimungkinkan
Simulasi	Kompleks dan sulit	Mudah untuk dilakukan simulasi
Input	Digitasi, dan memerlukan konversi dari scanner	Sangat memungkinkan untuk diaplikasikan dari hasil konversi dengan menggunakan scan
Volume	Bergantung pada kepadatan dan jumlah verteks	Bergantung pada ukuran grid/sel
Resolusi	Beragam-macam	Tetap