



Discrete-Event Simulation – Examples



- Projects of a consulting company Solvers, Ltd.
- European projects of the RTU Department of Modelling and Simulation
- Typical ARENA models – *by Mrs. Jelena Pecherska*



Solvers, Ltd.

Location: Riga, Latvia

Manager: Mr. Valery Lopatenok, M.Sc. (RTU ITI)

Main areas of consultancy:

- transportation engineering
- production
- logistics
- Web site: www.solvers.lv



E-n Microwave Systems

- Design of a new production line
- Aim: Optimisation of buffer capacities to maximise the throughput under a minimal WIP
- Result: Increase of the throughput by 20%



Production of accumulators by Tudor

- Production scheduling for different types of accumulators
- Aim: Minimisation of production time
(*by minimisation of re-settings*)
- Result: Production period of [34 - 36 days]
decreased to [27 - 29 days]



Ralf Nilson AB footwear warehouse

- Evaluation of a reconstruction plan
- Aim: Minimisation of investments
- Result: Decreasing investments by 70 %
(by suggesting an alternative reconstruction plan; the original one would cost 200.000 \$, but decrease the throughput by 30%)



Ventspils Nafta

- Operation planning for different emergency situations
- Aim: Minimisation of processing time
- Result: Operation scenarios



RTU Department of Modelling and Simulation

- Main areas of activities:
 - discrete-event system simulation
 - industrial logistics management
 - logistics information systems
 - decisions support systems
- Staff: 3 full professors, 1 associate professor,
3 part-time docents (industry),
1 lecturer, 5 teaching assistants,
2 research assistants, 1 research fellow
- Web site: www.itl.rtu.lv/mik/english.php

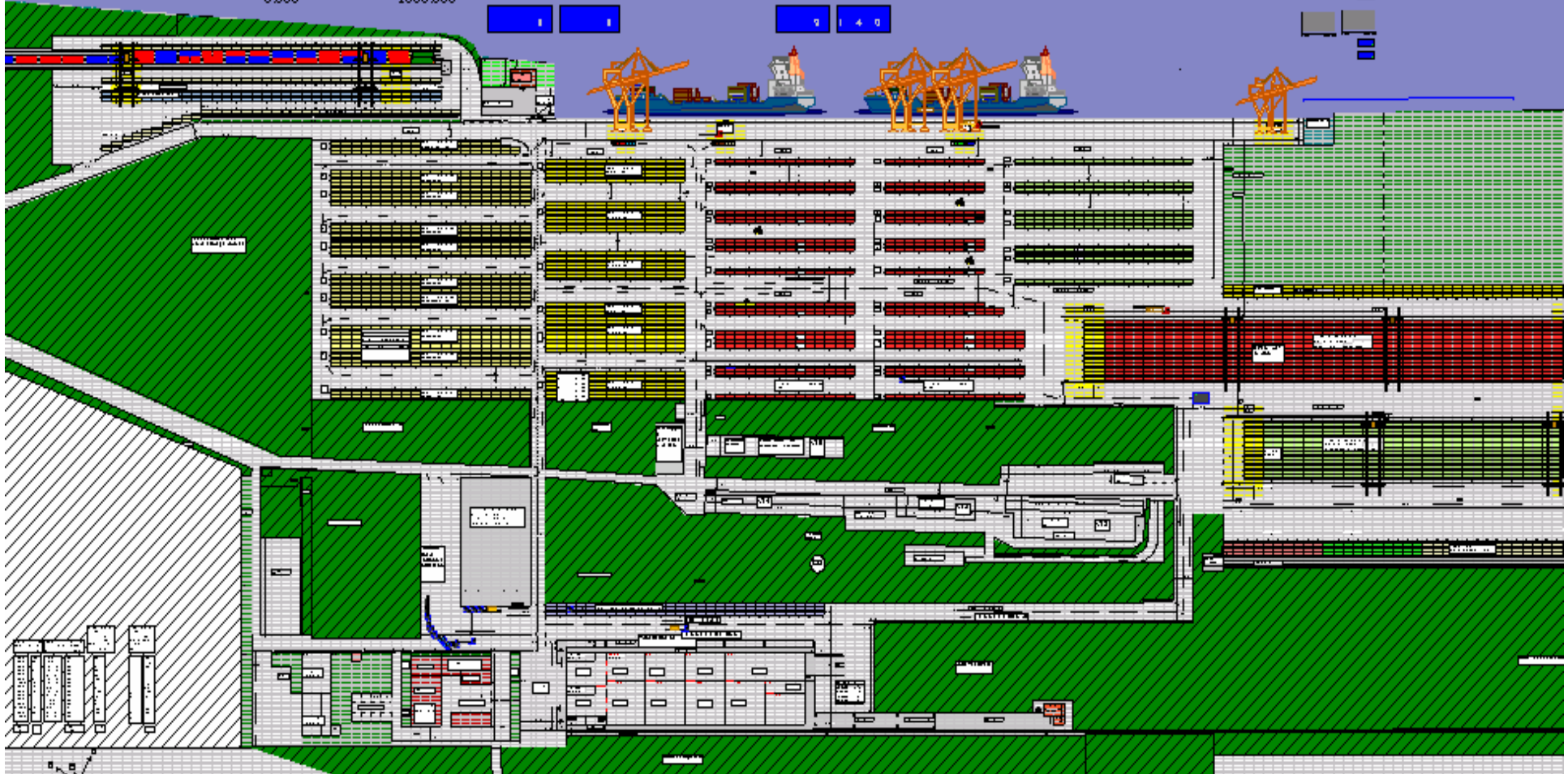


BALTPORTS-IT project "Simulation and IT-solutions: Applications in the Baltic ports' areas of the newly associated states" of the 5th Framework Programme (IST, 2001-2003, www.baltports-it.com)

- Simulation of logistics processes at the Baltic Container Terminal (*within Riga Free Port*)
- Aim: To support terminal management in operation planning and assigning technical resources
- Performance function: Productivity of berths and technical resources
- <http://www.balticit.com/main/solutions.htm>

02:06:54

10 September, 2003



Processing time

Monitoring of operations

Time (min:sec)
00:42:09

Model Time, sec
2 5 2 9

1 Management Algorithm

1 Restow
0 Hatches

Tot. Import onboard
0

Hatches Restow

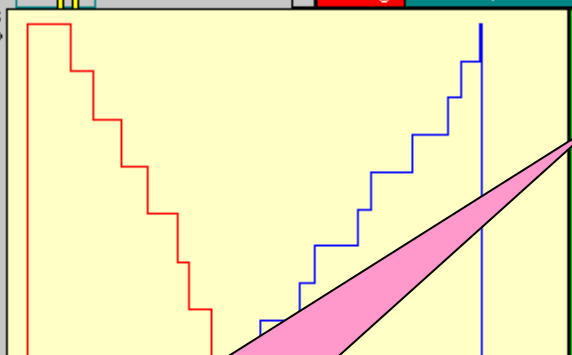
BERTH 1

DISCHARGE
7

LOADING
0

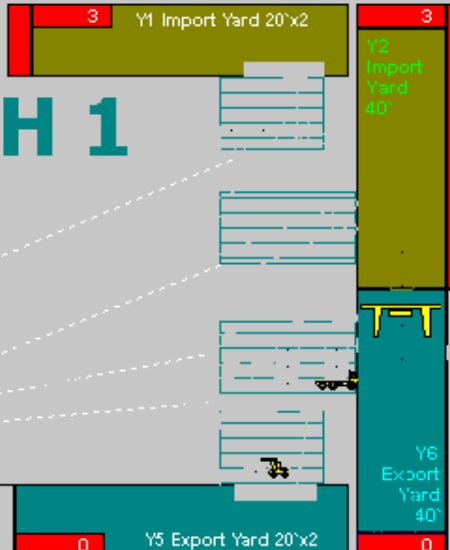
Tot. Export onboard
0

Units 100%

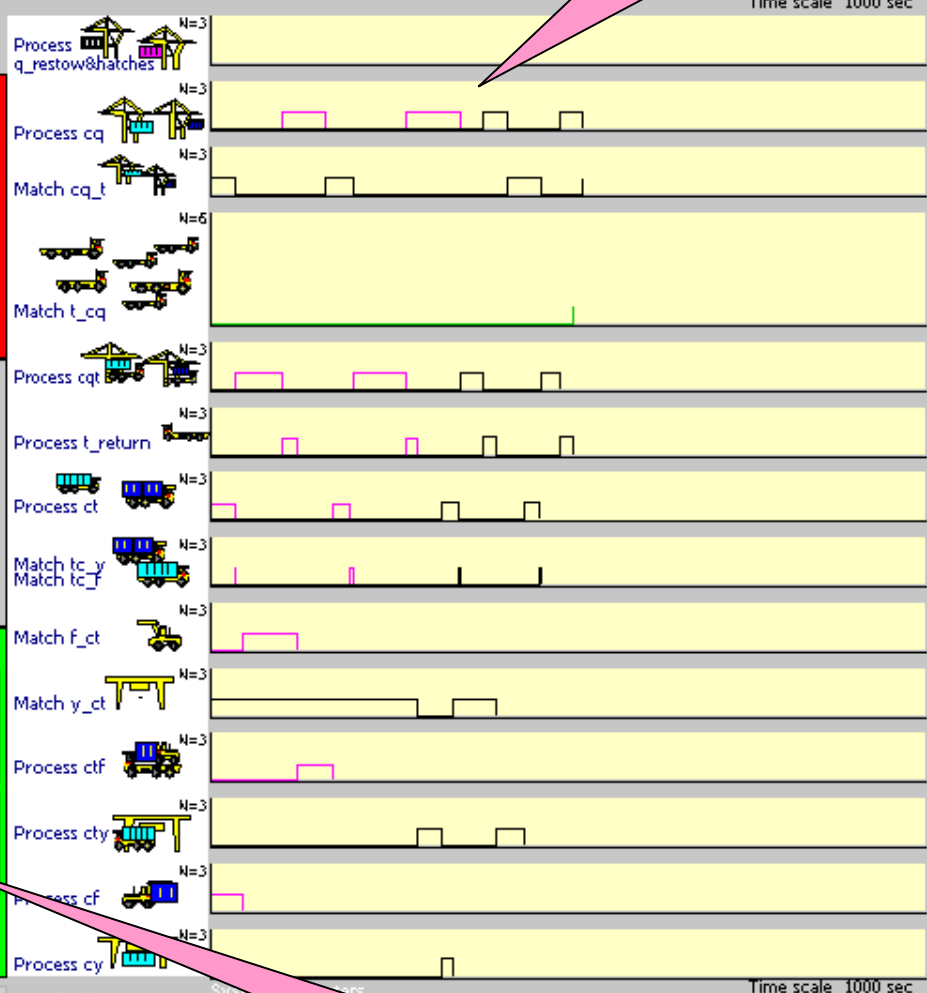


1QC+1TR+1FL+1YC
Moves/h, import
 4 8 . 1
Moves/h, export
 3 7 . 6
 Model Time, sec
 2 5 2 9

RESOURCES, discharge = 1, loading = 2
 QC1 TR1 TR2 TR3 FL1 YC1
 ● 2 ● 2 ● 2 ● 2 ● 2 ● 2
 QC2 TR4 TR5 TR6 FL2 YC2
 ● 2 ● 2 ● 2 ● 2 ● 2 ● 2



Berth 1. Import / Export Operations Dynamic
 QCranes=1, Trucks=1, FLifts=1, YCranes=1



Efficiency of import operations (moves)

Efficiency of export operations (moves)



Simulation of a production process at Decorpart company:

- Within a SimServ project of the 5th Framework Programme (*GROWTH, 2003: www.sim-serv.com*)
- Decorpart: Industrial partner in Nelson, UK
- Aim: Sequencing and scheduling of production orders
- Evaluation criterion: Total planning and production time for all orders
- 1st-level model: Business process simulation for identification of a critical stage => Anodising process
- 2nd-level model: Detailed simulation of the critical stage
- www.sim-serv.com/pdf/success_stories/member_24_story_84.pdf



Business process visualisation

PLANNING TIME FOR ENQUIRIES

Mode processing time: 0000

Half Range processing time: 0000

DECORPART

RUNTIME ESTIMATES

Confirmed orders in process (PH/PC): 0000 0000

Completed orders (PH/PC): 0000 0000

CUSTOMERS



Processed Enquiries 0000

Canceled Enquiries 0000

Pharmaceutical Enquiries



Processed Enquiries 0000

Canceled Enquiries 0000

Personal Care Enquiries

PLANNING

Waiting Enquiries

Waiting Orders



Pharmaceutical PLANNING for enquiries and orders

Waiting Enquiries



Waiting Orders



Personal Care PLANNING for enquiries and orders

Total Revenue (Euro) 00000000

FACTORY

Missed Revenue (Euro) 00000000

PRODUCTION

00

Work In progress



Pressing

00

Work In progress



Degreasing

00

Work In progress



Jigging

00

Work In progress



Anodising

00

Work In progress



Packing



Anodising process visualisation

ProModel - Model limited frames with loading and unloading.MOD - [Normal Run]

File Simulation Options Information Window Interact Help

Wk: 1 Thu 20:30

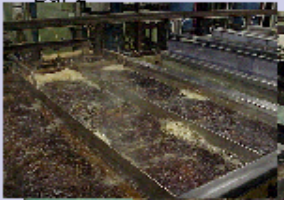
Bar 1



Order no
16

Colour code
58

Bar 2



Order no
11

Colour code
1

Bar 3



Order no
19

Colour code
1


Bar 4



Order no
0

Colour code
0


Bar 5



Order no
16

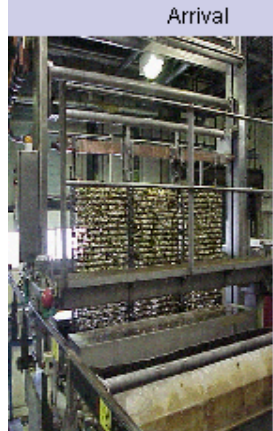
Colour code
58

Bar 6



Order no
22

Colour code
183




Bar 7



Order no
11

Colour code
1

Bar 8



Order no
0


Colour code
0

Number of orders left: 20

Number of batches left: 757

Batches per hour: 7.84

Bar 9



Order no
11

Colour code
1

Bar 10



Order no
0

Colour code
0





References

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2. Stewart Robinson. Simulation: The Practice of Model Development and Use. John Wiley & Sons, 2004; <http://eu.wiley.com//legacy/wileychi/robinson/>
3. Averill M. Law, W. David Kelton Simulation Modeling and Analysis. 1st edition, McGraw-Hill, 1982; 2nd edition, 1991; 3rd edition, 2000; <http://www.mhhe.com/engcs/industrial/lawkelton/>



References

4. *SCS, The Society for Modeling and Simulation International:*
<http://www.scs.org/>
5. *ECMS, European Council for Modelling and Simulation:*
<http://www.scs-europe.net/>
6. *Simulation software. Survey1:*
<http://www.lionhrtpub.com/orms/surveys/Simulation/Simulation.html>
7. *Simulation tools. Survey2:*
<http://www.idsia.ch/~andrea/sim/simtools.html>



References

8. *Winter Simulation Conference:*
<http://www.wintersim.org/> and
<http://www.informs-cs.org/wscpapers.html>
9. *Liophant Simulation, Italy:*
<http://st.itim.unige.it/liophant/>
10. *Sim-Serv Virtual Centre for Simulation in Manufacturing:*
<http://www.sim-serv.com/index.php>
11. *Institute for Simulation and Training/ University of Central Florida:*
<http://www.ist.ucf.edu/>