Gurobi Optimization Application Demos

Thank you for joining us. We will be starting shortly.

GUROBI
OPTIMIZATION

The World's Fastest Solver

Welcome to the Webinar

Gurobi Optimization Application Demos

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OPTIMIZATION

The World's Fastest Solver

Speaker Introduction

Dan Jeffrey

- Sr. Technical Account Manager at Gurobi Optimization.
- Over 20 years of professional experience in Math Programming and Data Science, working as a technical product expert and as a consultant.
- Dan has architecture and programming expertise with all major computer programming languages, math programming experience with Python, AMPL, and OPL plus programming expertise with the AMPL Solver library.

Optimization Application Demos: What They Are

Web-Based Live Demonstrations

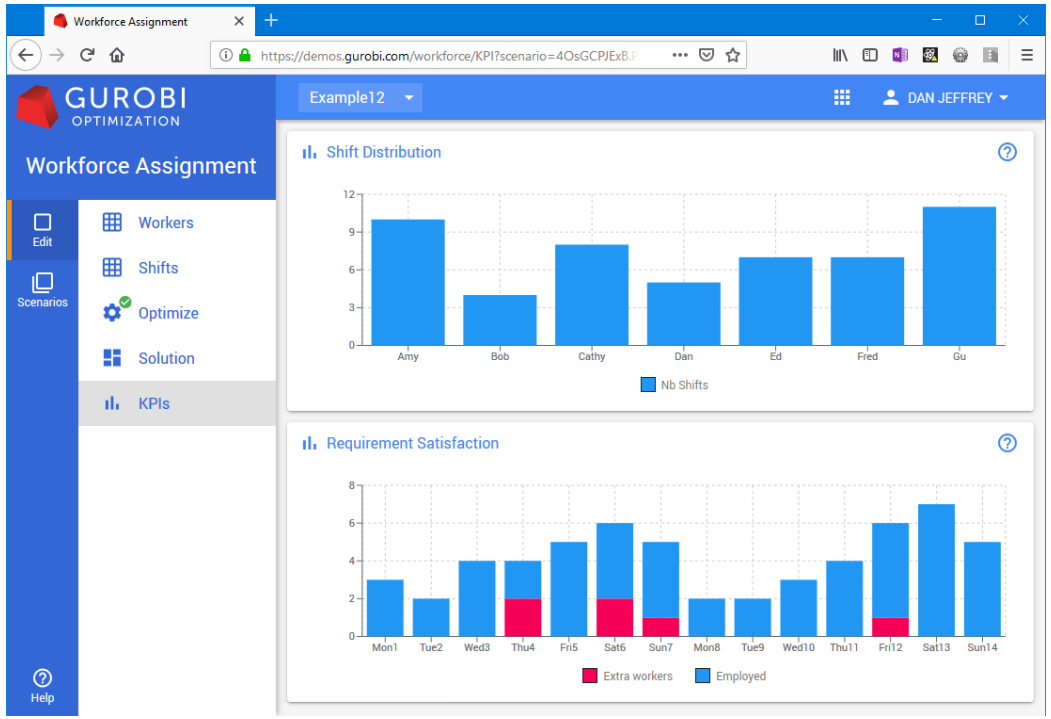
- Cutting Stock
- Workforce Assignment

Demonstrate Gurobi

- Operations Researchers
- Data Scientists
- Business people
- IT

Proof-of-Concept Optimization Applications

- Usable by non-OR people
- Demonstrate concepts to others



Screenshot of Gurobi Application Demo: Workforce Assignment

Optimization Application Demos: What They Are Not

Not part of the Gurobi solver

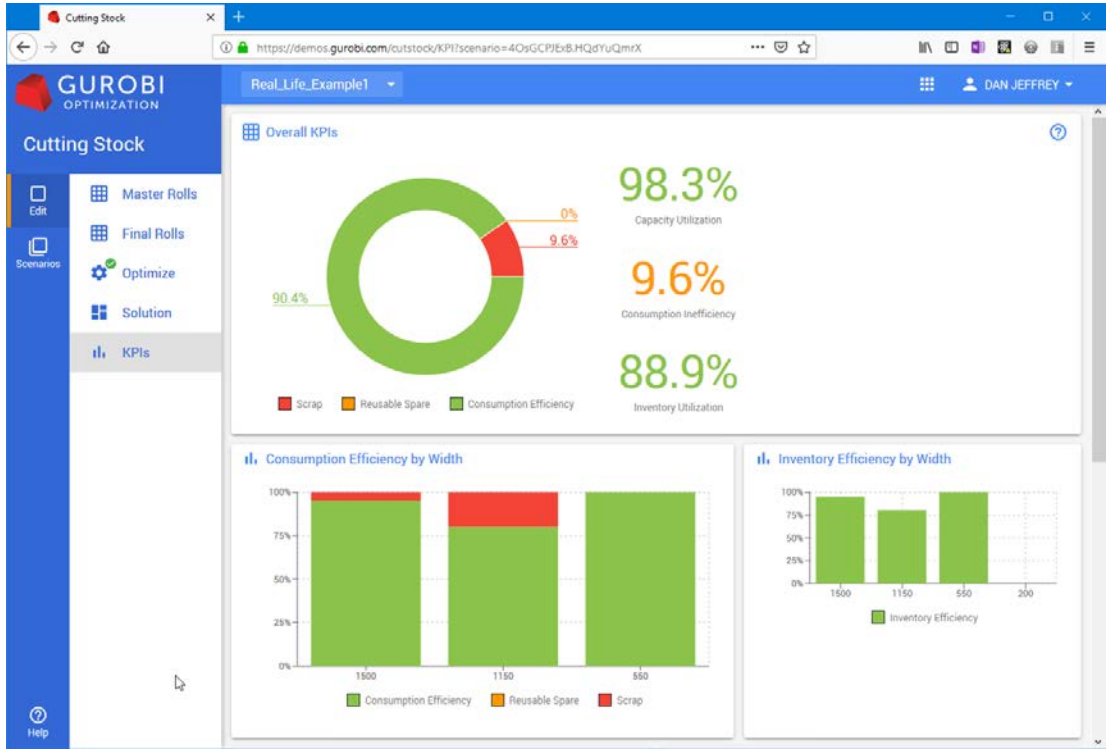
- Gurobi is a solver
- Focus is solving optimization models
  - quickly
  - robustly
- That is not changing

Not a Gurobi product

- These are free demos

Not a restrictive framework

- Source code available on request



Screenshot of Gurobi Application Demo: Cutting Stock

Development

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Experience in real-world deployments

- Michel Jaczynski: Lead architect
- Olivier Noiret: UI and UX architect & developer
- Fernando Orozco: Backend architect and developer
- Juan Orozco: Modeler and developer
- Pano Santos: Lead modeler

Demonstration #1: Cutting Stock

Factory lines need rolls of material

Buy large rolls then cut them

- paper or aluminum, for example

Meet internal factory demand

- Different manufacturing lines
- Each needs particular widths
- Each needs different quantity

Specify

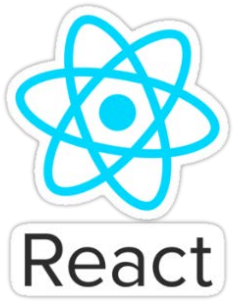
- Master rolls and costs
- Demand
- Spare threshold (how small to keep)
- Number of knives

Plan

- What to use from stock
- What to buy
- How to cut them

Minimize cost

Optimization Application Demos: Architecture



Tiered architecture

- Web User Interface
- Web application server
- Scenario database
- Message queue
- Optimization workers
- Solver = Instant Cloud or Compute Server

Scalable

- Can grow to serve more users

Architecture Key Factors

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Optimization is compute intensive

- More so than other software
- CPU is critical
  - Clock speed
  - Core count
- Running out of memory is costly
- Optimization doesn't "share well with others"

Optimization is synchronous

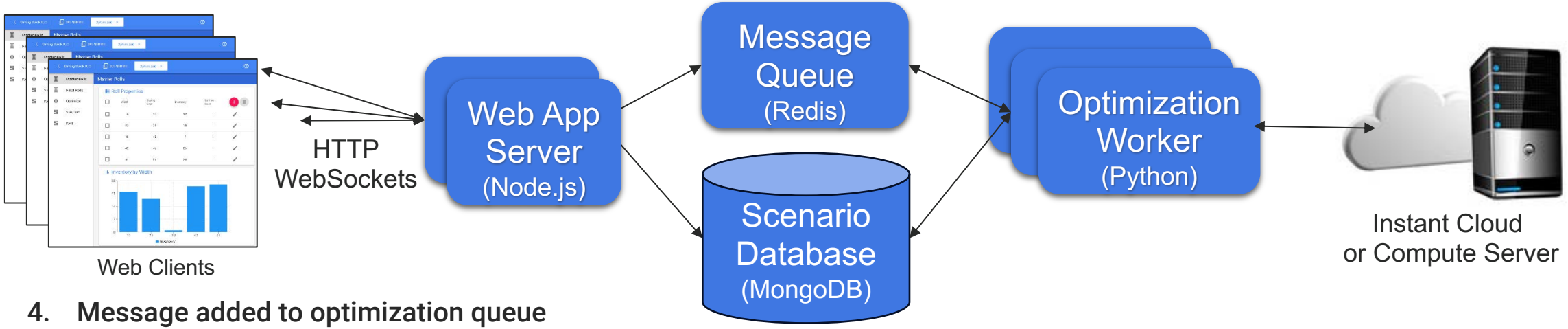
- Client connection required while optimizing
- Instant Cloud, Compute Server, Local

Compute Server and Instant Cloud

- Maximize use of compute resources

Application Flow

1. Users edit scenarios
2. Scenarios saved in database
3. User requests optimization



4. Message added to optimization queue
5. App server watches results queue

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12. App server gets solution from database
13. App server pushes new html to client

6. Worker watches optimization queue
7. Gets new request
8. Reads scenario from database

9. Submits job to Instant Cloud & waits
10. Writes solution to database
11. Pushes message to job-done queue

Architecture Best Practices

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Separate optimization from Webserver

- Optimization is CPU intensive
- Scale Optimization and Webserver independently

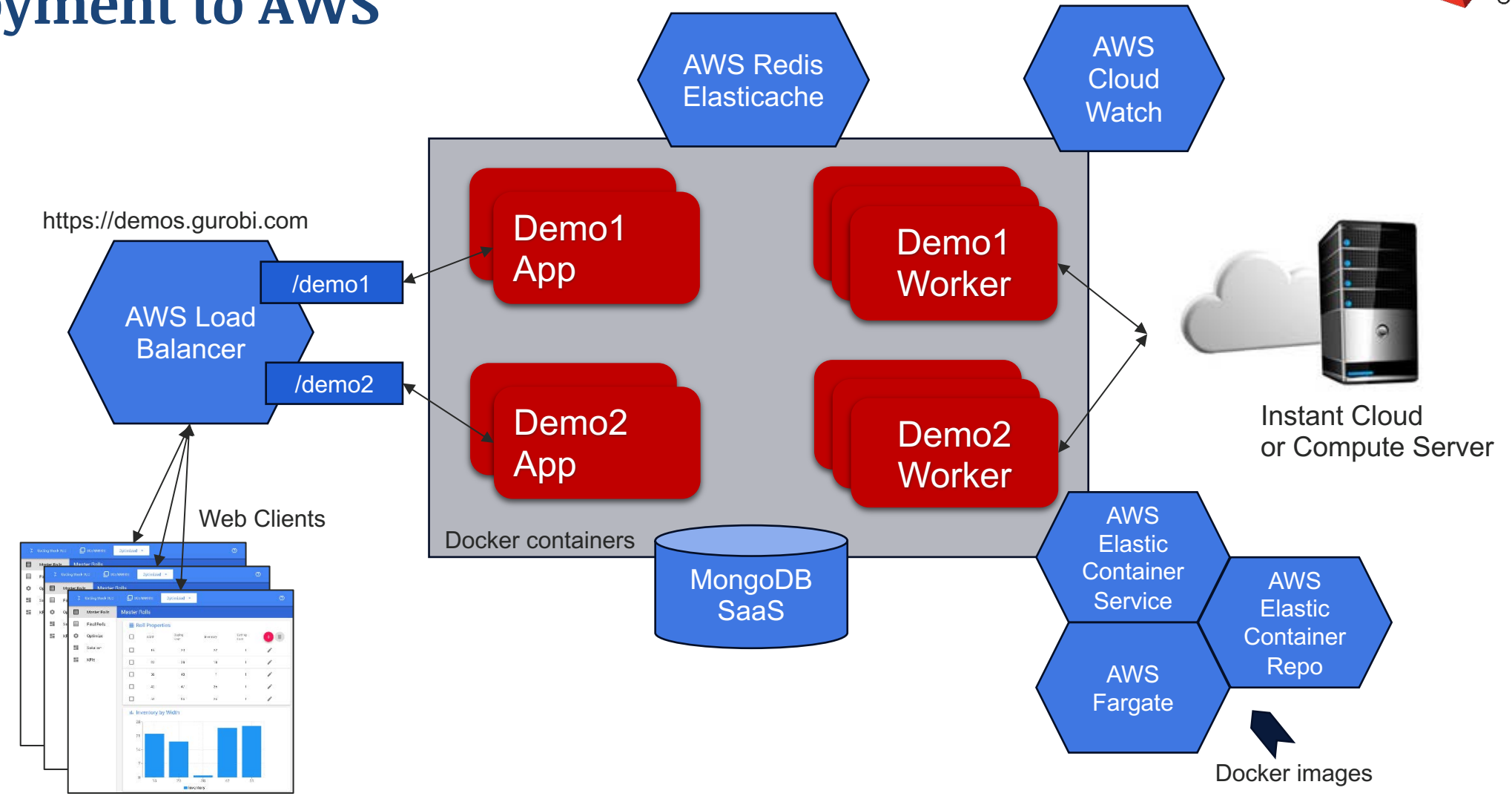
Application level queue for optimization

- Complements Compute Server
- Workers handle one problem at a time
- No blocking client interface
- No overloading database

Use the Python Gurobi modelling API

- Separate application and model
- True for any architecture

Deployment to AWS



Demonstration #2: Workforce Assignment (time permitting)

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Service business such as a restaurant

Plan worker schedules for 2 weeks

- Worker availability
- Hire outside if needed
- One shift per day
- Common skill set
- No labor laws

Objectives

1. Minimize outside hires
2. Optional: balance the workload
   - Allow hiring of extra workers to increase fairness
   - Up to specified % increase in temps

Next Steps

Try them now!

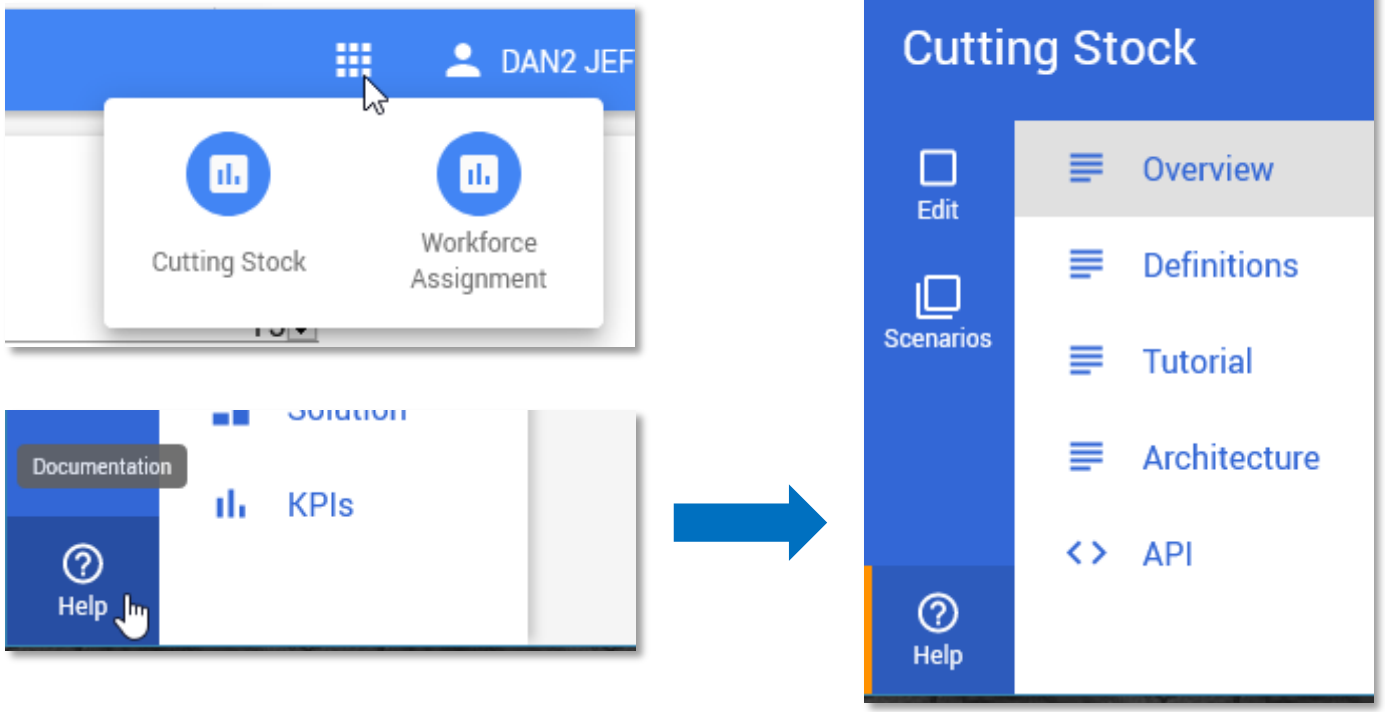
- Log into the Gurobi web site
- Then, enter the URL: https://demos.gurobi.com

Choose your application

- Apps icon at the upper right:
- Cutting Stock
- Workforce Assignment

Don't miss the documentation

- Help button at the lower left:



Please help

- What other demos should we make? Please email suggestions to info@gurobi.com.

Thank You – Questions?

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