Optimised allocation of vehicles to service taking into account light maintenance requests

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GIRO Inc.

- Experts in productivity solutions since 1979
- Recognised world leading solutions
  - Public transport
  - Adapted transport
  - Postal services
- The last four UITP host cities, Helsinki, Vienna, Dubai, and Geneva rely on GIRO’s HASTUS™ solution
HASTUS

- Integrated software suite
  - Scheduling and operations
  - Customer information
  - Planning and analysis
  - All modes and types
- Recognised industry leader
- Over 30 years of innovation
- Extensive collaboration with leading agencies and universities
The history of *PlanBus*

- Round tables in user groups addressed subject
- Targeted meetings with interested parties
- Early implementation of a semi-automatic solution (list processing)
  - Use of user-defined fields and attributes (client specific)
- Preliminary algorithm design based on our *PlanOpt* solution, enhanced to address the task complexity
- Project with client to implement new generic *PlanBus*
  - Adjustment of *HASTUS* data model
  - Algorithm development and tests with real problems
Resolving vehicle assignment

- A complex task:
  - Large number of vehicles
  - Wide variety of vehicle models and characteristics
  - Multiple requirements: capacity, equipment, livery, advertisement, etc.
  - Parking constraints
  - Maintenance synchronisation
  - Even use of vehicles within a lot
Resolving vehicle assignment

- Often best assignment = best compromise
  - At least respect most important criteria
  - Still difficult to attain without tools
Adjustments to *HASTUS* data model

- Adjustment to existing objects:
  - More details for individual vehicle characteristics

- New objects:
  - Vehicle coverage requirements
  - Maintenance activities
  - Maintenance activity requests
  - Maintenance capacity at depots
  - Vehicle assignment rules
  - Vehicle assignment procedures
Optimisation

- Minimum cost of a network flux problem with multiple iterations
- Possibility to define multiple procedures
  - Different depots/divisions/subset of network
  - Different planning horizons
  - Different rules and parameters
  - Control of maintenance activities generation
- Possibility to fix portions of the solution
Optimisation

Vehicles

Flux 1

1

adjusted

Veh 1

Veh 2

Veh i

Veh n

Free

Flux 1

1

adjusted

Block 1

Block 2

Block j

Block m

\[ f (\text{free}) \]

\[ 2 \cdot 10^6 \]

\[ 0 \]
Initial implementation (2012)

- Vehicle coverage requirements
- Blocks
- Maintenance activity requests
- Maintenance capacity
- Available vehicles
- Assignment rules
- Assignment solution: vehicle task-vehicle ID & maintenance activities

PlanBus
Evolution

- Initial version provided all functions required by our client
- Mini algorithm “BestNext” implemented in 2013
- On the drawing board:
  - Consider depot layout, circulation constraints, and parking location on return
  - Take into account rail constraints
  - And more....
Conclusions

- System has now been running every day for over six months
- Initial performance and stability issues quickly resolved
- Results with PlanBus much better than previous manual processes
- Significant gains were observed meeting vehicle allocation targets
- PlanBus introduction allowed reduction in peak vehicle requirements