

Cyclic planning in a multi-echelon network

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EURODECISION

10th of July 2007

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1.a) Characteristics

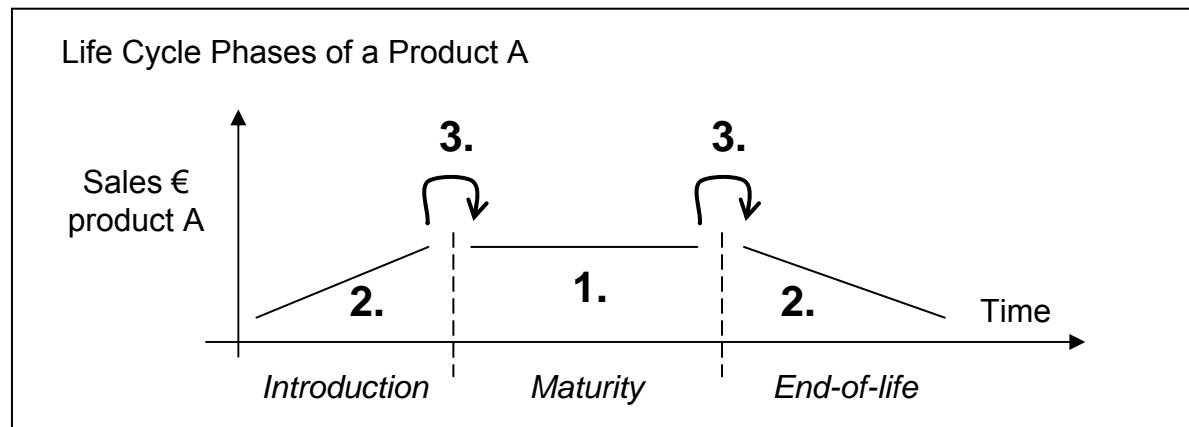
- I. ECLIPS : Extended Collaborative integrated Lifecycle Planning System
- II. Research project in Supply Chain Management
- III. Period : 3 years from Q2'06
- IV. Partners:
 - a) MÖBIUS Be Supply Chain expertise
 - b) Riga Technical University Lv Academic
 - c) EURODECISION Fr Optimization expertise
 - d) LOQUTUS Be Software development
 - e) Huntsman De End User (Chemical)
 - f) Pliva-Lachema Diagnostica Cz End User (Pharmaceutical)
- V. Partially funded by the European Commission in the context of its Research Framework Programme 6



1.b) Research Agenda

I. Extend the State-of-the-Art taking into account

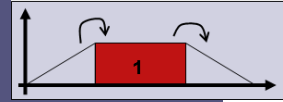
- a) The Multi-Echelon, optimization of a supply chain
- b) The different phases of a product lifecycle and their integration



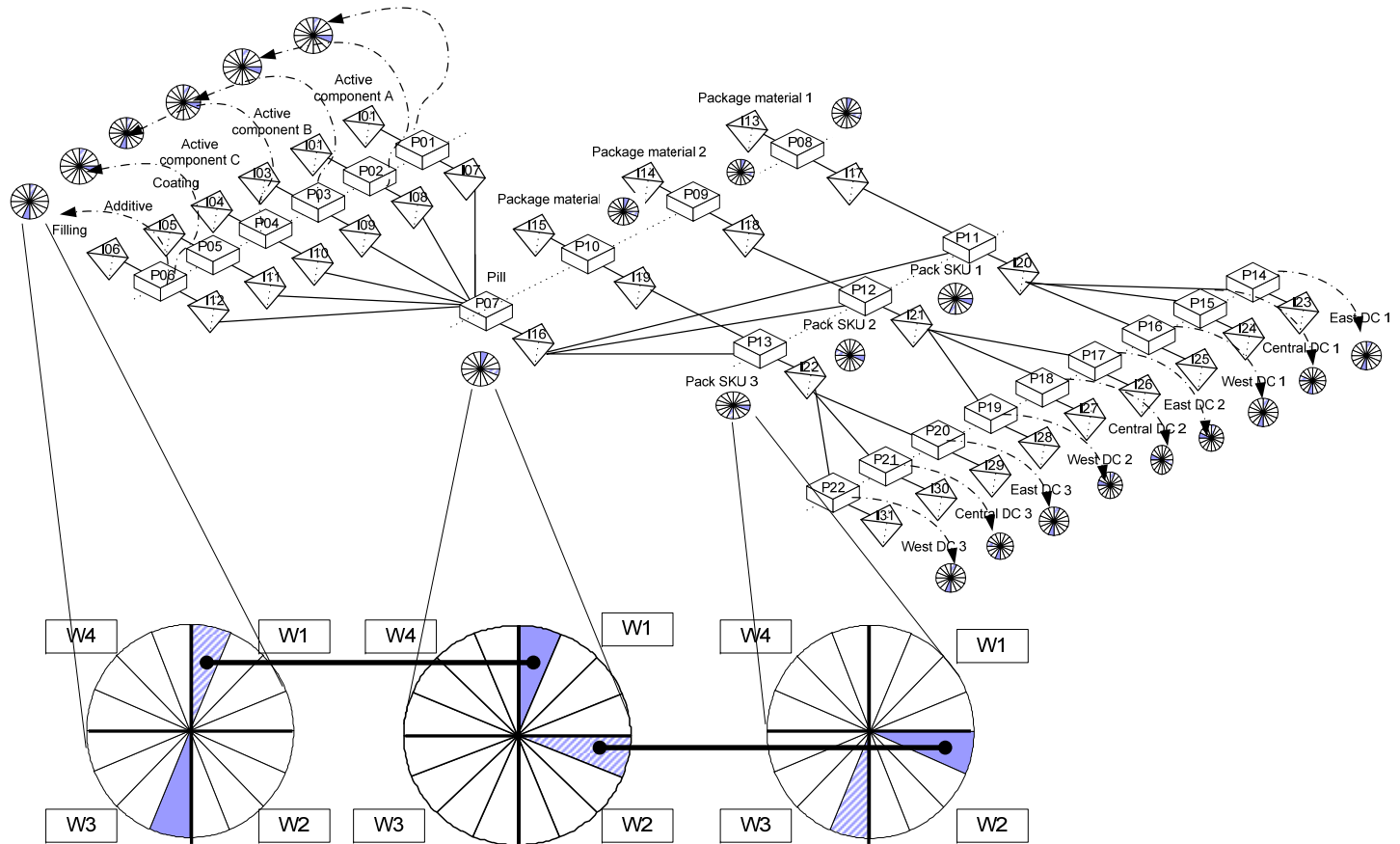
II. 3 Key Research Topics

- a) Maturity phase : Multi-Echelon Cyclic Planning
- b) Introduction / End-of-life : Improved Statistical Forecasting
- c) Lifecycle Integration : Automated switching of Supply Chain Control

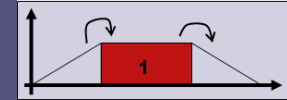
2.a) Multi echelon cyclic planning



- I. Find cyclic schedules for long term planning at every echelon.
- II. Example: 3 processes, Synchronized every 4 weeks.

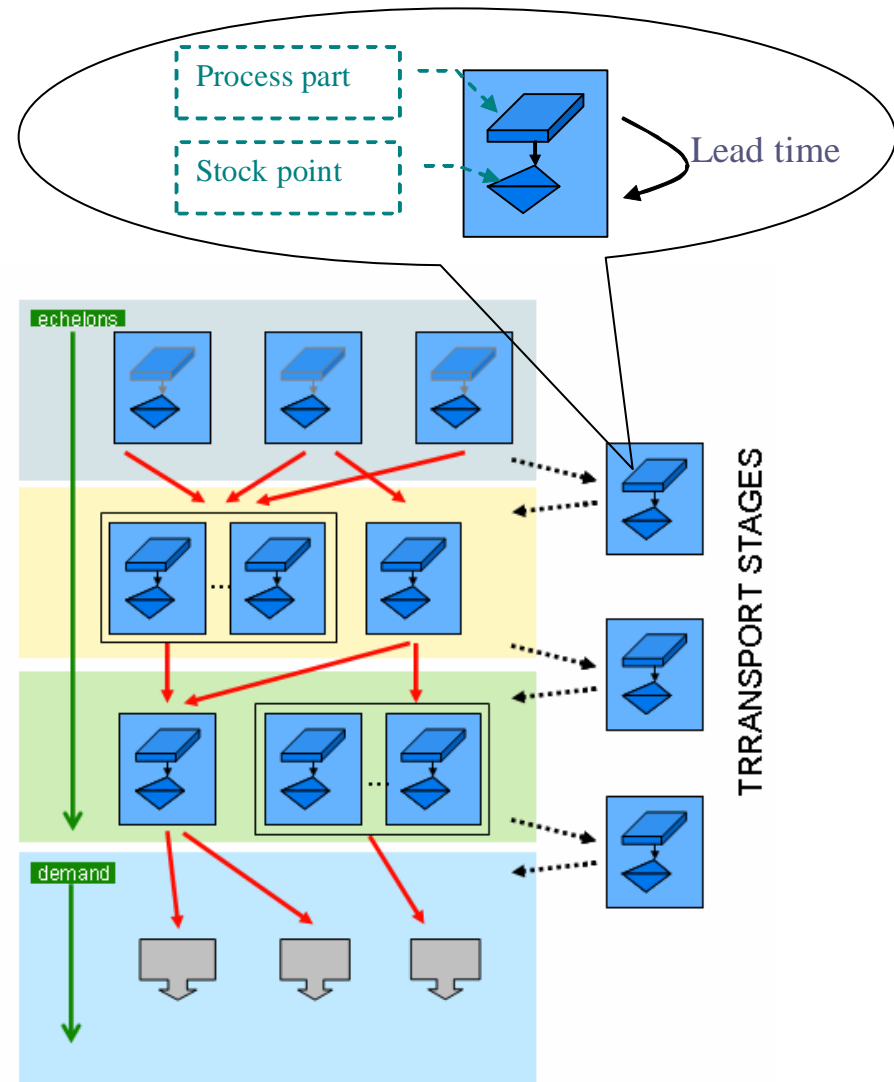
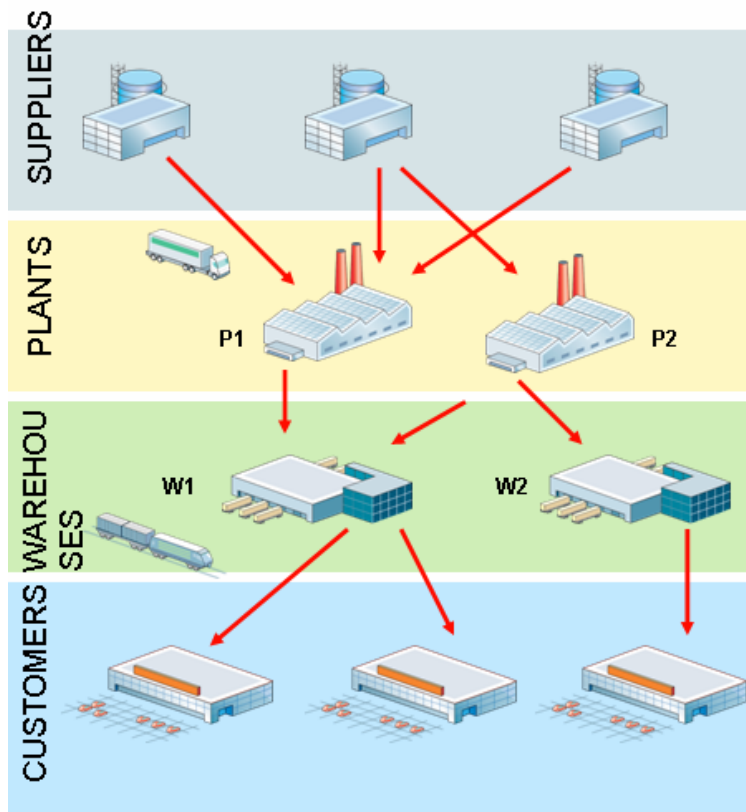


2.b) Network

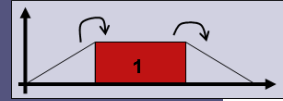


Network is a user input

Unlimited number of echelons, stages (processes)...

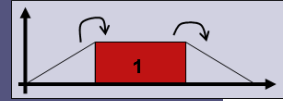


3.a) Data



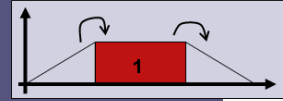
- I. Network
- II. BOM (Bill of material)
- III. Demand
- IV. Capacities (min/max for production and storage)
- V. Costs

3.b) Variables



- I. **Production quantity** for each stage and time step
- II. **Storage level** for each stage, product and time step
- III. **Flow of product** provided by one stage to another stage or customer at a given time step
- IV. **Status of the process** (switched on/off) for each time step
- V. **Cycle** for each stage (selected with binary variables)

3.c) Constraints



- I. Inventory, production and flows balance constraint** for each stage, product and time step
 - the new production once the lead time is passed +
 - the stock at previous period (or initial stock) =
 - the new stock +
 - quantities provided by current stage to following stages +
 - quantities provided by current stage to customers

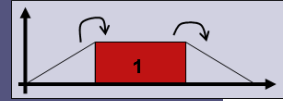
- II. Input product constraint (BOM)**

- III. Demand constraint** for each customer, product and time step

- IV. Production capacity constraints** by stage and time step

- V. Storage capacity constraints** by product, stage and time step

3.c) Constraints



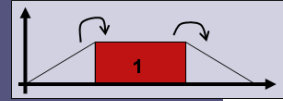
VI. Cyclic constraints

- A single cycle has to be selected by stage
- The production process is switched on once during each cycle for each stage
- The first production can happen at any moment during the cycle length

VII. Optional (shared capacity)

- Storage capacity constraints by stage and time step
- Storage capacity constraints by group of stages and time step
- Production capacity constraints by group of stages and time step

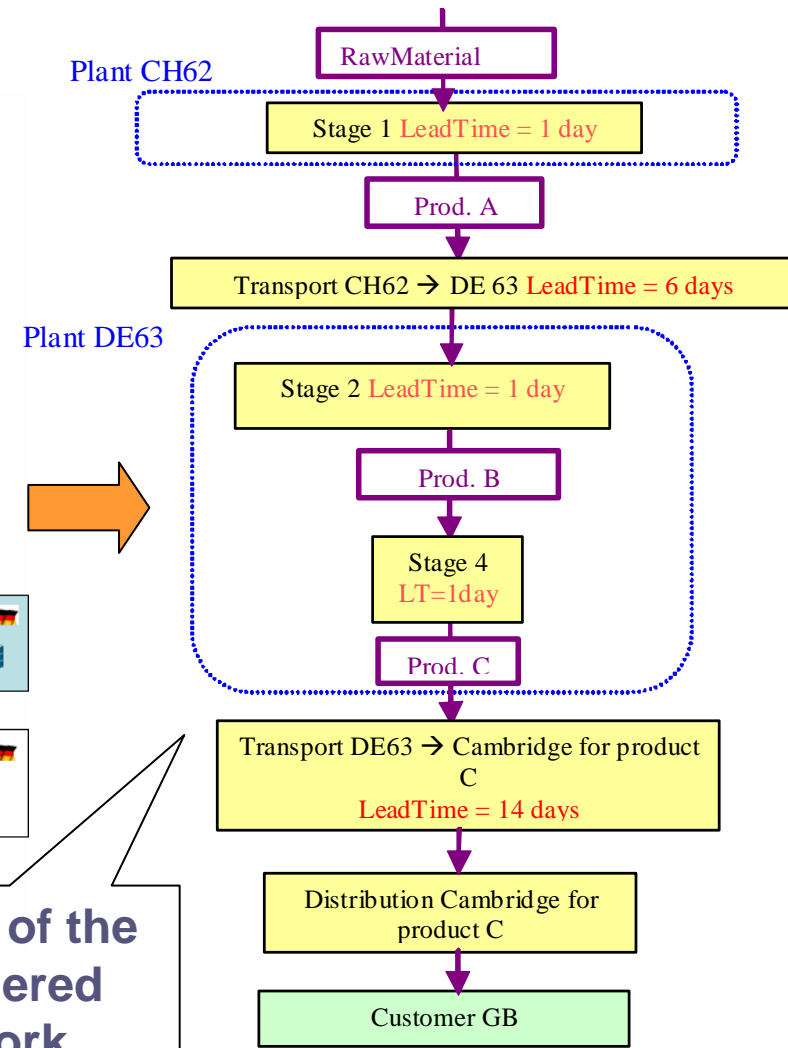
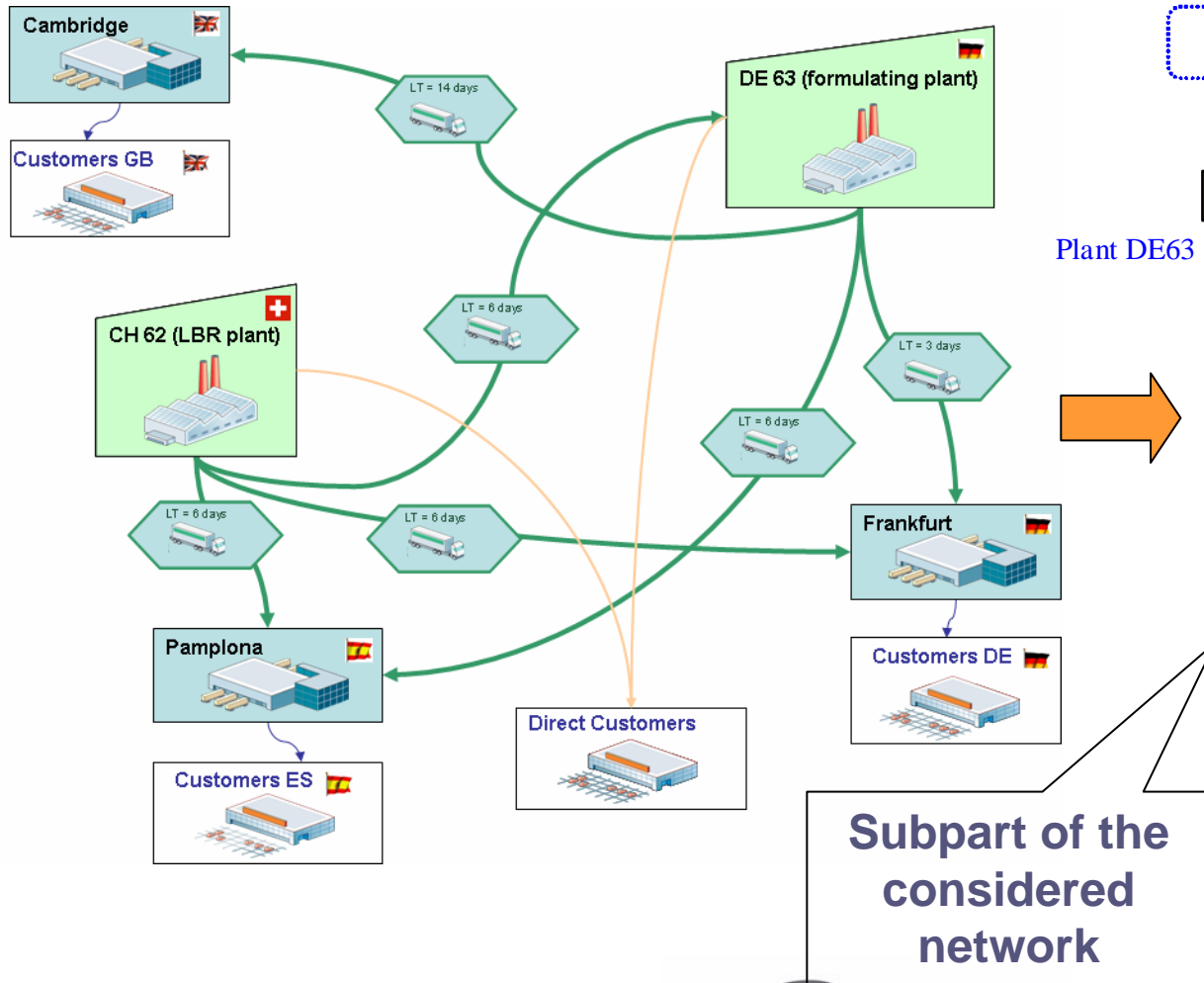
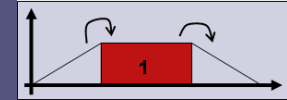
3.d) Economic function



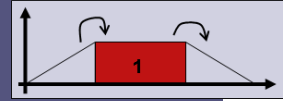
MINIMIZE

- a) Production costs
Linear cost (€ / unit of product)
- b) Setup costs
Fixed cost (€)
- c) Holding costs
Linear cost (€ / unit of product)

4.a) Huntsman network

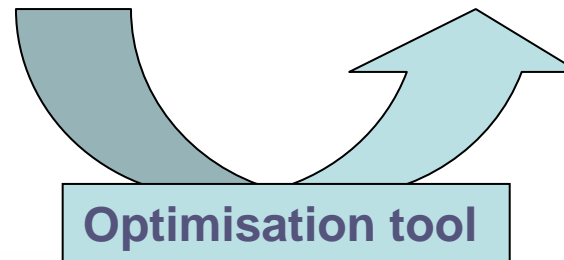


4.b) Inputs and outputs

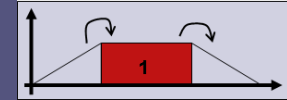


Inputs	Value
Network	1 products family
Granularity	Day
Planning horizon	90 days
Demand per period	Average of global demand
Costs : setup, holding, production	Assumed
Capacity limits	None

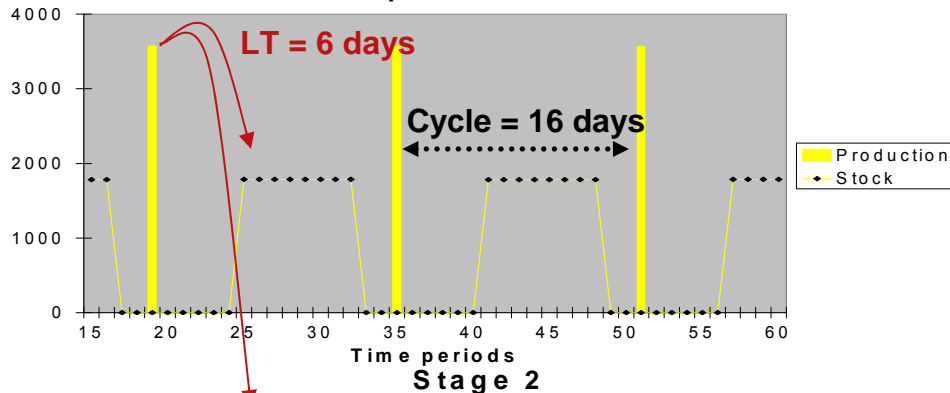
Outputs
Production quantity per stage and period
Stock level per product and period
Cycle per stage



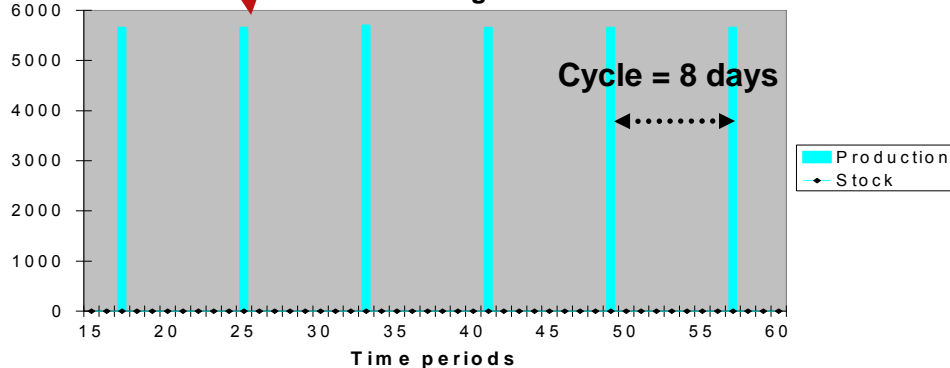
4.c) Production cyclic planning



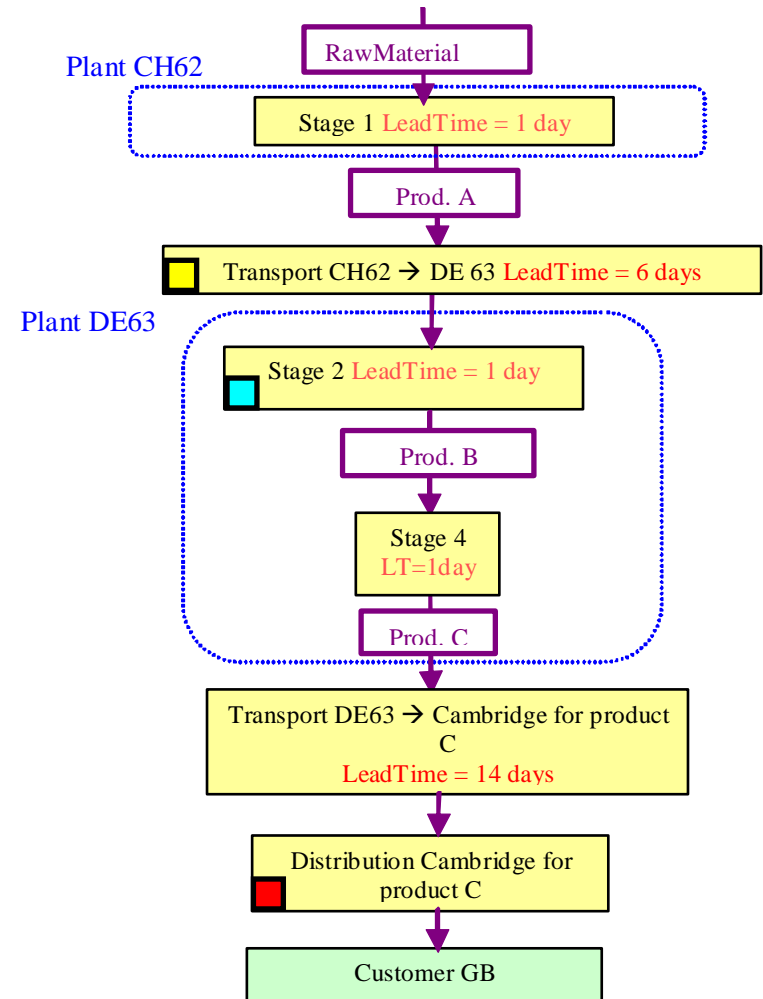
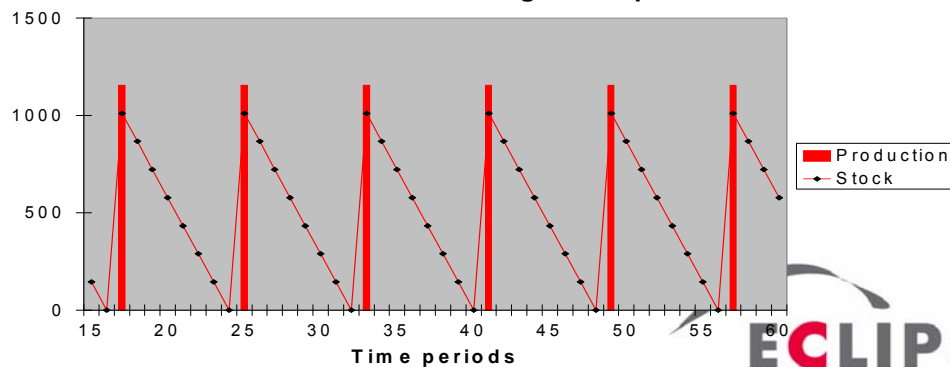
Transport CH62-DE63



Stage 2



Distribution Cambridge for product C



Any question?

