Optimization Challenges
**Optimization Challenge**

- **What?** A friendly competition to see who can find the best solution to one optimization puzzle!
- **Why?** To have fun, to learn something about our optimization tools and to improve our skills in solving puzzles.
- **Why?** To become number one in APS
- **Who?** Anyone in Quintiq
- **When?** Started August 6 and finished October 1
“Develop a single application capable of solving any type of planning puzzle”

With a healthy disregard for the impossible...
A successful planning system requires the benefits of tailor-made software (complete fit with the functional requirements) but also those of standard software (fast implementation, software upgrades, ...). This may seem like an either-or decision...

**Tailor made vs. traditional standard applications**

- **Specific functionality**
  - Perfect fit

- **Out-of-the-Box**
  - Fast implementation
  - Upgrades & support

- **Tailor made**
  - Long development
  - Difficult to maintain
  - No upgrades

- **Commercial Off-The-Shelf (COTS)**
  - Difficult to adapt
  - Fixed functionality
Quintiq turns this into an and-and decision: the best of both worlds with a 100% fitting solution, fully configured in standard software. All Quintiq customers use the same software which means you can benefit from the experience and quality of all these customers.

**Quintiq, best of both worlds**

- **Specific functionality**
  - Perfect fit

- **Out-of-the-box**
  - Fast implementation
  - Upgrades & support

**Quintiq**

- 100% fit solution
- Commercial-off-the-shelf standard software
- Flexible business logic
- Flexible (system) interfaces
Quintiq Architecture
Quintiq architecture

The silver layer makes each customer’s implementation unique. It is the part of the system that will be configured together during a project to provide the final 10% of the solution.

The blue layer represents a Quintiq Industry Solution. Quintiq has a number of different Industry-variant Solutions for different market segments. This represents a further 10% of the solution (market specific, but company independent logic).

The orange layer represents 80% or more of the solution. It is the standard Quintiq Application Suite, which consists of many planning functionalities, ranging from the Windows (and/or Web) user interface and the real-time knowledge engine where the knowledge tables and calculations can be specified, to the integrator that allows integration with other systems and optimizers that allows optimization of (parts of) the puzzle. The Quintiq Application Suite is used by all Quintiq customers.
## Market Segments

### Metals & Manufacturing
- Aluminum
- Copper
- Food Processing
- Manufacturing
- Packaging
- Service Centers
- Steel
Market Segments

Logistics

- Automotive
- Container Logistics
- Contract Logistics (3pl/4pl)
- Express
- Groupage
- Maritime
- Mining
- Ports and Terminals
- Postal
- Rail Cargo
- Retail
Market Segments

Workforce

- Air Traffic Control
- Aviation
- Broadcasting
- Field Services
- Healthcare
- Public Transport
- Security
- Rail
Agenda

Optimization Challenge prelude
Quintiq Introduction
Optimization Challenge
Question and Answers
Measuring is Knowing

How are we solving our puzzles?

How good are we solving our puzzles?

Are we using all the tools we have?

Are we using all the knowledge in the organization?
Optimization Challenge

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Optimization Challenge

DEPOT
5 Goals

1. Find excellent solutions
   - Average of 10 times a 60 minute run

2. Find reasonably good solutions very quickly
   - Average of 100 times a 5 minute run

3. Create a generic model
   - Average of 10 times 5 minute run on 10 sets

4. Find a new best solution
   - Best known solution 90 routes and 39641.46 km

5. Make valuable suggestions for the software
Optimization Challenge (Logic definition)
Optimization Challenge (GUI definition)
Optimization Challenge
Technologies

- We used a sequential insertion (construction) heuristic for initial solution
- Path Optimization Algorithm
- Constraint Logic Programming
- Mathematical Programming (Set covering)
Path Optimization Algorithm

- A local search framework for sequencing nodes on paths

- User configured search composed out of actions:
  - Destruction actions, remove nodes
    - Random destruction
    - Random area destruction
  - Construction action, insert nodes at best location by looking only at a random subset of unplanned nodes
Given a route invoke a ‘simple’ CP and execute a complete search to find the best sequence

- Extremely fast for small routes (<20) and improves or confirms optimality for a single route(s)
During search we store *all* intermediate routes and once every so often we invoke a set covering on this.
Quintiq took on the well-known Vehicle Routing Problem with Time Windows (VRPTW), a variation of an optimization problem created in 1959 by Dantzig and Ramser.

Service 1000 customers using a minimal number of vehicles traveling minimal distance.

The best known result prior to Quintiq was 90 vehicles with a total distance of 39,641.46 miles.

Quintiq was able to find a solution utilizing the optimal 90 vehicles, but with a total distance of only 39,468.68.

The VRPTW has been studied since the 1970’s and Quintiq achieved a result that researchers around the world have not been able to reach to date.

Quintiq's proprietary optimization technology which was used to solve this historic puzzle is the same software over used by our customers in over 500 locations in 78 countries around the world on a daily basis to solve their own unique planning puzzles.
Question and Answer Session