



GIS

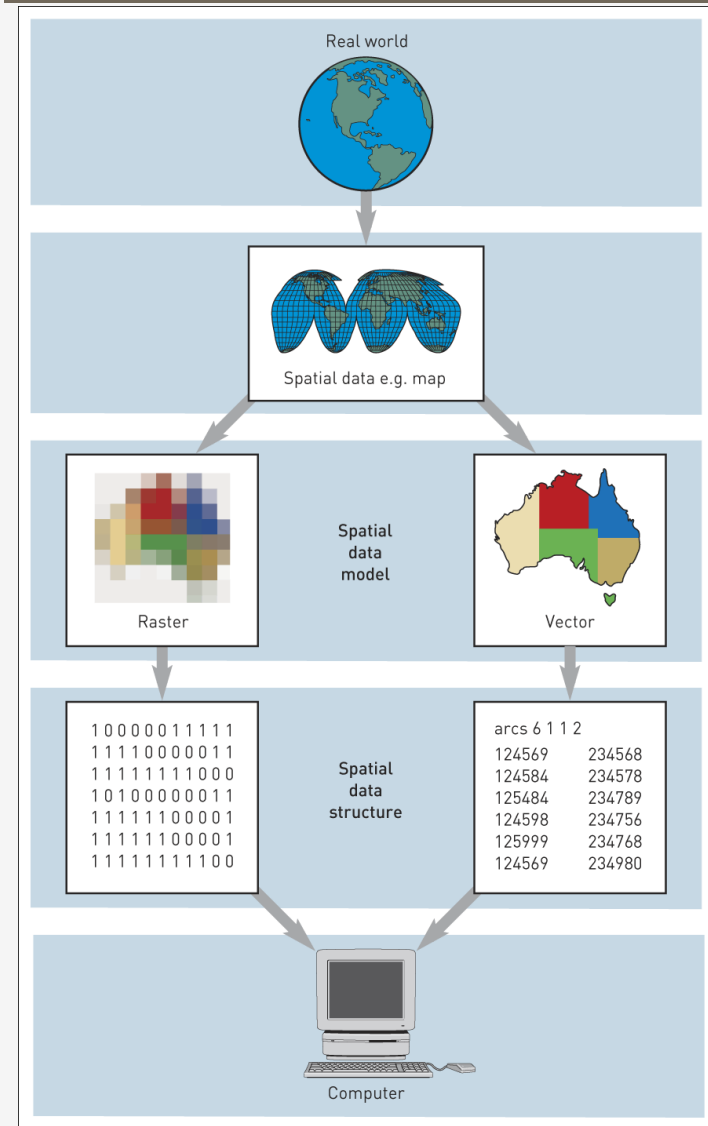
Beverley Holland

GIS Data representation



Stages involved in constructing a GIS data model

At each stage of the model building process the physical element represented on the map become more of an abstract of reality

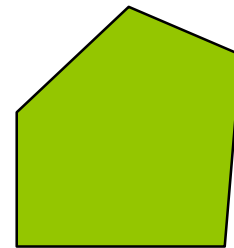
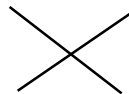


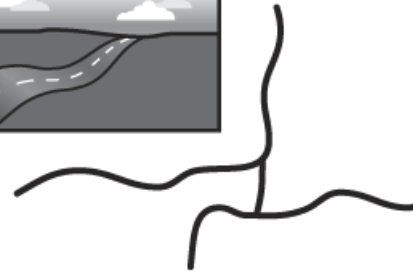
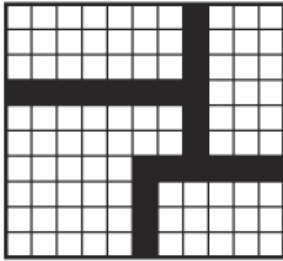
Modes or dimensions

- Temporal - Feb 10 2019
- Thematic - car accidents
- Spatial - near IQ car park
- Thus temporal dimensions indicate time, thematic indicates the characteristics of the real world feature and spatial gives it a location.

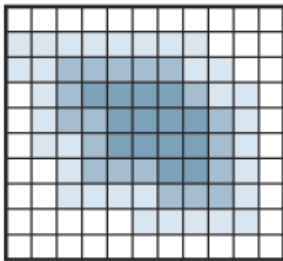
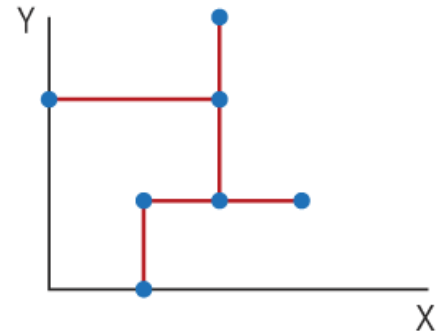
Classifying Spatial Data – Entity Definition

- Geographic theory employs the subdivision of spatial data into one of four object classes
 - Points, Lines, Areas, Surfaces
 - Vector Data structures - Use is made of the two-dimensional Cartesian (x,y) co-ordinate system to store shapes as spatial entities.
 - The following Diagram gives examples

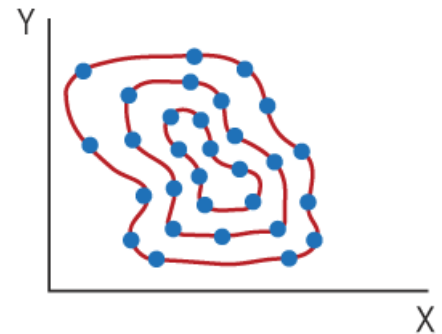




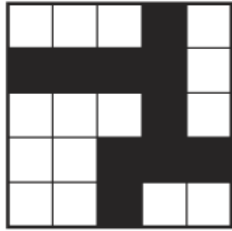
Network: roads



Surface: elevation



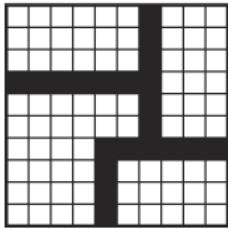
Raster and vector spatial data (Continued)



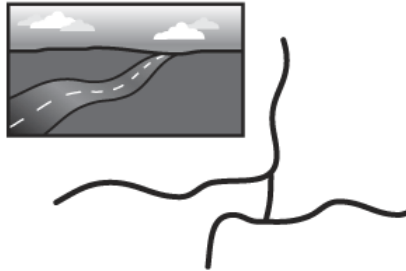
5 × 5 Grid



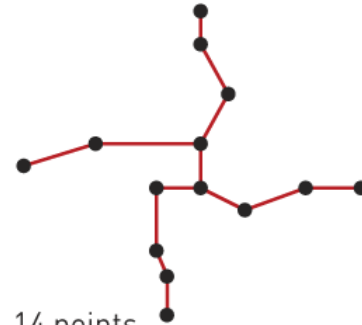
7 points



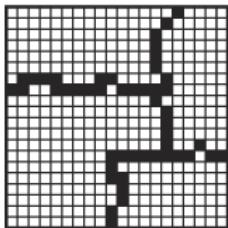
10 × 10 Grid



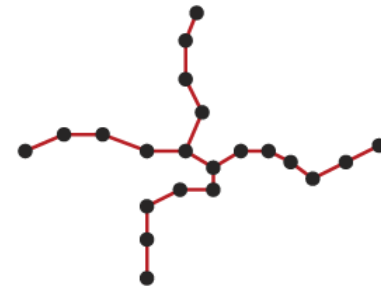
Network: roads



14 points



20 × 20 Grid

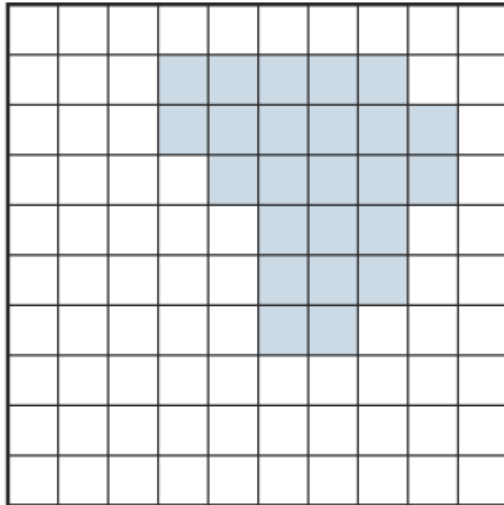


21 points

Effect of changing resolution in the raster (left) and vector worlds (right)

Raster data structures

- The following slide provides an example of a raster data representation
- Basically we use the principle of pixels on a computer screen – each pixel will have a grid reference. Each reference will have one or more values attached to it.
- In a simple raster structure different spatial features must be stored as separate data layers.
- To store images in raster format sometimes causes impact on the storage and retrieval of other GIS map information.
- Because vector storage only needs to retain the point values and then use is made of various algorithms the memory requirements are less.



(a) Entity model

0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	1	1	1	0	0
0	0	0	1	1	1	1	1	1	0
0	0	0	0	1	1	1	1	1	0
0	0	0	0	0	1	1	1	0	0
0	0	0	0	0	1	1	1	0	0
0	0	0	0	0	1	1	1	0	0
0	0	0	0	0	1	1	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

(b) Cell values

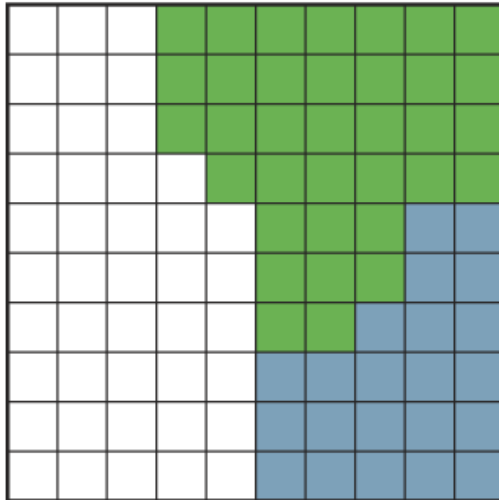
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0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0

```

(c) File structure

A simple raster data structure



(a) Entity model

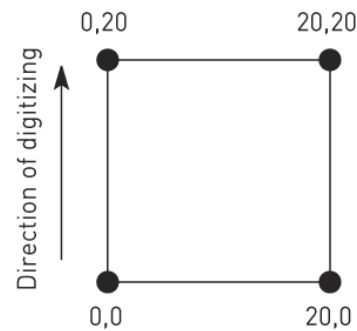
1	1	1	2	2	2	2	2	2	2
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1	1	1	2	2	2	2	2	2	2
1	1	1	1	2	2	2	2	2	2
1	1	1	1	1	2	2	2	3	3
1	1	1	1	1	2	2	2	3	3
1	1	1	1	1	2	2	3	3	3
1	1	1	1	1	3	3	3	3	3
1	1	1	1	1	3	3	3	3	3
1	1	1	1	1	3	3	3	3	3

(b) Cell values

10,10,3
 1,1,1,2,2,2,2,2,2,2
 1,1,1,2,2,2,2,2,2,2
 1,1,1,2,2,2,2,2,2,2
 1,1,1,2,2,2,2,2,2,2
 1,1,1,1,2,2,2,2,2,2
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 1,1,1,1,1,3,3,3,3,3

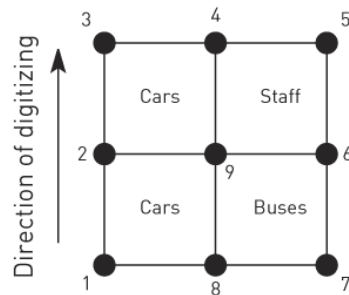
(c) File structure

Feature coding of cells in the raster world



'Spaghetti' file		
X	,	Y
0	,	0
0	,	20
20	,	20
20	,	0
0	,	0

(a)



'Point dictionary' file		
ID	X	Y
1	0	0
2	0	10
3	0	20
4	10	20
...	...	...
9	10	10

Polygon file	
ID	Points
Cars	1, 2, 3, 4, 9, 8,
Staff	4, 5, 6, 9
Buses	6, 7, 8, 9

(b)

Data structures in the vector world: (a) simple data structure;
(b) point dictionary



(a) Topography



(b) Imagery

Ordnance Survey MasterMap

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(c) ITN



(d) Address layer

Ordnance Survey MasterMap (Continued)

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Copyright London Underground Limited
Street Map 10/2000 - 10/11



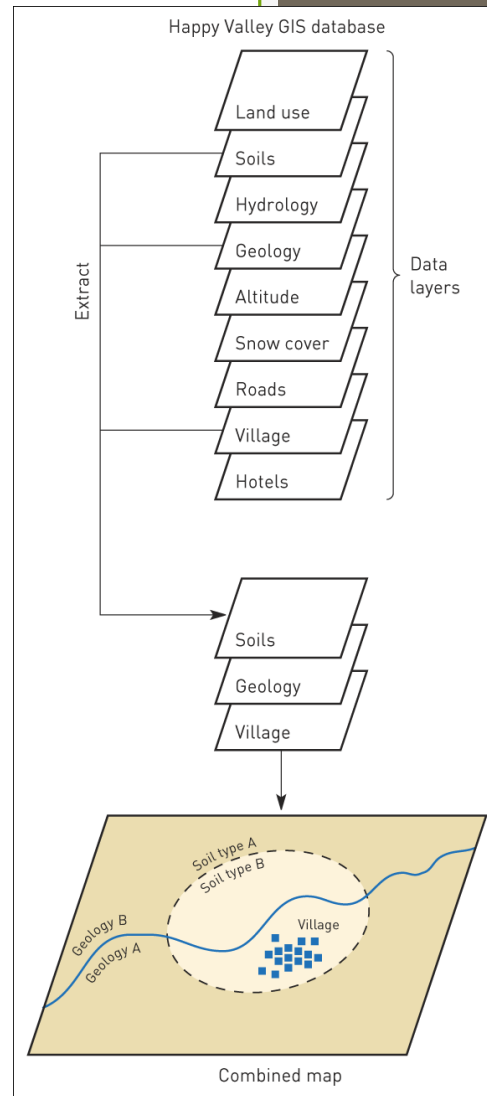
Real space

A representation of the London Underground network

Source: From SimonClark.org, © Simon Clark 2000, with permission

2D

- The above slides indicate how we store information in 2 dimensions to represent geographical reality.
- This can be done in raster or vector format.
- The GIS software is able to distinguish between the data types.

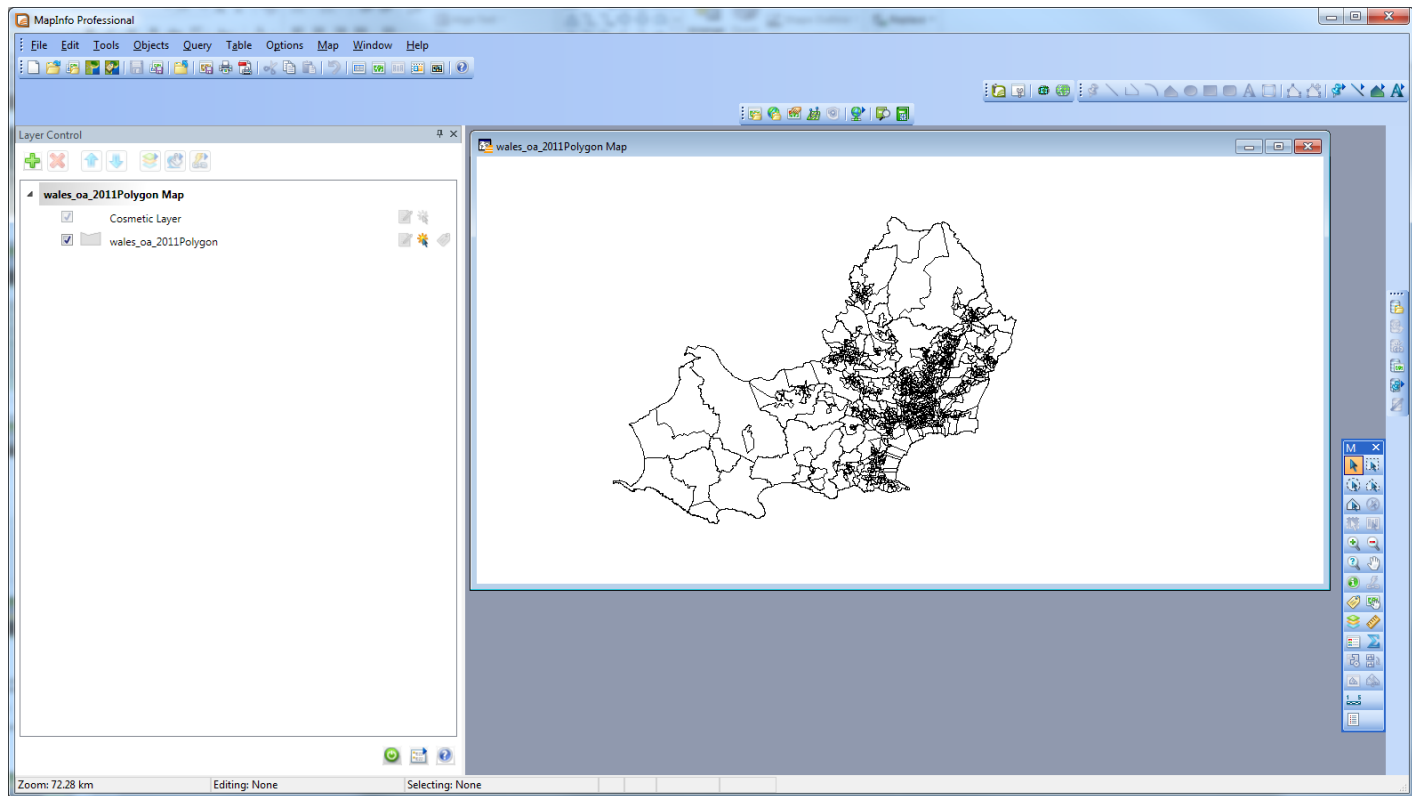


The layer-based approach

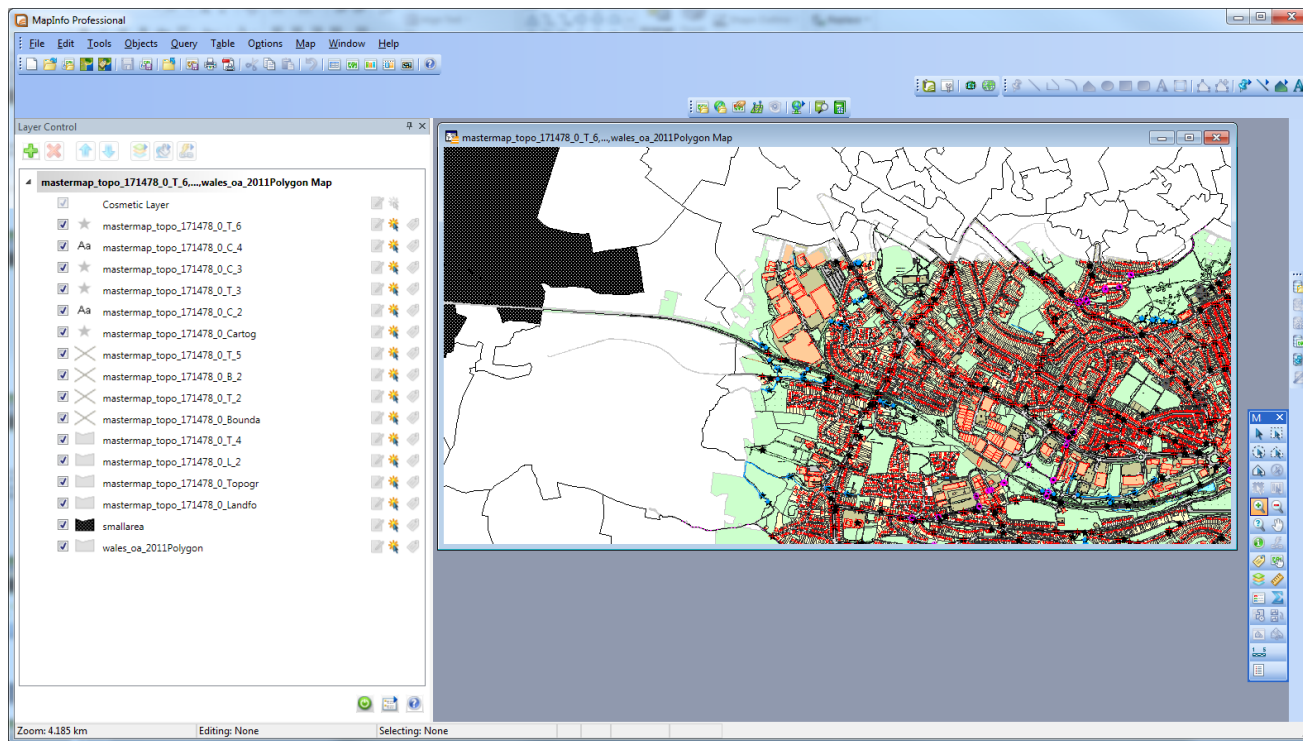
source

Hywood, Cornelius and Carver, *An Introduction to Geographical Information Systems*, 3rd Edition © Pearson Education Limited 2012

Data from UK Borders and outline or Swansea using Wales output area



Master Map Data of Swansea



Zoomed in detailed view

