University of L'Aquila

Department of Engineering and
Information Science and Mathematics

Report Homework #2

Water Distribution, Leakage and Quality Control System

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Github Project Repository:

https://github.com/GaetanoFichera/Water-Quality-Control-System

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Chapter 1

Light Rework On Our UML Model

- We have applied the stereotypes to the Communication Paths within the Deployment Diagram;
- For the connections between the Control Center Server and the two Inland and Outgoing Seaweed Picking Control Units we have inserted a new communication path stereotype that does not consume resources because when we started the modeling work for the Queueing Network we considered the two Control Units located in the same physical space as the Control Center Server, because when we considered the vectors of virtual resources for each step of the Execution Graph "Sampling Water" the communication between Control Center Server and Control Unit did not consume resources, then we use a "Internal Connection" stereotype with zero consumption of resources;
- We have added the operations to the components subsequently reused in the Sequence Diagram;
- we realized the lack of an internal server to the Control Center Pomezia that managed the requests coming from the App inside it;
- we realized that in the sequence diagram "check quality" the call from the component "check quality parameters inland / outgoing" was missing to the component parameters archieve to ask the desired water parameters;
- we have established the types of connections between one node and the other of the deployment diagram, obtaining:
  - between the control center server and the two apps a wired connection (internal to the control center node therefore without delays);
  - between control center server and seaweed picking a wireless connection;
  - between the control center server and the water company server and the purification system center an internet connection.
- we have agreed that there is a single database that is connected to the water company server or water archives, and the qn we will develop with this consideration, in case we see that the performance is very bad we could consider the choice to dislocate the db between purifcation system, control center and water company nodes;
- we realized that in the water sampling phase, the sensors will send the data of the water samples to the control center which, in turn, using the sample archieve component will send the data to the water company server, the problem is that in the SD after the component sample archive is not invoked any component that refers to the water company server;
- =====> We have decided to add a component called "Sample Archive" to the water company server which is responsible for saving data on the DB. In going to add this correction we realized that in fact we have failed to use sample sender;

- =====> then we have made a small change:
  - sample sender is inside the control center server;
  - sample archive is located inside the water company server and manages the data on the db.
- in order to improve system performance and to better stratify the deployment, we decided to add 3 new nodes: "SeaweedPickingInlandControlUnit", "Seaweed Picking Outgoing Control Unit" and "MagikarpControlUnit", for this purpose we have also inserted a new profile called "Control Unit" from the server stereotype, these 3 new nodes are connected to the server with a wired connection and to sensors with a wireless connection;
- We modified the sequence diagram of "UC SturUpSamplingWater" as we realized that the component sample data on the SeadweedPIckingInland / Outgoing node communicated with the "SampleSender" component on the ControlCenterServer node but from our component + deployment diagram it was not.

Below you can find the description of the new profiles popping out.

1.1 Wired Connection Profile

Wired Connection	
Metamodel Class	Communication Path
Description	It is a representation of the physical meaning of Wired Connection
Tagged Values	
Constraints	

1.2 Internet Connection Profile

Internet Connection	
Metamodel Class	Communication Path
Description	It is a representation of the physical meaning of Internet Connection
Tagged Values	
Constraints	

1.3 Wireless Connection Profile

Wireless Connection	
Metamodel Class	Communication Path
Description	It is a representation of the physical meaning of Wireless Connection
Tagged Values	
Constraints	

1.4 Internal Connection Profile

Internal Connection	
Metamodel Class	Communication Path
Description	It is a representation of the physical meaning of Internal Connection
Tagged Values	
Constraints	

1.5 Control Unit Profile

Internal Connection	
Metamodel Class	Node
Description	It is a representation of the physical meaning of Control Unit
Tagged Values	
Constraints	

Chapter 2

Identification of performance Requirements

The following consideration has been made:
1 Km of the route with respect to the connection point with the system is taken into account for an Entry Water Channel or Exit of 5 meters radius, and every 10 meters must be 10 Seaweed Picking, with a total of 1000 Seaweed Picking.
Non-functional requirements are:

- Each sensor must take 500 ms to carry out a sampling;
- The time tat passes between a sampling and the other is 60 s;
- The time that each node must use to send the data to the archive is 200 ms;
- The time of use of each node must be less than 90
- The response time of the Archive after a call by an actor must not exceed 300 ms.

Chapter 3

Model WCS With Execution Graphs

The Use Cases we have considered are:

- UC1 StartUp Sampling Water activated by Sample Supervisor;
- UC3 Check Water Quality activated by Quality Control Supervisor.

In reference to the Use Cases taken into consideration, to better understand our architecture, we have combined the Deployment Diagram with Component Diagram. In the figure below this is represented.

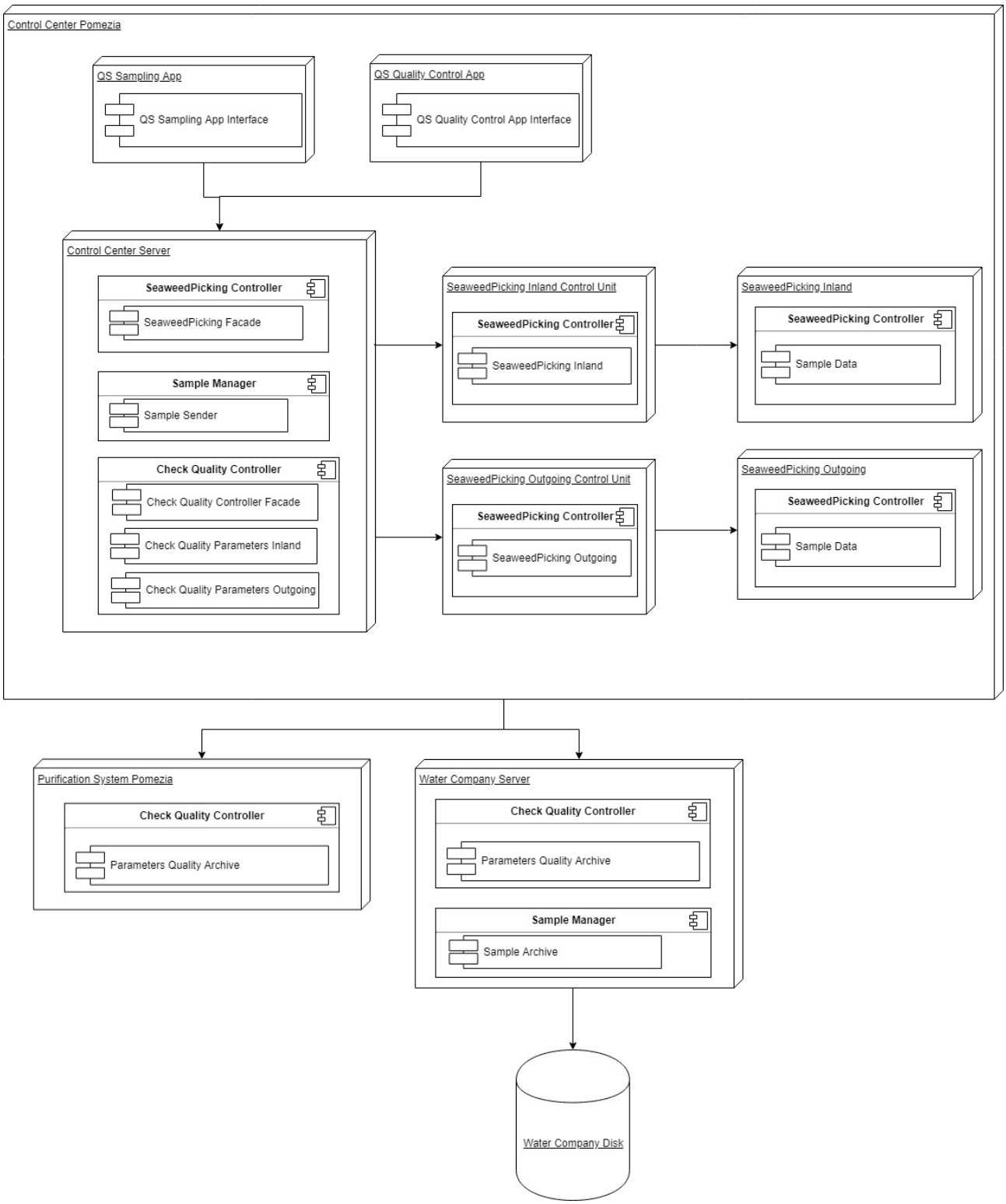

Figure 3.1: Deployment Diagram + Component Diagram

3.1 Demand Vector

Il Demand Vector scelto in base alle risorse virtuali che risaltano dal deployment diagram sono:

Wired Connection Request	
Wireless Connection Request	
Internet Connection Request	
Database Request	
Control Center Server CPU	
Water Company Server CPU	
Purification System Pomezia CPU	
Seaweed Picking Inland Control Unit CPU	
Seaweed Picking Outgoing Control Unit CPU	
Seaweed Picking Outgoings Sample Request	
Seaweed Picking Inlands Sample Request	

Spiegare cosa sono queste risorse virtuali

The Execution Graphs obtained are:

- UC1 Sampling Water activated by Sample Supervisor:

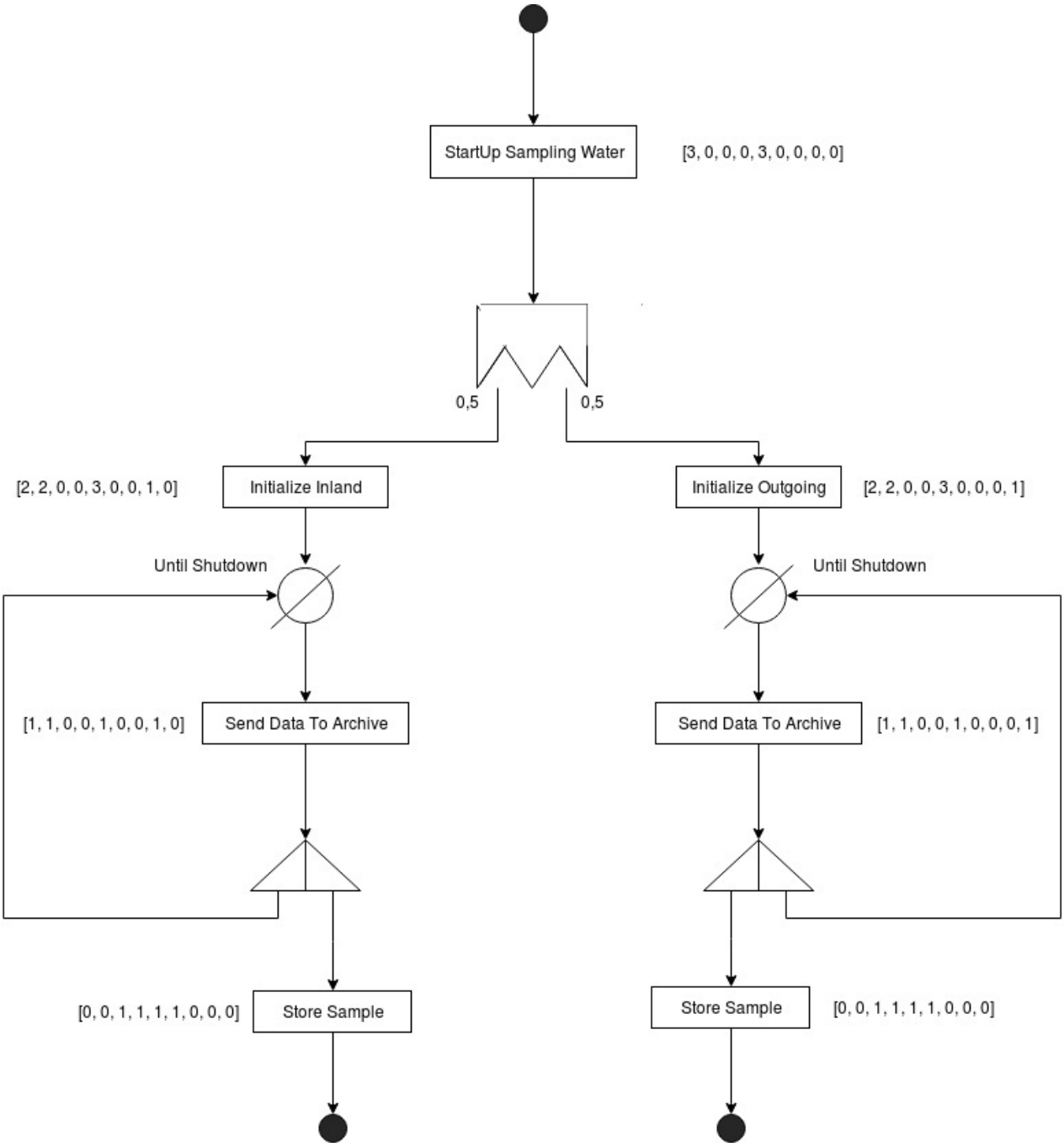

Figure 3.2: EG UC1 StartUp Sampling Water

- UC3 Check Water Quality activated by Quality Control Supervisor:

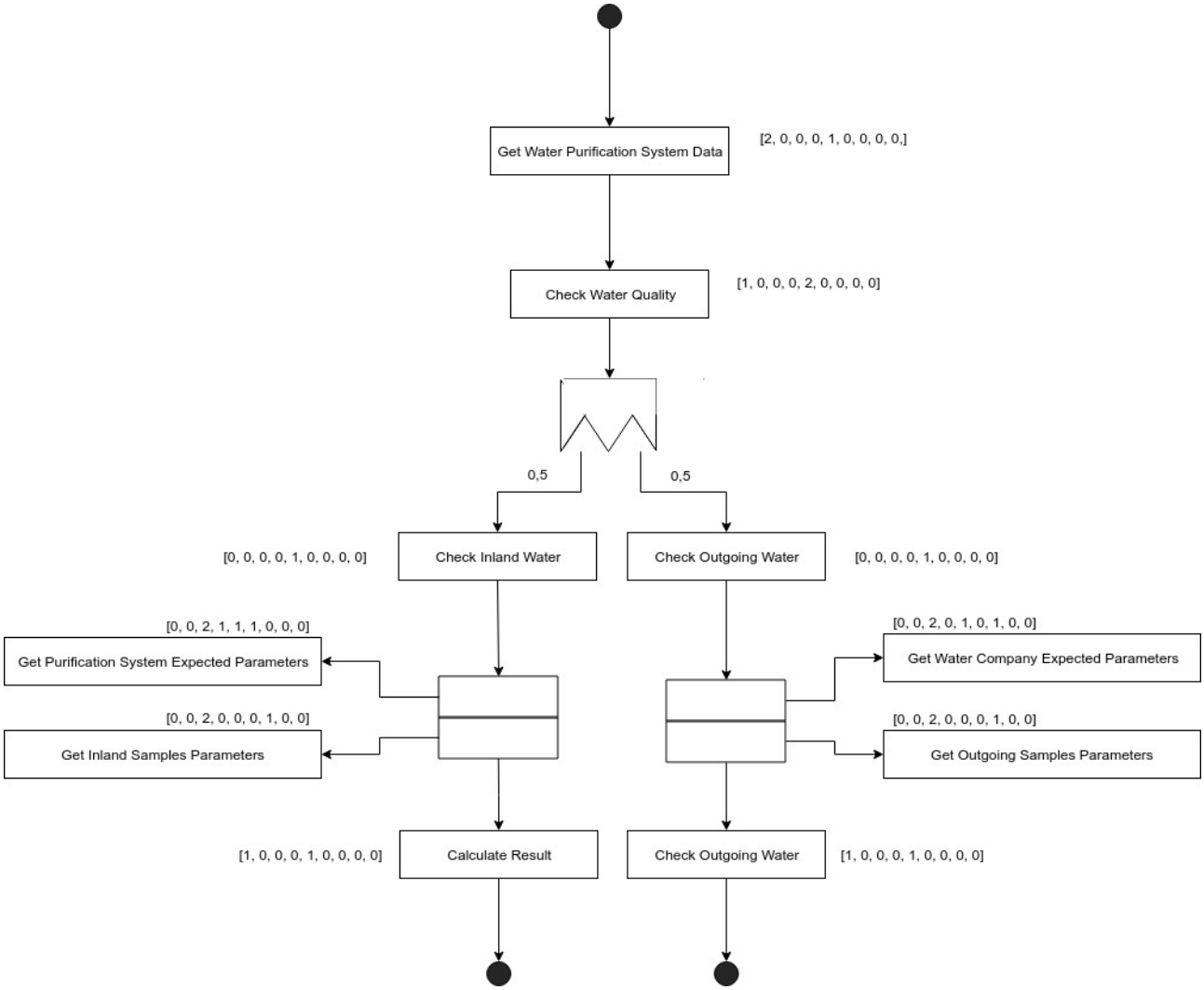

Figure 3.3: EG UC3 Check Water Quality

Chapter 4

Queueing Network Model

Then we have identified the physical nodes of our system going to introduce how the Execution Graphs are connected to them:

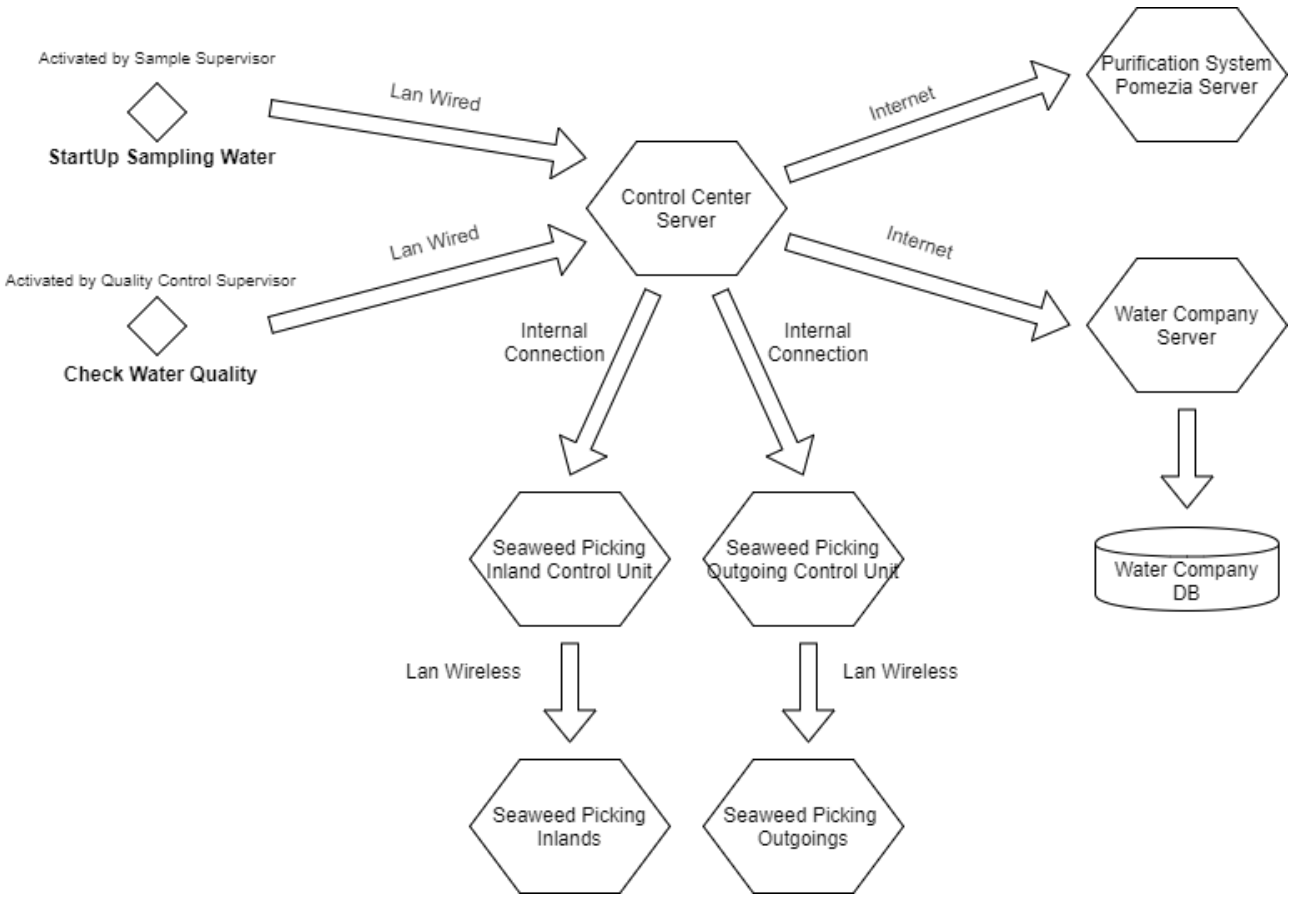

Figure 4.1: Physical Nodes

This is the Queueing Network so obtained:

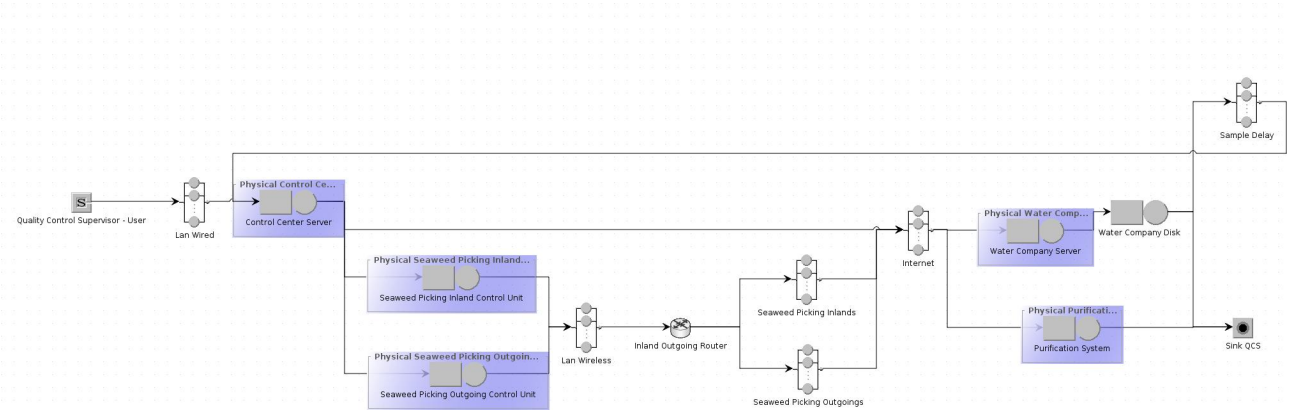

Figure 4.2: Queueing Network

After several tests, we agreed to reduce the sampling time to 500 seconds to refine the performance analysis. On jmt for the same reason we have only one SeaweedPicking Control Unit and no two for In / Out