Workforce Optimization With Business Resource Planner and OpenShift

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Agenda

- Problem Space
- Thyssenkrupp Elevator Use Case
- Business Resource Planner
- Openshift
- Demo
- Q&A

Planning planning problem use cases

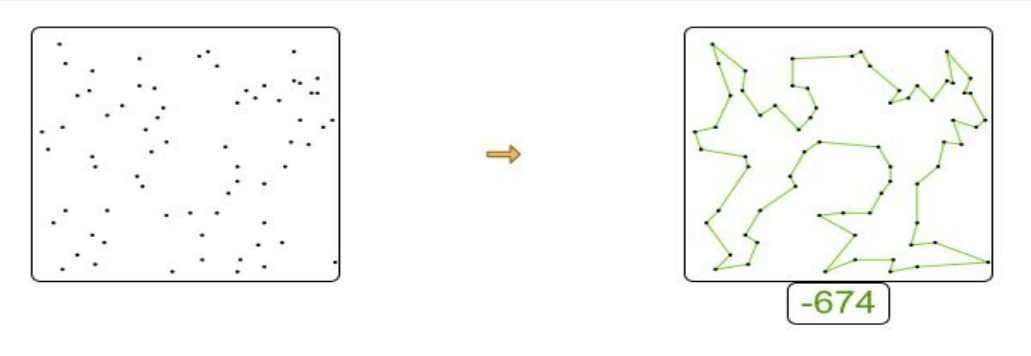
- **Agenda scheduling:** doctor appointments, court hearings, maintenance jobs, TV advertisements, ...
- **Educational timetabling:** lectures, exams, conference presentations, ...
- **Task assignment:** affinity/skill matchmaking for tax audits, wage calc, ...
- **Employee shift rostering:** nurses, repairmen, help desk, firemen, ...
- **Vehicle routing:** route trucks, buses, trains, boats, airplanes, ...
- **Bin packing:** fill containers, trucks, ships, storage warehouses, cloud computers nodes, prisons, hospitals, ...
- **Job shop scheduling:** assembly lines for cars, furniture, books, ...
- **Cutting stock:** minimize waste while cutting paper, steel, carpet, ...
- **Sport scheduling:** football/baseball league, tennis court utilization, ...
- **Financial optimization:** investment portfolio balance, risk spreading, ...

What is a planning problem

- Optimize goals with limited resources under constraints

Why are planning problems hard

- No known solution to solve in polynomial time
- Traveling Salesman
  - Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the origin city
  - O(n!)
  - Just 10 cities would be 3628800 combinations
  - 25 cities is 1.551121e+25



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Company Overview

Essen, Germany

- Integrated Materials and Technology Company
- 156,000 employees in 80 countries
- €40 billion order intake

Component Technology	Elevator Technology	Industrial Solutions	Material Services	Steel Europe	Steel Americas

Service	Repairs	New Installation & Mod	New Construction

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- 50,000 employees
- 20 plants, > 900 branches in 70 Countries
- 1.1 m units under maintenance,
- 24,000 technicians
- €6 BILLION ORDER INTAKE

thyssenkrupp elevator US

- 8,600 employees
- 115 branches
- ~220,000 units under maintenance
- 5,000 technicians
- $2 BILLION ORDER INTAKE

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Maintenance Overview

- Field service organization of 2500+
- Install base of 220K +

- Various Service Levels
  - Contractual maintenance (Planned)
  - Break-fix (Unplanned)

- Planning Model
  - Routes
  - Location
  - Frequency, Durations

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Measuring Maintenance

Objectives

- Reduce/eliminate missed maintenance
- Reduce break fix
- Increase customer service
- Increase service efficiencies

Measuring Success

- Increased % Mechanic total productive time
- Reduction % in NB CB OT hours
- Reduction % in missed maintenance
- Increase % in contract renewals

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Future of Maintenance Planning

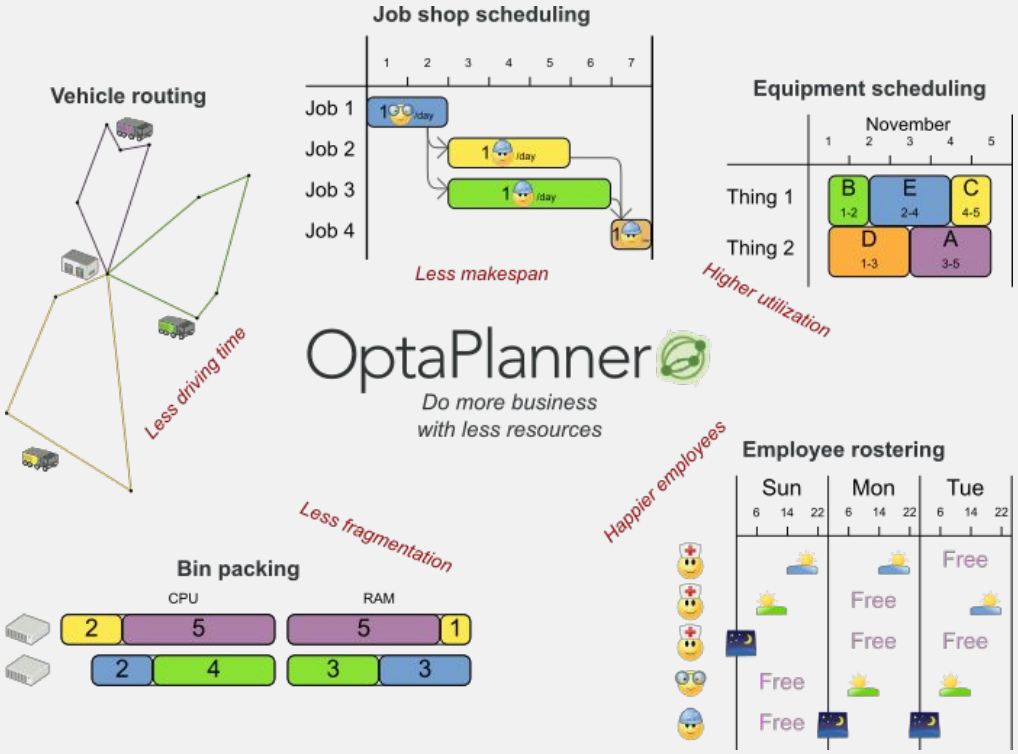
Plan

- Install base clean up
- SLA integration
- Resource availability
- Location grouping
- Unit scoring
- Service levels
- Schedule and balance routes

Future

- IOT
- Repairs
- Safety

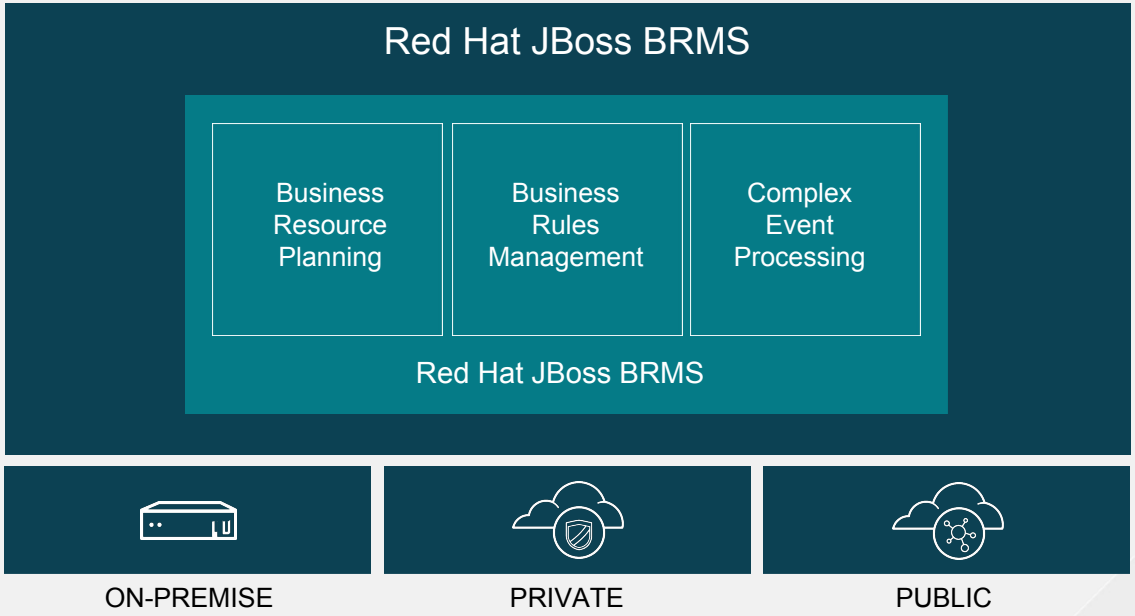
Business Resource Planner



Business Resource Planner

Business Resource Planner is an “optimization engine” (or “constraint satisfaction solver”) platform that runs on JBoss BRMS

It enables **regular Java developers** to create solvers for complex planning problems using a variety of out-of-the-box provided algorithms



Business Resource Planner

Types of constraints

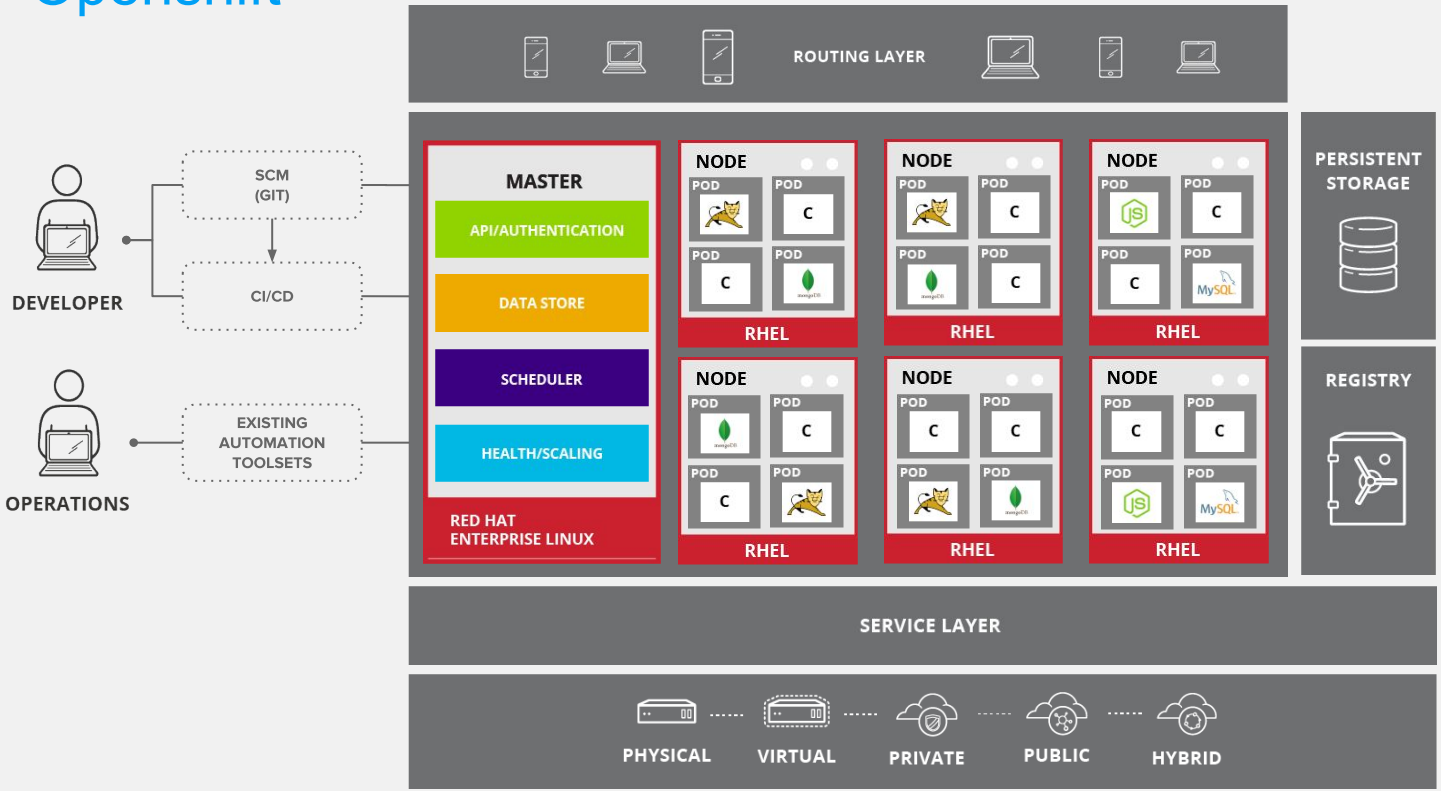
Hard Constraints must be satisfied by any solution (for it to be a feasible solution)

- Crew must not exceed 8 hours in 24
- Truck must not be overloaded
- Every shift must have a full complement of nurses
- PM visit should be before safety inspection in a year

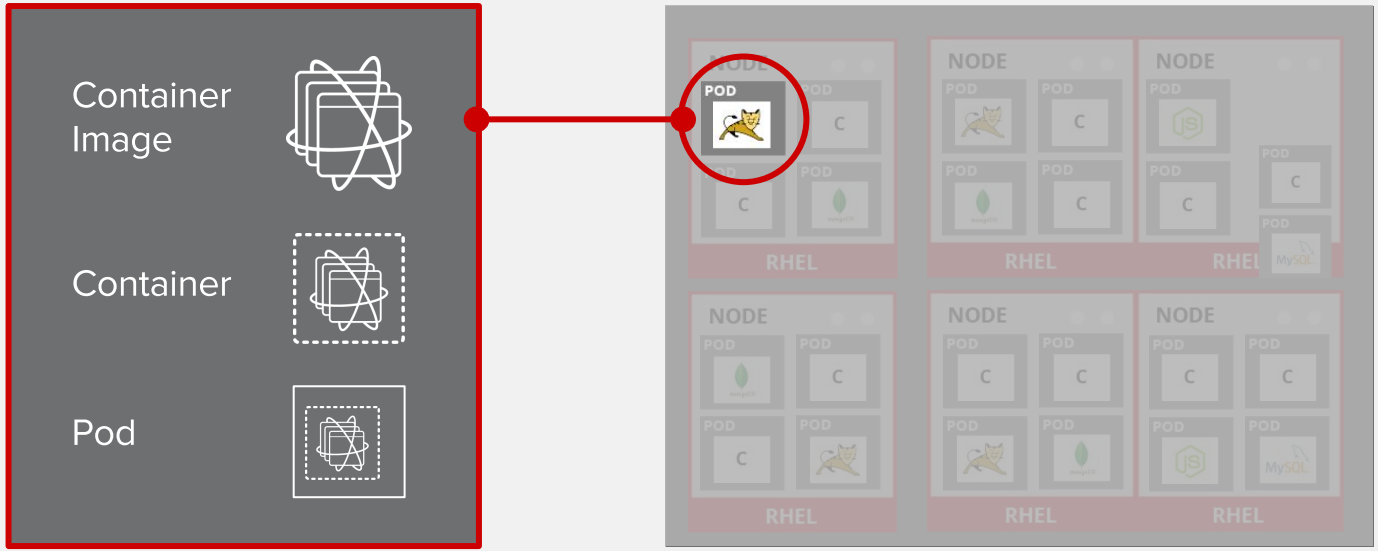
Soft Constraints should be satisfied as much as possible (better solutions satisfy more soft constraints)

- Crews should return home every 5 days
- A nurse's time preference should be honored
- A mechanic should have about an equal amount of work each week

Openshift



Openshift

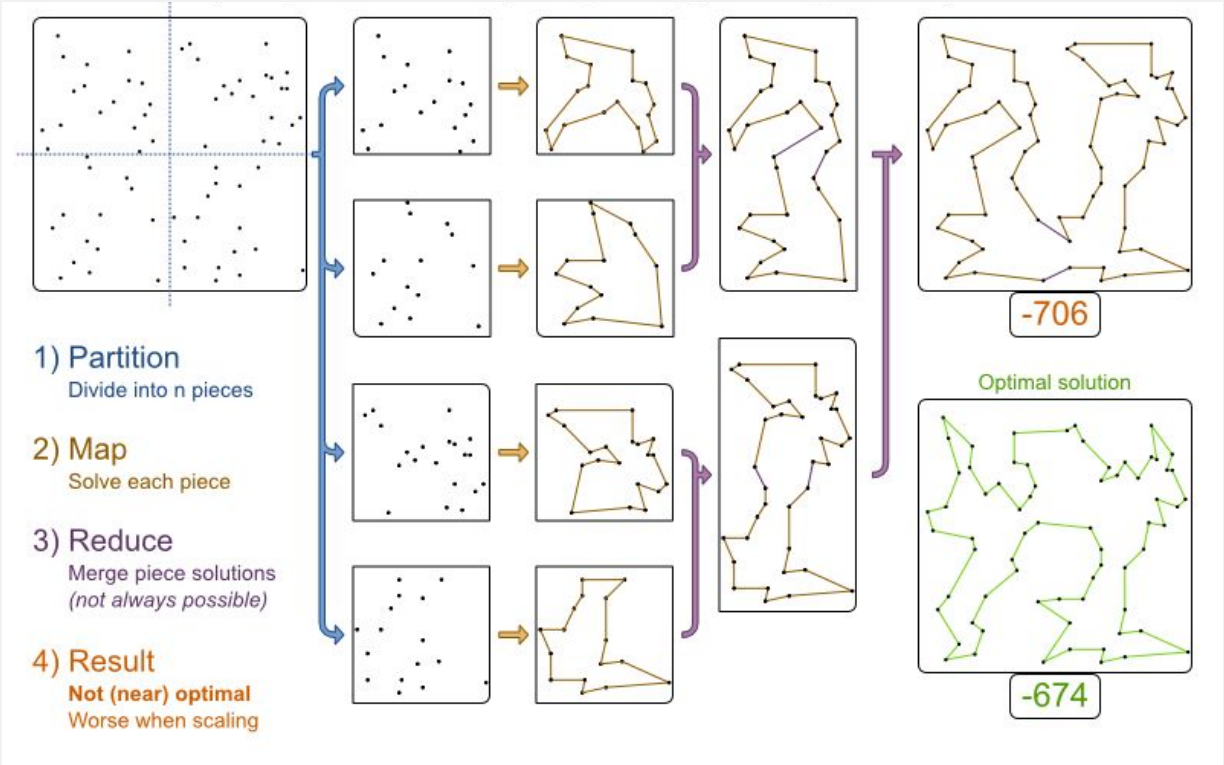


Openshift Jobs

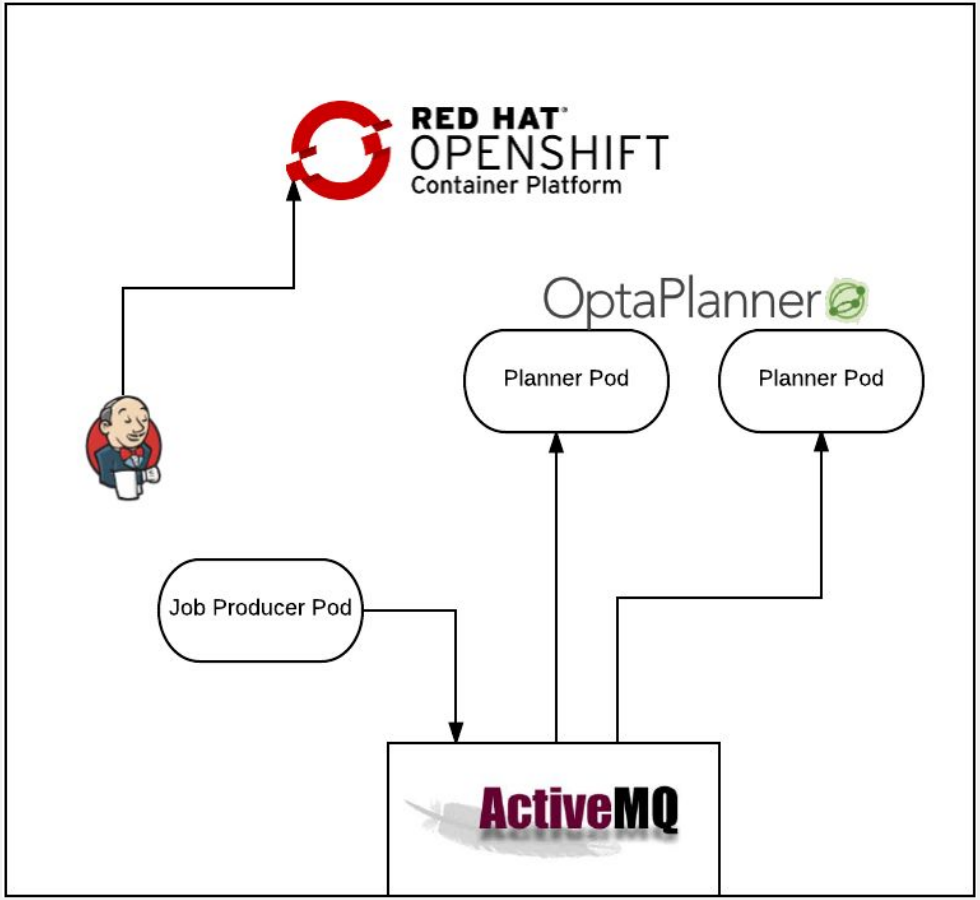
- Jobs are Pods that run to completion
- Jobs are a kubernetes object
  - Creates one or more pods and ensures they complete successfully

```yaml
apiVersion: batch/v1
kind: Job
metadata:
  name: planner-job
spec:
  parallelism: 2
  template:
    metadata:
      name: planner-job
    spec:
      containers:
      - name: planner-job
        image: 172.30.1.1:5000/test/test:latest
        volumeMounts:
         - name: sample-data
           mountPath: /etc/sample-data
         - name: report-data
           mountPath: /etc/report-data
        resources:
          limits:
            cpu: "1"
          requests:
            cpu: "1"
        env:
         - name: JAVA_MAIN_CLASS
           value: com.rhc.planner.app.PlannerRunner
```

Partitioned Jobs



Demo Architecture



DEMO

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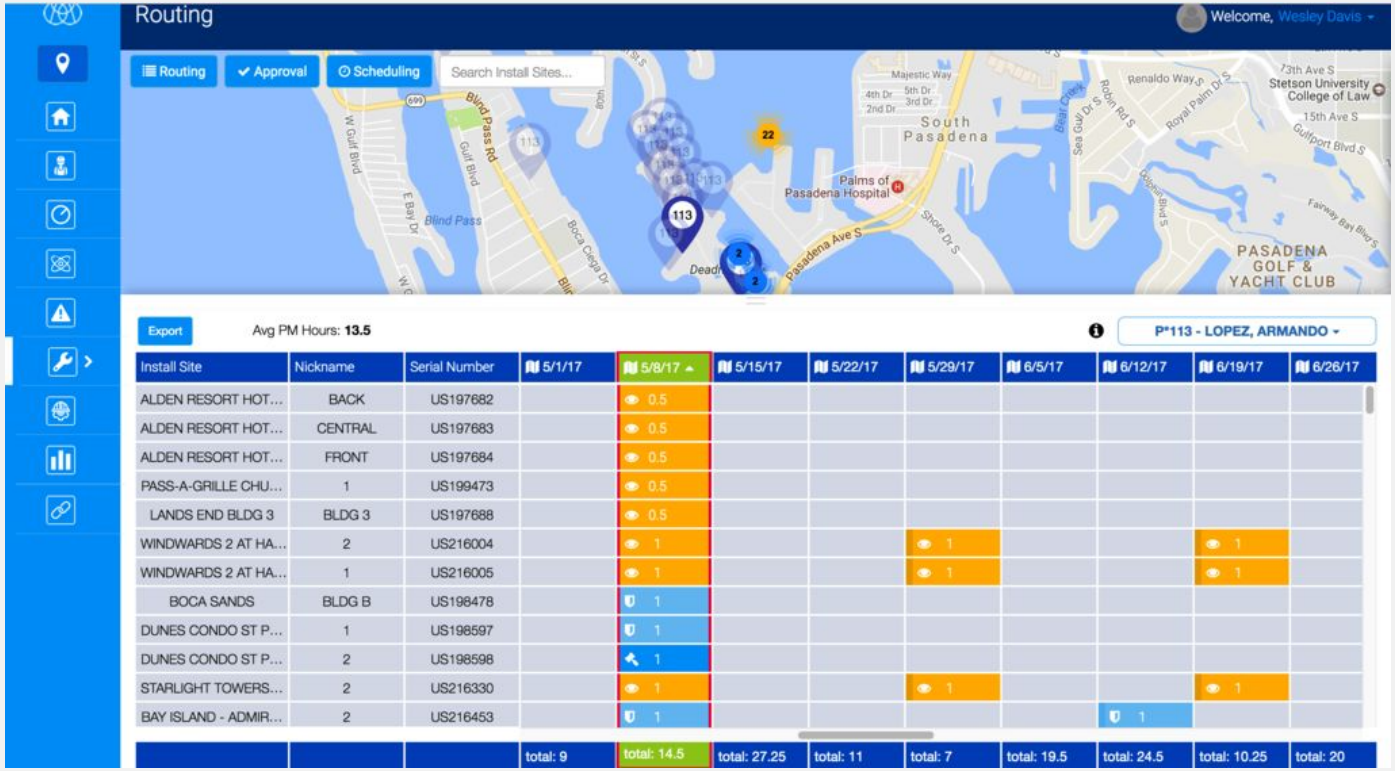

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