WORK ORDER SCHEDULING

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Contents

WORK ORDER SCHEDULING

Objective

The objective of the document is to highlight core items involved in implementing the given project.

Technology Stack:

1. JDK 1.8
2. Spring Boot
3. Spring Core
4. RxJava
5. Spring Data JPA
6. MYSQL5.6
7. Amazon AWS EC2 instance
8. Maven build tool
9. STS IDE
10. java.util.concurrent package, Multi-Threading, and Design patterns.
11. Vaadin – To build Front End in Java
12. Google Guava

Design patterns used:

Strategy Design Pattern: Used to choose work order scheduling algorithm at run time.

Routing Algorithm:

PRIM Minimum Spanning Tree Algorithm on undirected graph.

Other algorithms considered and can be implemented so that can be picked at run time using Strategy design pattern.

Such as: Nearest Neighbor algorithm, Kruskal algorithm, Dijkstra Algorithm.

Work flow steps:

1. Add work order. Work order will be added to queue.
2. Work orders can be added in parallel. This has been implanted using RxJava framework. Publish subject receives all work orders and once received produces the same to observers.

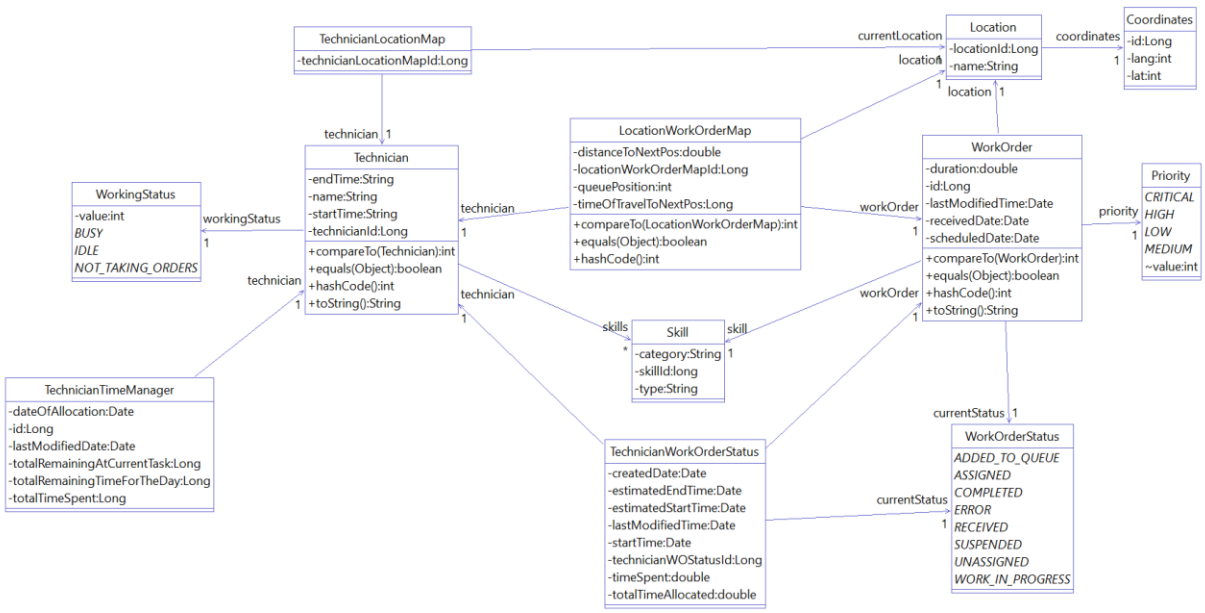
3. Identify Technician available based on skill required to perform the work order.
4. If more than one technician available, then identify the best possible technician using following filters.
    a. Identify whether available technician has enough time to perform the current task and travel to the new work order and perform new work order for the given duration.
    b. 3.a leads to technicians available to perform the new work order.
    c. From list of technicians identified in 3.b filter the technician who is nearby to reach the new work order location and or who is idle currently. IDLE technicians will be preferred if available any. Else from working technicians the one who is nearest to the given work order location will be considered.
    d. From 3.c best possible technician is identified and if the same is busy then work order will be assigned to him to perform in queue.
    e. If the identified technician is idle, then he will perform the task immediately.
5. While identifying technician, who is nearest to perform worm order, PRIM algorithm is used to identify the shortest path that can be travelled.
6. Here strategy pattern is implemented to consider various routing algorithms as needed.

Assumptions:

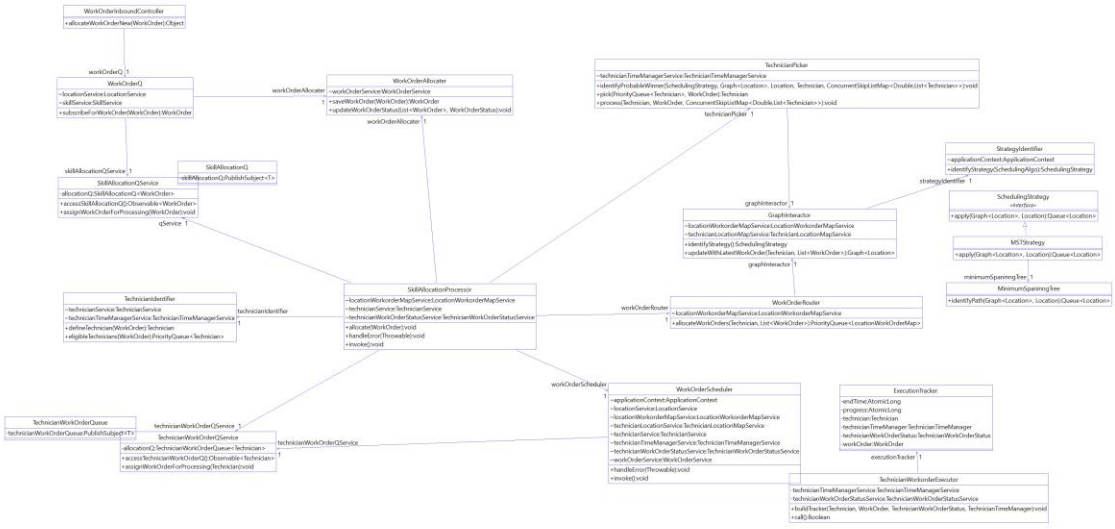
Location of the work order has been assumed as (x,y) co-ordinates. In real time, actual location can be used and longitude and latitude of the location can be considered.

UML Class Diagrams

Entity Class Diagram

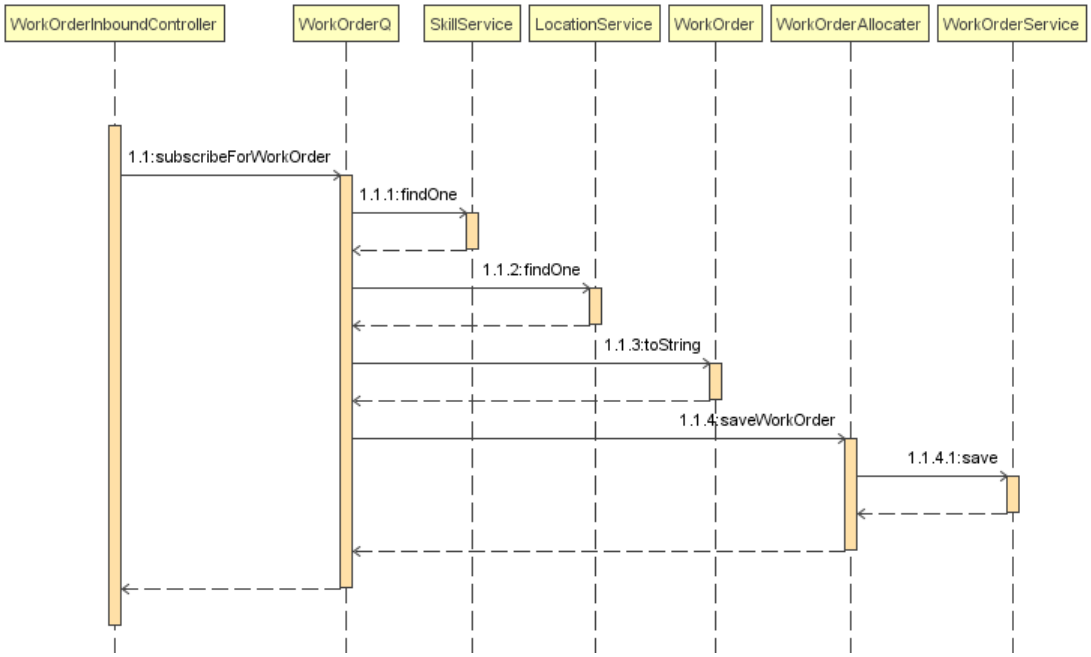


Work Order Allocation Class Diagram

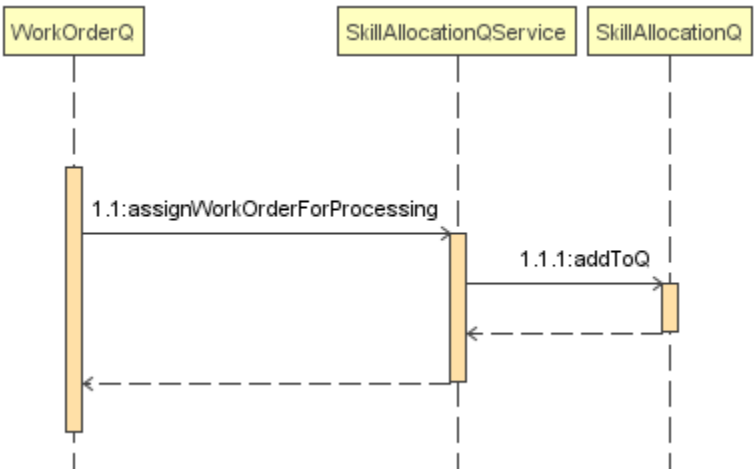


Sequence Diagrams

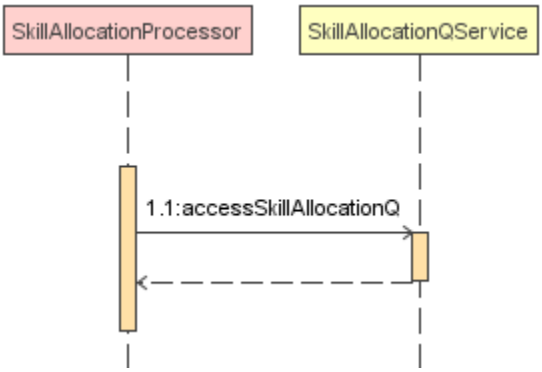
Add New Work Order



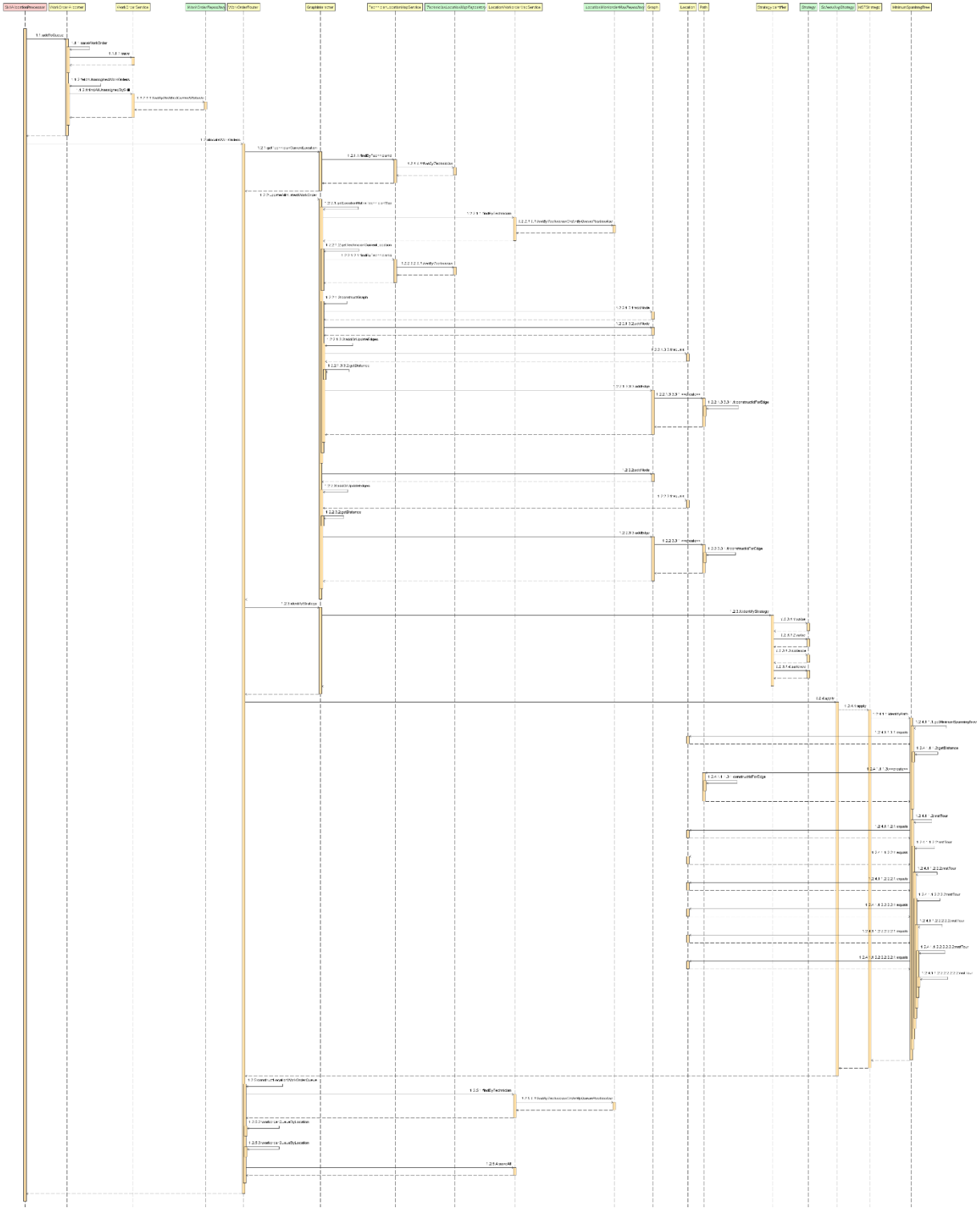
Publishing Queue



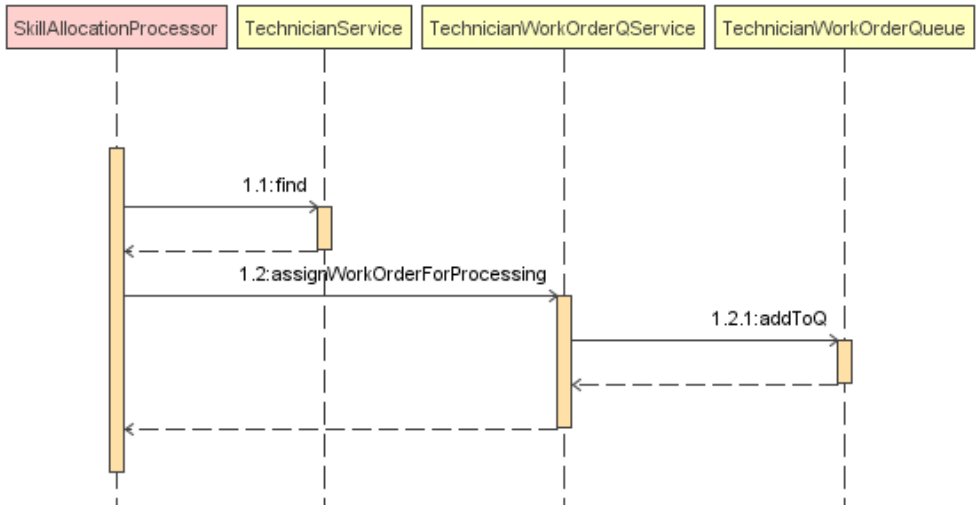
Access Allocation Queue



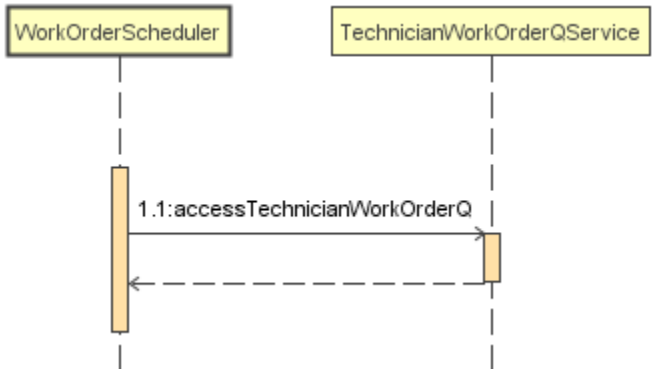
Scheduling Work Order



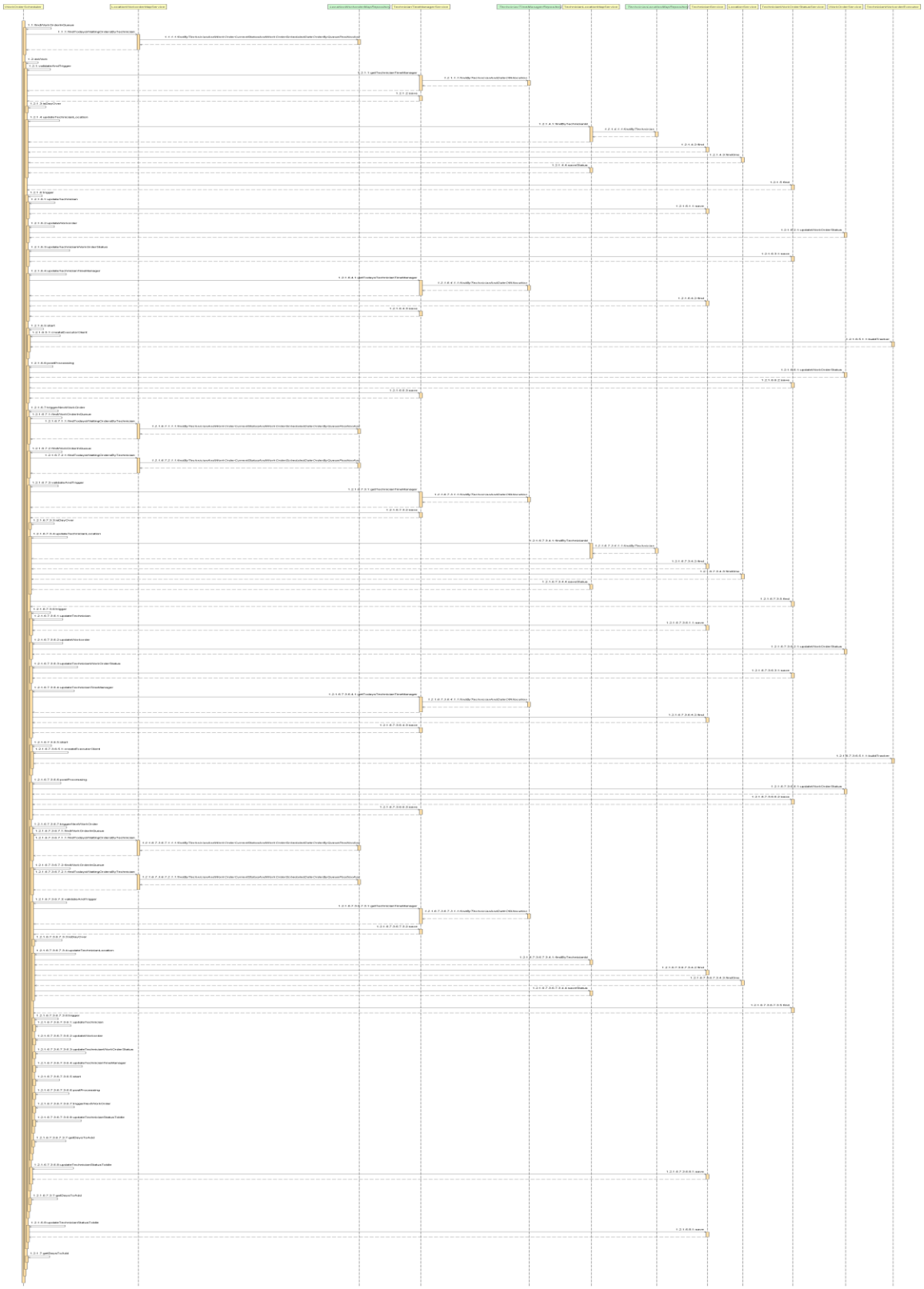
Processing Work Order



Technician Publishing Queue

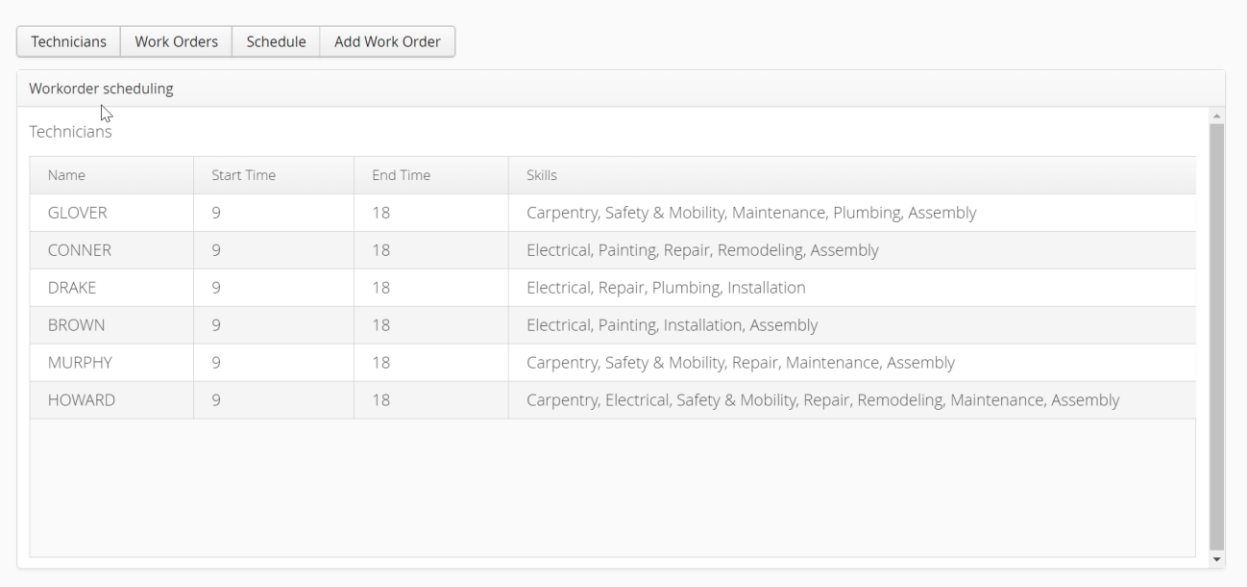


Trigger and Perform work

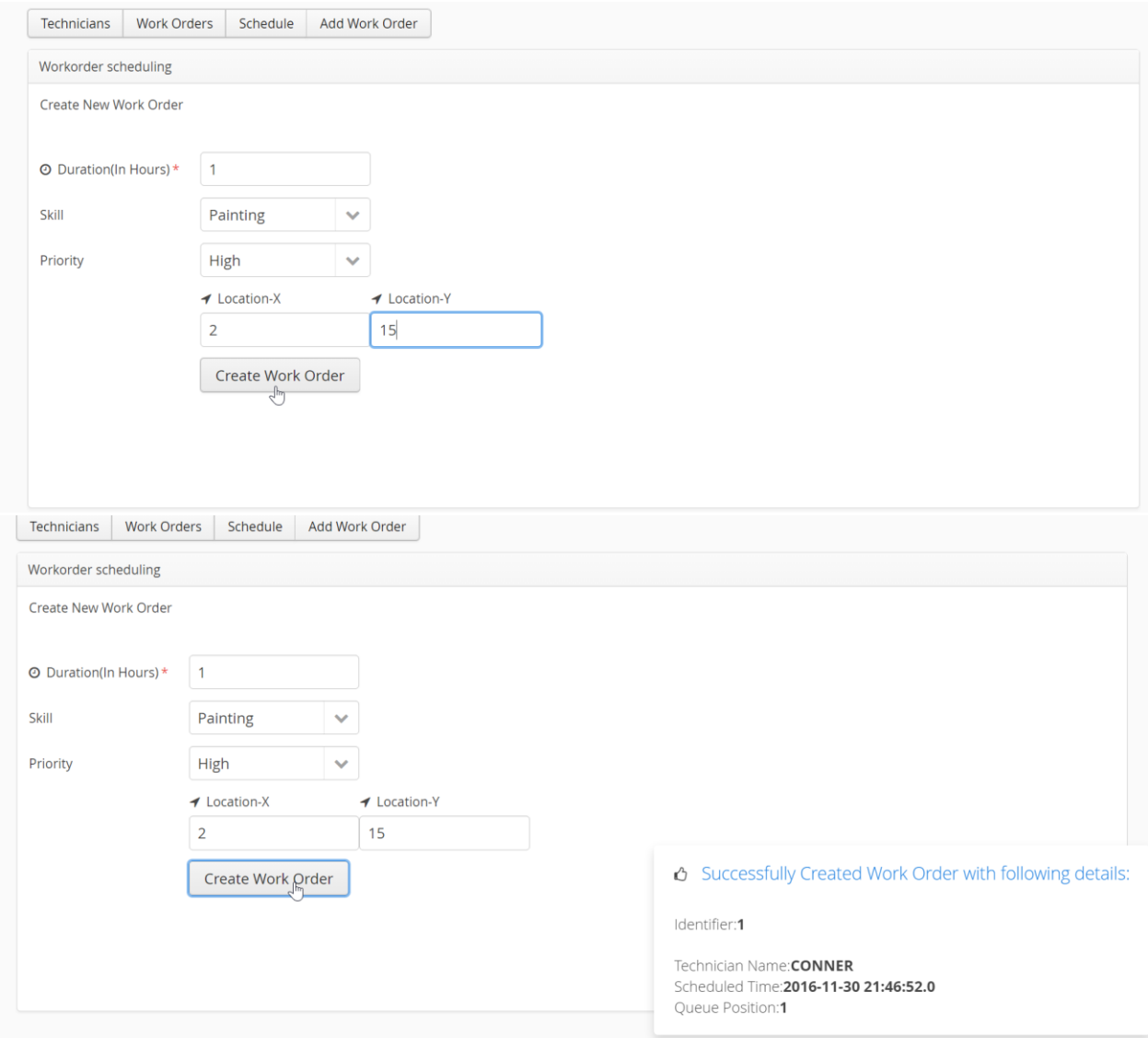


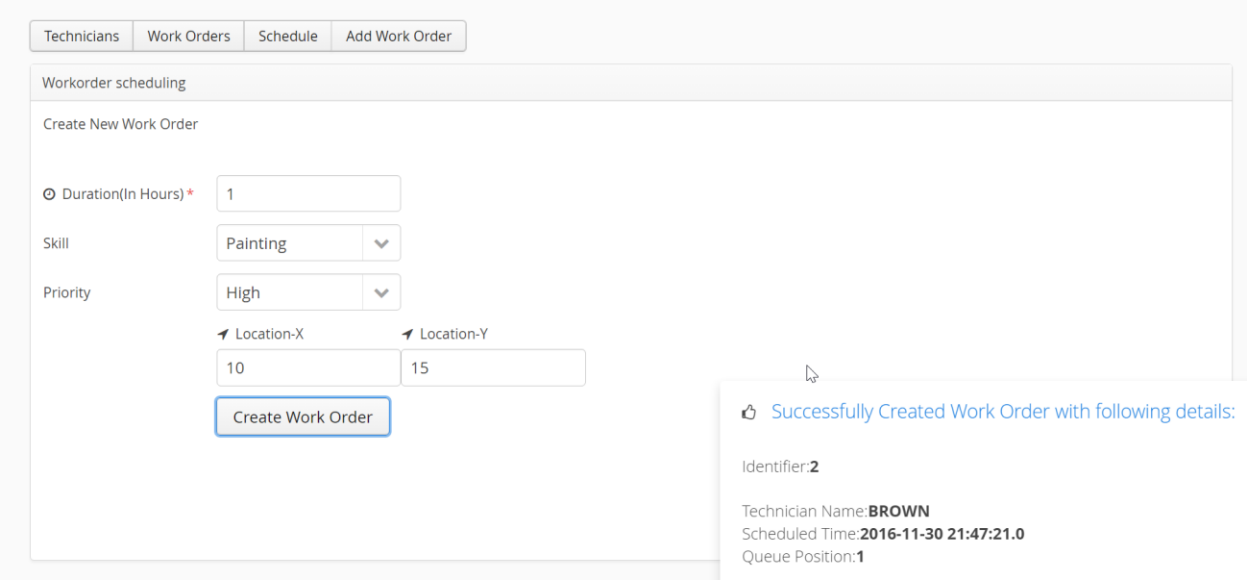
Screenshots:

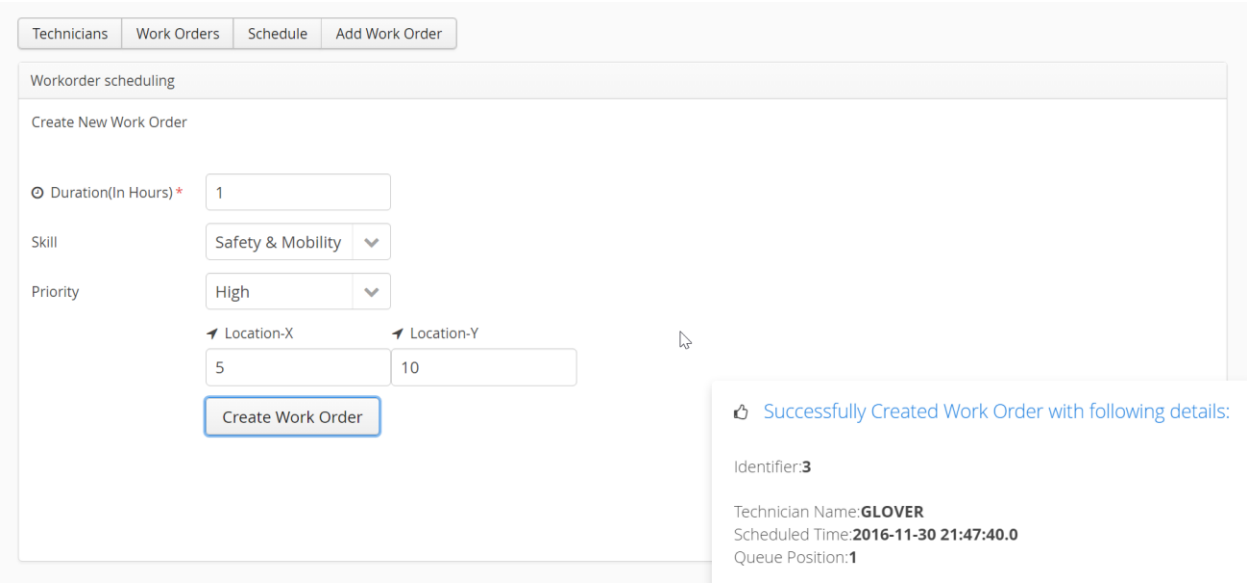
Technicians

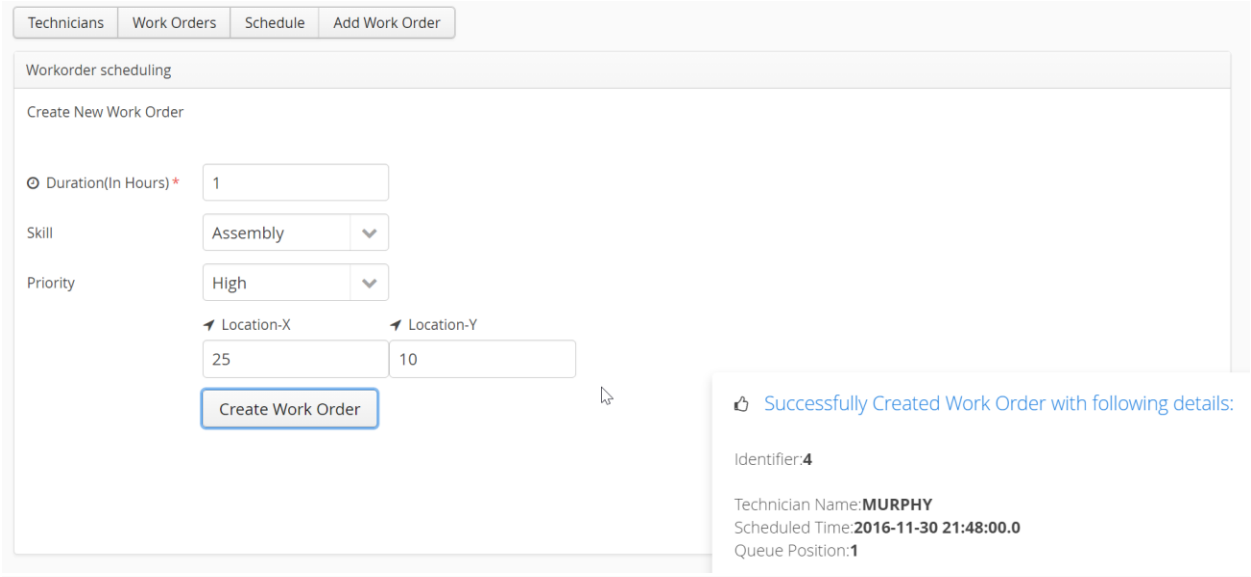


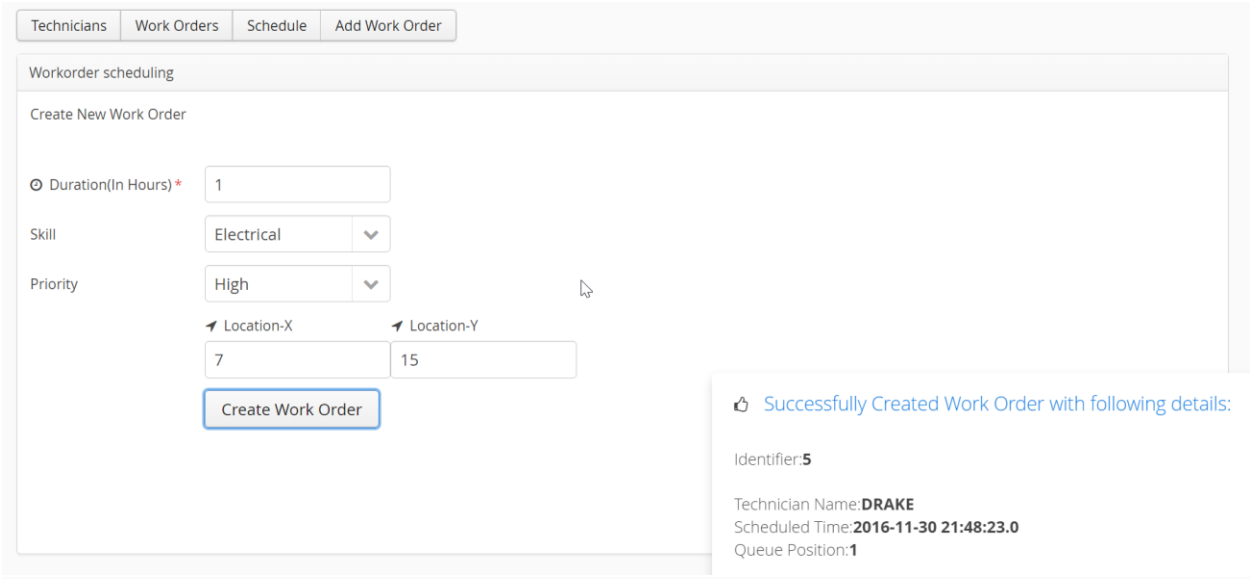
Adding Work Orders

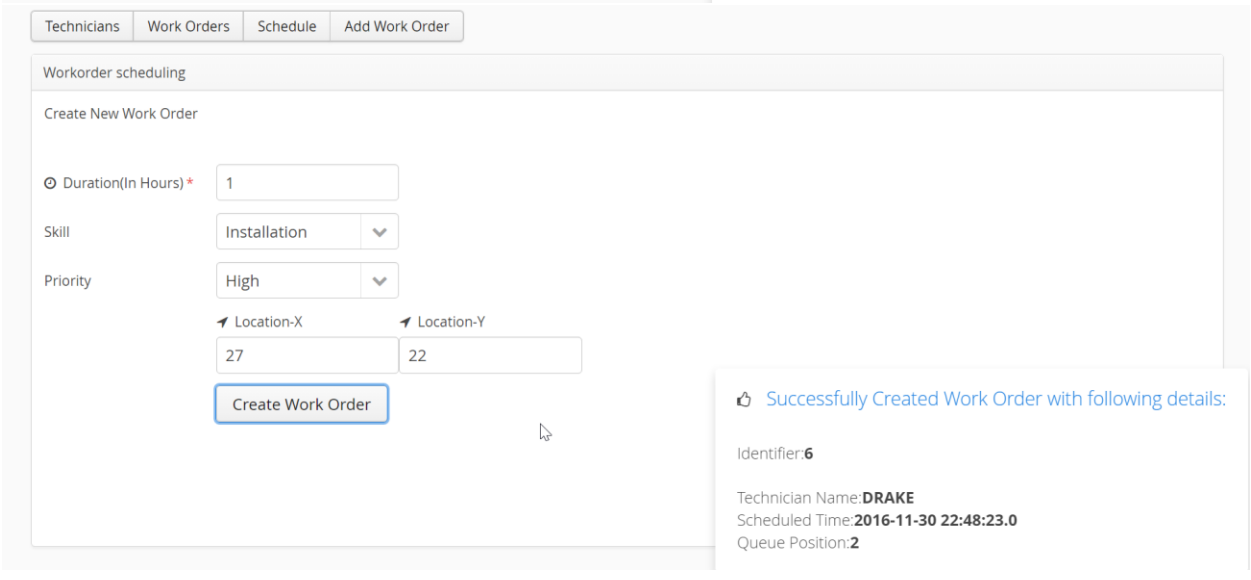


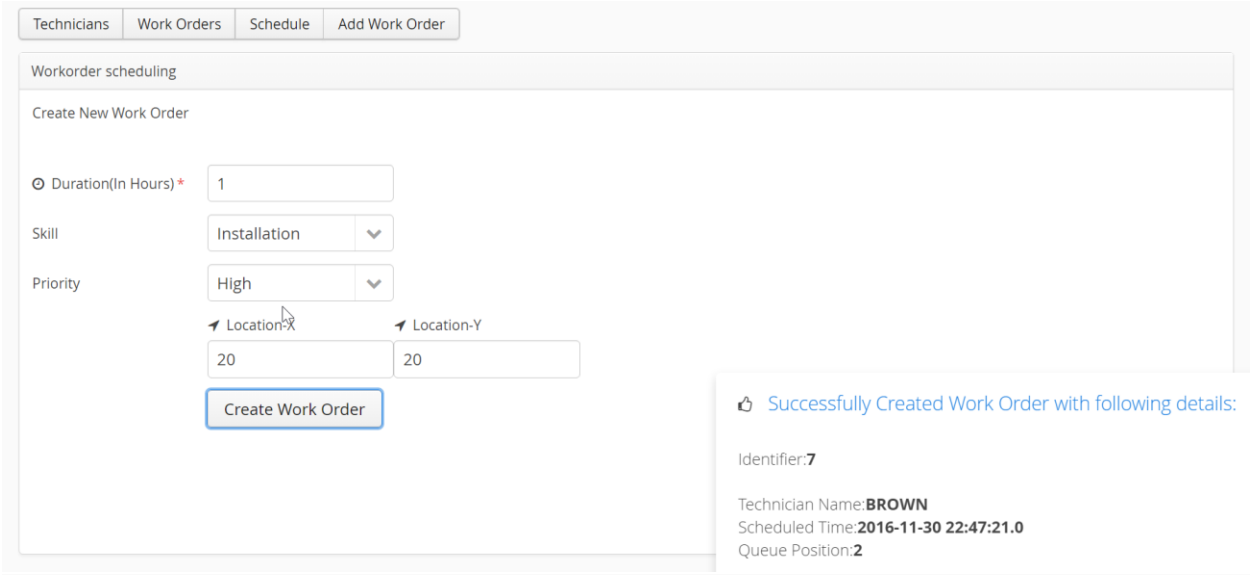

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Painting
Priority
High
Location-X
Location-Y
10
15
Create Work Order
Successfully Created Work Order with following details:
Identifier:2
Technician Name:BROWN
Scheduled Time:2016-11-30 21:47:21.0
Queue Position:1

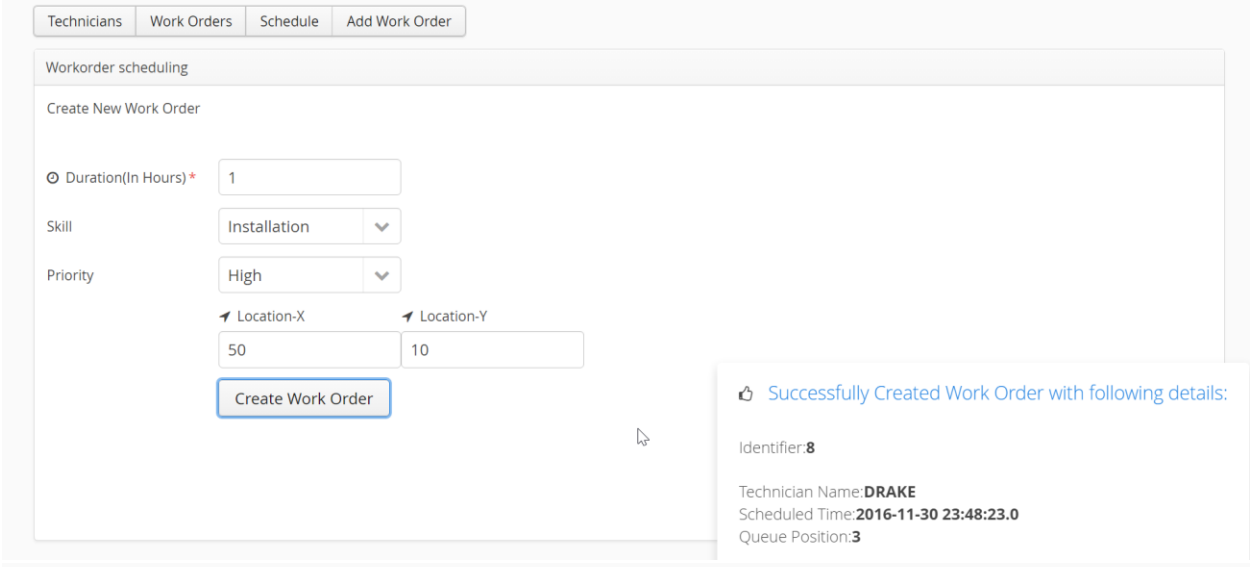

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Safety & Mobility
Priority
High
Location-X
Location-Y
5
10
Create Work Order
Successfully Created Work Order with following details:
Identifier:3
Technician Name:GLOVER
Scheduled Time:2016-11-30 21:47:40.0
Queue Position:1

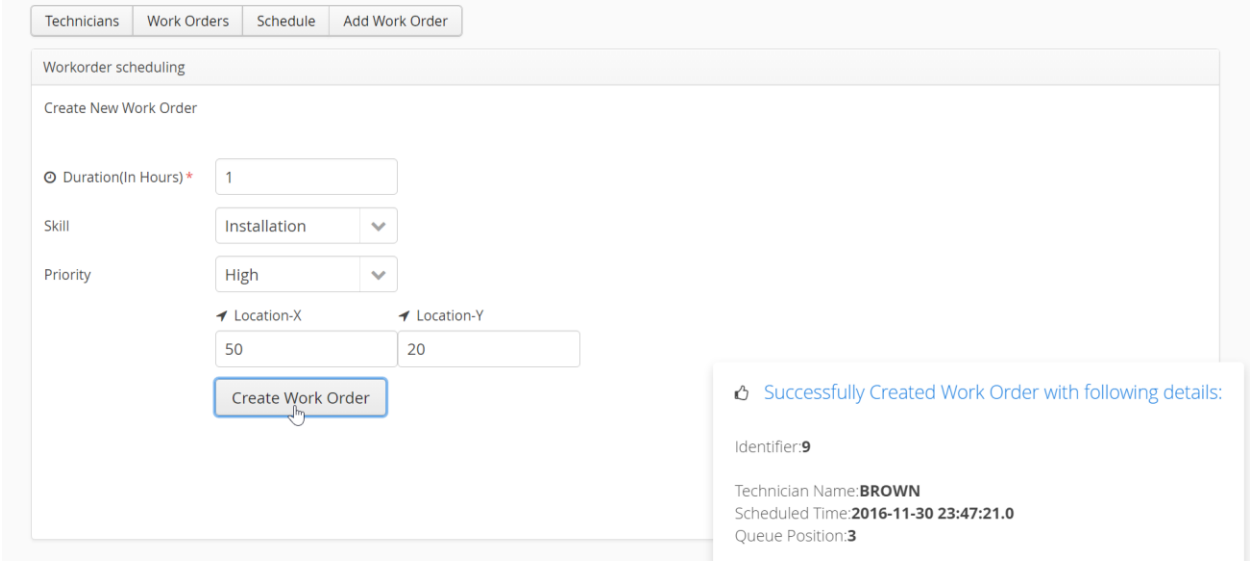

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Assembly
Priority
High
Location-X
Location-Y
25
10
Create Work Order
Successfully Created Work Order with following details:
Identifier:4
Technician Name:MURPHY
Scheduled Time:2016-11-30 21:48:00.0
Queue Position:1

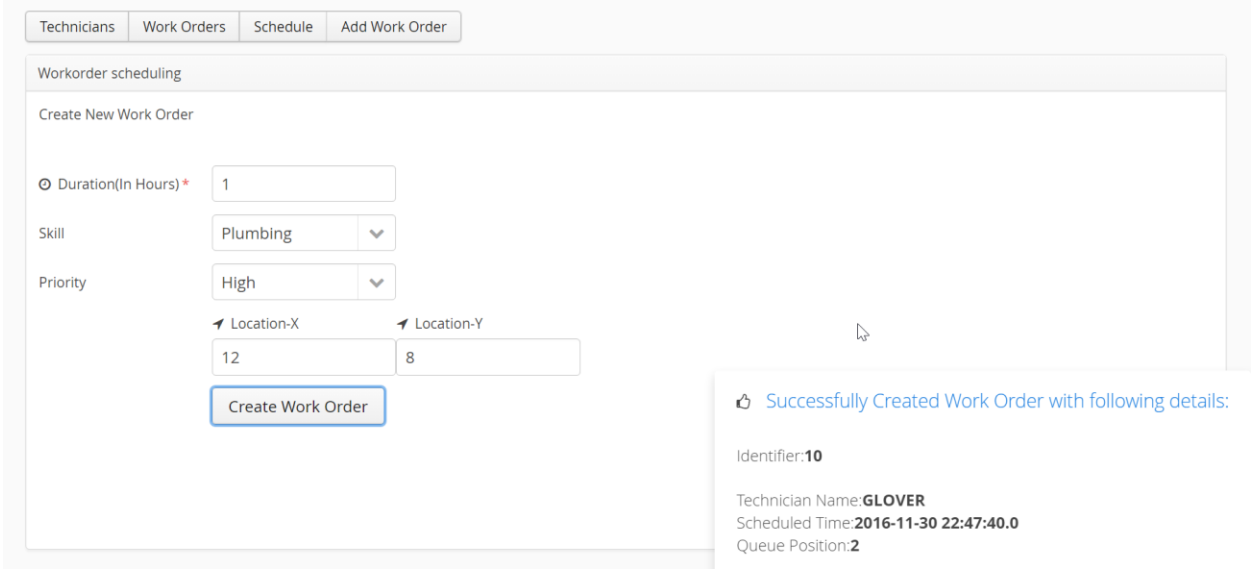

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Electrical
Priority
High
Location-X
Location-Y
7
15
Create Work Order
Successfully Created Work Order with following details:
Identifier:5
Technician Name:DRAKE
Scheduled Time:2016-11-30 21:48:23.0
Queue Position:1

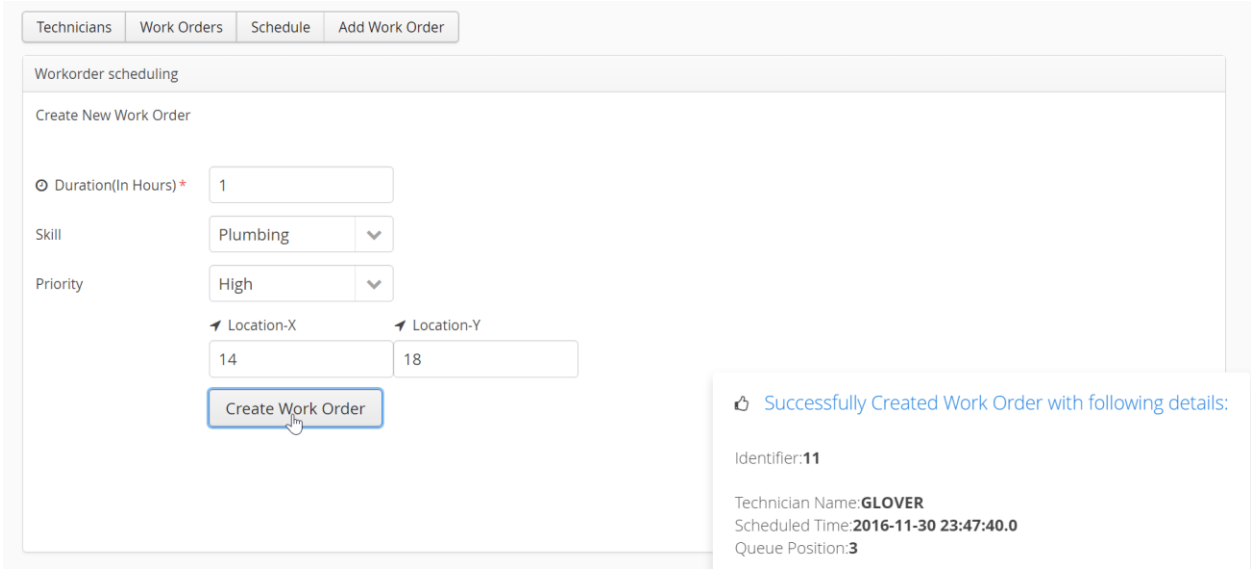

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Installation
Priority
High
Location-X
Location-Y
27
22
Create Work Order
Successfully Created Work Order with following details:
Identifier:6
Technician Name:DRAKE
Scheduled Time:2016-11-30 22:48:23.0
Queue Position:2

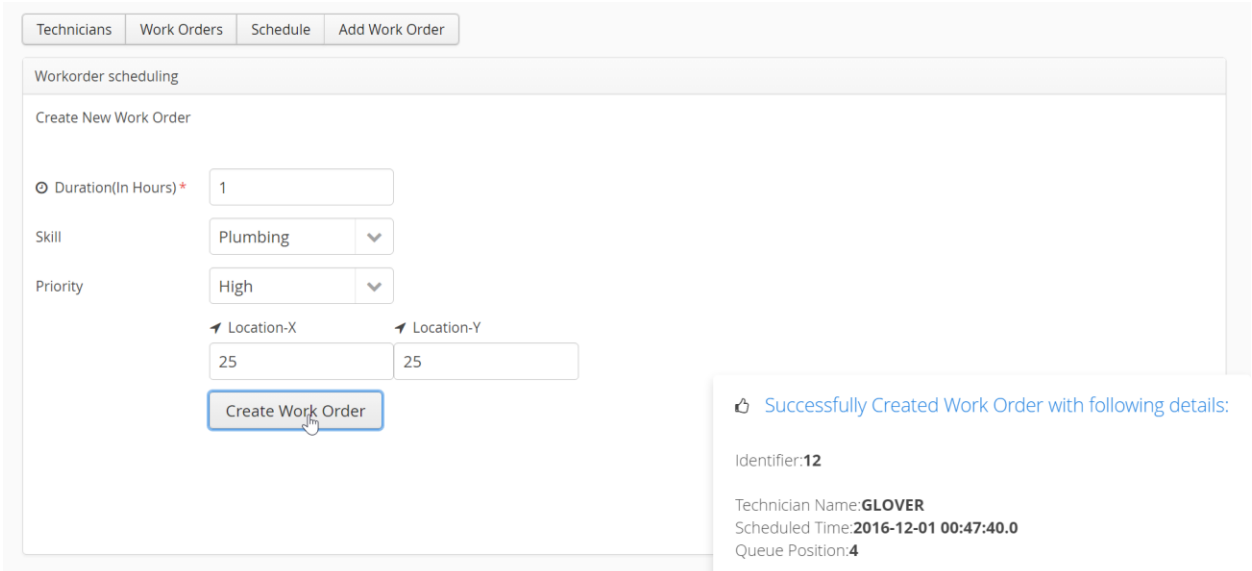

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Installation
Priority
High
Location-X
Location-Y
20
20
Create Work Order
Successfully Created Work Order with following details:
Identifier:7
Technician Name:BROWN
Scheduled Time:2016-11-30 22:47:21.0
Queue Position:2


Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Installation
Priority
High
Location-X
Location-Y
50
10
Create Work Order
Successfully Created Work Order with following details:
Identifier:8
Technician Name:DRAKE
Scheduled Time:2016-11-30 23:48:23.0
Queue Position:3

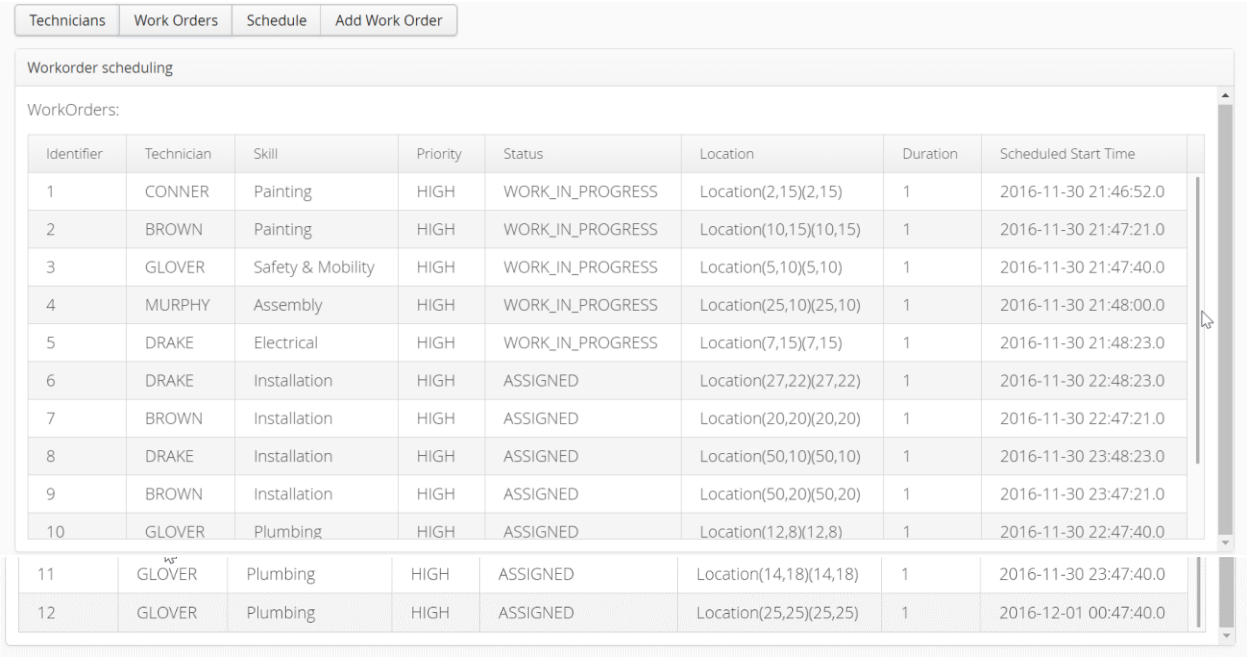

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Installation
Priority
High
Location-X
Location-Y
50
20
Create Work Order
Successfully Created Work Order with following details:
Identifier:9
Technician Name:BROWN
Scheduled Time:2016-11-30 23:47:21.0
Queue Position:3


Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Plumbing
Priority
High
Location-X
Location-Y
12
8
Create Work Order
Successfully Created Work Order with following details:
Identifier:10
Technician Name:GLOVER
Scheduled Time:2016-11-30 22:47:40.0
Queue Position:2


Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Plumbing
Priority
High
Location-X
Location-Y
14
18
Create Work Order
Successfully Created Work Order with following details:
Identifier:11
Technician Name:GLOVER
Scheduled Time:2016-11-30 23:47:40.0
Queue Position:3

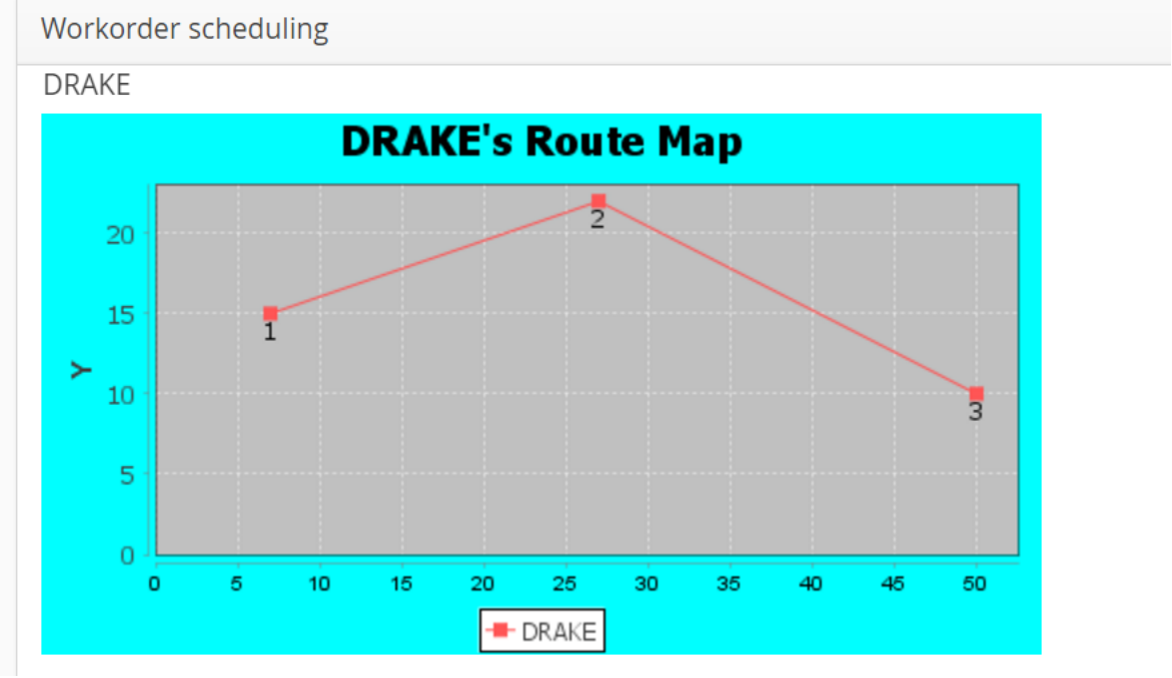

Technicians
Work Orders
Schedule
Add Work Order
Workorder scheduling
Create New Work Order
Duration(In Hours) *
1
Skill
Plumbing
Priority
High
Location-X
Location-Y
25
25
Create Work Order
Successfully Created Work Order with following details:
Identifier:12
Technician Name:GLOVER
Scheduled Time:2016-12-01 00:47:40.0
Queue Position:4

Work orders allocation



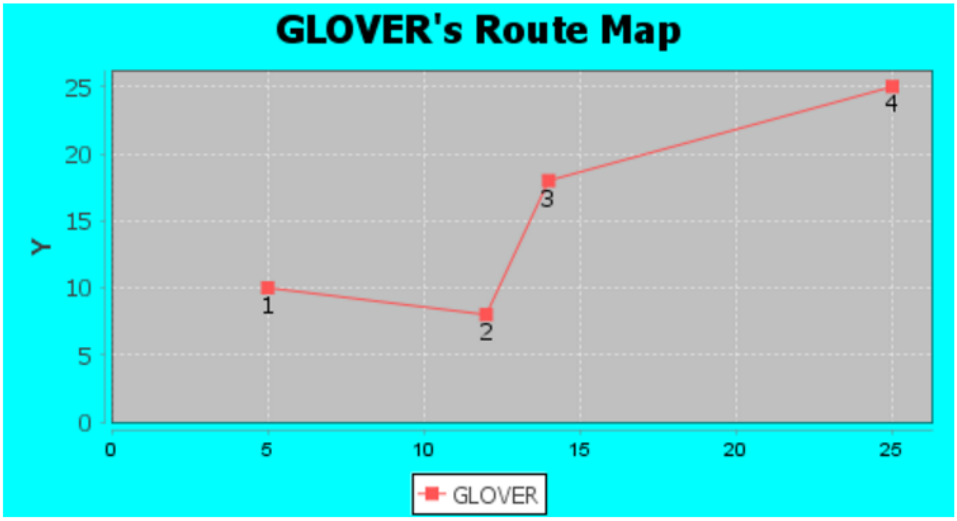
Identifier	Technician	Skill	Priority	Status	Location	Duration	Scheduled Start Time
1	CONNER	Painting	HIGH	WORK_IN_PROGRESS	Location(2,15)(2,15)	1	2016-11-30 21:46:52.0
2	BROWN	Painting	HIGH	WORK_IN_PROGRESS	Location(10,15)(10,15)	1	2016-11-30 21:47:21.0
3	GLOVER	Safety & Mobility	HIGH	WORK_IN_PROGRESS	Location(5,10)(5,10)	1	2016-11-30 21:47:40.0
4	MURPHY	Assembly	HIGH	WORK_IN_PROGRESS	Location(25,10)(25,10)	1	2016-11-30 21:48:00.0
5	DRAKE	Electrical	HIGH	WORK_IN_PROGRESS	Location(7,15)(7,15)	1	2016-11-30 21:48:23.0
6	DRAKE	Installation	HIGH	ASSIGNED	Location(27,22)(27,22)	1	2016-11-30 22:48:23.0
7	BROWN	Installation	HIGH	ASSIGNED	Location(20,20)(20,20)	1	2016-11-30 22:47:21.0
8	DRAKE	Installation	HIGH	ASSIGNED	Location(50,10)(50,10)	1	2016-11-30 23:48:23.0
9	BROWN	Installation	HIGH	ASSIGNED	Location(50,20)(50,20)	1	2016-11-30 23:47:21.0
10	GLOVER	Plumbing	HIGH	ASSIGNED	Location(12,8)(12,8)	1	2016-11-30 22:47:40.0
11	GLOVER	Plumbing	HIGH	ASSIGNED	Location(14,18)(14,18)	1	2016-11-30 23:47:40.0
12	GLOVER	Plumbing	HIGH	ASSIGNED	Location(25,25)(25,25)	1	2016-12-01 00:47:40.0

Technician’s Route Map



Workorder scheduling

GLOVER



BROWN