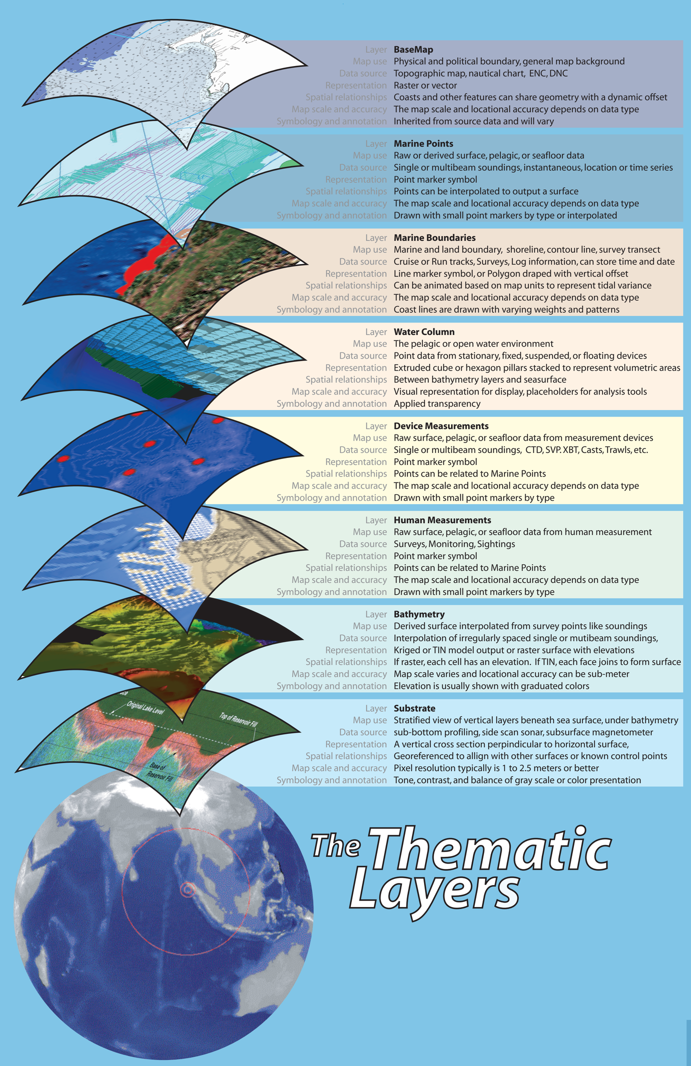
The ArcGIS Marine data model



Layer: BaseMap
- Map use: Physical and political boundary, general map background
- Data source: Topographic map, nautical chart, ENC, DNC
- Representation: Raster or vector
- Spatial relationships: Coasts and other features can share geometry with a dynamic offset
- Map scale and accuracy: The map scale and locational accuracy depends on data type
- Symbology and annotation: Inherited from source data and will vary

Layer: Marine Points
- Map use: Raw or derived surface, pelagic, or seafloor data
- Data source: Single or multibeam soundings, instantaneous, location or time series
- Representation: Point marker symbol
- Spatial relationships: Points can be interpolated to output a surface
- Map scale and accuracy: The map scale and locational accuracy depends on data type
- Symbology and annotation: Drawn with small point markers by type or interpolated

Layer: Marine Boundaries
- Map use: Marine and land boundary, shoreline, contour line, survey transect
- Data source: Cruise or Run tracks, Surveys, Log information, can store time and date
- Representation: Line marker symbol, or Polygon draped with vertical offset
- Spatial relationships: Can be animated based on map units to represent tidal variance
- Map scale and accuracy: The map scale and locational accuracy depends on data type
- Symbology and annotation: Coast lines are drawn with varying weights and patterns

Layer: Water Column
- Map use: The pelagic or open water environment
- Data source: Point data from stationary, fixed, suspended, or floating devices
- Representation: Extruded cube or hexagon pillars stacked to represent volumetric areas
- Spatial relationships: Between bathymetry layers and seasurface
- Map scale and accuracy: Visual representation for display, placeholders for analysis tools
- Symbology and annotation: Applied transparency

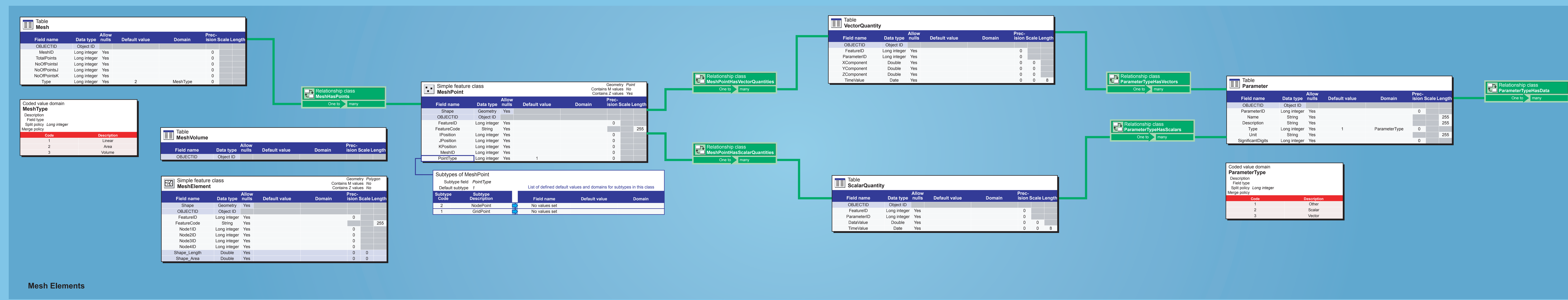
Layer: Device Measurements
- Map use: Raw surface, pelagic, or seafloor data from measurement devices
- Data source: Single or multibeam soundings, CTD, SVP. XBT, Casts, Trawls, etc.
- Representation: Point marker symbol
- Spatial relationships: Points can be related to Marine Points
- Map scale and accuracy: The map scale and locational accuracy depends on data type
- Symbology and annotation: Drawn with small point markers by type

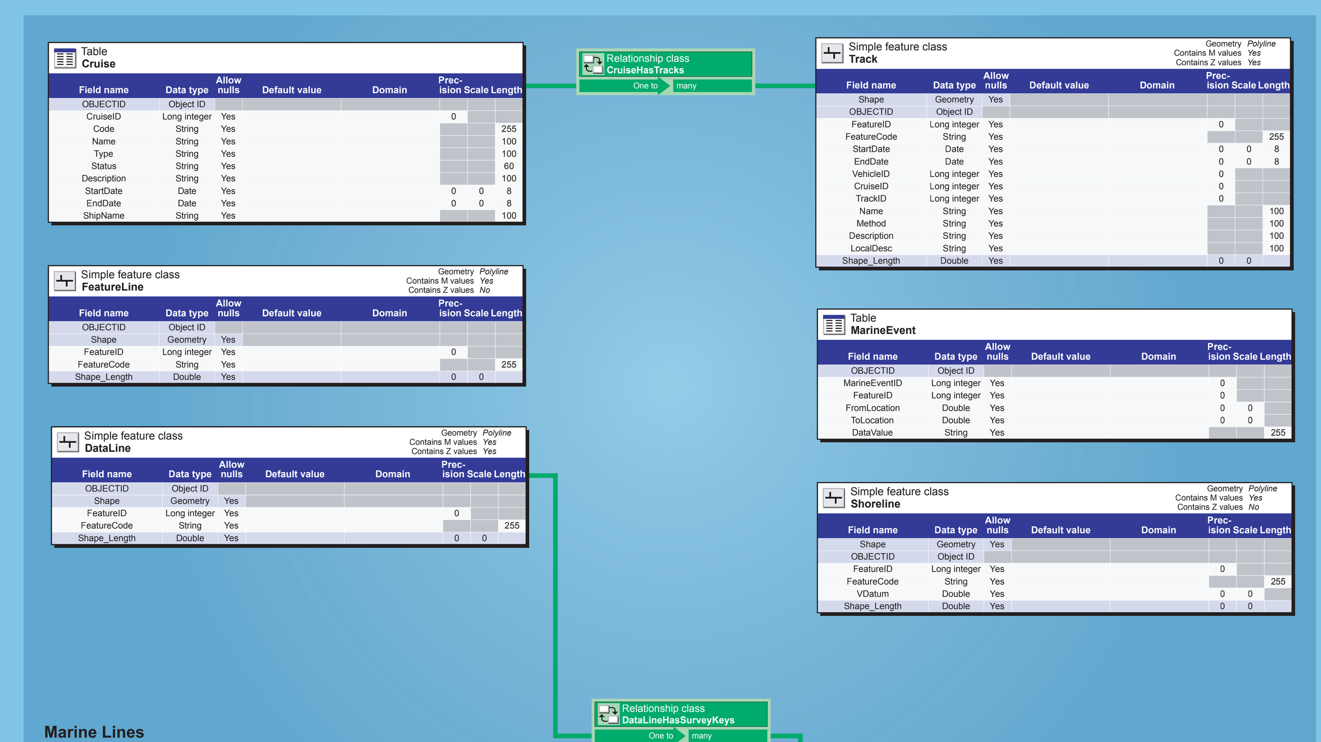
Layer: Human Measurements
- Map use: Raw surface, pelagic, or seafloor data from human measurement
- Data source: Surveys, Monitoring, Sightings
- Representation: Point marker symbol
- Spatial relationships: Points can be related to Marine Points
- Map scale and accuracy: The map scale and locational accuracy depends on data type
- Symbology and annotation: Drawn with small point markers by type

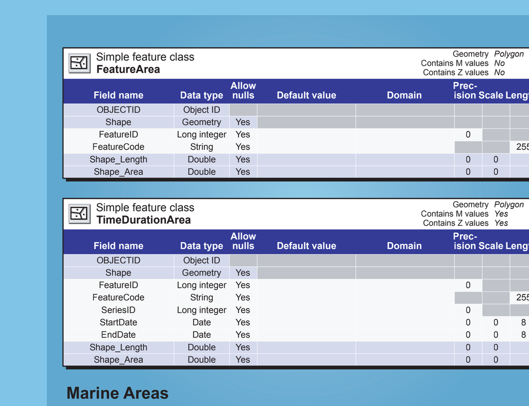
Layer: Bathymetry
- Map use: Derived surface interpolated from survey points like soundings
- Data source: Interpolation of irregularly spaced single or mutibeam soundings,
- Representation: Kriged or TIN model output or raster surface with elevations
- Spatial relationships: If raster, each cell has an elevation. If TIN, each face joins to form surface
- Map scale and accuracy: Map scale varies and locational accuracy can be sub-meter
- Symbology and annotation: Elevation is usually shown with graduated colors

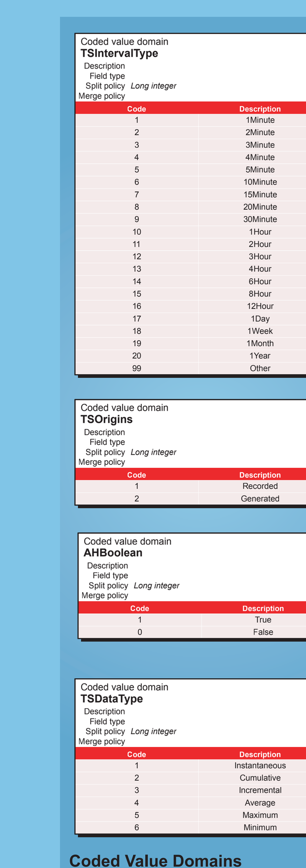
Layer: Substrate
- Map use: Stratified view of vertical layers beneath sea surface, under bathymetry
- Data source: sub-bottom profiling, side scan sonar, subsurface magnetometer
- Representation: A vertical cross section perpindicular to horizontal surface,
- Spatial relationships: Georeferenced to allign with other surfaces or known control points
- Map scale and accuracy: Pixel resolution typically is 1 to 2.5 meters or better
- Symbology and annotation: Tone, contrast, and balance of gray scale or color presentation

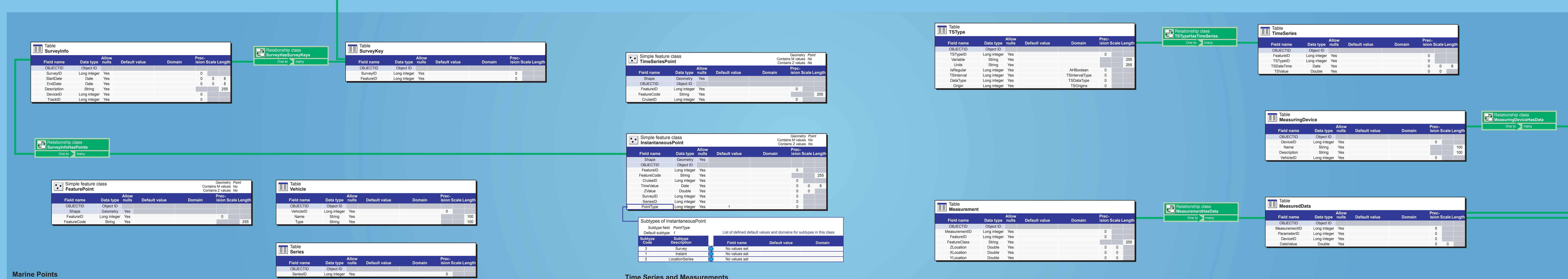
The Thematic Layers

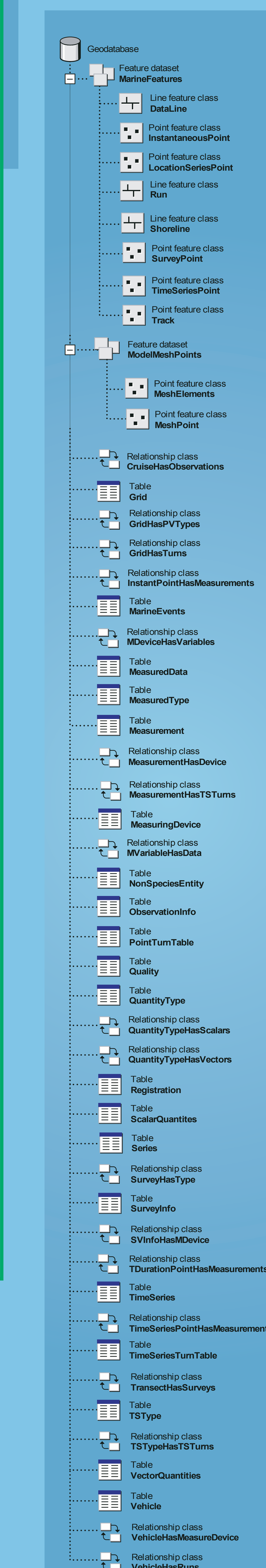




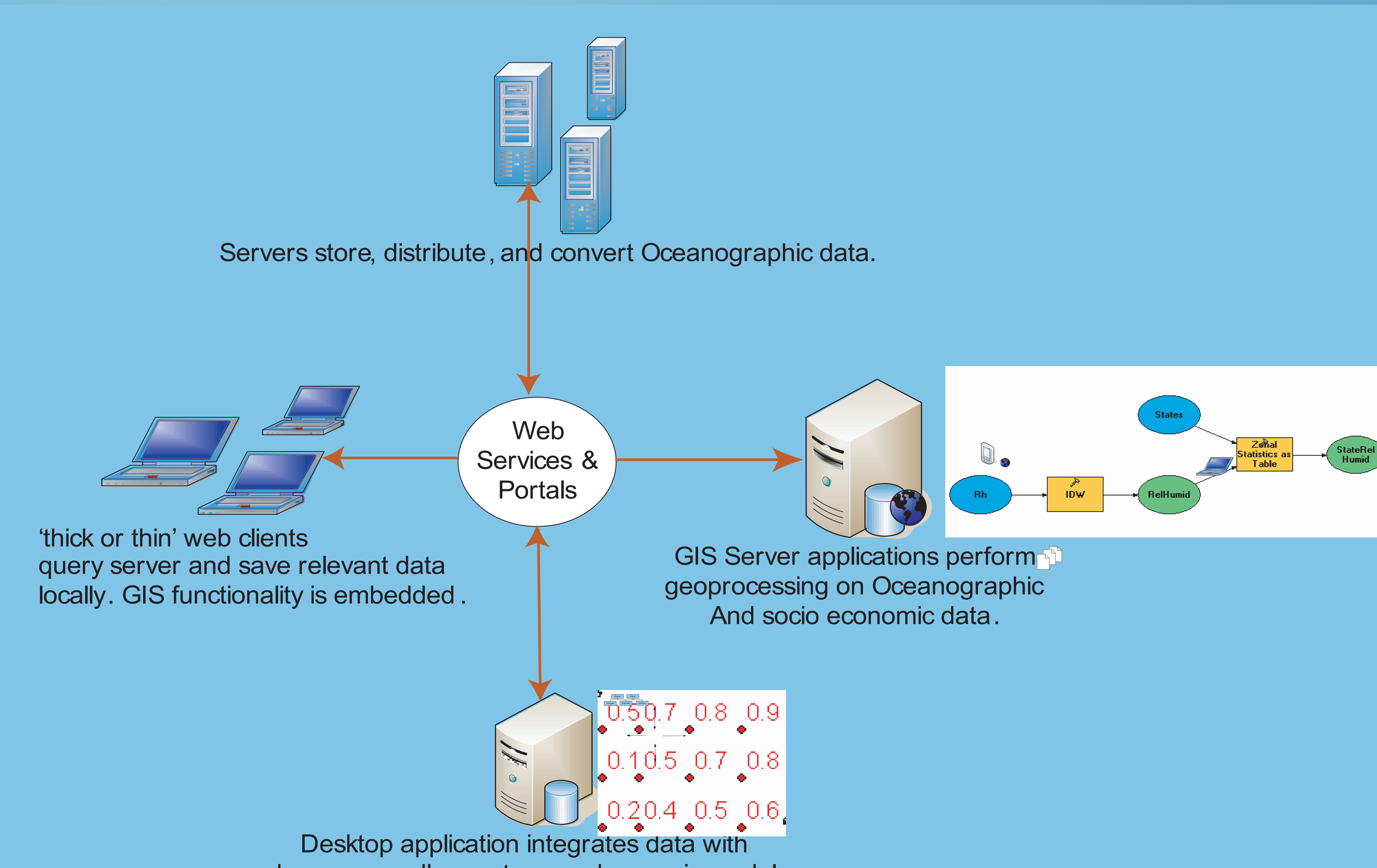
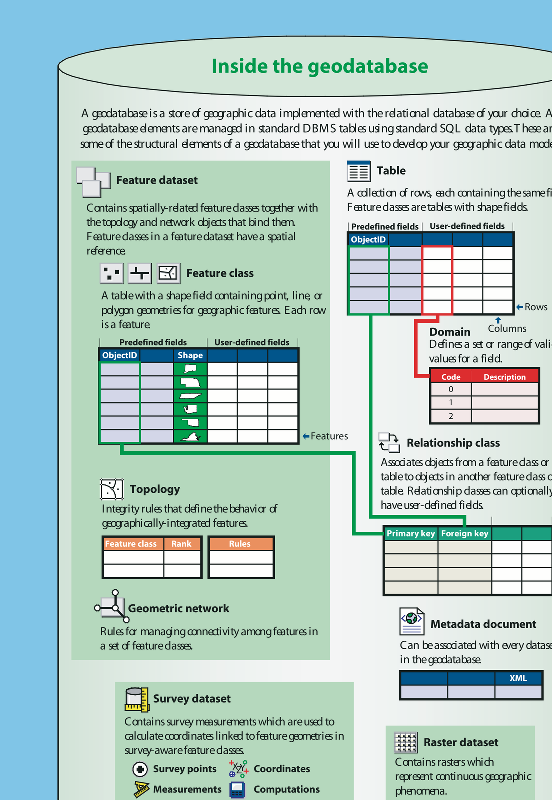








High-resolution multibeam bathymetry was used to create this representation of offshore San Diego. Pulses of sound are emitted from a boat or a *"fish"* (a device towed behind a boat). The time it takes for the pulses to reach the seafloor and return are used to calculate distances or water depths. These measurements, a series of x,y, and z coordinates can then be interpolated to create a surface representing the seafloor. The sea surface is a dynamic layer with wave heights constantly changing due to swell, tides, water temperature, currents and variations in atmospheric pressure. The volume of water between the sea surface and the seafloor can be extruded to represent the water column and some of the phenomena occurring there.

Image courtesy of the Neptune Project, www.neptune.washington.edu, University of Washington Center for Environmental Visualization

The dynamic and multidimensional nature of marine data can be captured in many ways. Some of the sensors and collection techniques produce high-resolution data with submeter accuracy. The amount of data collected presents a challenge, some sensors will produce one gigabyte of data per survey/day, while others stream a gigabyte per hour.