

WORK ORDER SCHEDULING

Chandrashekar V

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Contents

WORK ORDER SCHEDULING.....	2
Objective	2
Technology Stack:	2
Design patterns used:	2
Routing Algorithm:.....	2
Work flow steps:	2
Assumptions:.....	3
UML Class Diagrams.....	3
Entity Class Diagram.....	3
Work Order Allocation Class Diagram.....	4
Sequence Diagrams.....	4
Add New Work Order.....	4
Publishing Queue	5
Access Allocation Queue	5
Scheduling Work Order	6
Processing Work Order	7
Technician Publishing Queue	7
Trigger and Perform work.....	8
Screenshots:.....	9
Technicians.....	9
Adding Work Orders	10
Work orders allocation	15
Technician's Route Map.....	15

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.

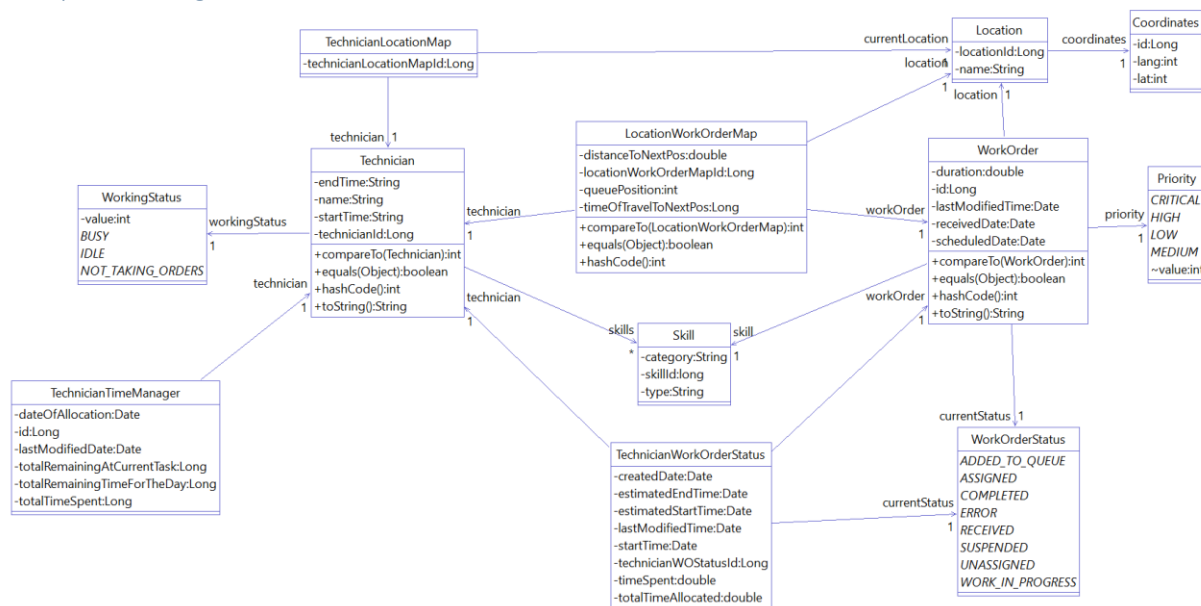
3. Identify Technician available based on skill required to perform the work order.
4. If more than one technician available, then identify the best possible technician using following filters.
 - a. Identify whether available technician has enough time to perform the current task and travel to the new 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:

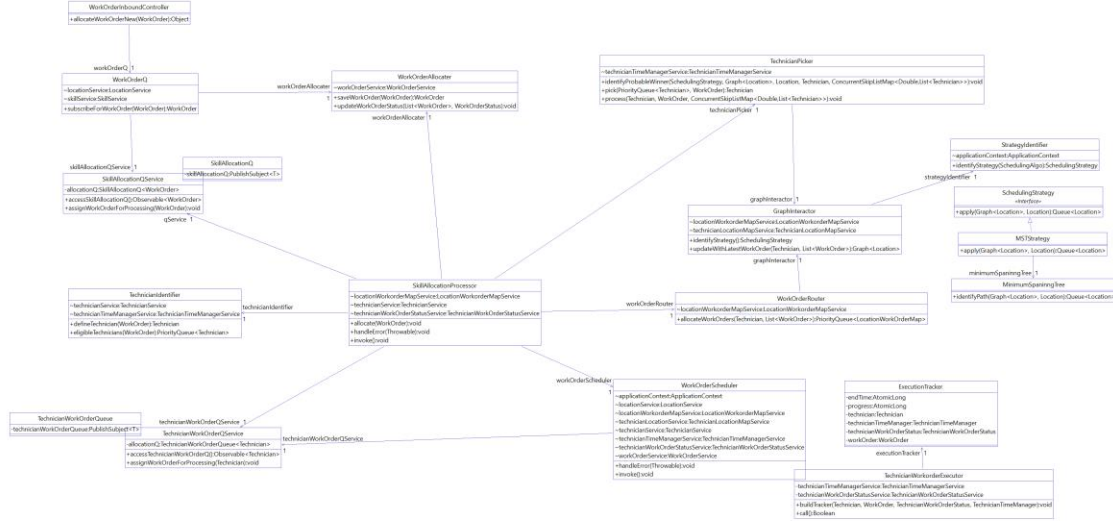
Location of the work order has been assumed as (x,y) co-ordinates. In real time, actual location can be used and longitude and latitude of the location can be considered.

UML Class Diagrams

Entity Class Diagram

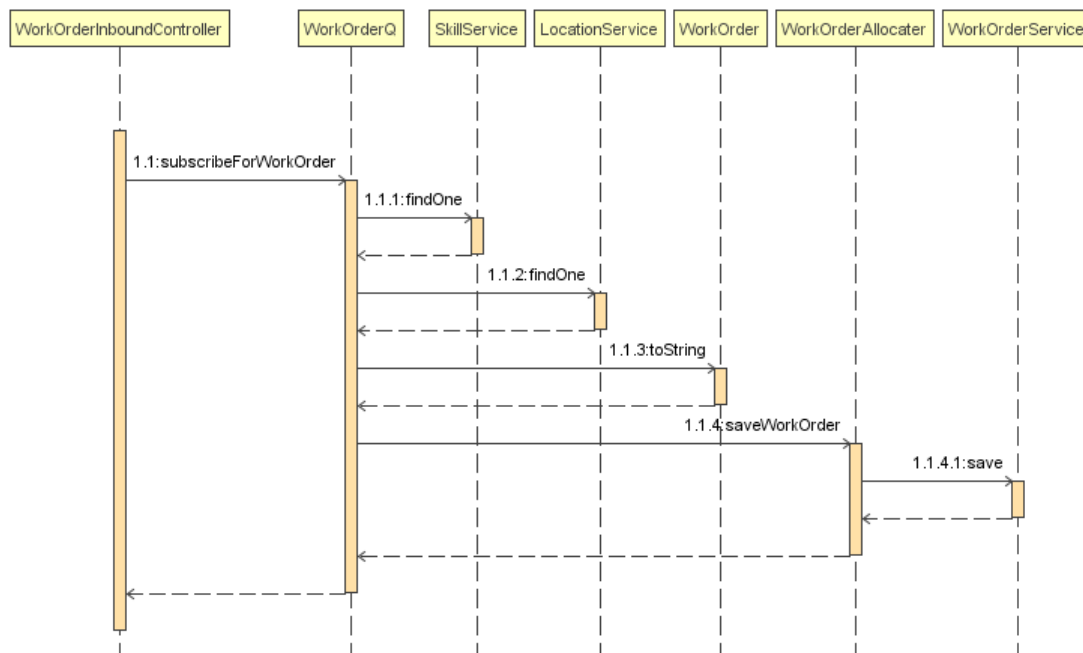


Work Order Allocation Class Diagram

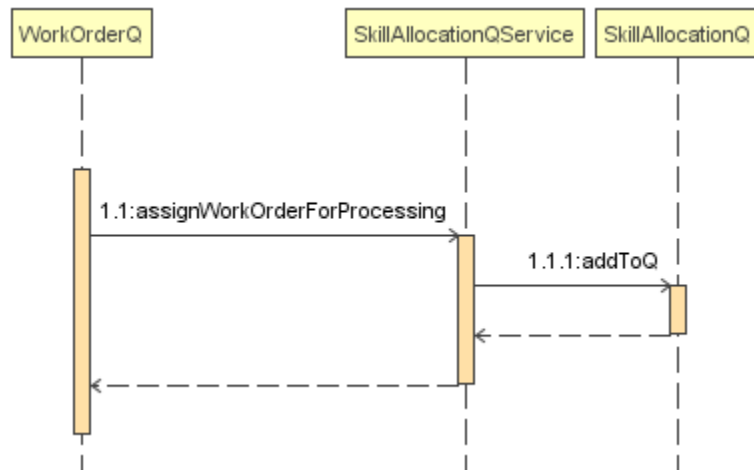


Sequence Diagrams

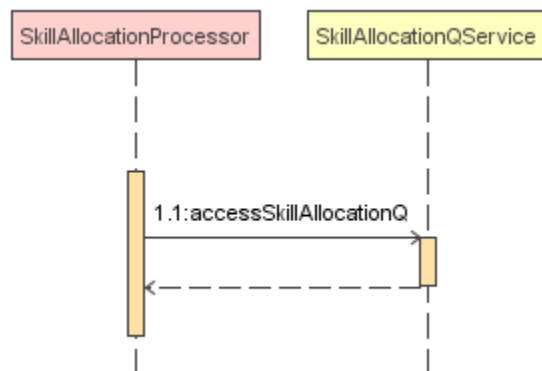
Add New Work Order



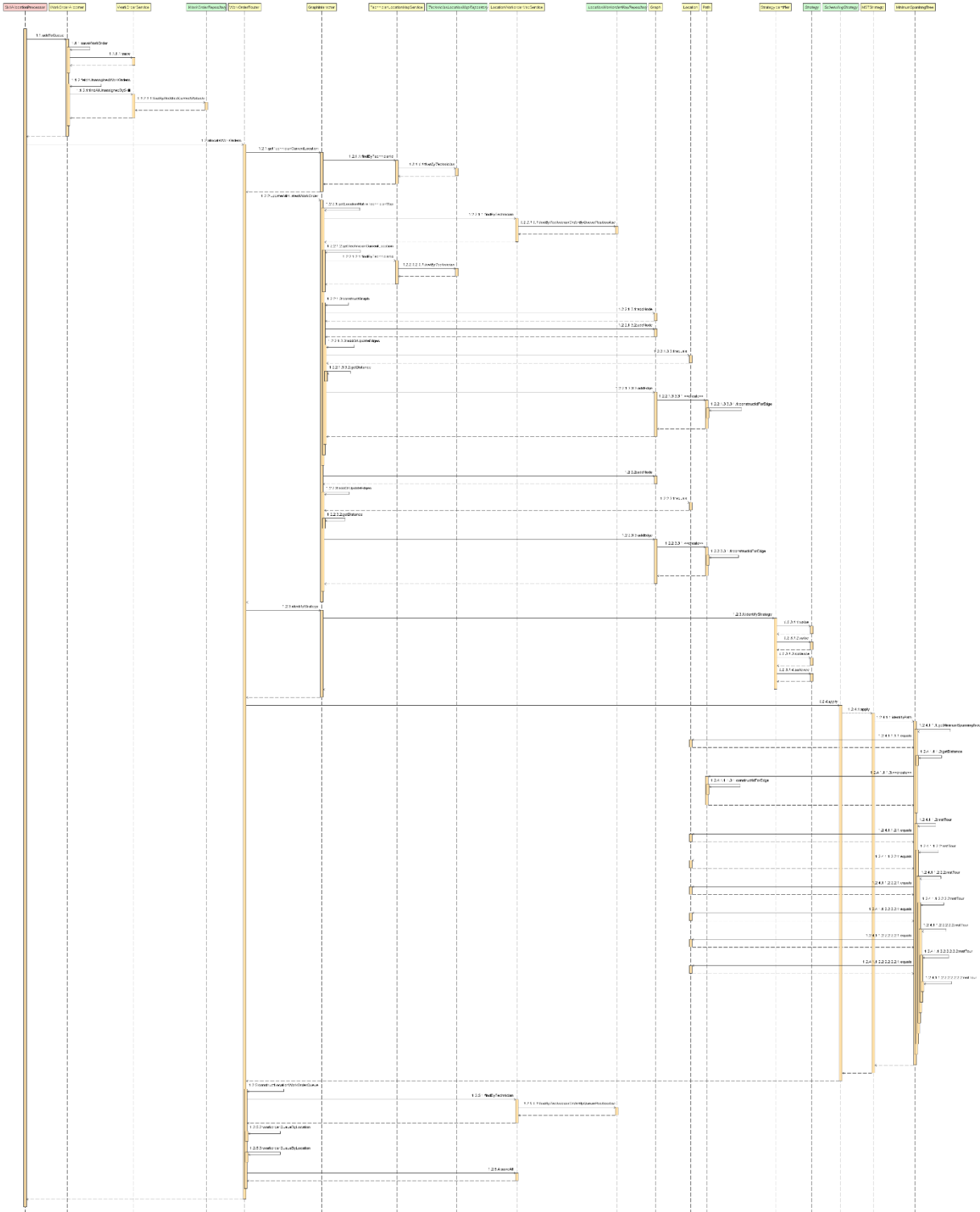
Publishing Queue



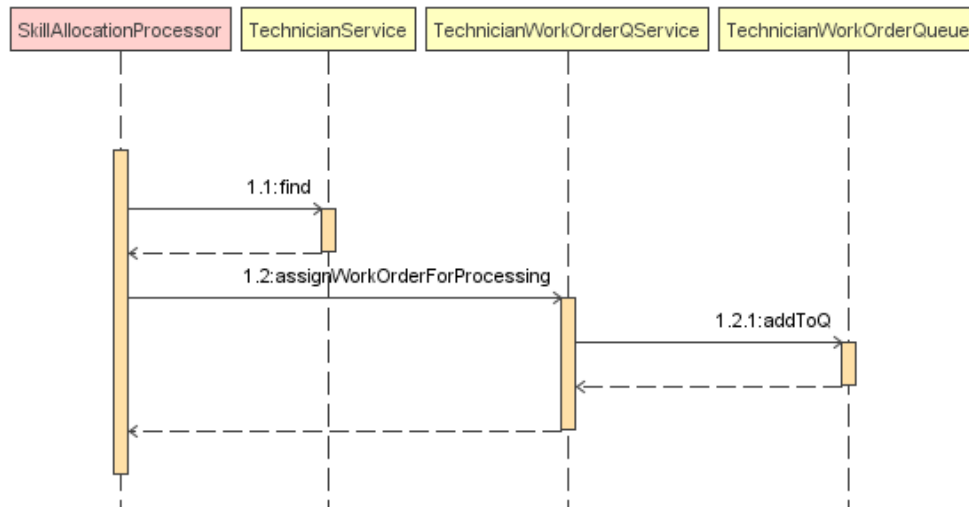
Access Allocation Queue



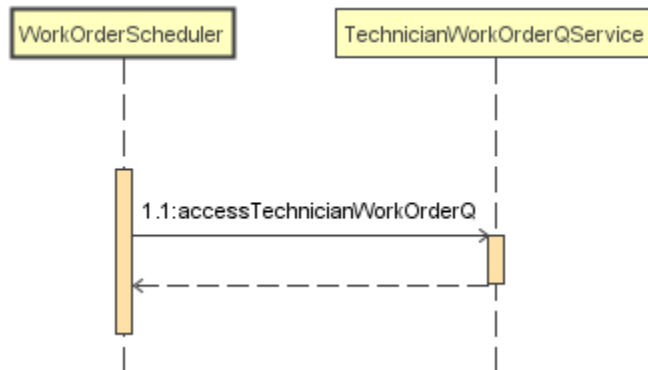
Scheduling Work Order



Processing Work Order



Technician Publishing Queue



The Gantt chart displays the project schedule for the 'Development of a New Product' from January 2023 to December 2023. The chart is organized into columns for each month. The left side lists tasks, and the right side shows their durations. Tasks are color-coded: yellow for planning, blue for development, green for testing, and red for deployment. The chart shows a sequential flow of tasks, with some parallel activities and dependencies indicated by arrows. The project starts in January 2023 and ends in December 2023.

Task Name	Start Date	End Date	Duration (Days)	Category
Project Initiation	2023-01-01	2023-01-05	5	Planning
Requirement Gathering	2023-01-06	2023-01-15	10	Planning
Product Design	2023-01-16	2023-01-25	10	Development
Development of Core Features	2023-01-26	2023-02-10	15	Development
Integration Testing	2023-02-11	2023-02-20	10	Testing
User Acceptance Testing	2023-02-21	2023-03-05	15	Testing
Deployment Preparation	2023-03-06	2023-03-15	10	Deployment
Product Launch	2023-03-16	2023-03-20	5	Deployment
Post-Launch Monitoring	2023-03-21	2023-04-05	15	Deployment
Feedback Collection	2023-04-06	2023-04-15	10	Deployment
Product Iteration	2023-04-16	2023-04-25	10	Development
Development of New Features	2023-04-26	2023-05-10	15	Development
Integration Testing	2023-05-11	2023-05-20	10	Testing
User Acceptance Testing	2023-05-21	2023-06-05	15	Testing
Deployment Preparation	2023-06-06	2023-06-15	10	Deployment
Product Launch	2023-06-16	2023-06-20	5	Deployment
Post-Launch Monitoring	2023-06-21	2023-07-05	15	Deployment
Feedback Collection	2023-07-06	2023-07-15	10	Deployment
Product Iteration	2023-07-16	2023-07-25	10	Development
Development of New Features	2023-07-26	2023-08-10	15	Development
Integration Testing	2023-08-11	2023-08-20	10	Testing
User Acceptance Testing	2023-08-21	2023-09-05	15	Testing
Deployment Preparation	2023-09-06	2023-09-15	10	Deployment
Product Launch	2023-09-16	2023-09-20	5	Deployment
Post-Launch Monitoring	2023-09-21	2023-10-05	15	Deployment
Feedback Collection	2023-10-06	2023-10-15	10	Deployment
Product Iteration	2023-10-16	2023-10-25	10	Development
Development of New Features	2023-10-26	2023-11-10	15	Development
Integration Testing	2023-11-11	2023-11-20	10	Testing
User Acceptance Testing	2023-11-21	2023-12-05	15	Testing
Deployment Preparation	2023-12-06	2023-12-15	10	Deployment
Product Launch	2023-12-16	2023-12-20	5	Deployment
Post-Launch Monitoring	2023-12-21	2024-01-05	15	Deployment
Feedback Collection	2024-01-06	2024-01-15	10	Deployment
Product Iteration	2024-01-16	2024-01-25	10	Development
Development of New Features	2024-01-26	2024-02-10	15	Development
Integration Testing	2024-02-11	2024-02-20	10	Testing
User Acceptance Testing	2024-02-21	2024-03-05	15	Testing
Deployment Preparation	2024-03-06	2024-03-15	10	Deployment
Product Launch	2024-03-16	2024-03-20	5	Deployment
Post-Launch Monitoring	2024-03-21	2024-04-05	15	Deployment
Feedback Collection	2024-04-06	2024-04-15	10	Deployment
Product Iteration	2024-04-16	2024-04-25	10	Development
Development of New Features	2024-04-26	2024-05-10	15	Development
Integration Testing	2024-05-11	2024-05-20	10	Testing
User Acceptance Testing	2024-05-21	2024-06-05	15	Testing
Deployment Preparation	2024-06-06	2024-06-15	10	Deployment
Product Launch	2024-06-16	2024-06-20	5	Deployment
Post-Launch Monitoring	2024-06-21	2024-07-05	15	Deployment
Feedback Collection	2024-07-06	2024-07-15	10	Deployment
Product Iteration	2024-07-16	2024-07-25	10	Development
Development of New Features	2024-07-26	2024-08-10	15	Development
Integration Testing	2024-08-11	2024-08-20	10	Testing
User Acceptance Testing	2024-08-21	2024-09-05	15	Testing
Deployment Preparation	2024-09-06	2024-09-15	10	Deployment
Product Launch	2024-09-16	2024-09-20	5	Deployment
Post-Launch Monitoring	2024-09-21	2024-10-05	15	Deployment
Feedback Collection	2024-10-06	2024-10-15	10	Deployment
Product Iteration	2024-10-16	2024-10-25	10	Development
Development of New Features	2024-10-26	2024-11-10	15	Development
Integration Testing	2024-11-11	202		

Screenshots:

Technicians

Technicians	Work Orders	Schedule	Add Work Order
Workorder scheduling			
Technicians			
Name	Start Time	End Time	Skills
GLOVER	9	18	Carpentry, Safety & Mobility, Maintenance, Plumbing, Assembly
CONNER	9	18	Electrical, Painting, Repair, Remodeling, Assembly
DRAKE	9	18	Electrical, Repair, Plumbing, Installation
BROWN	9	18	Electrical, Painting, Installation, Assembly
MURPHY	9	18	Carpentry, Safety & Mobility, Repair, Maintenance, Assembly
HOWARD	9	18	Carpentry, Electrical, Safety & Mobility, Repair, Remodeling, Maintenance, Assembly

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

2

📍 Location-Y

15

Create Work Order

Technicians

Work Orders

Schedule

Add Work Order

Workorder scheduling

Create New Work Order

⌕ Duration(In Hours) *

1

Skill

Painting

▼

Priority

High

▼

📍 Location-X

2

📍 Location-Y

15

Create Work Order

🔔 Successfully Created Work Order with following details:

Identifier:1

Technician Name:CONNER

Scheduled Time:2016-11-30 21:46:52.0

Queue Position:1

Workorder scheduling

Create New Work Order

⊙ Duration(In Hours) *

Skill ▼

Priority ▼

📍 Location-X 📍 Location-Y

[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

Workorder scheduling

Create New Work Order

⊙ Duration(In Hours) *

Skill ▼

Priority ▼

📍 Location-X 📍 Location-Y

[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

25

📍 Location-Y

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

7

📍 Location-Y

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

27

📍 Location-Y

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

20

📍 Location-Y

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

50

📍 Location-Y

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

50

📍 Location-Y

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

Workorder scheduling

Create New Work Order

⊙ Duration(In Hours) *

Skill ▼

Priority ▼

📍 Location-X 📍 Location-Y

[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

Workorder scheduling

Create New Work Order

⊙ Duration(In Hours) *

Skill ▼

Priority ▼

📍 Location-X 📍 Location-Y

[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

Workorder scheduling

Create New Work Order

⊙ Duration(In Hours) *

Skill ▼

Priority ▼

📍 Location-X 📍 Location-Y

[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

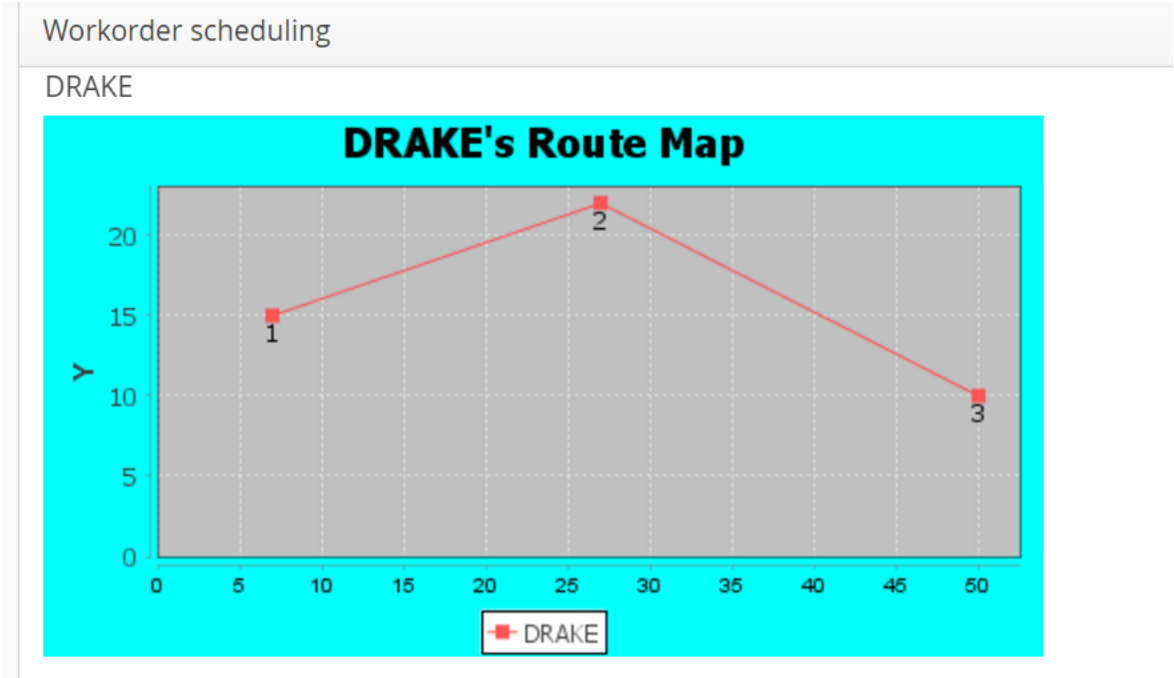
TechniciansWork OrdersScheduleAdd Work Order

Workorder scheduling

WorkOrders:

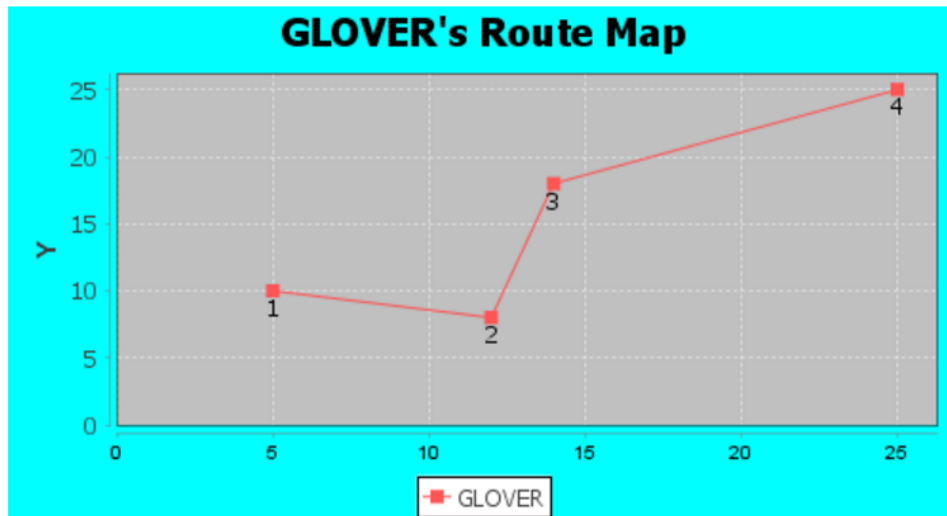
Identifier	Technician	Skill	Priority	Status	Location	Duration	Scheduled Start Time
1	CONNER	Painting	HIGH	WORK_IN_PROGRESS	Location(2,15)(2,15)	1	2016-11-30 21:46:52.0
2	BROWN	Painting	HIGH	WORK_IN_PROGRESS	Location(10,15)(10,15)	1	2016-11-30 21:47:21.0
3	GLOVER	Safety & Mobility	HIGH	WORK_IN_PROGRESS	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

