

# Commercial Realities of Applied Mathematics

Joe Forbes and Matt Herbert

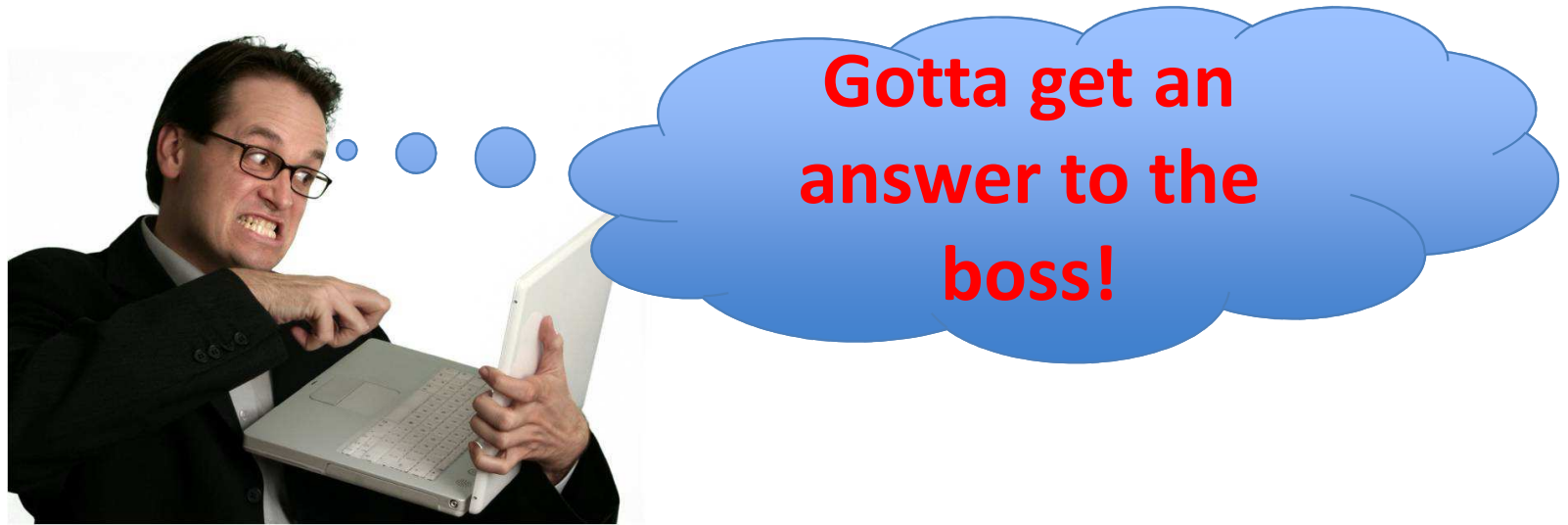
# Commercial Realities of Applied Mathematics

Selling It and Doing It

# **Joe is: Selling It!**

4 Step System

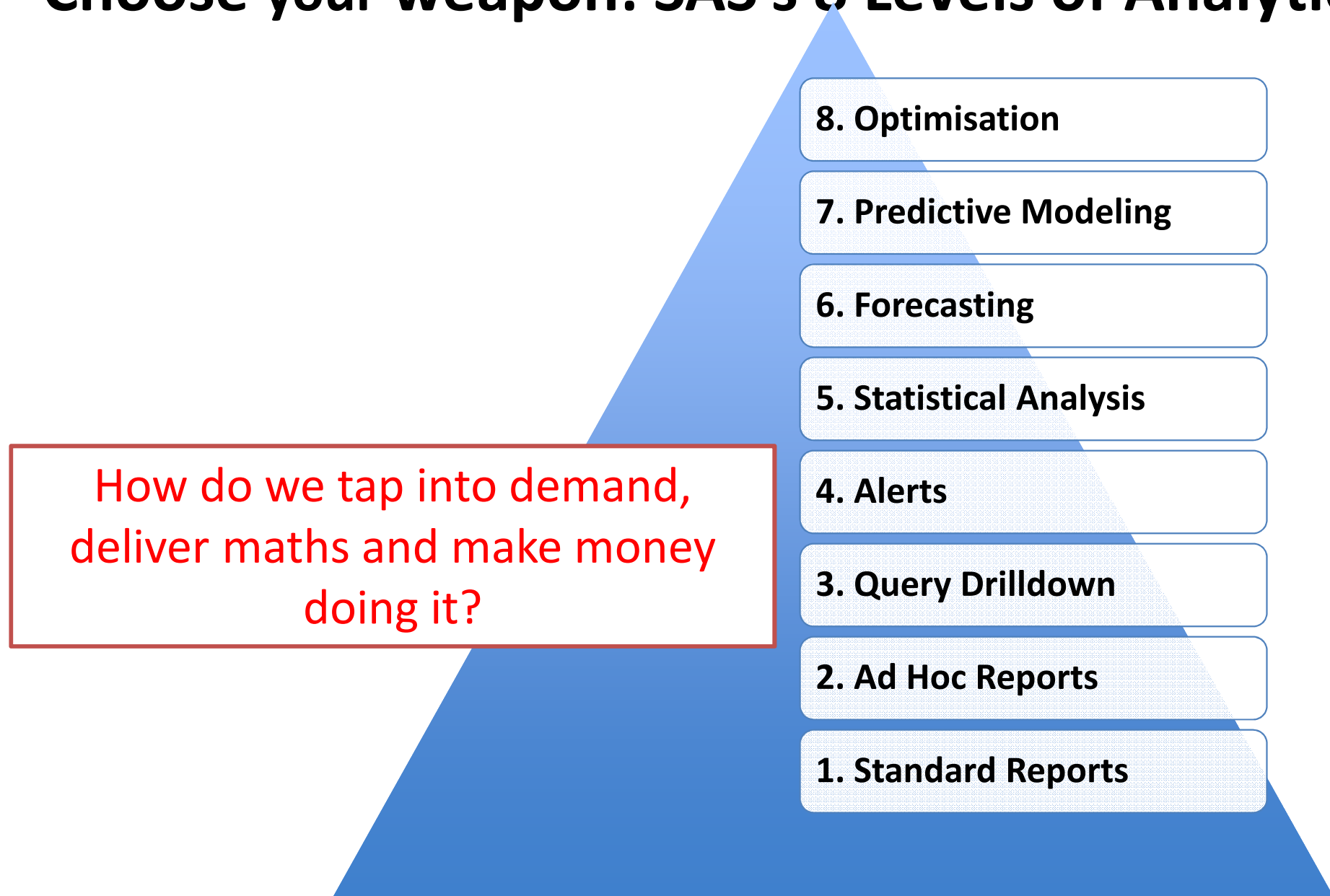
# Demand is growing



- ✓ Complex environment
- ✓ Hard decisions
- ✓ IT hassles
- ✓ Clunky software

# So is supply:

## Choose your weapon: SAS's 8 Levels of Analytics



# Step 1: Differentiate Accessible Optimisation



**Models for decision support: Insight, Collaboration, Analysis**

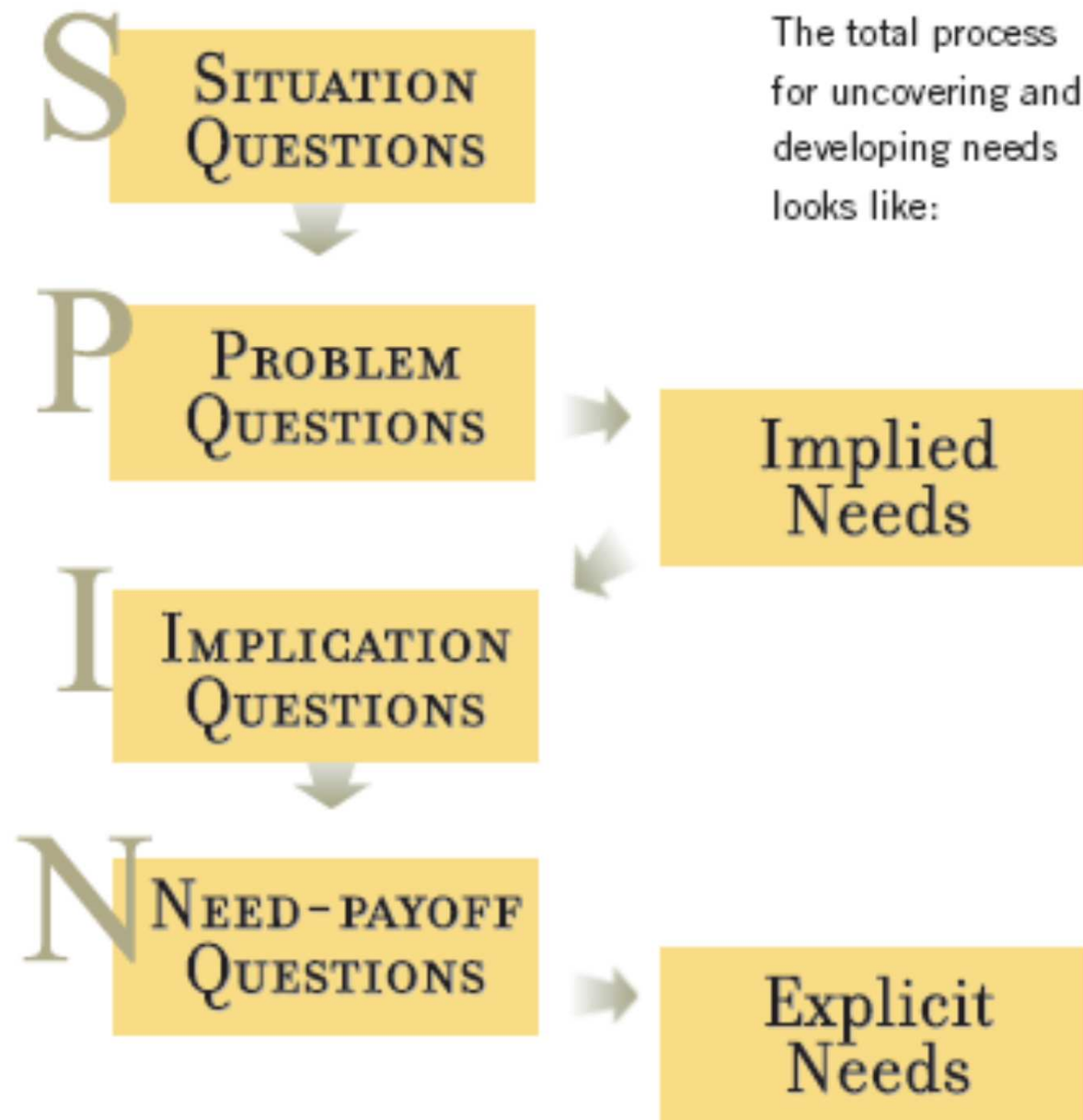
**Quantitative Models**  
Business analytics and custom models...

The graphic for Quantitative Models features a line graph with two lines, one red and one blue, plotted against a background of binary code (0s and 1s). To the left, there is a circular icon containing a grid with red squares, similar to the one in the main diagram.

**Web Apps**  
Optimisation tools for planning and scheduling...

The graphic for Web Apps displays a horizontal row of seven circular icons. From left to right, they represent: a server rack, a truck, a person, a network diagram, a truck, a person, and a globe. The final icon on the right is a checkmark inside a circle.

# Step 2: Sell to the Need

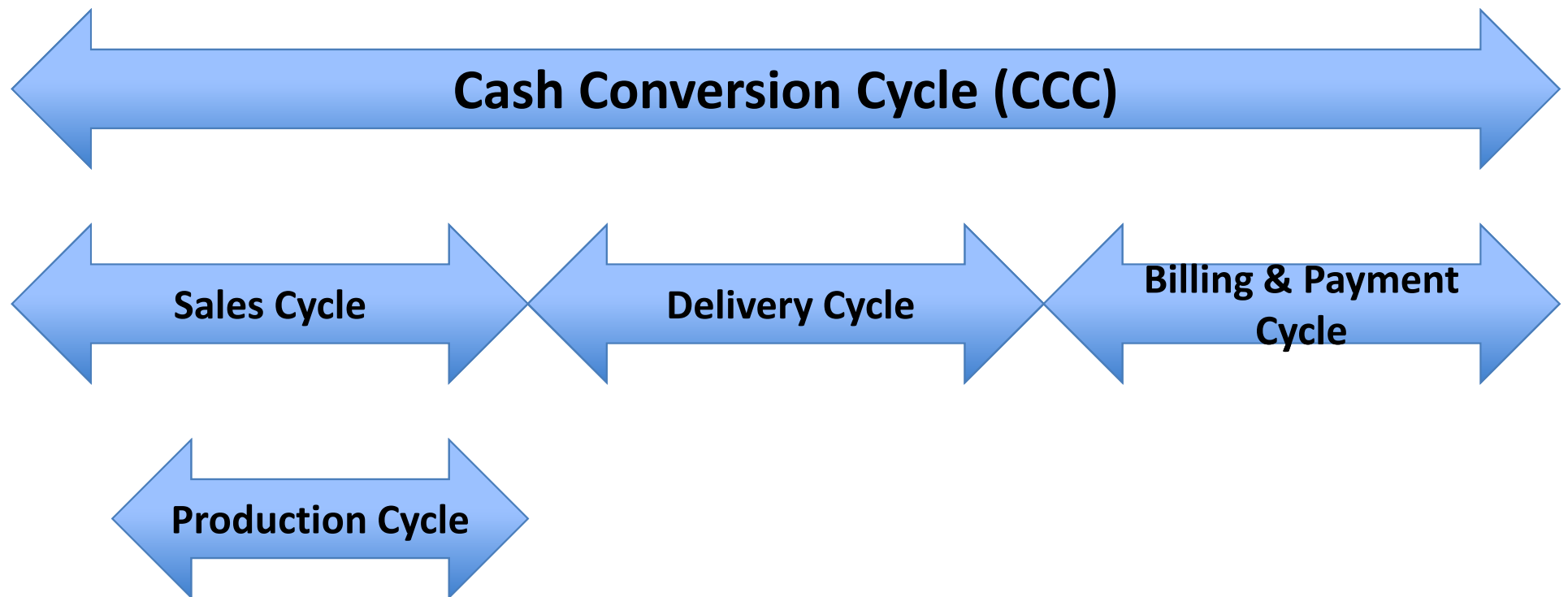


# Step 3: Get the Contract Right

- ✓ “I would love a PoC - Do it for Free”
- ✓ “I don’t know exactly what I want but give me a fixed price for it”
- ✓ No plan survives contact with reality
- ✓ Benefits owner vs cost owner
- ✓ Pricing:
  - ✓ Gain Share
  - ✓ Volume base pricing
  - ✓ Cost, Customers and Competitors



# Step 4: Don't go broke do it



# Special Secret Extra Step: Get the Right People



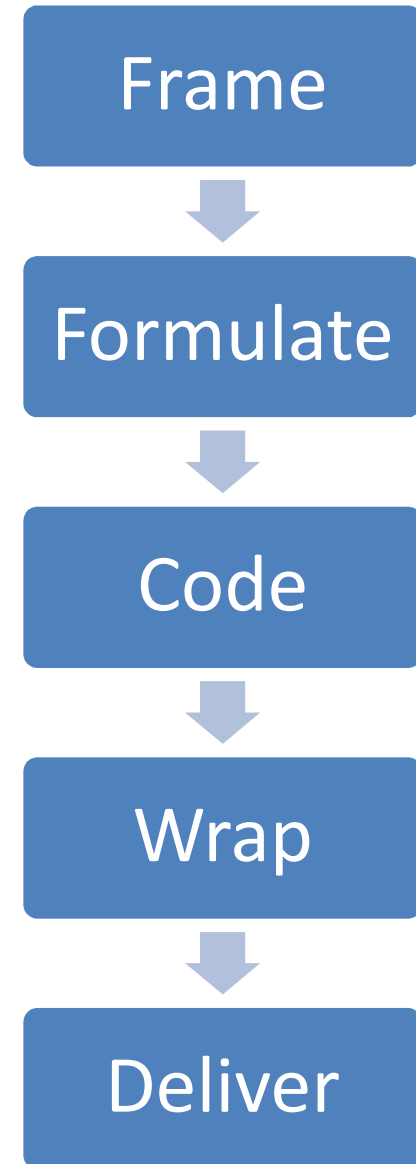
- ✓ A team of experts: mathematicians, computer scientists, designers, industry and commercial specialists, developers and analysts
- ✓ Building cool stuff

# **Matt is: Doing It!**

It is the 'applied' in applied  
mathematics that is hard

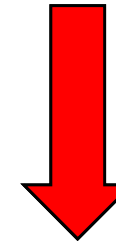
# How we do it?

- ✓ Commercial Mathematicians
- ✓ Apply advanced **scientific methods** to frame real problems.
- ✓ Mathematical and statistical modelling, optimisation and simulation to arrive at optimal or near optimal solutions to complex problems.



# Framing & Formulating

- ✓ **Why?**
- ✓ Understand the problem, and client expectations.
- ✓ “Bridge the gap” between cutting edge science and commercial users.
- ✓ Operations Research is a rich area of mathematics. We want the benefits to be accessible to everyone.

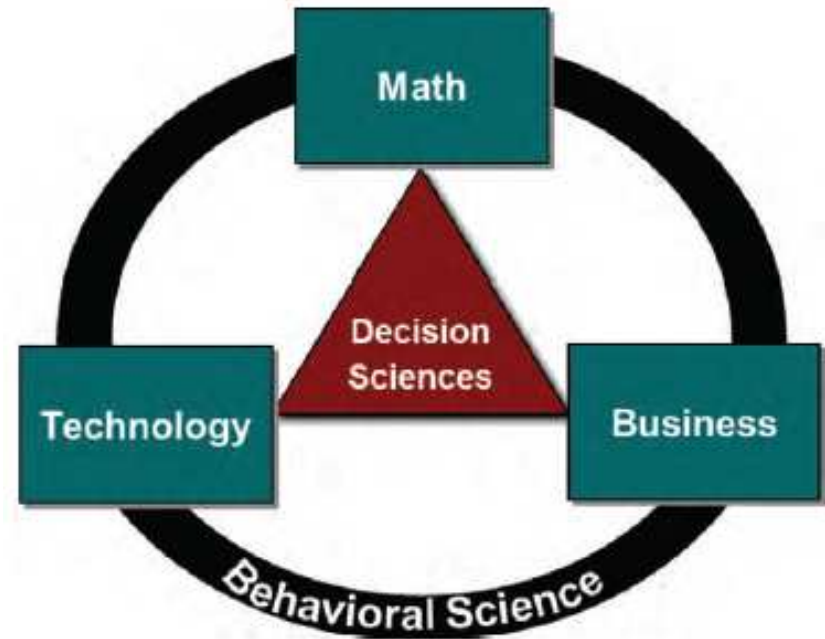


- ✓ **What makes this hard in the real world?**
- ✓ Working through a project creates new ideas - keep client and consultant views aligned.
- ✓ Avoid “back room IT” & disconnection with client expectations.

$$\begin{aligned} (GP) : Z_{GP} = \min & \sum_{j=1}^N h_j \Phi_j (SI_j + T_j - S_j) \\ \text{s.t.} & S_j - SI_j \leq T_j, \\ & \forall j = 1, \dots, N, \\ & SI_j - S_i \geq 0, \\ & \forall (i, j) \in A(G), \\ & S_j \leq \bar{S}_j, \quad \forall j \in D, \\ & S_j, SI_j \geq 0, \quad \forall j = 1, \dots, N. \end{aligned}$$

# Coding the problem

- ✓ **Why is this important?**
- ✓ Develop our own optimisation engines, customised for each problem.
- ✓ Joint implementation of mathematics, technology and business.
- ✓ Combined knowledge from multiple disciplines to create great results.



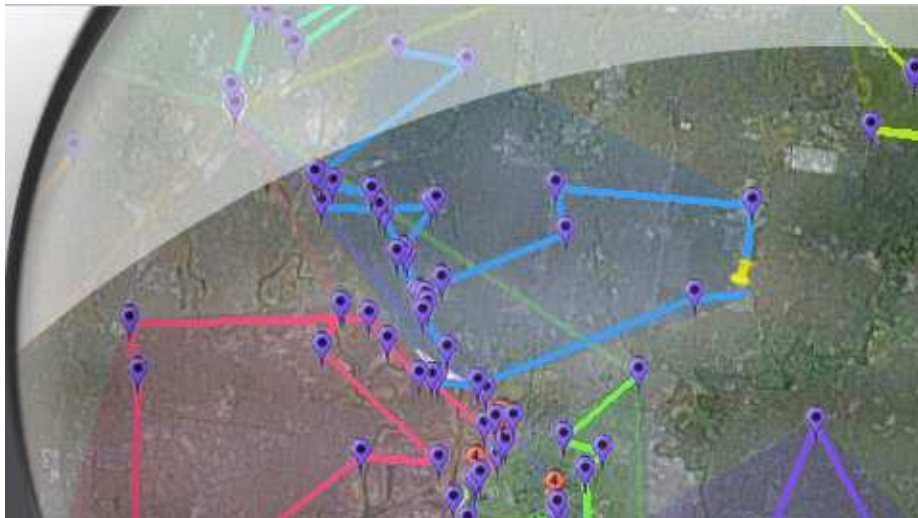
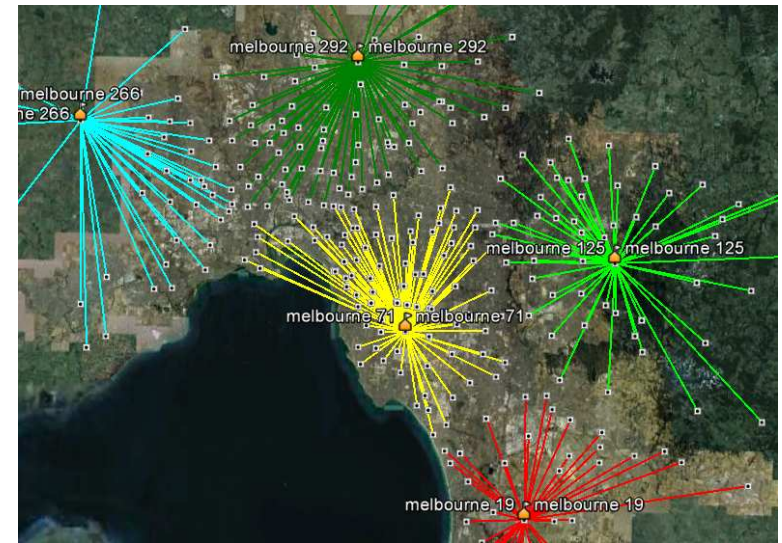
- ✓ **What makes this hard in the real world?**
- ✓ Customers will never be happy with optimization running times.<sup>2</sup>
- ✓ Deliver a high quality optimization tool, and customers will want to use that tool for all of their problems; often much larger - creating scalability issues.

<sup>1</sup>Image from Dhingra & Padmanabhan. "Educating Data Scientists". ORMS Aug '12.

<sup>2</sup>Jean Francois Puget | 21 Aug 12 [www.ibm.com/developerworks](http://www.ibm.com/developerworks)

# Wrapping the problem / Visualizations

- ✓ Why?
- ✓ Avoid “black box optimisation”.
- ✓ We provide a tool our clients can use to understand and solve their problems.
- ✓ Client asks for an answer – instead, give them understanding & empowerment.



- ✓ What makes this hard in the real world?
- ✓ Clients are under pressure to get results – properly presenting a solution takes more time.
- ✓ Customers may reject a solution they don't understand.

# Questions



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