

'09 IFDA
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Best Practices for Today's Times



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Best Practices for Today's Times



'09 IFDA Distribution Solutions Conference

SCIENTIFIC
logistics

“Power” Optimization

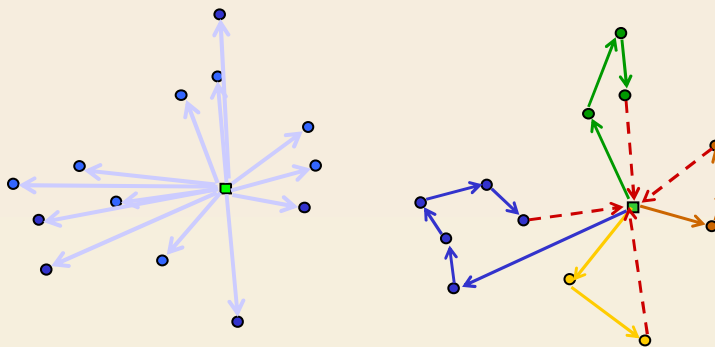
Next Generation Routing Technology

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25 Years Experience Solving Complex Route Planning Problems

- **Founded by Dr. Don Ratliff**
 - Founded, built and sold CAPS Logistics (1982 – 1998)
 - Regents Professor at Georgia Tech in Industrial Engineering
 - Executive Director of The Supply Chain & Logistics Institute at Georgia Tech
- **Senior Leadership**
 - CEO Ron Gable - former Campbell Soup VP of Global Supply Chain; former Managing Partner of PricewaterhouseCoopers Manufacturing and Supply Chain Consulting Practice
 - CTO - Dr. Bill Nulty former CAPS Logistics CTO; former Baan VP of Supply Chain
- **Professional Staff**
 - Core team
 - Algorithm development, software design, strategy, customer support
 - Contract "stringers"
 - Database development, web portal development, standard programming

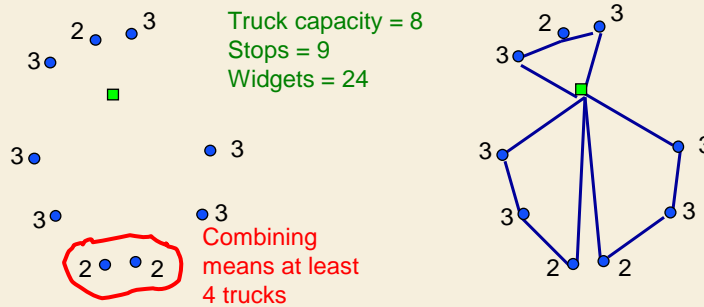
Basic Delivery Planning Problem



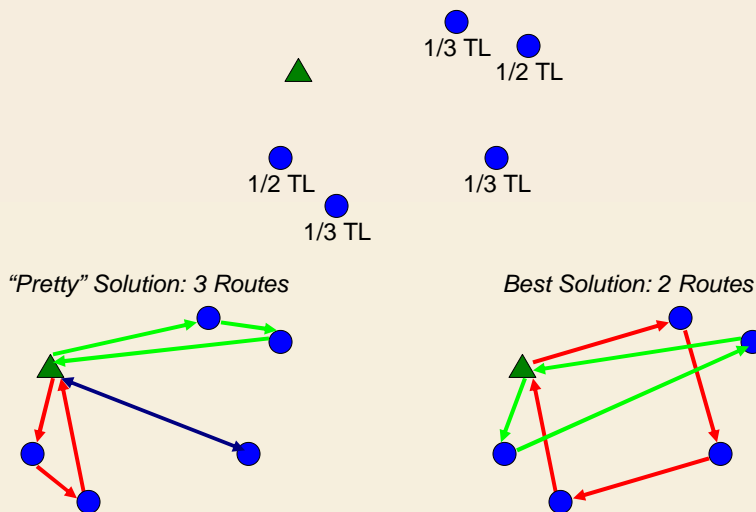
- **Determine delivery itineraries**
 - Loads, routes, schedules
 - Satisfy constraints – loading restrictions, delivery windows, driver restrictions, load-vehicle-site compatibility, etc.
 - Achieve service targets at minimum cost

Why Is Route Planning So Difficult?

- **Huge number of possible solutions**
 - Approximately 1.3 trillion possible sequences for a 15 stop route
 - Requires massive computing power to consider all solutions
- **It is difficult to determine if you have a “good” solution**
- **It is tough to tell which stops should go on the same truck**
 - Human judgment and interactive routing software lack this capability

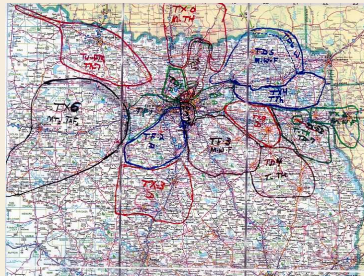


Counterintuitive! “Pretty” Routes or Best Solution?

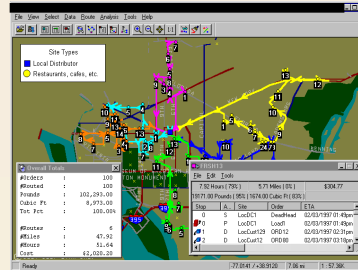


Evolution of Route Planning Software: Little Change in 25 years

Pre 1980

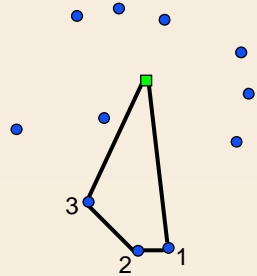


Mid 1980s

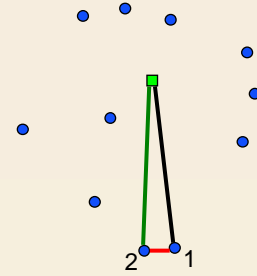


Interactive Starting Solution Algorithms Variants of "Insertion" and "Savings" Most Common

"Savings" = black + green - red

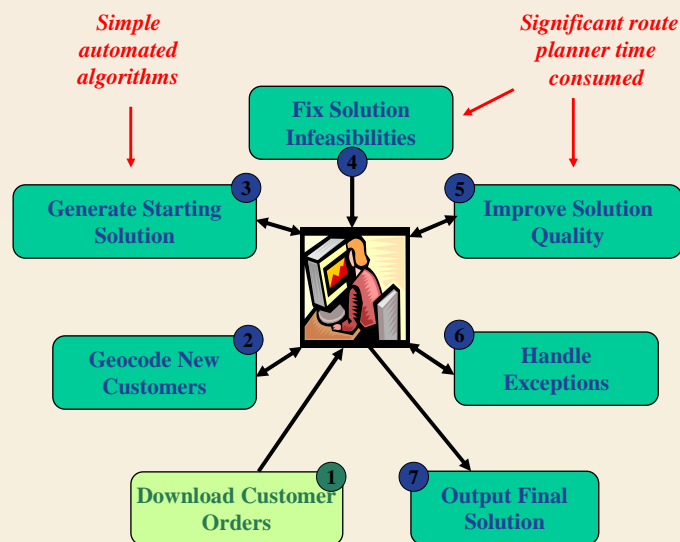


- **"Insertion" methods**
 - Select a delivery (typically farthest from terminal)
 - Insert selected delivery (#1)
 - Pick "best" unrouted delivery
 - Insert if feasible (#2 then #3)
 - Continue until truck reaches capacity then start new route

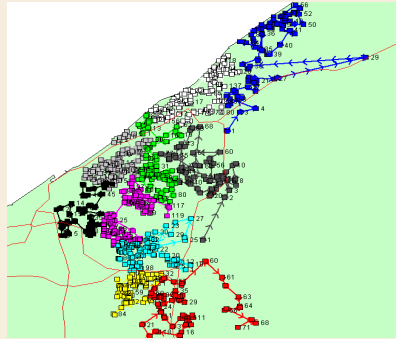


- **"Savings" methods**
 - Assume each delivery has its own truck
 - Calculate "savings" from combining routes
 - Merge routes based on largest "savings" until no feasible mergers remain

Typical Route Planning Process



Fix and Improve Solutions



"Interactive" Solution

10 Routes
2006 Miles

- Is this a "good" solution?
- How much time should be spent trying to improve this?
- How is the route planner motivated to ensure solution quality?

We will revisit this slide...

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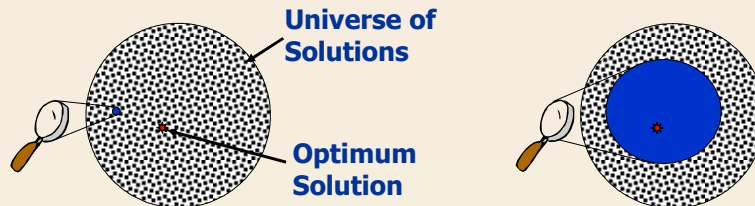
Two Fundamental Weaknesses

- **Algorithms**
 - Simplistic "starting point" solution – not optimization!
 - Limited computing power; single PC or server
 - Not architected to seek lowest cost solution
- **Human interaction required**
 - "Pretty routes" versus lowest cost solution
 - Unique blend of operations and computer skills talent necessary
 - Limited career path for the upwardly capable planner
 - Distributed workforce complicates enterprise wide routing strategies

There must be a better way...

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Motivation for Building “Power” Optimization



“Interactive” Planning

- Provides a starting solution
- Requires intensive human interaction to “fix” or improve solutions
- Inconsistent solution quality
- Decentralized

“Power” Optimization

- Consider very large number of “good” solutions – picks best
- Consistently beats human judgment
- Eliminates need for most human interaction
- Centralized

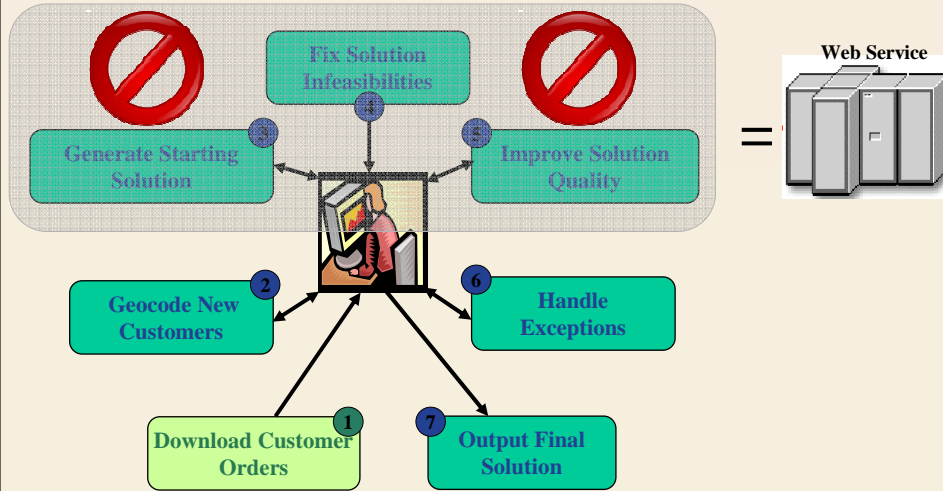
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What is “Power” Optimization?

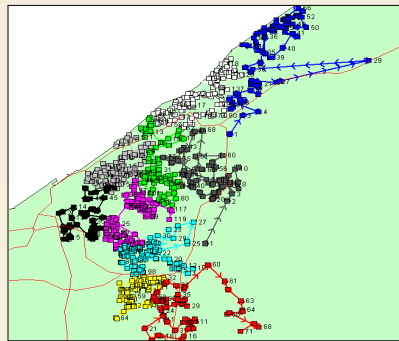
- **Technology – Optimization based enumeration**
 - Structured search of a huge numbers of good candidate solutions to pick the best
 - Search guided by problem characteristics (geography, time windows, etc.)
 - Solution quality improves with number of solutions considered
 - Focus is on computing power rather than human judgment
- **Infrastructure – Web services**
 - Began emerging early 2001
 - Enables use of centralized power computing (multiple servers)
 - Allows access as a service (software-as-a-service)

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Automated Process and Better Solutions

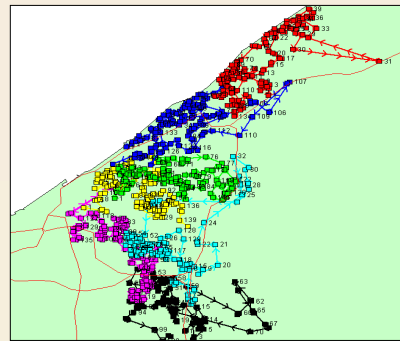


“Interactive” Planning vs. “Power” Optimization



PC Interactive Solution

10 Routes
2006 Miles

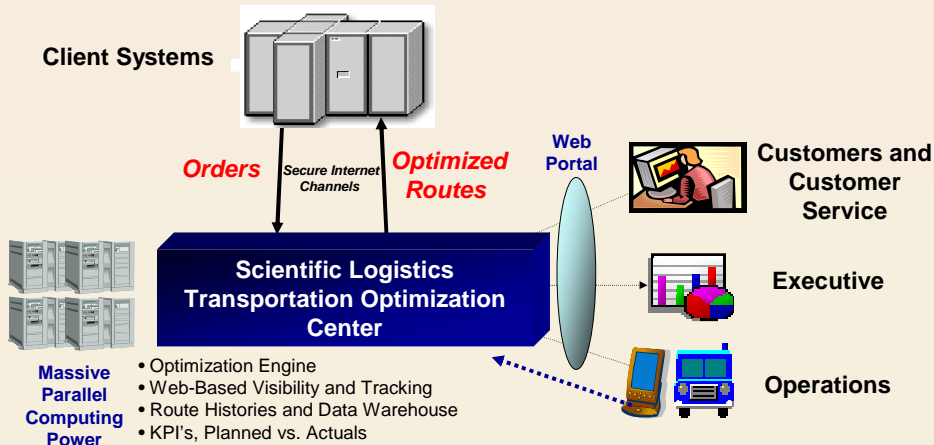


Power Optimization Solution

7 Routes
1345 Miles

30% fewer routes
33% less miles
With no human interaction!

How We Do It: Power Optimization Web Service



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Takeaways

- **Consistently beats interactive software solutions**
 - 5 – 20% fewer routes and miles
 - Dramatically less human effort required
- **No disruption to existing processes and systems**
 - “Bolt on” to existing solution – does not replace
 - No messy system integration
- **No up front investment**
 - Subscription service fee based
 - Try before subscribing
 - Savings precede any expense
 - Self funding

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Thank You!

