Data Format Transformation and Validation Language
Functional Requirements
23 October 2020

The language must support this validation function:

> Is this point in this polygon?

Use Case #1

A Unmanned Air Vehicle (UAV) is to begin transmitted images to a ground station when it is flying over Italy. The UAV is represented as a point with a location. Italy is represented as a polygon. Is the UAV flying over Italy? If yes, transmit images.

There are additional requirements on the function, which are elaborated in the following text.

Some areas (polygons) have holes. We must expand the validation function to accommodate this requirement:

> Is this point in polygon 1 but not in polygon 2?

Use Case #2

A UAV is flying over Italy and transmitting images to a ground station. The UAV must not transmit any images when it is over Vatican City. Italy is polygon 1 and within it is polygon 2 representing Vatican City. Vatican City is a "hole" in Italy. Is the UAV flying over Italy and not flying over Vatican City? If yes, transmit images.

Polygon 2 is nested within polygon 1. There may be polygon 3 within polygon 2 and polygon 4 within polygon 3, and so forth. Polygons may be arbitrarily deeply nested. We must expand the validation function to accommodate this requirement:

> Is this point in polygon N?

Some use cases have a time associated with the polygon, i.e., the polygon only exists for a certain period. Time must be factored into the validation function:

> Is this point within this polygon at this time?

Some areas are multi-polygons. We must expand the validation function to accommodate this requirement:

> Is this point within this polygon at this time?

Use Case #3

Virginia has a continuous land mass, but it also has a little bit of land adjacent to Maryland at the southern tip of the eastern shore. To validate that a point is within Virginia, the validation must be on the continuous land mass plus the bit of land adjacent to Maryland.

Some areas are 3-dimensional. We must expand the validation function to accommodate this requirement:

> Is this point within this 3-D area?

Use Case #4
Check whether the UAV is flying over Italy above 20,000 feet.

Other use cases:

Use Case #5
I received an email saying that I won $25 million dollars. When I looked at the location of the sender, I saw that the sender is located within Nigeria. So I rejected the email.

> Is the sender in Nigeria?

Use Case #6
There is a data set of building footprints (polygons) in Zambia. There is a point file of locations of medical facilities. Determine if all the medical facilities fall within a building.

> Is medical facility ABC in building footprint XYZ?

Use Case #7
Check on data quality: See if any building footprints are inside another footprint or if footprints overlap.

> Is footprint RST within footprint XYZ?

Note that this is a use case of: Is polygon A within polygon B?

Use Case #8
Consider the fires out west. Which state, county, fire district, water district, congressional district, etc. are the fires in?

> Is the Zogg Fire in Shasta County, California?

Use Case #9
The infantry soldier needs to keep his commander apprised for situational awareness. The network that the infantry soldier uses operates at a lower classification level than the platoon's command and control network that his commander uses. The soldier wears a Wearable One-Way Transfer (WOWT) device. The device emits radio signals. The radio signals contain tactical information and this information is to be transferred to the commander's command and control network. Included in the information is the location of the soldier. A boundary device resides between the two networks. The boundary device receives data packets from the soldier's radio and checks that the location specified in each packet is within the area of operation.

Is the location specified in the tactical data packet within the configured operations area?