Next we will define the Data Models architecture of the project**“angel”** which is project based**“SHOP4CF”**.

In the first instance we will define the different elements of the architecture:

Definitions.

Locations.

In principle we will have two default locations:

- The factory or warehouse in which people and robots will carry out their work.
- The palletizing cells that the factory specified in the previous point may contain and where a robot is located to carry out a specific task in the manufacturing process.

We will be based on the class**Location** de SHOP4CF

Robots.

We will define industrial robots as a**Resource** abstract architecture**SHOP4CF** and more specifically using the definition**Device.**

In this way we always have control over the relative position of the robot within the palletizing cell in which it is located.

Workers.

By using the model**Person** we will represent the operators who work within the main location specified as a factory. We will distinguish different types of operators according to their role:

- **maintenance operators**, that interact with the robots in the tasks that have to do with this typology.
- **Operators**, interact with the robot for the configuration and supervision of the robots.
- **Workers**, in charge of supplying the necessary materials to the robot in the palletizing cell or who, due to being inside the factory, can interact with the robots by invading the palletizing cells.

The operators will carry a tag that will be considered a**Device** and that it will be the one that allows us to know the relative position of the people inside the palletizing cells.

Tags.

As we have commented, based on the model**Device** is related to the operators in such a way that it is able to define the position relative to the palletizing cells controlled by**angel**, of these.

Tasks.

We will define the jobs performed by the robots as tasks, making use of the model**Task**, the task will take place in a specific palletizing area and therefore will use a specific robot, we will associate the tasks with the appropriate operators depending on the type of task in question.
With the information provided by the robot through**angel** we will be able to maintain the state of the task during its execution, as well as collect the relevant manufacturing data in the output attributes of the model**Task**, in order to allow productivity calculations, etc.

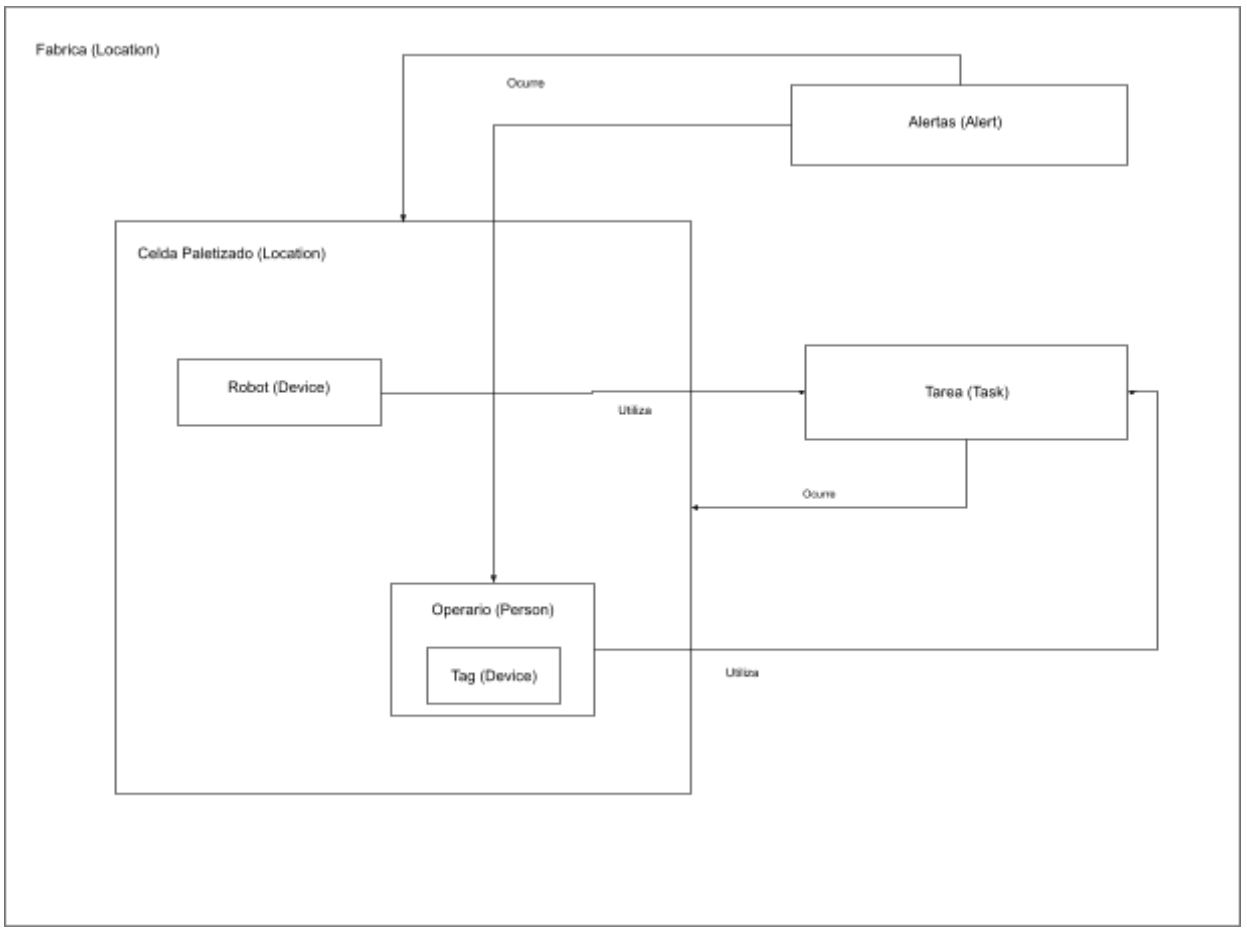
Alerts.

Finally **angel** It generates the security levels based on the geofences that are defined in 10 alert levels between people and robots, which allows us to control the speed of the robot as well as collect the robot's information regarding security.
With this information we can generate the alerts that can be given in each of the palletizing cells using the model**Alert** within a**Location** determined and for a**Device** determined that represents the tag carried by the operator that generates the alert.
Since the architecture of "**SHOP4CF"** define **Alert** as immutable we will generate a different alert instance for each different level of security, from one to ten, as well as being able to include other additional alerts.

Production process, Materials, Miscellaneous assets.

"**SHOP4CF"** allows the definition of these data models, since they do not intervene directly in the scope of **angel**, will not be defined.

Diagram.



Previous considerations.

For our projects we will consider the definitions established and based on NGSI V2, since fiware currently recommends using this version, we will define our datamodels based on those defined by shop4cf and fiware but adapting them to version 2 since these are defined in v1.

Regarding the Location entity, since it is not defined, we will present a definition of it.

Data Models.

Location Data Model.


```
{
    "id": "urn:ngsi-ld:Location:wepall-lab:nave-1",
    "type": "Location",
    "location": {
        "type": "Property",
        "value": "wepall-lab:nave-1",
        "metadata": {}
    }
}
```


Robot Data Model.


```
{
    "id": "urn:ngsi-ld:Device:wepall-lab:0d9a9b4e-dfd0-47ce-81e8-03de5b863eb5",
    "type": "Device",
    "category": {
        "type": "Property",
        "value": [
            "robot"
        ],
        "metadata": {}
    },
    "controlledProperty": {
        "type": "Property",
        "value": [
            "relativePosition"
        ],
        "metadata": {}
    },
    "deviceState": {
        "type": "Property",
        "value": "palletizing",
        "metadata": {}
    },
    "relativePosition": {
        "type": "Property",
        "value": [
            422,
            1024,
            1893
        ],
```

```
            "metadata": {
                "timestamp": {
                    "type": "DateTime",
                    "value": "2023-05-09T05:46:12.152Z"
                }
            }
        }
    }
```


Data Model Operator.


```
    {
        "id": "urn:ngsi-ld:Person:wepall-lab:78529032K",
        "type": "Person",
        "firstName": {
            "type": "Property",
            "value": "Lucas",
            "metadata": {}
        },
        "lastName": {
            "type": "Property",
            "value": "Kaiwolker",
            "metadata": {}
        },
        "status": {
            "type": "Property",
            "value": "Working",
            "metadata": {
                "timestamp": {
                    "type": "DateTime",
                    "value": "2023-05-09T05:46:12.152Z"
                }
            }
        },
        "tag": {
            "type": "Property",
            "value": {
                "type": "Relationship",
                "object": "urn:ngsi-ld:Device:wepall-lab:tag-DW1597"
            },
            "metadata": {}
        }
    }
```

Tag data model.


```
{
    "id": "urn:ngsi-ld:Device:wepall-lab:tag-DW1597",
    "type": "Device",
    "category": {
        "type": "Property",
        "value": [
            "tag"
        ],
        "metadata": {}
    },
    "controlledProperty": {
        "type": "Property",
        "value": [
            "relativePosition"
        ],
        "metadata": {}
    },
    "deviceState": {
        "type": "Property",
        "value": "ok",
        "metadata": {}
    },
    "relativePosition": {
        "type": "Property",
        "value": [
            50,
            1800,
            120
        ],
        "metadata": {
            "timestamp": {
                "type": "DateTime",
                "value": "2023-05-09T05:46:12.152Z"
            }
        }
    }
}
```

Hard Data Model.


```
    {
        "id": "urn:ngsi-ld:Task:wepall-lab:bd0c3617-044b-40f7-8e69-cfa05dbed0cd",
        "type": "Task",
        "happensAt": {
            "type": "Property",
            "value": [
                {
                    "type": "Relationship",
                    "object": "urn:ngsi-ld:Location:wepall-lab:nave-1",
                    "locationFunction": {
                        "type": "Property",
                        "value": "factory"
                    }
                },
                {
                    "type": "Relationship",
                    "object": "urn:ngsi-ld:Location:wepall-lab:palletized-cell-1",
                    "locationFunction": {
                        "type": "Property",
                        "value": "cell"
                    }
                }
            ],
            "metadata": {}
        },
        "involves": {
            "type": "Property",
            "value": [
                {
                    "type": "Relationship",
                    "object":
"urn:ngsi-ld:Device:wepall-lab:0d9a9b4e-dfd0-47ce-81e8-03de5b863eb5"
                },
                {
                    "type": "Relationship",
                    "object": "urn:ngsi-ld:Person:wepall-lab:78529032K"
                }
            ],
            "metadata": {}
        },
        "outputParameters": {
            "type": "Property",
            "value": {
                "activity": "palletizing",
```

```
            "selectedRecipe": 2,
            "productDimensions": {
                "length": 200,
                "width": 150,
                "height": 100
            },
            "averageSpeed": 0,
            "numPalletizingCycles": 0,
            "numPalletizingProducts": 0,
            "numRejectedProducts": 0,
            "palletizingSequence": {
                "startDateTime": "08/05/2023 11:36:21",
                "endDateTime": "",
                "workingTimeRobotPalletizing": "20:04:34.7861082",
                "waitingTimeRobotPalletizingSeq": "00:00:00",
                "waitingTimeRobotPalletizing": "00:00:00",
                "numStopsPalletizingSeq": 0,
                "numSpeedReductionsPalletizingSeq": 0,
                "numStopsPalletizingCycle": 0,
                "numSpeedReductionsPalletizingCycle": 0
            }
        },
        "metadata": {
            "timestamp": {
                "type": "DateTime",
                "value": "2023-05-09T05:46:12.152Z"
            }
        }
    },
    "status": {
        "type": "Property",
        "value": "palletizing",
        "metadata": {
            "timestamp": {
                "type": "DateTime",
                "value": "2023-05-09T05:46:12.152Z"
            }
        }
    }
}
```

Data Model alert.


```
{
    "id": "urn:ngsi-ld:Alert:wepall-lab:tag-DW1597-palletized-cell-1",
    "type": "Alert",
    "alertSource": {
        "type": "Property",
        "value": {
            "type": "Relationship",
            "object": "urn:ngsi-ld:Location:wepall-lab:palletized-cell-1"
        },
        "metadata": {}
    },
    "category": {
        "type": "Property",
        "value": "angel",
        "metadata": {}
    },
    "data": {
        "type": "Property",
        "value": {
            "zoneCode": "cell-palletized-1",
            "coordinates": {
                "x": 50,
                "and": 1800,
                "With": 120
            },
            "sensorId": "tag-DW1597",
            "alertType": "DANGER"
        },
        "metadata": {}
    },
    "dateIssued": {
        "type": "Property",
        "value": {
            "type": "DateTime",
            "value": "2023-05-09T05:45:56.825Z"
        },
        "metadata": {}
    },
    "description": {
        "type": "Property",
        "value": "Tag enter palletizing zone",
        "metadata": {}
    },
    "humanVerified": {
```

```
            "type": "Property",
            "value": false,
            "metadata": {}
        },
        "severity": {
            "type": "Property",
            "value": "medium",
            "metadata": {}
        },
        "source": {
            "type": "Property",
            "value": "tag-DW1597",
            "metadata": {}
        },
        "subCategory": {
            "type": "Property",
            "value": "DANGER",
            "metadata": {}
        },
        "validFrom": {
            "type": "Property",
            "value": {
                "type": "DateTime",
                "value": "2023-05-09T05:45:56.825Z"
            },
            "metadata": {}
        },
        "validTwo": {
            "type": "Property",
            "value": {
                "type": "DateTime",
                "value": "2023-05-09T05:46:16.825Z"
            },
            "metadata": {}
        }
}
```