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Design Patterns 101

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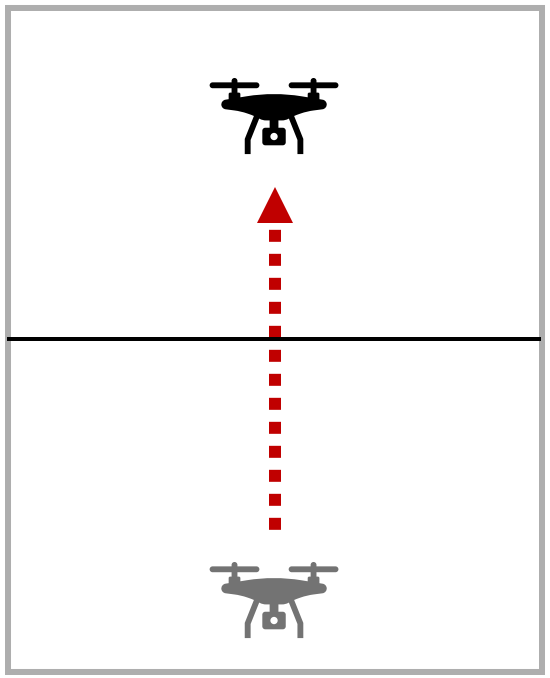
Competency Question

- *Competency questions* represent functional requirements for ontologies; they are used to evaluate the quality of ontologies with respect to user goals

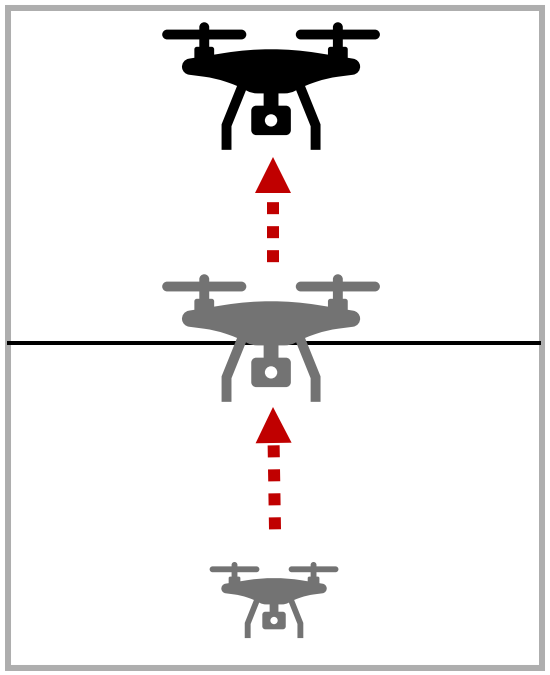
- Competency question used for this demo:

Has a drone crossed the Arizona-Mexico border?

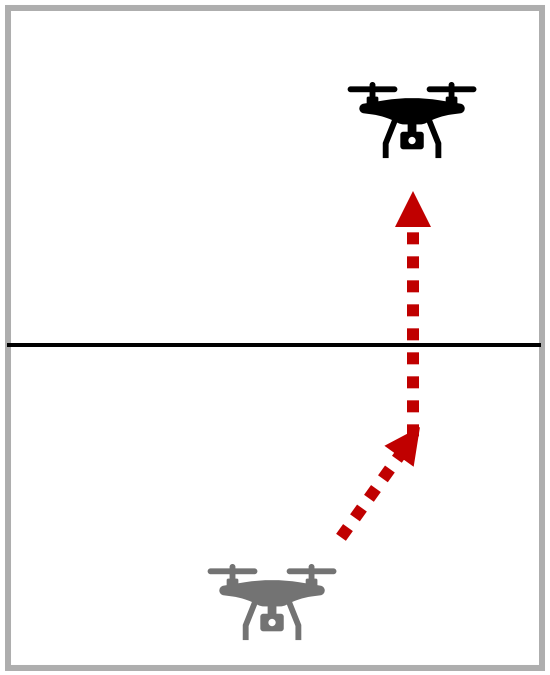
Three Drone Border Crossing Scenarios



Flat, Linear Path



Climbing Linear Path



Flat Non-Linear Path

Each flight path is a way in which a drone might cross the a US border.

Ontology Design

- Addressing the competency question requires ontologically representing data relevant to the question

- For our example, we will need representations of:

border/boundary	latitude
geographic region	altitude
drone	longitude
speed	time

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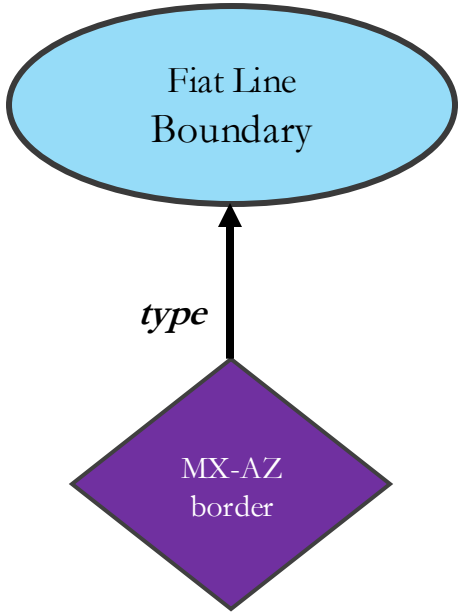
Definition of Boundary

- Fiat Line Boundary =def A continuous flat line whose location is defined in relation to some material entity.

- The MX-AZ border is an instance of the class Fiat Line Boundary.

- We visually represent this relationship with an oval for the class Fiat Line Boundary, a diamond for the instance MX-AZ border, and an arrow indicating the latter is a type of the former.



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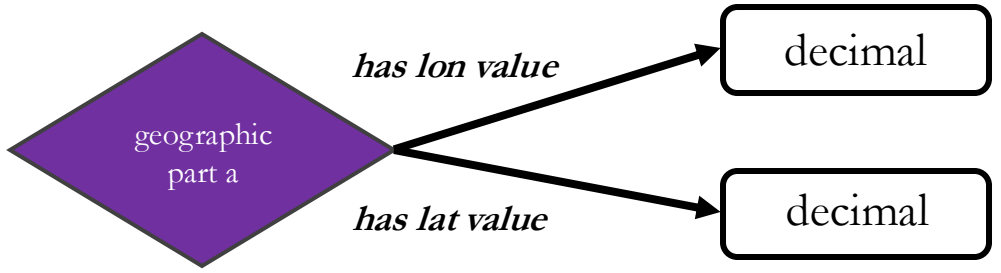
Definition of Geographic Region

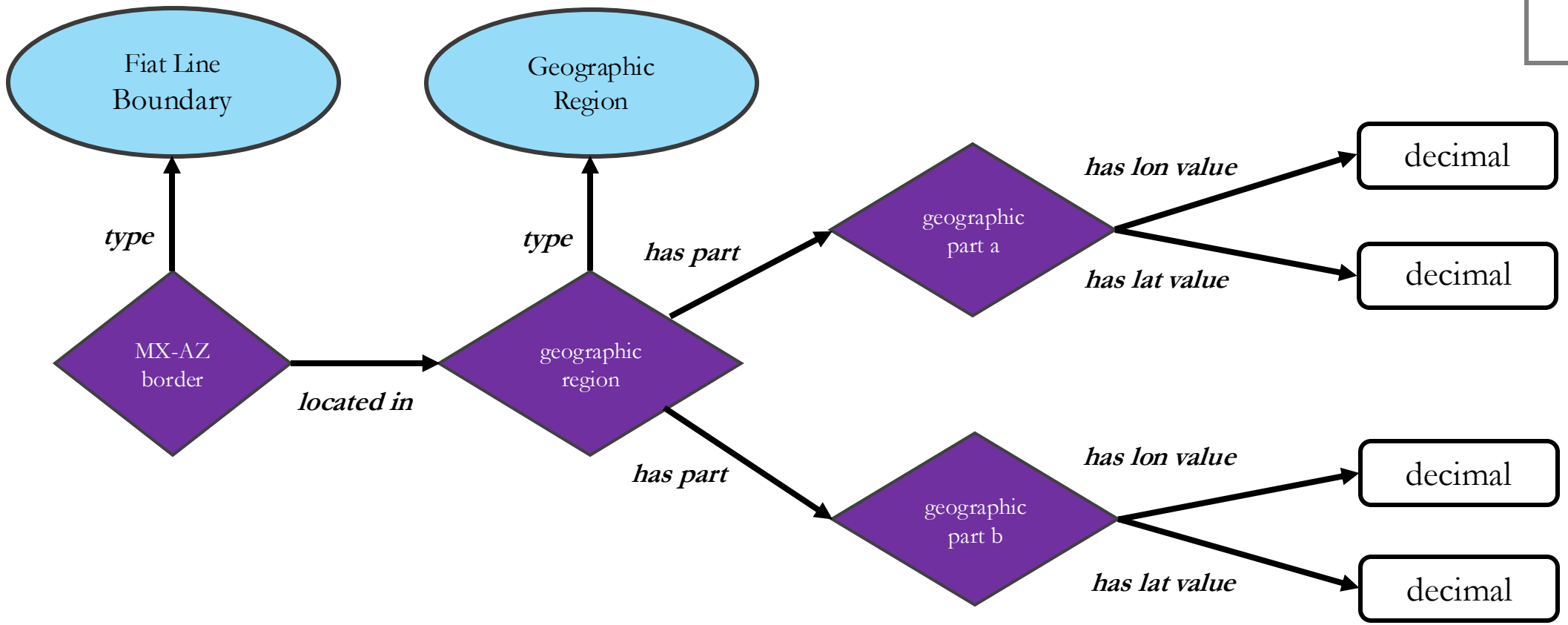
- Geographic Region =def A geographic entity demarcated by one or more boundaries all of whose lines are located on the Earth's surface.

- The MX-AZ border is located in some instance of Geographic Region, which has parts corresponding to parts of the border

- The geographic parts are associated with latitude and longitudes, represented by, for simplicity, decimal values represented by rectangles



Representing Borders



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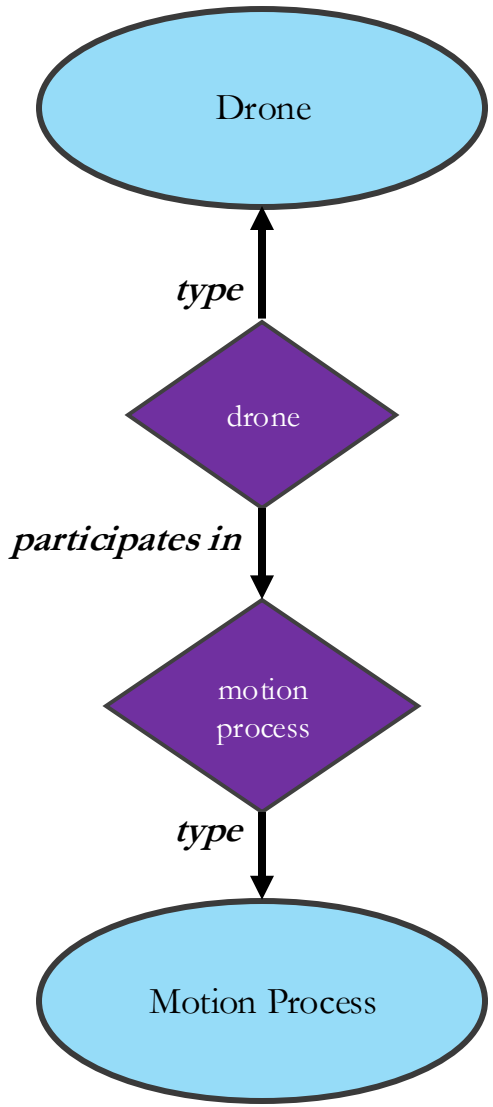
Definitions of Drone, Motion

- Drone =def An aircraft designed to be powered, fly autonomously or be piloted remotely, without a human operator onboard

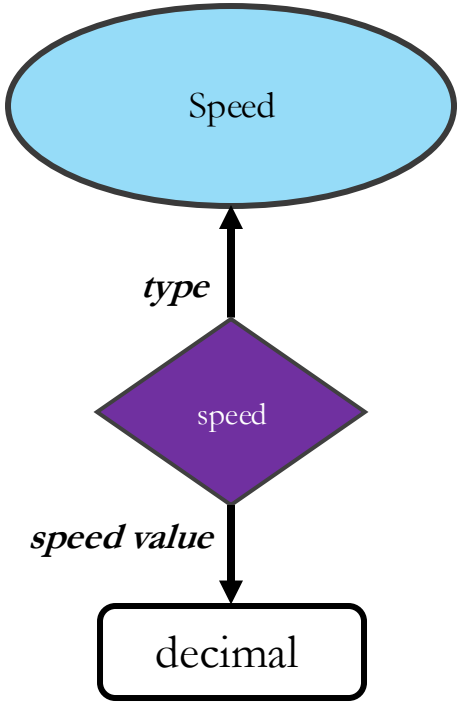
- Motion Process =def A process in which a material entity changes its spatial orientation over time

- An instance of drone participates in an instance of a motion process



Process Profile, Definition of Speed

- A process profile is an abstraction of some relevant aspect of a given process, e.g. the velocity of traveling missile
- Speed =def A process profile characterized by the magnitude of an object's motion relative to a reference frame over time
- A drone participating in a motion process will have some associated speed value



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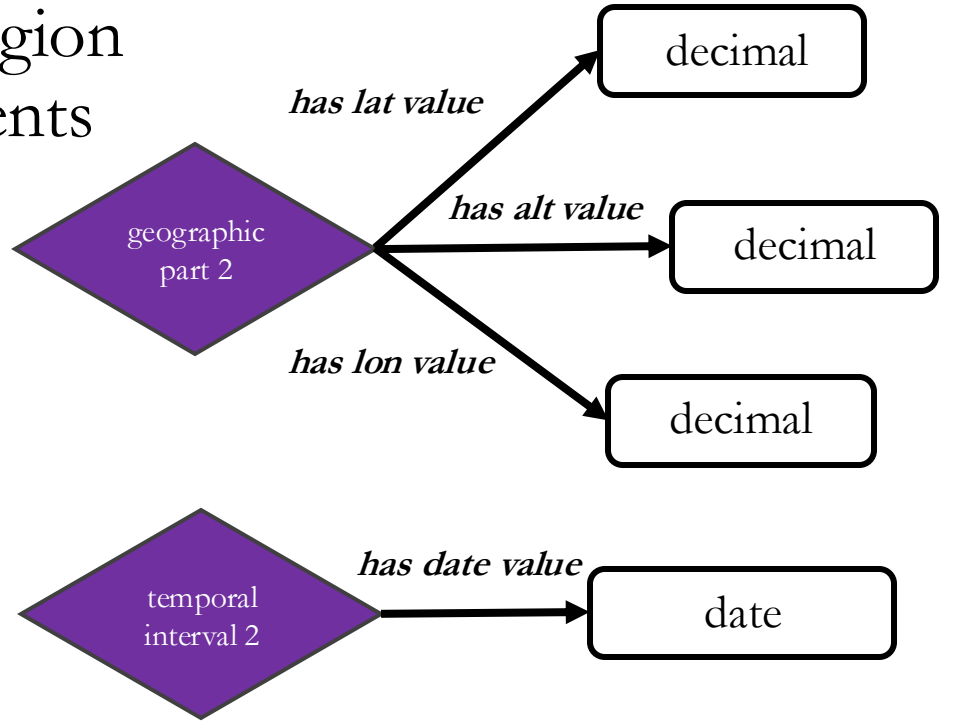
Definition of Spatiotemporal Region

- Spatiotemporal Region =def An occurrent entity that is part of spacetime

- The drone's motion occupies spatiotemporal region instances which have geographic/temporal extents

- Geographic extents are associated with longitude, latitude, and altitude values; temporal extents are associated with date time stamps



*Classes not diagramed due to space constraints

Representing Drone Motion