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Programme 3 - Harvesting and Operations

Improving forest transport efficiency through truck schedule optimization: a case study and software tool for the Australian industry

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Outline

- Timber transport in Australia
- Centralised scheduling and dispatching
- Fast Truck – CRC for Forestry
- Results from tests
- Road map

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Timber transport in Australia

- Transportation is the largest single component of wood supply costs (usually over 40% of total costs)
- The Australian forest industry spends about $1.2 M per day on transportation by trucks
- Identifying some efficiencies in transport management, such as dispatching and scheduling, should reduce some of this transportation expenditure

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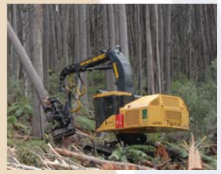
Centralised transport scheduling and dispatching



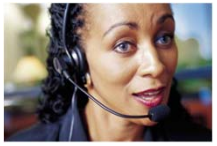
Current status/ location

Next haulage task

Operational plan

Production records

Roadside stocks



Haulage requirements

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Demonstrated results of centralised scheduling and dispatching

Some examples of where centralised dispatching has led to noticeable quantitative efficiency results:

- Hancock Victorian Plantations (HVP) using ASSET dispatching system:
  - 25% reduction in fleet size in Gippsland
- Stora Enso in Finland using EPO (Kuorma):
  - 5% reduction in annual transport costs
- Arauco in Chile using ASICAM scheduling system:
  - 20% reduction in operating costs
  - 30% increase in productive hours
  - 16 - 22% reduction in total costs

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Fast Truck: Motivation for software approach

- It creates truck schedules by a (annealing) simulation process minimizing the number of trucks required and the waiting times at origins and destinations, to meet demand at customers
- More efficient means of deriving an optimal schedule when compared to exhaustive search of solution space
- When number of trucks and loads increases, the possible number of dispatch solutions to choose from significantly rises,
- The most efficient approach is a software system to this problem in concert with a human-dispatcher

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Fast Truck: A software approach

- Fast Truck's current high level algorithmic approach:
  - Inform on possible efficiencies in truck schedules
  - Produces daily plan in advance
  - Assigns loads and trips to individual trucks
  - Minimise number of trucks and waiting times
  - Maximises utilisation of logging crews
  - Control stocks at landings
  - Display results in a spreadsheet

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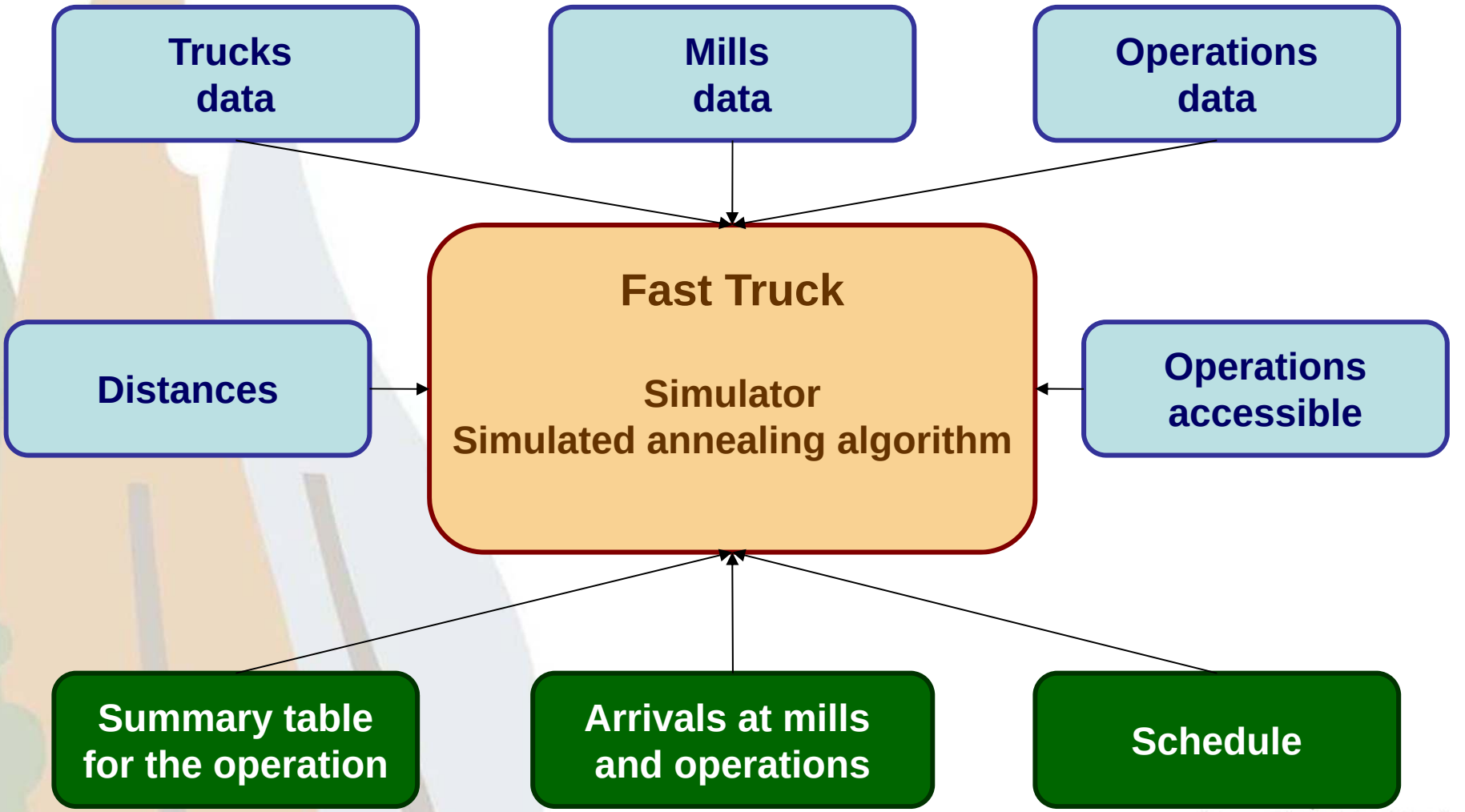
Fast Truck scheduling system



Software version comparisons

Fast Truck 1.0	Fast Truck 2.0
• Transportation efficiency due to in-field chipping operations of trucks • Single product (chips) and truck configuration, few destinations • Use at a tactical level • Factors analysed – chipper productivity and utilization, number of chipping operations, loading times, net truck payload	• Satisfy demand for different log products from forests, maximizing utilization of trucks, while minimizing transportation costs and waiting times • Use at an operational level • Multiple products, truck configurations, destinations • Use to inform on possible efficiencies in truck schedules and/or to plan a day in advance (linked to a dispatching system)

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Fast Truck 1.0

Untitled - FastTRUCK 2.0 - CRC Forestry

File Edit View Data Algorithm Solution Help

FastTRUCK 2.0

Summary of results

Number of trucks	=	21
Total daily cost ($)	=	26146 ($10.3 / t)
Total daily volume (tonnes)	=	2550.0
Average truck utilisation (%)	=	91.7
Average truck utilisation over shift (%)	=	78.9
Average truck waiting time (minutes)	=	55.0
Average loaded running (%)	=	54.5

Truck	Truck ID	Total time (hours)	Total cost ($)	Trips to custom.	Volume to custom. (tonnes)	Waiting time (minutes)	Utilisation (%)	Utilisation OS (%)	Running loaded (%)
1	1	9.9	1249.7	2	100.0	62.0	89.6	74.3	51.0
2	2	12.4	1372.8	3	150.0	49.0	93.4	96.1	44.4
3	4	8.9	1130.0	2	100.0	0.0	100.0	74.2	39.4
4	5	8.6	1143.1	2	100.0	16.0	96.9	69.0	60.3
5	6	11.3	1276.6	3	150.0	0.0	100.0	94.2	50.6
6	7	7.0	1019.4	2	100.0	26.0	93.8	55.0	71.6
7	8	8.0	1092.7	2	100.0	22.0	95.4	63.7	40.5
8	10	12.2	1371.0	3	150.0	90.0	87.7	89.4	53.7
9	11	12.8	1501.4	3	150.0	55.0	92.8	98.6	52.7
10	12	9.8	1196.7	2	100.0	15.0	97.5	80.0	53.5
11	13	11.9	1427.0	3	150.0	44.0	93.9	93.5	57.5
12	14	9.6	1121.8	3	150.0	27.0	95.3	76.0	63.0
13	15	8.6	1188.5	2	100.0	24.0	95.4	68.6	51.9
14	16	10.6	1216.6	3	150.0	26.0	95.9	84.6	57.7
15	17	11.3	1214.4	2	100.0	145.0	78.6	73.8	54.1
16	18	11.4	1335.5	3	150.0	21.0	96.9	91.7	71.4
17	19	8.4	1076.9	2	100.0	77.0	84.7	59.2	46.7
18	20	13.8	1522.4	3	150.0	136.0	83.5	95.7	68.4
19	21	8.4	1122.9	2	100.0	20.0	96.0	67.4	56.3
20	23	11.5	1312.9	2	100.0	135.0	80.5	77.2	52.0
21	25	11.8	1253.7	2	100.0	164.0	76.9	75.8	48.2

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Fast Truck 1.0: Metrics for evaluating efficiency

- Fleet size
- Truck utilisation
- Cost per tonne
- Daily production

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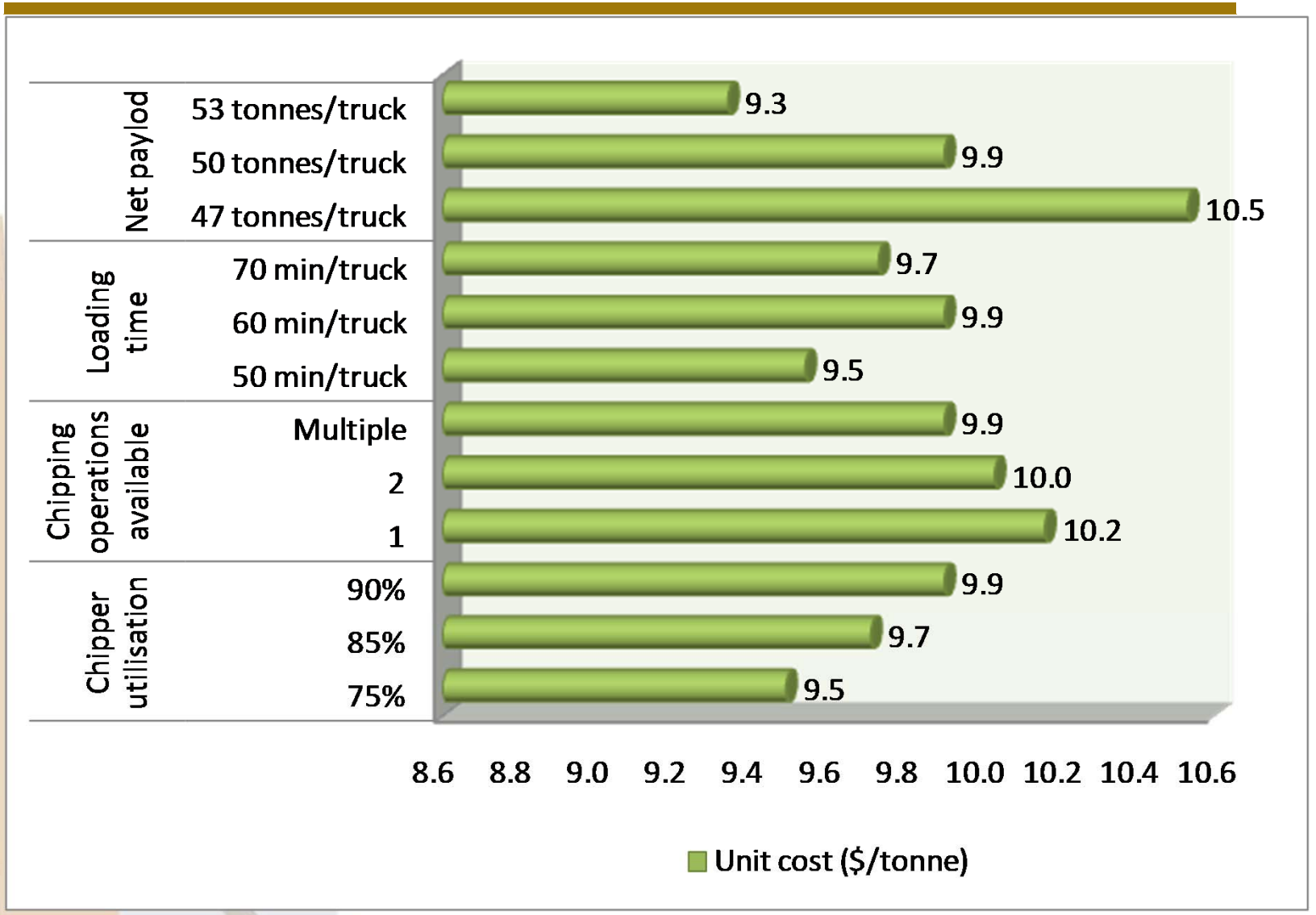
(Forecast) Effect on cost per tonne



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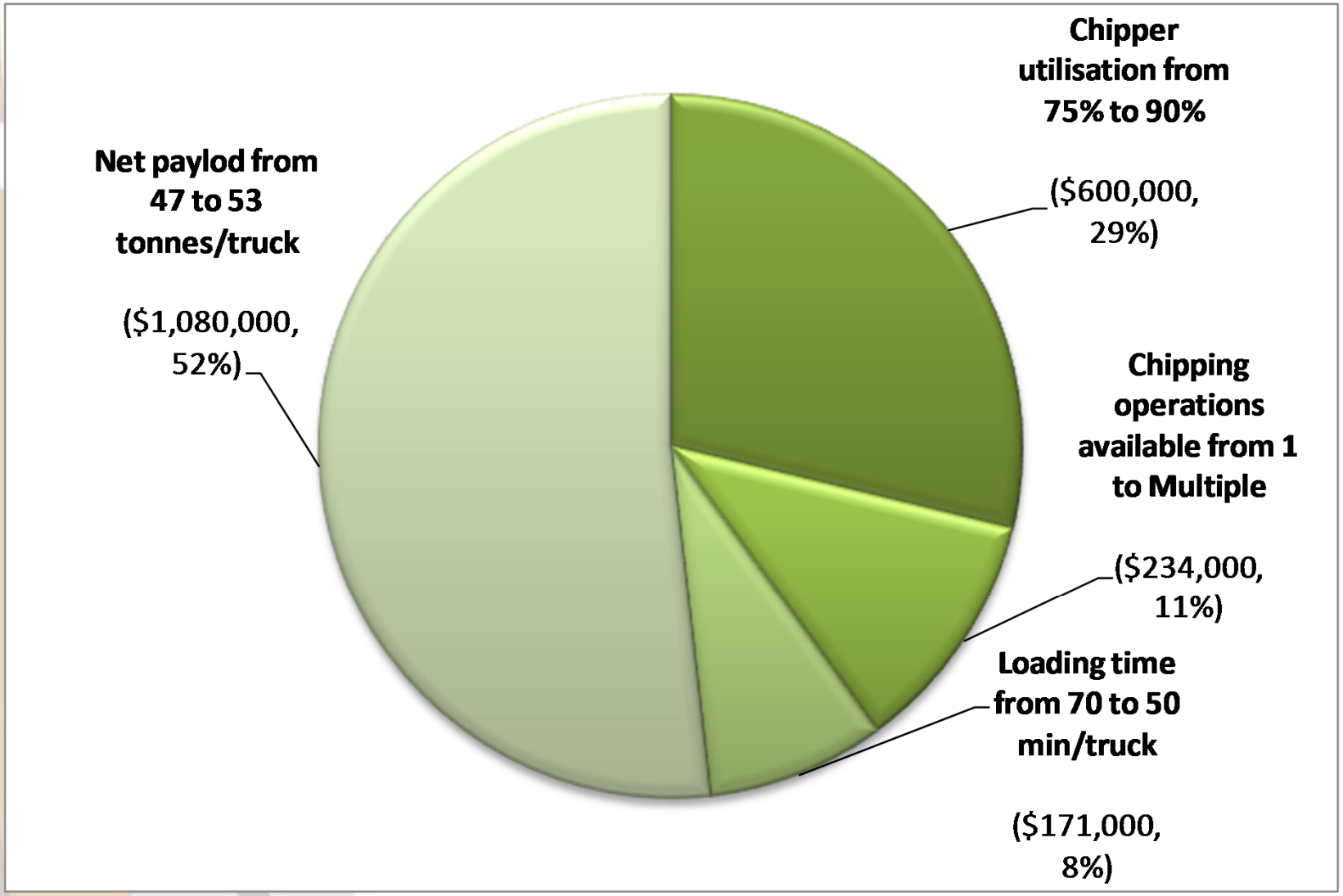
(Forecast) savings for an annual freight task of 900,000 tonnes



Fast Truck 2.0

- Hypothesis: forestry supply chains lose ***value*** from the costs arising from the **inefficient scheduling** of trucks which transport wood from coupes to customers

- The **Fast Truck 2.0** project is developing simulation software to support expert schedulers in the **efficient** daily scheduling of trucks to realize cost savings of around **10%**

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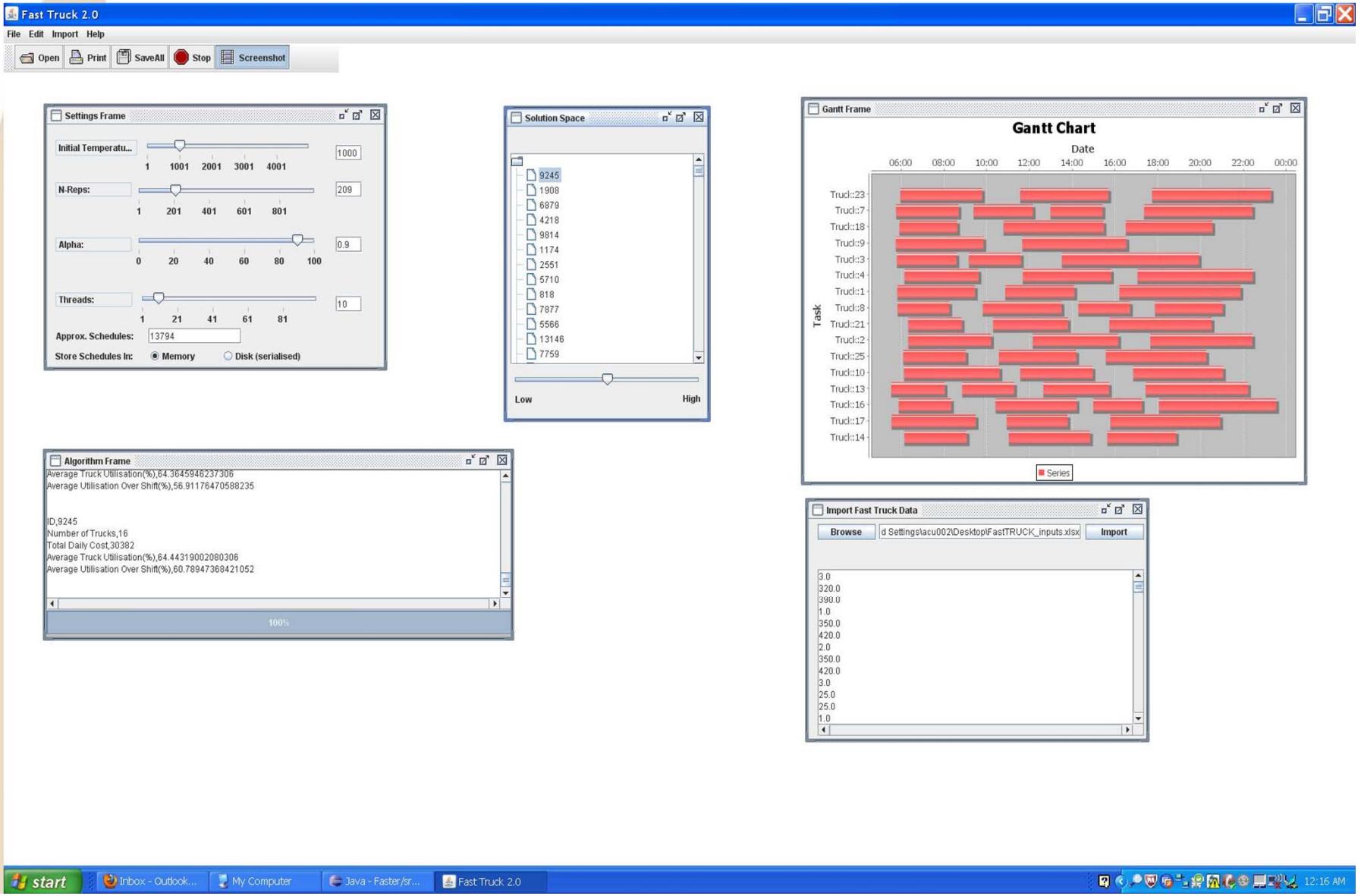
Fast Truck 2.0



Human Scheduler versus Fast Truck 2.0

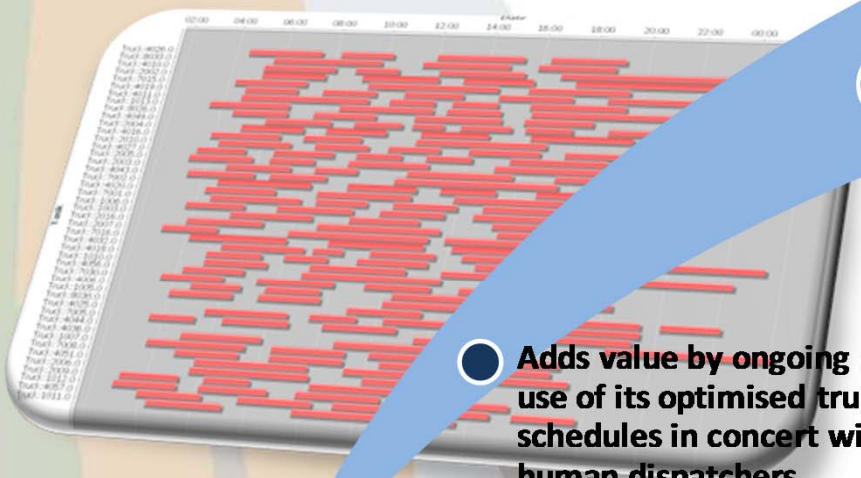
Metrics	Human	Fast Truck	Comparison (Fast Truck Improves)
Number of Trucks	55	45	↓ 22% (10)
Total Daily Cost ($)	99,215	81,585	↓ 21.61% ($17,630)
Average Utilization over 12-hr shift (%)	73.92	78.60	↑ 6.33% (4.68%)

Based on one day's analysis of data from the Asset system used by Hancock Victoria Plantations (HPV). Data set consists of: 362 truck movements, 55 trucks, 13 customers, 15 forests, 25 coupes, 11 products. Future work is validating on several months of data before moving into field trials.

Fast Truck 2.0: Benefits

- These results suggest a more efficient schedule adds value of 21% or $17,630 each day into this forestry chain.
- Current work with expert schedulers from Hancock Victoria Plantations (HVP) is validating the system to ensure these forecast savings can be realized in practice.

Fast Truck optimised schedule



Human-expert derived schedule

Adds value by ongoing daily use of its optimised truck schedules in concert with human dispatchers.

Adds value by exploring the solution space with alternative scheduling strategies such as back hauling, to identify improvements in organisational wide scheduling operations.

Adds value by forecasting results for long term decision support across the chain for such decisions as: purchasing of equipment, coupe and equipment placement, road design, and centralised truck dispatch.

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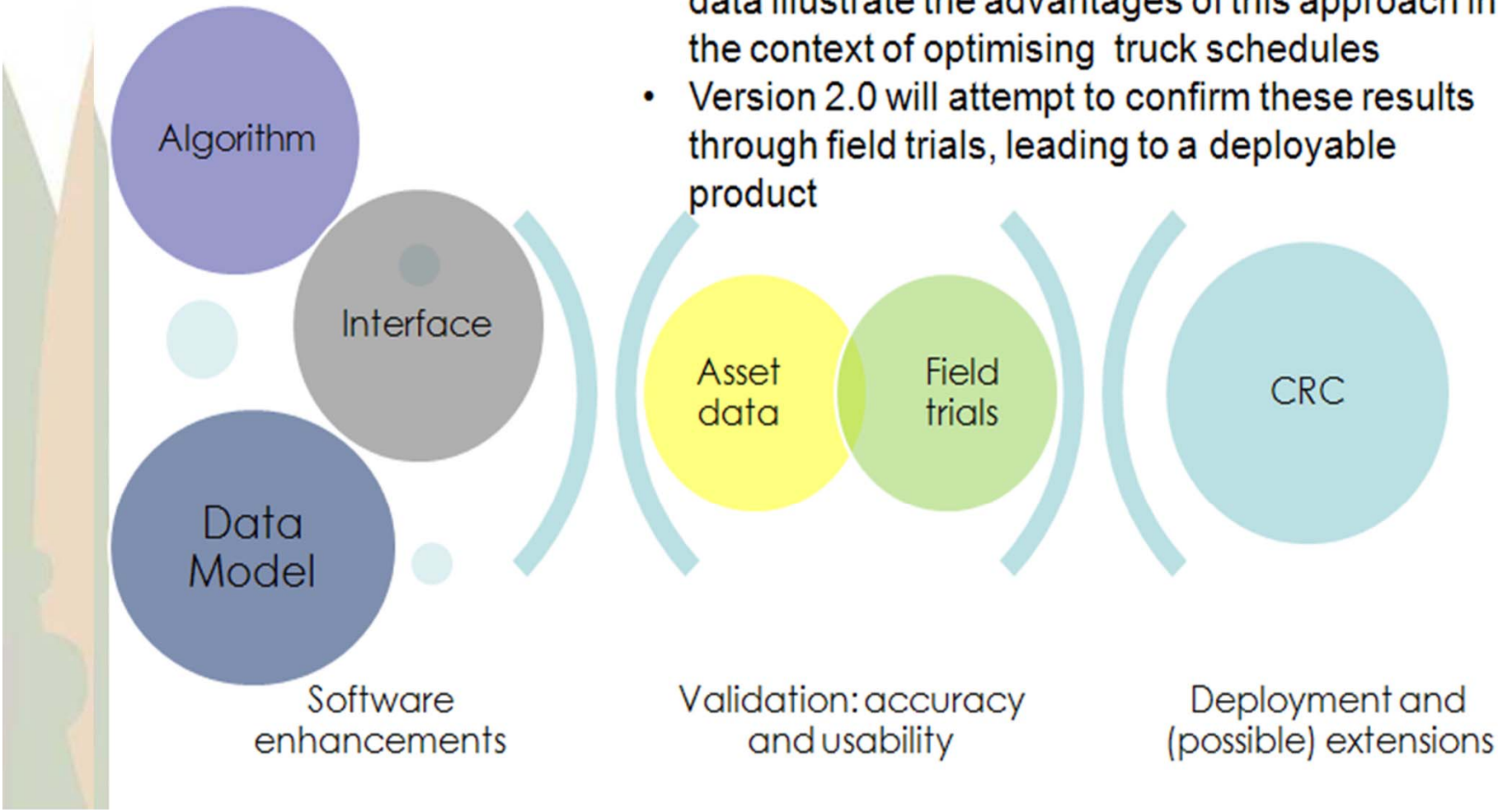
Fast Truck 2.0 roadmap

- Results obtained from version 1.0 on synthetic data illustrate the advantages of this approach in the context of optimising truck schedules
- Version 2.0 will attempt to confirm these results through field trials, leading to a deployable product



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