PRACTICAL WORK

GEOGRAPHIC INFORMATION SYSTEM

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Syllabus- Geographic Information System

Unit	Topic
1	Introduction Meaning and Scope of GIS, Components of GIS, History of Geographic Information System(GIS)
2	Data Types GIS Data Structures: Types (Spatial and Non-spatial), Raster and Vector Data Structure.
3	Spatial Referencing System Concept of Georeferencing, Editing and attribute data integration
4	GIS based Exercises on Georeferencing, Subsetting, Extraction of Land Use/Land Cover layers of any area and Thematic Mapping

Geographic

+

Information

+

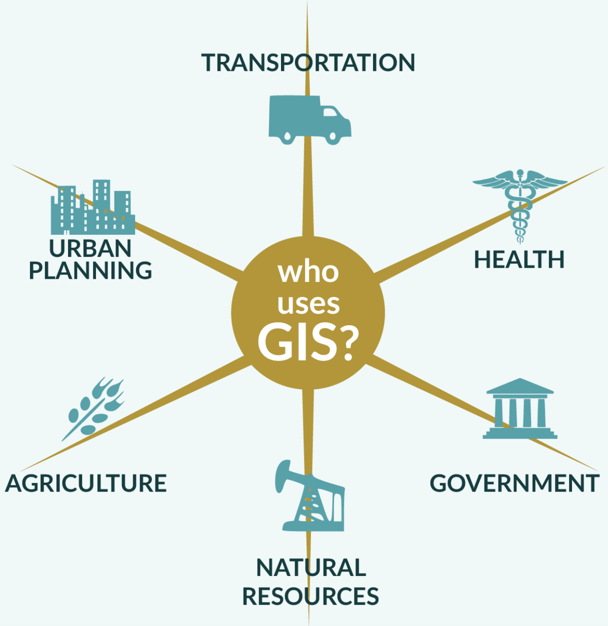
Systems

- भौगोलिक
- सूचना
- प्रणाली

what is GIS?

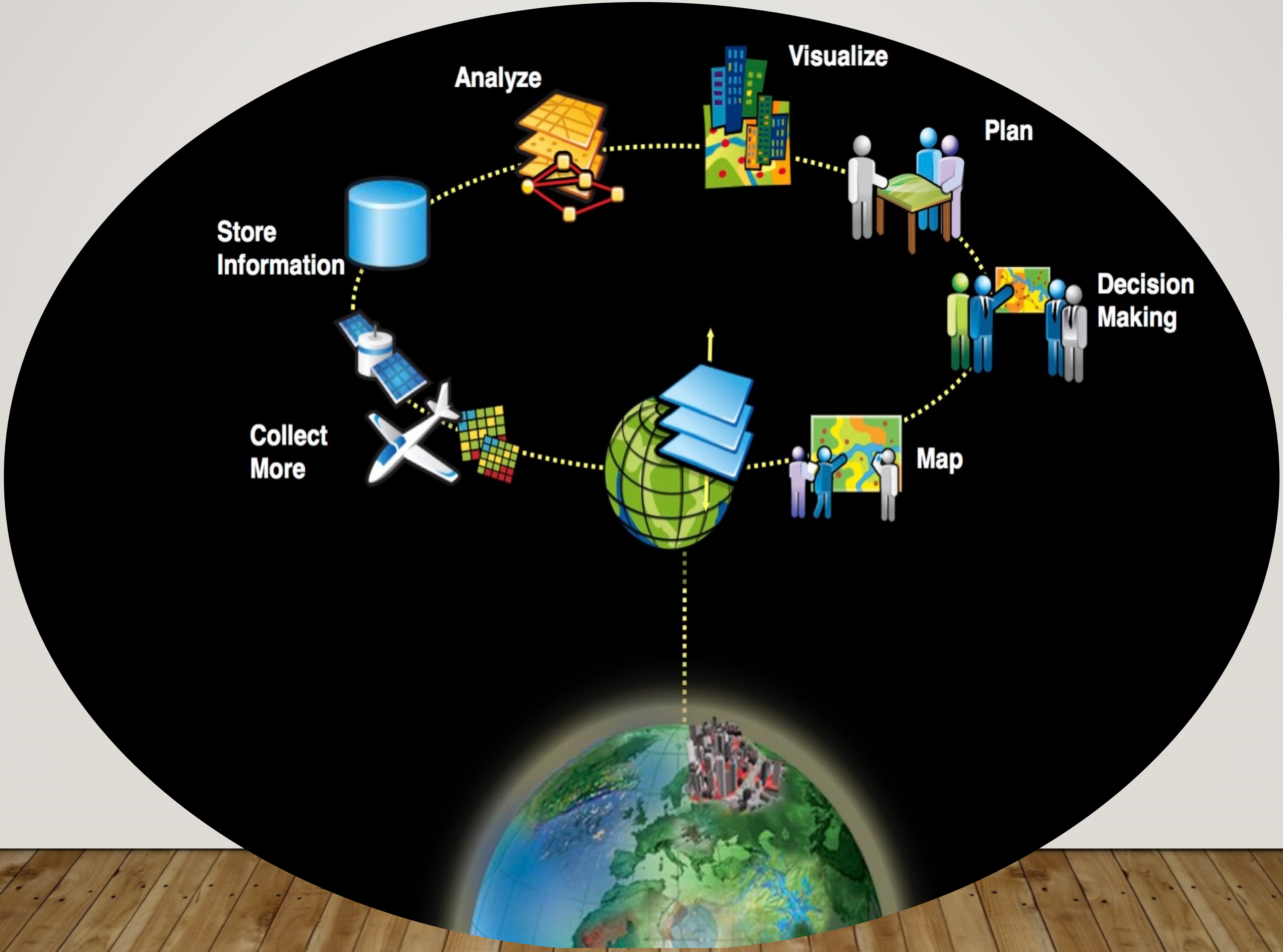
GEOGRAPHIC INFORMATION SYSTEMS

"A geographic information system (GIS) lets us **visualize, question, analyze** and **interpret** data to understand **relationships, patterns and trends**."



THINK FAST

What does it take to succeed in the geospatial industry?


Analyze
Visualize
Plan
Store
Information
Decision
Making
Collect
More
Map


GIS in Medical
GIS in Advertising
GIS in Insurance
GIS in Government Needs
GIS in Environment Management
GIS in Mapping and Technology
GIS
Geographic Information Systems


GIS ENABLES
CUSTOMER SERVICE
Higher customer engagement and communication
PLANNING & ANALYSIS
Organization of data into actionable information
DATA MANAGEMENT
Collection, organization and integration of data
OPERATIONAL AWARENESS
Data integration for operational readiness
ASSET MANAGEMENT
Maintenance & management of infrastructure data
FIELD MOBILITY
Collection and assessment of data from field

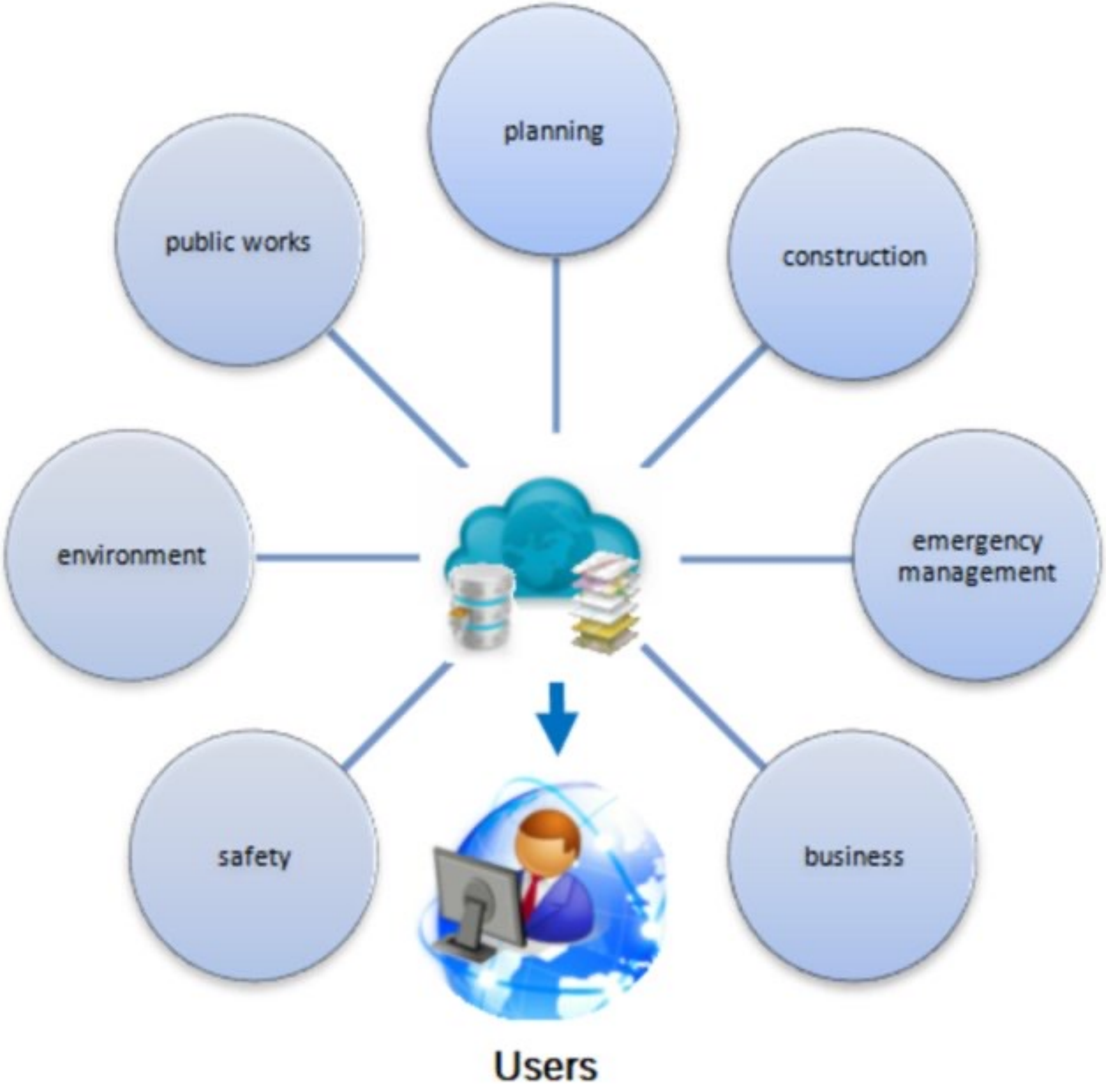

Site Selection
Watershed Analysis
Resource Inventories
Land Management
Engineering Design
Demographic Analysis
Spatial Measurement
Incident Mapping
Corridor Selection
Network Analysis
Logistics Routing
Topographic Analysis
Spread and Diffusion
Geoprocess Modeling
Facility Management
Resource Exploration
Transportation Modeling

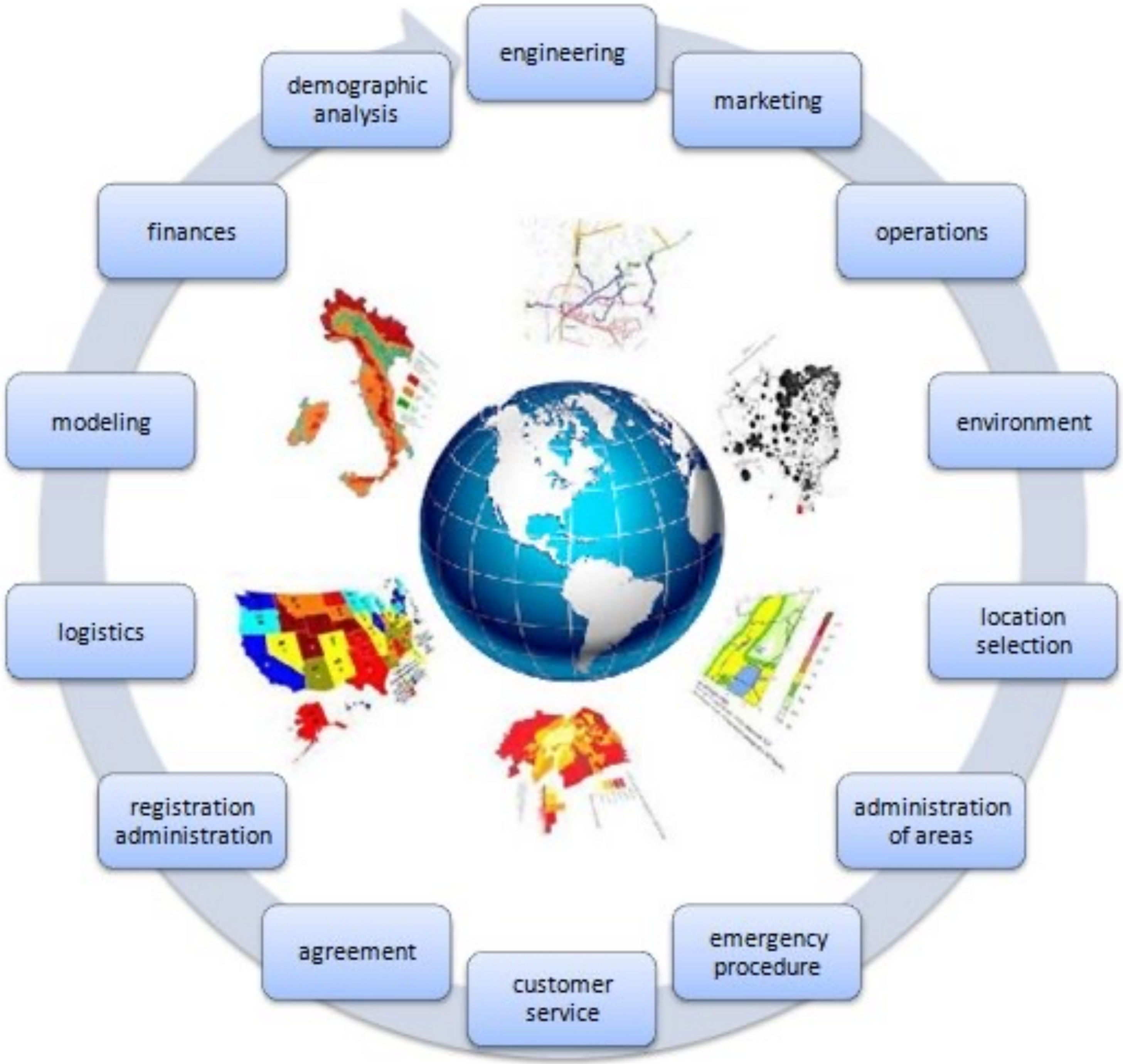
भौगोलिक सूचना प्रणाली के उद्देश्य (Objectives of GIS)- भौगोलिक सूचना प्रणाली के प्रमुख उद्देश्य निम्न प्रकार हैं :

- ✓ योजना तथा निर्णय लेने की क्षमता को बढ़ाना।
- ✓ आँकड़ों के वितरण तथा संचालन के लिये सफल साधनों की पूर्ति करना।
- ✓ आँकड़ा भण्डार से अनावश्यक आंकड़ों को हटाना तथा पुनरावृत्ति को कम करना।
- ✓ विभिन्न स्त्रोतों से एकत्रित सूचनाओं को संगठित करने की क्षमता रखना।
- ✓ अति जटिल विश्लेषण करना।
- ✓ भौगोलिक आँकड़ों के जटिल विश्लेषणों से नई-नई सूचनाओं को प्राप्त करना।


GIS

SCOPE
OF
GEOGRAPHIC INFORMATION SYSTEM

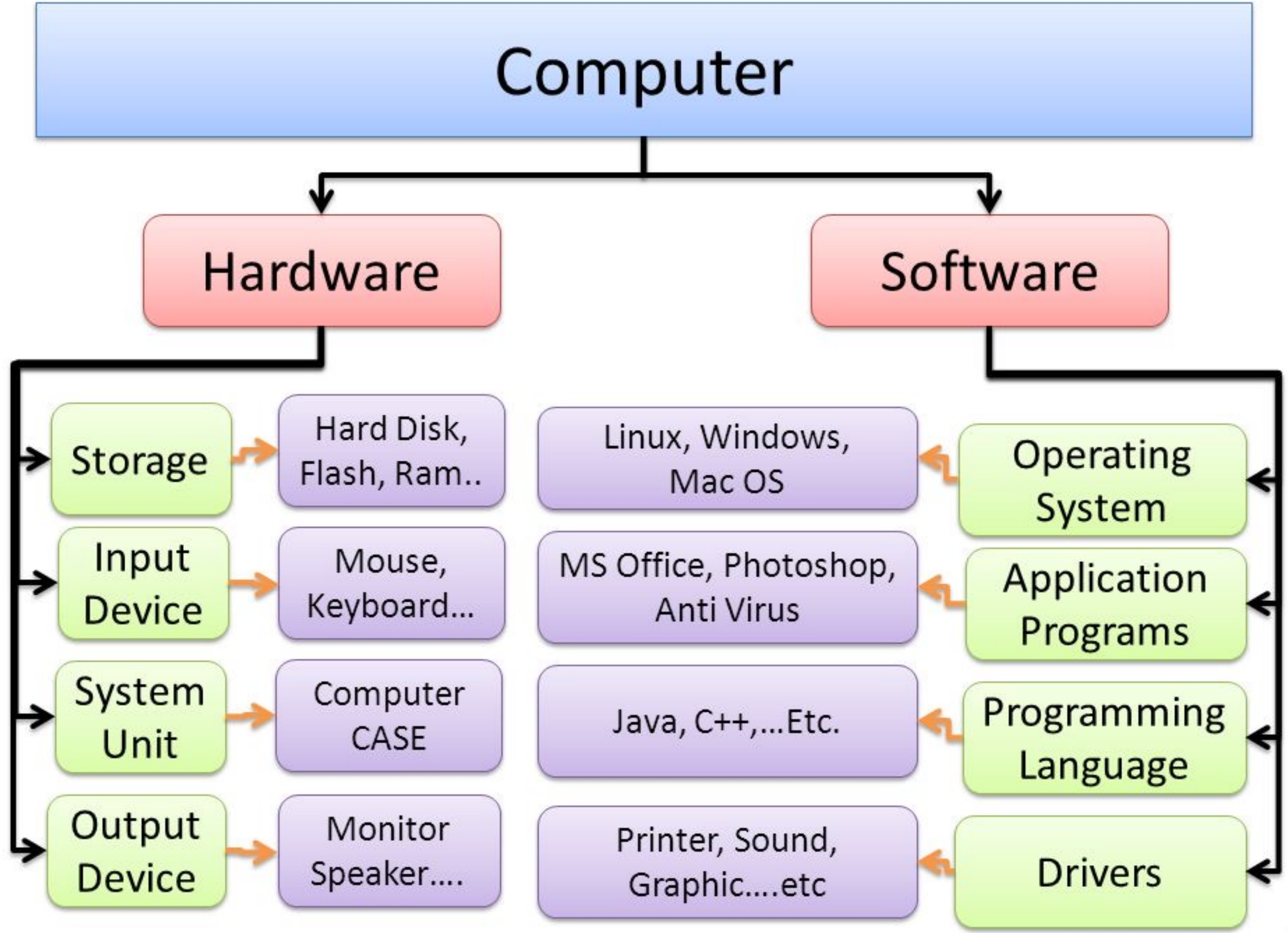

planning
public works
construction
environment
emergency management
safety
business
Users


engineering
marketing
operations
environment
location selection
administration of areas
emergency procedure
customer service
agreement
registration administration
logistics
modeling
finances
demographic analysis

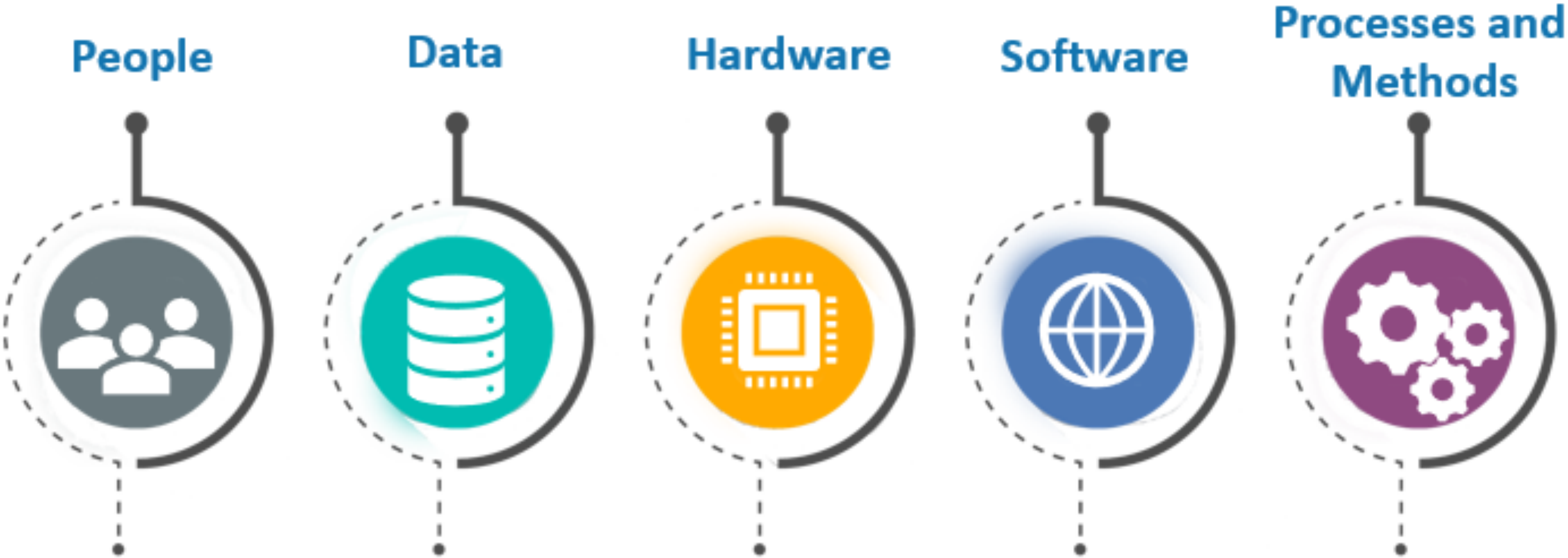
COMPONENTS

OF

GEOGRAPHIC INFORMATION SYSTEM


Computer
Hardware
Software
Storage
Hard Disk, Flash, Ram..
Input Device
Mouse, Keyboard…
System Unit
Computer CASE
Output Device
Monitor Speaker….
Linux, Windows, Mac OS
Operating System
MS Office, Photoshop, Anti Virus
Application Programs
Java, C++,…Etc.
Programming Language
Printer, Sound, Graphic….etc
Drivers

Components of Geographic Information System (GIS)


People
Data
Hardware
Software
Processes and Methods


GIS
People
Researchers
Developers
Specialists
Cartographers
Data
Vector
Rasters
3D models
Online resources
Procedures
Modeling
Analysis
Data Collection/ QA
Representation
Hardware
Satellites
Servers
PCs
Networks
GPS
Plotters &Printers
Mobiles
Sensors
Software
Web Apps
Desktop Apps
Mobile Apps
Web Services

History of GIS

Within the last five decades, GIS has evolved from a concept to a science. The phenomenal evolution of GIS from a rudimentary tool to a modern, powerful platform for understanding and planning our world is marked by several key milestones.

The Early History of GIS

The field of geographic information systems (GIS) started in the 1960s as computers and early concepts of quantitative and computational geography emerged. Early GIS work included important research by the academic community. Later, the National Center for Geographic Information and Analysis, led by Michael Goodchild, formalized research on key geographic information science topics such as spatial analysis and visualization. These efforts fueled a quantitative revolution in the world of geographic science and laid the groundwork for GIS.

1960

1963

The First GIS

Roger Tomlinson's pioneering work to initiate, plan, and develop the Canada Geographic Information System resulted in the first computerized GIS in the world in 1963. The Canadian government had commissioned Tomlinson to create a manageable inventory of its natural resources. He envisioned using computers to merge natural resource data from all provinces. Tomlinson created the design for automated computing to store and process large amounts of data, which enabled Canada to begin its national land-use management program. He also gave GIS its name.

1965

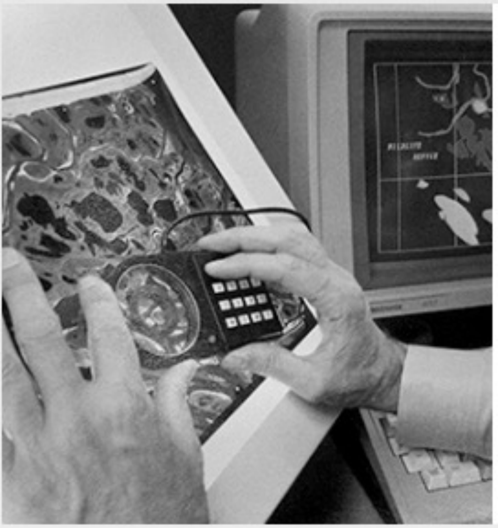
The Harvard Laboratory

While at Northwestern University in 1964, Howard Fisher created one of the first computer mapping software programs known as SYMAP. In 1965, he established the Harvard Laboratory for Computer Graphics. While some of the first computer map-making software was created and refined at the Lab, it also became a research center for spatial analysis and visualization. Many of the early concepts for GIS and its applications were conceived at the Lab by a talented collection of geographers, planners, computer scientists, and others from many fields.

Esri is Founded

1969

In 1969, Jack Dangermond—a member of the Harvard Lab—and his wife Laura founded Environmental Systems Research Institute, Inc. (Esri). The consulting firm applied computer mapping and spatial analysis to help land use planners and land resource managers make informed decisions. The company's early work demonstrated the value of GIS for problem solving. Esri went on to develop many of the GIS mapping and spatial analysis methods now in use. These results generated a wider interest in the company's software tools and work-flows that are now standard to GIS.



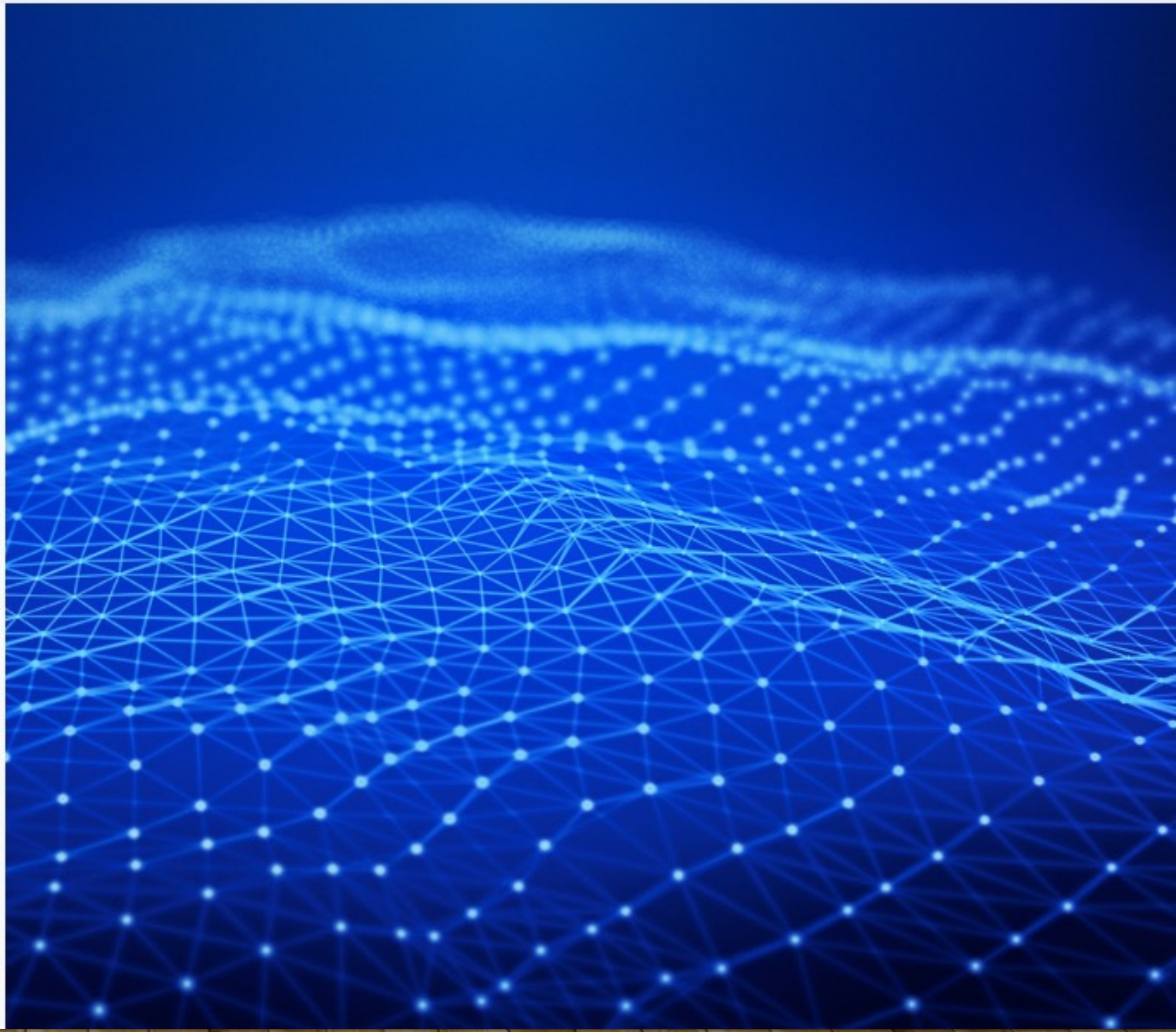
GIS Goes Commercial

1981

As computing became more powerful, Esri improved its software tools. Working on projects that solved real-world problems led the company to innovate and develop robust GIS tools and approaches that could be broadly used. Esri's work gained recognition from the academic community as a new way of doing spatial analysis and planning. In need of analyzing an increasing number of projects more effectively, Esri developed ARC/INFO—the first commercial GIS product. The technology was released in 1981 and began the evolution of Esri into a software company.

GIS Today

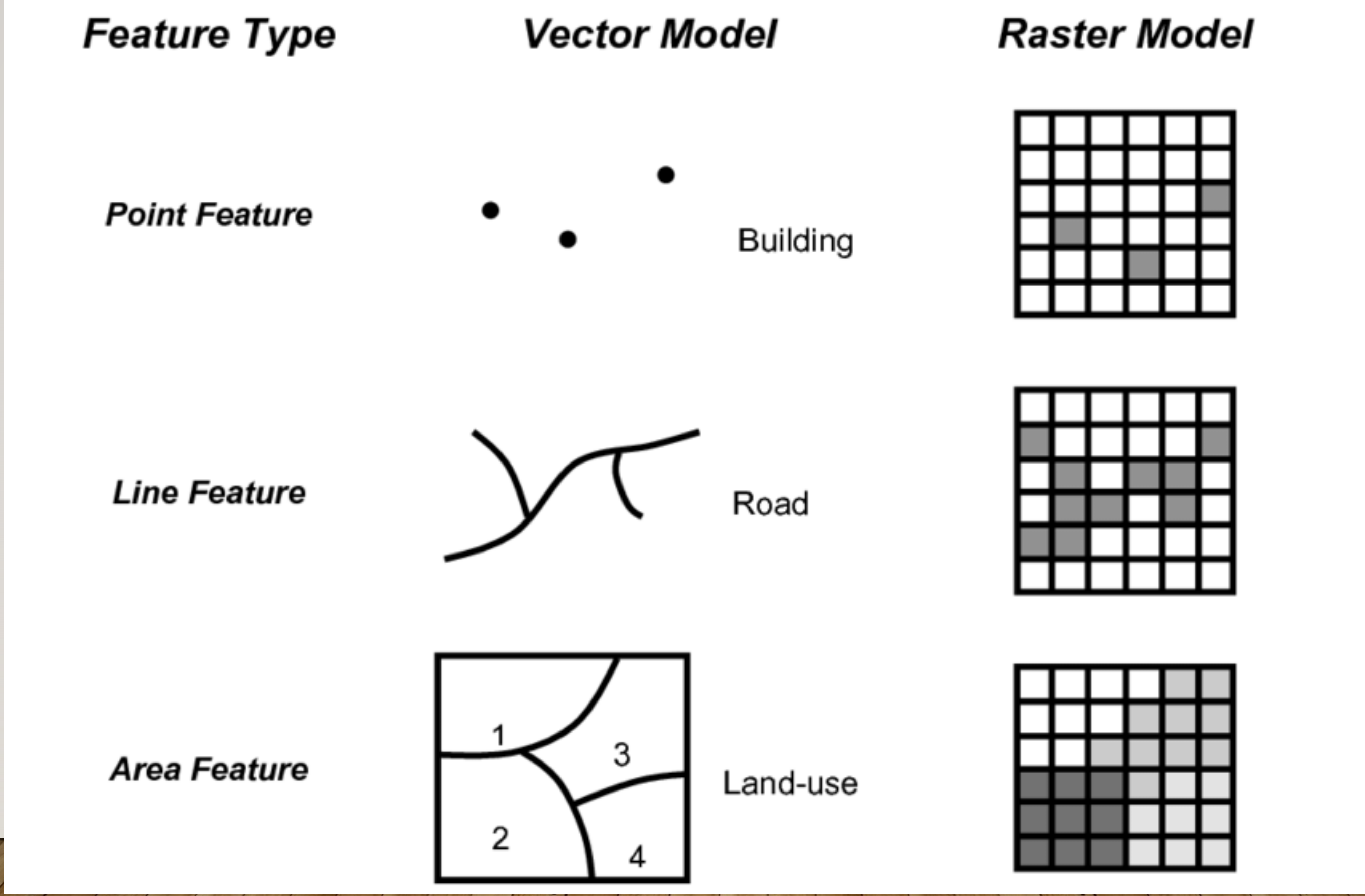
GIS gives people the ability to create their own digital map layers to help solve real-world problems. GIS has also evolved into a means for data sharing and collaboration, inspiring a vision that is now rapidly becoming a reality—a continuous, overlapping, and interoperable GIS database of the world, about virtually all subjects. Today, hundreds of thousands of organizations are sharing their work and creating billions of maps every day to tell stories and reveal patterns, trends, and relationships about everything.

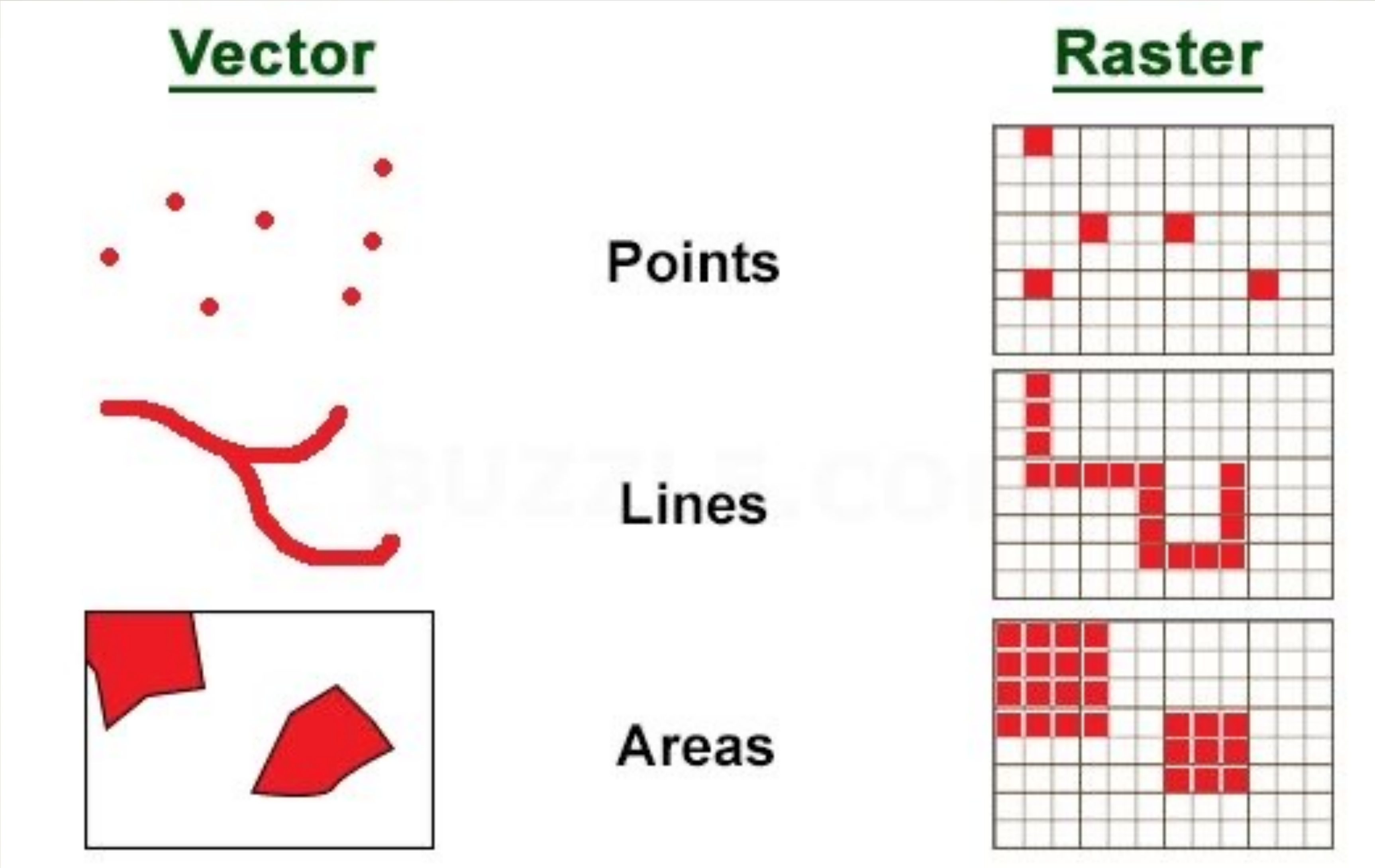


The Future of GIS

With its movement to web and cloud computing, and integration with real-time information via the Internet of Things, GIS has become a platform relevant to almost every human endeavor—a nervous system of the planet. As our world faces problems from expanding population, loss of nature, and pollution, GIS will play an increasingly important role in how we understand and address these issues and provide a means for communicating solutions using the common language of mapping.

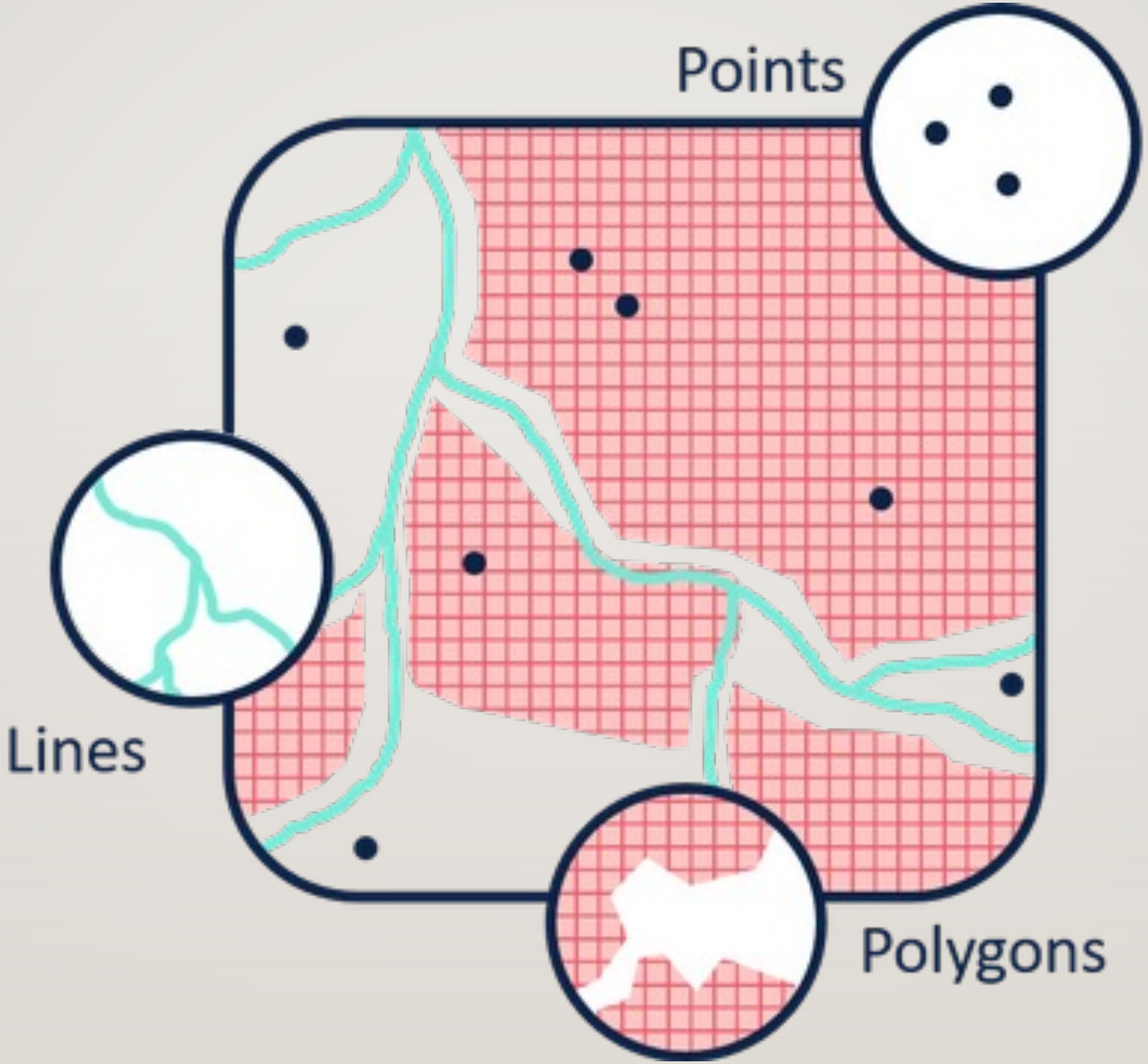
Data Structure


Feature Type
Vector Model
Raster Model
Point Feature
Building
Line Feature
Road
Area Feature
1
2
3
4
Land-use


Vector
Raster
Points
Lines
Areas

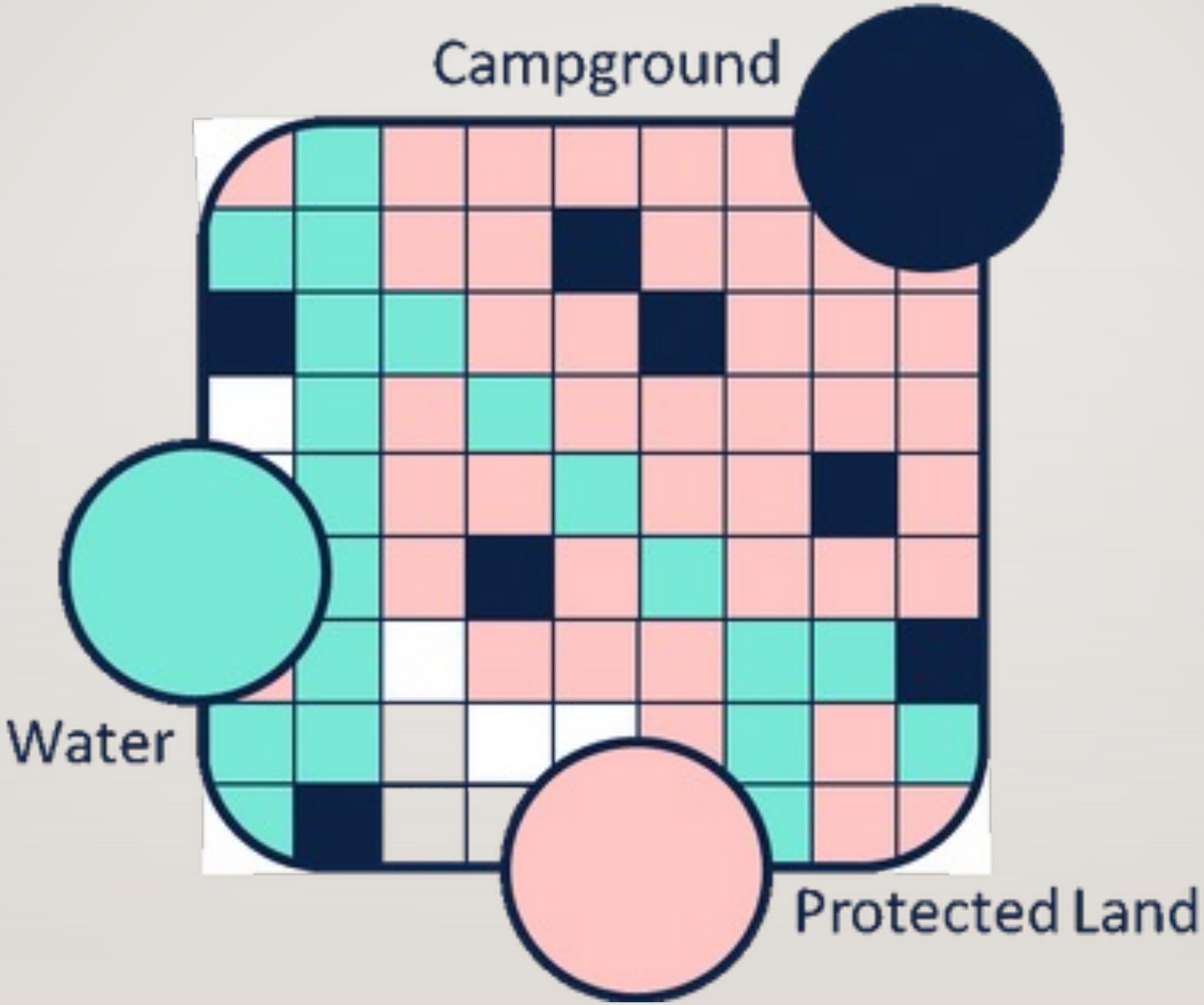
Vector Data

Vector data represents the world with points, lines, and polygons. Vector data is stored as a list of coordinates that define vertices (points), and a set of rules that determine if and how the vertices are joined into lines or polygons. Vector data is most useful to represent spatial phenomena that has discrete boundaries, like county borders or streets.


Points
Lines
Polygons

Raster Data

Raster data represents the world as a continuous surface divided into a regular grid of cells (pixels), where each cell contains a value corresponding to the measured value for the area the cell represents. The spatial resolution of raster data is determined by the size of the cells it is comprised of (e.g., one cell in a raster map can represent a 10x10m area on the surface of the Earth). Raster data can be continuous (e.g., elevation or rainfall) or discrete (e.g., land use or vegetation type).


Campground
Water
Protected Land

Georeferencing

- 'To georeference' is the act of **assigning accurate locations** to spatial information
- Is essential in GIS, since all information must be **linked to the Earth's surface**
- The method of georeferencing must be:
  - Unique, linking information to exactly one location
  - Shared, so different users understand the meaning of a georeference
  - Persistent through time, so today's georeferences are still meaningful tomorrow

EUROPEAN FORUM FOR GEOSTATISTICS

Georeferencing

- To georeference something means to define its existence in physical space. That is, establishing its location in terms of map projections or coordinate systems.
- The term is used both when establishing the relation between raster or vector images and coordinates, and when determining the spatial location of other geographical features.
- Examples would include establishing the correct position of an aerial photograph within a map or finding the geographical coordinates of a place name or street address.
- Most georeferencing tasks are undertaken either because the user wants to produce a new map or because they want to link two or more different datasets together by virtue of the fact that they relate to the same geographic locations.

भौगोलिक सूचना तंत्र के अनुप्रयोग

Applications of GIS

वनविज्ञान एवं कृषि (FORESTRY AND AGRICULTURE)

- वनों की वृद्धि एवं अवस्था की जाँच-पड़ताल।
- वनों की आग का अनुरूपण (simulation)।
- वनों के पारिस्थितिक-अवनयन की मॉडलिंग (Modelling eco-degradation of forests)।
- फसलों की उपज का प्रबन्धन।
- शस्यावर्तन (crop rotation) तकनीक की मॉनीटरिंग।
- कृषि भूमि में मृदा अपरदन की मॉडलिंग।
- किसी विशिष्ट फसल के लिए भूमि की उपयोगिता का विश्लेषण।

भूगर्भ विज्ञान (GEOLOGY)

- मृदा एवं भूगर्भिक संरचनाओं का विश्लेषण।
- भू-स्खलन प्रवण क्षेत्रों की मॉडलिंग।
- अधस्थल (subsurface) स्तरों का त्रि-विमीय दृश्य तैयार करना।
- आपदा मानचित्रण के लिए भूकंपीय सूचना का विश्लेषण।

जलविज्ञान (HYDROLOGY)

- वर्षा के जल के प्रवाह की मॉडलिंग।
- बाढ़ग्रस्त क्षेत्रों की मानचित्रण।
- भू-जल के प्रवाह की मॉडलिंग।
- जलाशयों एवं भूजल में प्रदूषकों के प्रवेश का मानचित्रण।

मानव अधिवास (HUMAN SETTLEMENTS)

- नगरों एवं कस्बों की वृद्धि का निरीक्षण।
- योजना के लिए नगरीय क्षेत्रों की मॉडलिंग।
- पर्यटन के लिए नगरों एवं सांस्कृतिक स्थानों का त्रि-विमीय दृश्य तैयार करना।
- प्रस्तावित परियोजना पर पर्यावरणीय प्रभाव का निरीक्षण करना।

स्थानीय इकाइयों का प्रशासन (GOVERNANCE OF LOCAL BODIES)

- गृह कर प्रणाली की सूचना का विकास।
- ठोस अवशिष्ट पर्दाथ के निपटान के लिए उपयक्त स्थान ढूँढना (Locating a sunt disposal)।
- उपयुक्त स्थान ढूँढ़ना (Locating a suitable site for solid waste disposal
- ऊँजा, संचार, पेय जल तथा अवशिष्ट जल जैसी जवोपयोगी सेवाओं के लिए सूचना प्रणाली का विकास करना।
- जनोपयोगी सेवाओं के प्रबन्धन एवं रखरखाव की योजना बनाना।
- भौगोलिक सूचना तंत्र पर आधारित परिवहन र्मागों की स्थिति निश्चित करना तथा उसकी सूचना दना।

उद्योग (INDUSTRY)

- इंजीनियरिंग, सर्वेक्षण एवं मानचित्रण, स्थिति (Site) एवं भमि का विकास, सड़क के किनारे की पटरी (पदल यात्रियों के लिए) का प्रबन्धन। सामान तथा यात्रियों को ढ़ोने के लिए सार्वजनिक परिवहन व्यवस्था तथा वाहनों का निरीक्षण।
- सामान तथा यात्रियों को ढ़ोने के लिए सार्वजनिक परिवहन व्यवस्था तथा वाहनों का निरीक्षण।
- बिजली, गैस आदि के वितरण के लिए तारें एवं पाइपलाइन, तथा दूर-संचार प्रणाली की व्यवस्था करना।
- खनिजों की खोज एवं खनन र्काय।

परिवहन (TRANSPORT)

- सड़कों से संबंधित सूचना प्रणाली का विकास।
- दुर्घटनाओं के प्रारूप की माडलिंग।
- सड़कों के सरेखण की योजना।
- प्रारम्भिक एवं गन्तव्य स्थानों के बीच वैकल्पिक र्मार्ग ढूँढ़ना।
- निश्चित गन्तव्य स्थानों तक डाकिए एवं कोरियर से संबंधित व्यक्तियों के लिए अनुकूलतम र्मार्ग का मानचित्रण।

बिक्री-कला (MARKETING)

- ग्राहक की सूचना प्रणाली का विकास।
- ग्राहक की वरीयता की मॉडलिंग।
- भविष्य के लिए बिक्री संबंधी प्रबन्धन।

सरकार (GOVERNMENT)

- **संघीय सरकार (Federal government) :** राष्ट्र ीय स्थलाकृतिक मानचित्रण, संसाधन एवं पर्यावरणीय प्रबन्धन मासम संबंधी सेवाएं, सरकारी भूमि का प्रबन्धन, जनगणना, चुनाव तथा वोटिंग।

- **राज्य सरकार :** सर्वेक्षण एवं मानचित्रण, भूमि एवं संसाधनों का प्रबन्धन, महार्मागो का नियोजन एवं प्रबन्धन।

- **स्थानीय सरकार :** सामाजिक एवं समुदायिक विकास, भूमि का पंजीकरण तथा संपत्ति का मूल्यांकन जल एवं अवशिष्ट जल सेवा।

- सुरक्षा, कानून व्यवस्था, अपराधों का विश्लेषण, मानक संसाधन की नियुक्ति, समुदाय के लिए पुलिस की व्यवस
- आपातकाल के लिए नियोजन एवं प्रबन्धन।

- **स्वास्थ्य :** रोगों के फैलाने का प्रारूप, स्वास्थ्य सेवाओं का वितरण।
- अतर्राष्ट्र ीय विकास एवं मानवीय राहत।

व्यापार (BUSINESS)

- बैंकिंग एवं बीमा।
- इमारतों की बिक्री एवं किराया संबंधी सेवाओं का प्रबन्धन तथा योजना।
- खुदरा बाजार का विश्लेषण।
- वस्तुओं एवं सेवाओं को मांग के स्थानों तक पहुँचाने की व्यवस्था।

सेना (MILITARY)

- आधार स्थल एवं सैनिकों के आवागमन के लिए मानचित्र तैयार करना।
- मिसाइल दागने तथा गोलाबारी करने के लिए भूमि का विश्लेषण एवं मूल्यांकन करना।
- युद्ध की स्थिति में योजना तैयार करना।

शिक्षा (ACADEMIC)

- कला, विज्ञान तथा इंजीनियरिंग में शोध ।
- प्राथमिक एवं सैकण्डरी स्कूल, कालेज के प्रभाव क्षेत्र का निर्धारण, बस रूट, सुविधाओं का प्रबन्धन।
- स्थानिक अंकीय पुस्तकालय (Spatial digital libraries)।

QGIS is a user friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities. It allows to create, edit, visualise, analyse and publish geospatial information on different platforms.

GRASS GIS

THANKS