# Agents and Multi-Agent Systems

## Assignment 1 - Theme definition (Group B)

### Global Logistics

In the globalized world we live in, logistics is a central part of it. There are **global container ports** and **logistic companies** that operate them and use them with their cargo ships. In parallel, there are also **long land** routes and **short** ones following the same logic. Some logistics companies operate at several routes, and others just at some.
There are **producer companies** that want to transport their products from an origin to a destination. These companies will sell at **auction** to the logistics companies the transportation of their products, which may involve several types of routes (**international**, **regional**, **neighborhood**).

#### Agent definition

- **Logistics Company:** An entity that provides a logistics service. It will compete or collaborate with other companies to get the product to the destination. It has hub(s) with which it cooperates to make the best decision for the transport of the products.
    - **Global hub:** An entity that can manage ships and semi trucks. It manages the operations of those vehicles for international and regional routes.
    - **Regional hub:** An entity that can manage semi trucks and vans. It manages the operations of those vehicles for regional and neighborhood routes.
- **Producer:** An entity that has a steady supply of a product of a given type (and characteristics). It wants to sell it to a client for a given price. It will negotiate with one or multiple logistics companies to get the product to its destination.
- **Client:** A spontaneous sprouting entity that has demand for a product within a certain price range.

#### Additional details

- **Vehicles:** Belong to a company. Have a determined cargo size, speed, cost per mile, monthly upkeep.
    - **Van:** Vehicle with a predetermined travel time which is scheduled by the region hub. Makes transportation within neighborhood routes.
    - **Semi truck:** Vehicle with a predetermined travel time which is scheduled by the region or global hub. Makes transportation within regional routes.
    - **Ship:** Vehicle with a predetermined travel time which is scheduled by the global hub. Makes transportation within international routes.
- **Routes:** They are static, but can be predetermined or randomized at initialization.
    - **International:** Connect two long range hubs.
    - **Regional:** Connect a long range to a region hub.
    - **Neighborhood:** Connect a region hub to a client or producer.

## Variables

### Dependent variables:

- Log each item transport chain (and by company)
- Log each vehicles trip (and by company)
- Metrics on:
  - Time to destination (and by of trip)
  - Cost per trip (and by of trip)
  - Money made per producer
  - Money made per company
  - Money spent per client
  - Vehicle run time
  - Vehicle number trips
  - Vehicles cargo transported

### Independent variables:

- **World:**
  - Graph structure (3 trees, each with height 2 connected by the route)
  - Number of nodes and routes (per type),
  - Distance of routes
- **Clients:**
  - Client demand spawn ratio, distribution and TTL
  - Price ranges
  - Time ranges
  - Utility function for time and price
- **Producers:**
  - Number and distribution
  - Produced types
  - Product cost (producers may have higher or lower cost for a given product)
  - Utility function for time and price
- **Logistics Companies:**
  - Number
  - Number and place of each of the vehicles
  - Utility function and deciding strategies
- **Products:**
  - Types
  - Price range
  - Size
- **Vehicles:**
  - Cargo size
  - Speed
  - Cost per mile
  - Monthly upkeep