Incontrol Enterprise Dynamics

Modeling
Simulation
Visualization
and Control

EduSuite
v. 4.01

www.EnterpriseDynamics.com

What is Entreprise Dynamics ?

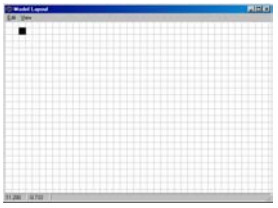
- **ED** is a 3D computer modeling tool for discrete processes
- **ED** is used to simulate, monitor, or even control processes
- **ED** can run models in synchronized real time or compressed simulated time
- **ED** has many links to external software and devices
- **ED** is expandable, customizable, and reusable
- **ED** allows you to add your own functionality to the software
- **ED** is auto-compiled allowing model changes during run time
- **ED** models can be run, animated, saved and viewed from any hierarchical level

ED is based on the 'Atom Concept'

- An atom is an "object" that contains code, data, relationships, connectivity, and animation.
- Everything in ED is structured as an atom
- Atoms have four dimensions (x,y,z,time):
  - (x,y,z) location, speed and rotation (relative to atom's container)
  - (time) dynamic behavior over time
- In the future we will call atoms by more functional names such as products, queues, servers, conveyors and so forth
- 4D-script: functional programming language behind atoms specifically developed for ED

ED Interface

- Library tree
- Model layout window



Model Layout Window

- Edit:
  - Cut, copy, paste and delete atoms
  - Set the rotation
- View:
  - Channels and grid settings
  - Override display settings
  - Up <Ctrl+U> and down <Ctrl+D> in hierarchy (highest is the model level)

Library Tree

- Atoms categorized
- Ready to be dragged in the model layout to create model
- Add atoms to library
- Delete atoms from library
- Always save library when changed

Library Tree Atom Info

- View:
  - Atom Info: will display atom help

- Tree
  - refreshes, collapse or expand the treeview

ED Interface

- Model tree
- Menu and toolbars

Model Tree <Shift + F3>

- The treeview of the complete model
- See hierarchical relationships more easily
- Tree-menu is the same as the library tree plus VEG:
  - visual editing guide: displays the active tree atom in a simple layout view
  - autoscale, zoom in, zoom out

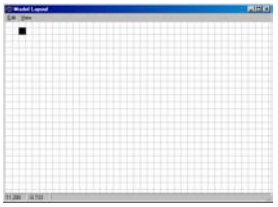
Basic steps of modeling in ED

1. Create a model layout
2. Connect channels
3. Edit the resource parameters
4. Run simulation
5. Analyze results

Step 1. Create a model layout

Menu: <Model | Create a Model>

Drag atoms from the atom tree in the Library window and drop into the Model Layout window



Move and resize atoms in the model layout

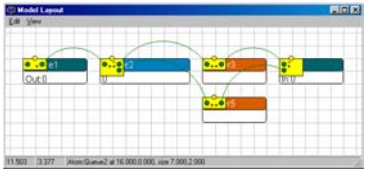
- Resize atoms
  - click on the *bottom right-hand corner* of the atom and drag
- Move atoms:
  - click *anywhere* (except on the bottom right-hand corner) on the atom and drag

Moving around in a view

- Pan:
  - press and hold left mouse button
  - move around your mouse
- Zoom
  - press and hold both left and right mouse button
  - zoom in: move your mouse vertically up
  - zoom out: move your mouse vertically down
- Change view angle (3D only)
  - press and hold right mouse button
  - move around your mouse: the center of the view window is your pivot point

Step 2. Connect the atom channels

- Model Layout Menu: <View | Channels>



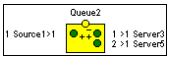
Atom Channel Concept

- 0..n input/output channels
  - Input and output channels are used to pass atoms or to reference to other atoms
- 1 central channel
  - Central channel is used for referencing only
- Channels connect:
  - one output channel is connected to one input channel
  - multiple channels can be connected to the central channel
  - connect to own central channel to delete the connection

Atom channel connections

- <View | Channels> to
  - connect by dragging mouse from dot to dot
  - double click on channel dot: interactively change a connection
  - right click on channel dot: show current connections
  - create/delete channels by pressing the small plus "+" or minus "-" sign

- Channels as arch or line
  - <view | set | channels as arch>
  - <file | preferences | visualization>

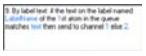


Step 3. Edit the atom parameters

- Click on an atom in either the Model Layout window or the Model Tree window
- double click or right-click (sometimes different functions)

Predefined Logic

- Predefined logic can be used by choosing a logic from the list and entering the values



- By clicking the square next to the smart list you can look at the corresponding 4D Script

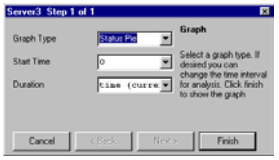
Step 4. Run the Model

- <model | run>, <Shift + F4> or  to popup run control
  - unlimited speed
  - (synchro) real time
  - slide control
  - custom speed

- press reset and then run to start the simulation
- watch the clock with <view | clock> or 

Step 5. Analyze results with reports and graphs

- Menu: <Results | Summary Report>
- Menu: <Results | Graphs>



Reset

- Always press the reset-button before running a model
- Reset is automatically executed when
  - opening and saving a model
  - saving an atom to disk

- Reset initializes the model, clears statistics and destroys all “flow”-elements (products) from the model

Viewing graphs

To generate graphs, always

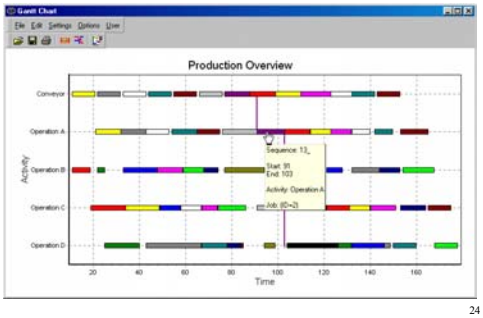
- switch on history (run control menu).
- switch on the history of the atoms that you want to get results from (< Simulate | History>).

- Be careful with switching on the history of atoms because the history file grows very fast in large models.
- Careful when selecting <Results | Graphs>, only have atom selected in model layout which have history turned on

Step 5. Analyze results with reports and graphs

- T131-Data Recorder
  - writes user defined variables to table when product enters
- T033-Graph
  - creates customizable graphs/charts
- T154-History viewer
  - displays raw history data for a specified atom
- T149-Model Documentation
  - creates a text file listing key information for all atoms in model
- T090-Monitor
  - graphically displays user defined variables in 2d window
- T147-Report
  - creates report of standard system variables in table or rtf format
- T112-ExcelTableWrite
  - writes user defined variables to table at specified time intervals

Gantt-chart



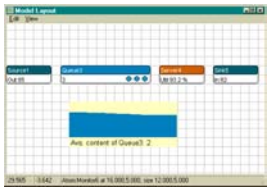
Gantt-chart

- Use Gantt-chart atom
- Use as
  1. **Stand alone**: generate Gantt-chart from data contained by table

  2. **In the flow**: in combination with Gantt Initialize atom, collect data from atoms passing by

Monitoring

- Drag and drop monitor atom into layout
- Choose the resource that you want to monitor
- Choose the variable that you want to display
- Set the preferences

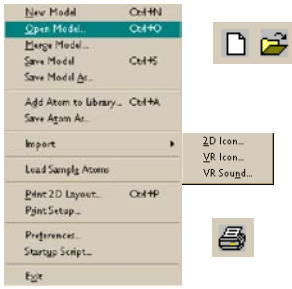


ED menu structure

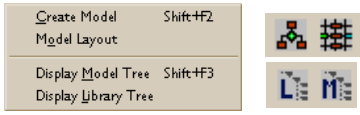
File Model Simulate Results Tools Display Window Help

- File
- Model
- Simulate
- Results
- Tools
- Display
- Windows
- Help

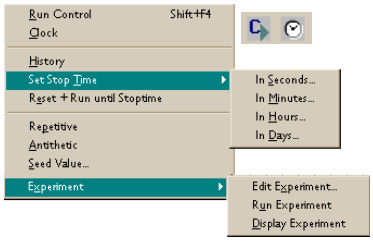
File Menu



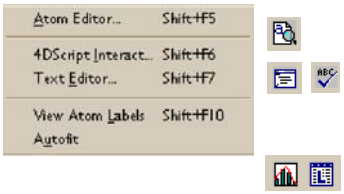
Model Menu



Simulate Menu



Tools Menu

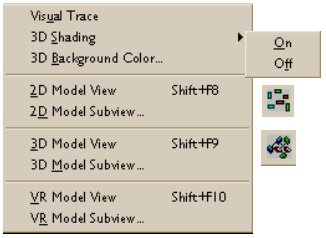


Results Menu

Autofit

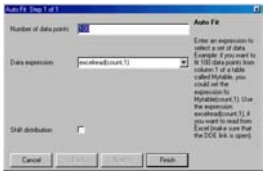
- ED offers a 'goodness of fit' test. It determines if a certain data set can be represented by a certain distribution based on:
  - Shape
  - Mean
  - Deviation

Display Menu

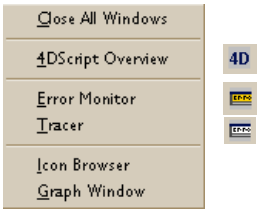


Example: Goodness of Fit Test

- Use Excel atom in <Data> to establish dde link with timestudy.xls workbook
- Go to menu Tools | Autofit



Windows Menu



Help Menu

- Also use atom help in library (select atom, choose <view | atom help> in library menu)
- Take a look at the sample models, including explanation