WebSphere Education

Profile and dynamic analysis

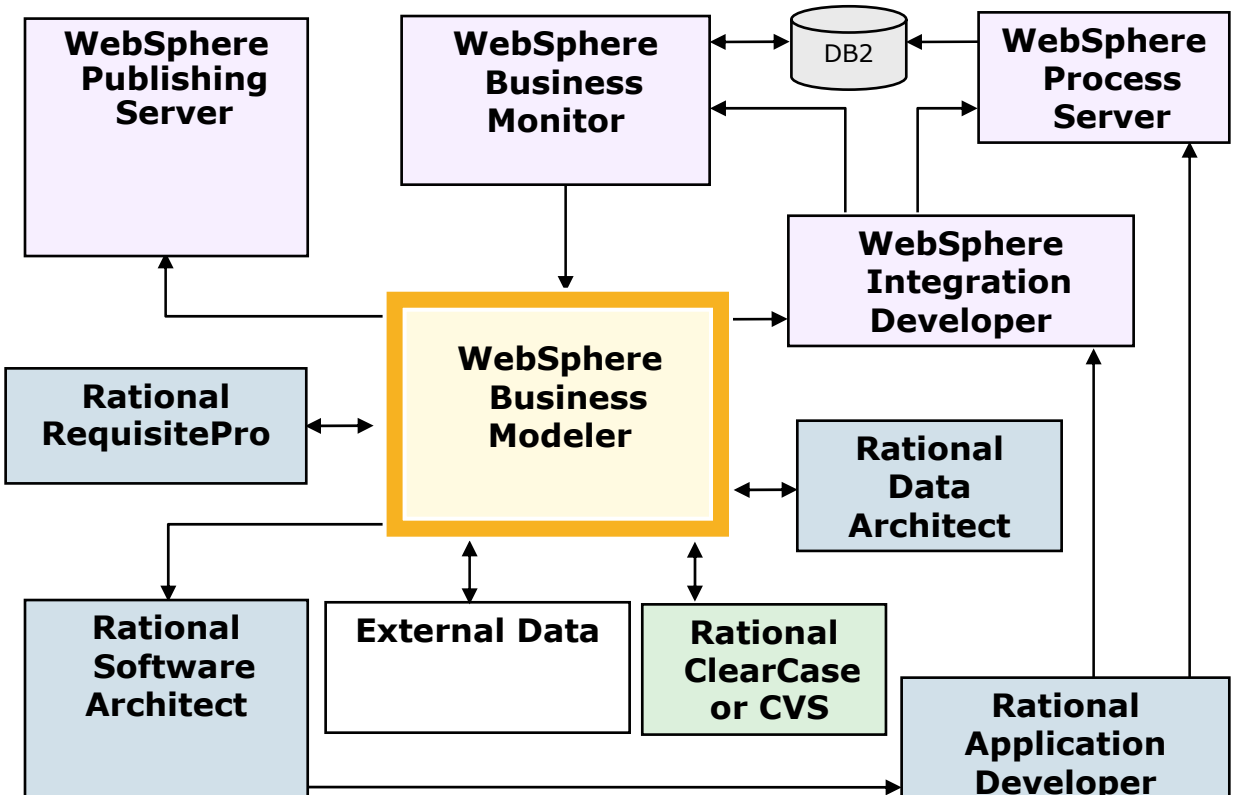
Unit 19

Unit objectives

After completing this unit, you should be able to:

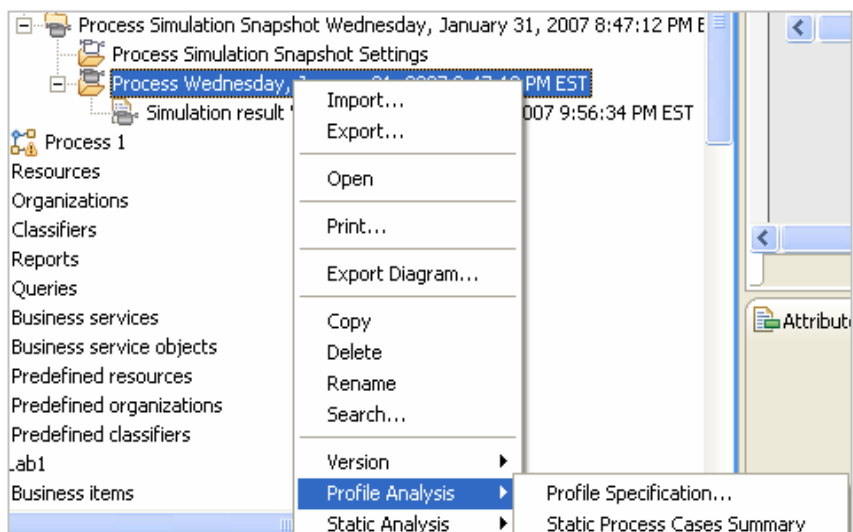
- Conduct profile analysis:
  - Profile specification
  - Cases summary
- Conduct dynamic analysis:
  - Aggregated
  - Process instance
  - Process cases
  - Process comparison

Analyzing simulation data in Modeler



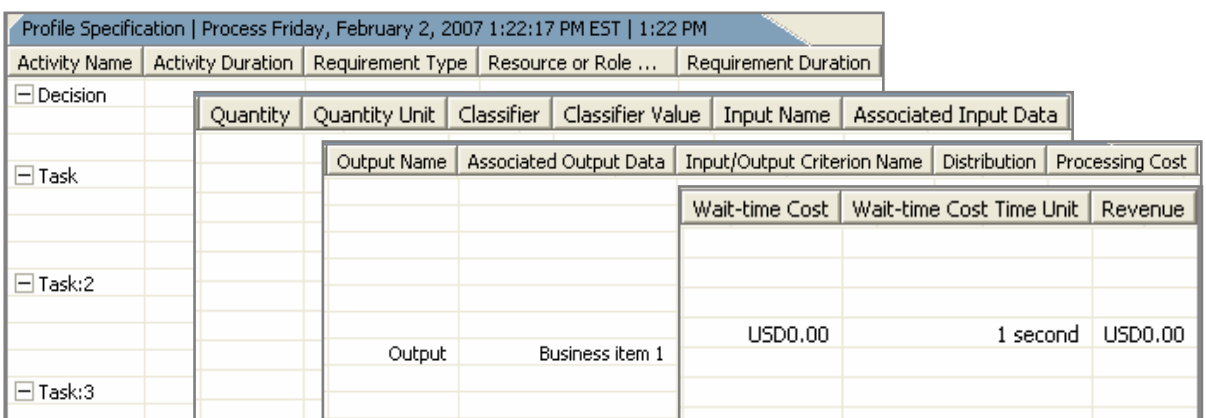
Analyzing process simulation profiles

- Profile analysis is performed on process simulation profiles before simulations are run.
  - A simulation profile must be created before conducting the analysis.
  - Profile specification.
    - Shows the simulation settings for each of the activities in a simulation profile
  - Static process cases summary:
    - Shows summary information describing each of the process cases (paths) through the process recorded by the simulation profile



Profile specification

- Specification provides a way of reviewing, documenting, and validating values that are used during a simulation run.
- This analysis reports seven different types of activities:
  - Decisions, loops, tasks, global tasks, services, subprocesses, and global processes
- Analysis attributes can be customized by activity type.



Static process cases summary

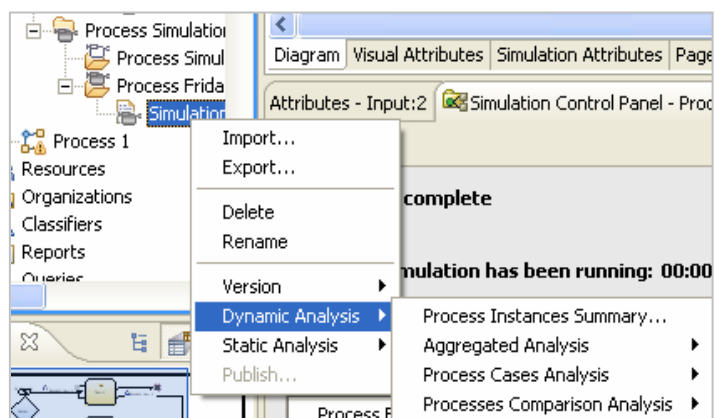
- A static case summary shows each of the process cases (paths).
- The model cannot contain the following elements, which keep Modeler from determining a finite set of process cases:
  - Repositories, notification broadcasters, notification receivers, observers, and timers
    - The presence of these elements causes an error during analysis.
- Provides a comprehensive description of the possible paths
  - Including the costs and revenue generated by each possible path
  - Includes the expected relative frequencies of each path
- Results for this analysis use several assumptions and limitations

Static Process Cases Summary | Process Friday, February 2, 2007 1:22:17 PM EST | 2:26 PM

Case Name	Activity Name	Cost	Revenue	Run Cost	Resource Cost	Profit	Elapsed Duration	Working Duration	Resource Duration	Distribution
⊟ Case 1		U...	USD0.00	USD16...	USD0.00	(U...	20 minutes	20 minutes	0 seconds	50.00%
	Decision	U...	USD0.00	USD0.00	USD0.00	US...	0 seconds	0 seconds	0 seconds	
	Task	U...	USD0.00	USD5.00	USD0.00	(U...	6 minutes	6 minutes	0 seconds	
	Task:2	U...	USD0.00	USD11...	USD0.00	(U...	14 minutes	14 minutes	0 seconds	
⊟ Case 2		U...	USD0.00	USD5.00	USD0.00	(U...	6 minutes 1 se...	6 minutes 1 se...	0 seconds	50.00%
	Decision	U...	USD0.00	USD0.00	USD0.00	US...	0 seconds	0 seconds	0 seconds	
	Task	U...	USD0.00	USD5.00	USD0.00	(U...	6 minutes	6 minutes	0 seconds	
	Task:3	U...	USD0.00	USD0.00	USD0.00	US...	1 second	1 second	0 seconds	
All Cases		U...	USD0.00	USD10...	USD0.00	(U...	13 minutes 0....	13 minutes 0.5...	0 seconds	

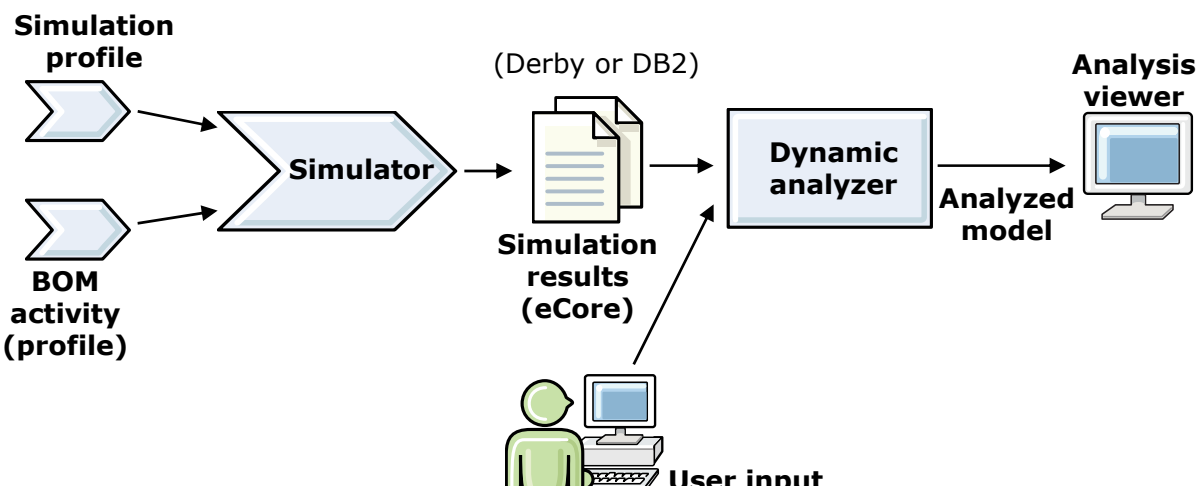
Dynamic analysis

- Dynamic analysis shows the results of a process simulation from different perspectives:
  - Time, money, and statistics
- Analysis can be performed at three levels of granularity:
  - Aggregated analysis
    - Uses all the data from the entire simulation
  - Process cases analysis
    - Uses data from specific cases
  - Process instance analysis
    - Uses data from a specific instance of a process case
- Comparative analysis
  - Compares two simulation runs



Analyzing simulation data

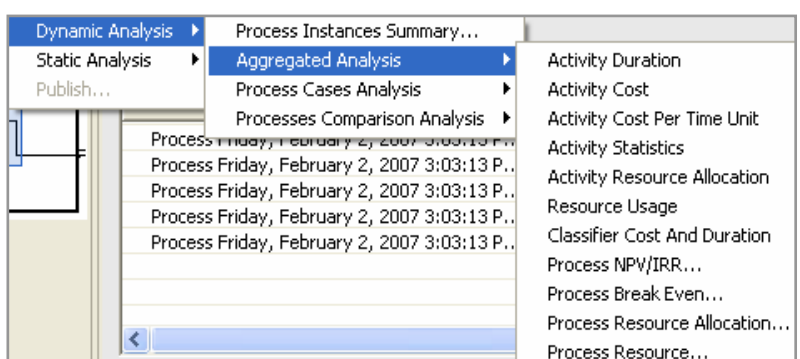
- A simulation provides a wealth of data, but without detailed analysis, that data is limited in its usefulness.
  - To get the most out of simulation data, dynamic analysis needs to be performed on the results.
  - Extract information regarding scheduling, costs, output, and other statistics pertaining to your processes.



Aggregated analysis (1)

- Used to gain an understanding of the behavior of the process as a whole
  - Most broadly scoped of the dynamic analyses
    - Uses all the data from the entire simulation run

- Determines information about activities and resources used in all process instances generated during a simulation



Aggregated analysis (2)

- Analyzing activity durations
  - Shows the average time it takes for each activity to complete
  - Indicates time taken waiting for resources to be available
- Analyzing activity costs
  - Understand the costs incurred by the activities
- Analyzing activity cost per time unit
  - Compute the average rate of cost of each activity
- Analyzing activity statistics
  - Information on the successful completion of the process activities
- Analyzing activity resource allocations
  - Summary of the resources allocated to each activity
  - Resources allocated and the average allocation time, cost, and shortages for each resource

Aggregated analysis (3)

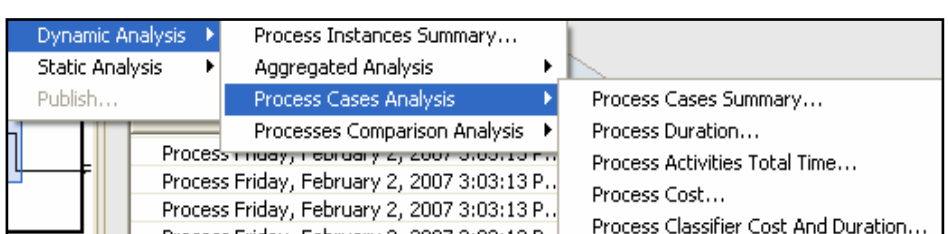
- Analyzing resource usage
  - Activities that each resource was allocated to
  - Information about time, cost, and shortage durations
  - Detailed information about every allocation of the resource
- Analyzing classifier cost and duration
  - Information regarding the average cost and duration of an entire classification of activities within the process.
- Analyzing net present value and internal rate of return
  - Current net present value of a process
    - Need to provide an initial cost, a discount rate, and a payback period
    - Internal rate of return necessary to produce a net present value of zero by the end of the payback period

Aggregated analysis (4)

- Analyzing the break-even point
  - Number of times a process must run to generate enough profit to recover a specified fixed cost
    - Value is based on the average costs and revenue for the process as a whole.
- Analyzing process resource allocations
  - How each activity uses its resources to help identify resource shortages
  - How the resources required by an activity contribute to the cost
- Analyzing process resources
  - List of the resources used by the process
  - Average allocations of the resources

Process cases analysis (1)

- Used to gain an understanding of a specific case (process flow) within the process
- Shows weighted average values, where the average value is weighted for each process case to account for the distribution of process instances to that case relative to other cases
- Organizes and averages the simulation results generated for each process case, which enables you to investigate variations in performance between different patterns of process flow

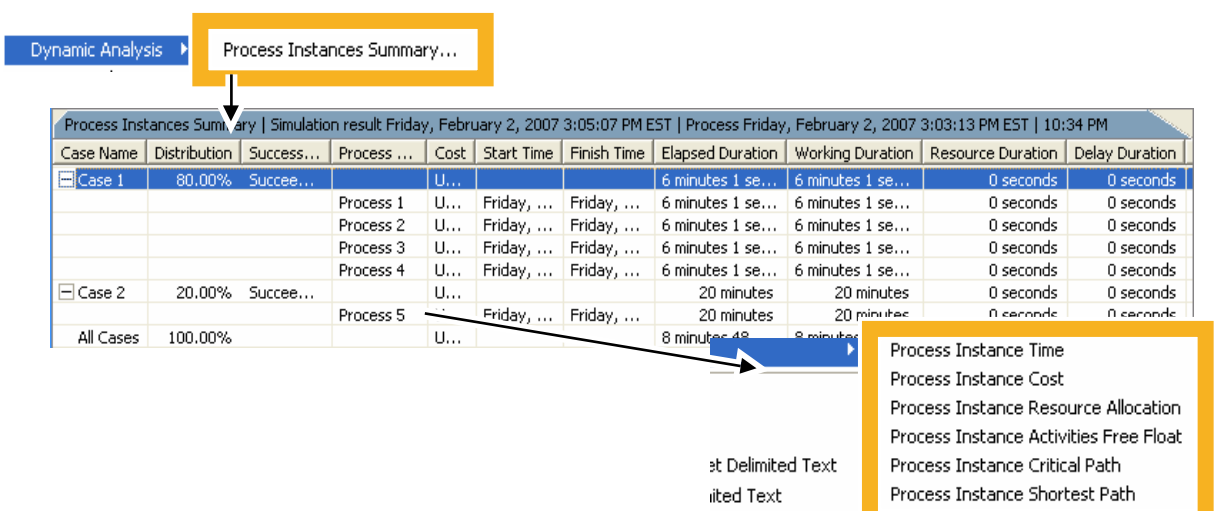


Process cases analysis (2)

- Analyzing process cases summaries
  - Display summary information for each of the process cases produced during a simulation
- Analyzing process durations
  - Examine the average durations of all process cases
- Analyzing process activities total times
  - Determine the average total time values for all process instances
- Analyzing process costs
  - Examine the average costs, revenues, and profits for all process instances
- Analyzing classifier costs and durations
  - Show the costs and durations of activities associated with each classifier value used in a process

Process instance analysis (1)

- Process instance analysis is used to gain an understanding of the behavior of a specific token's run through the process.
  - Get a detailed understanding of each individual pass through a process during simulation
- Process instance analyses are the most granular of the dynamic analyses.
  - Use data from a single instance of a process case

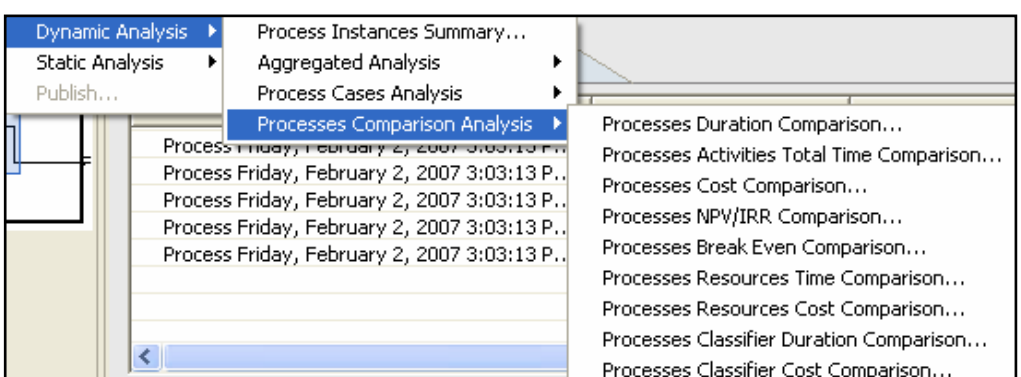


Process instance analysis (2)

- Analyzing process instance times
  - Display the durations of each of the activities involved in a process instance
- Analyzing process instance costs
  - Display detailed information about the cost and revenue for each activity within a process instance
- Analyzing process instance resource allocation
  - Obtain detailed information about the resources allocated to activities in a process instance
- Analyzing process instance activities free float
  - Display information about the available free float (slack time) periods associated with activities in a process instance
- Analyzing process instance critical paths
  - Display the path of longest duration within the process instance
- Analyzing process instance shortest paths
  - Display the path in a process instance that has the shortest duration of all parallel paths

Processes comparison analysis (1)

- Used to highlight differences and similarities in simulation results between two different simulation runs
  - Different versions of a modeled process
  - Different simulation sizes
  - Different decision probabilities
- Compares the weighted average analysis results for two simulated processes that use the same input parameters
  - For example, compare the average length of time it takes to complete your current process versus your proposed future process.



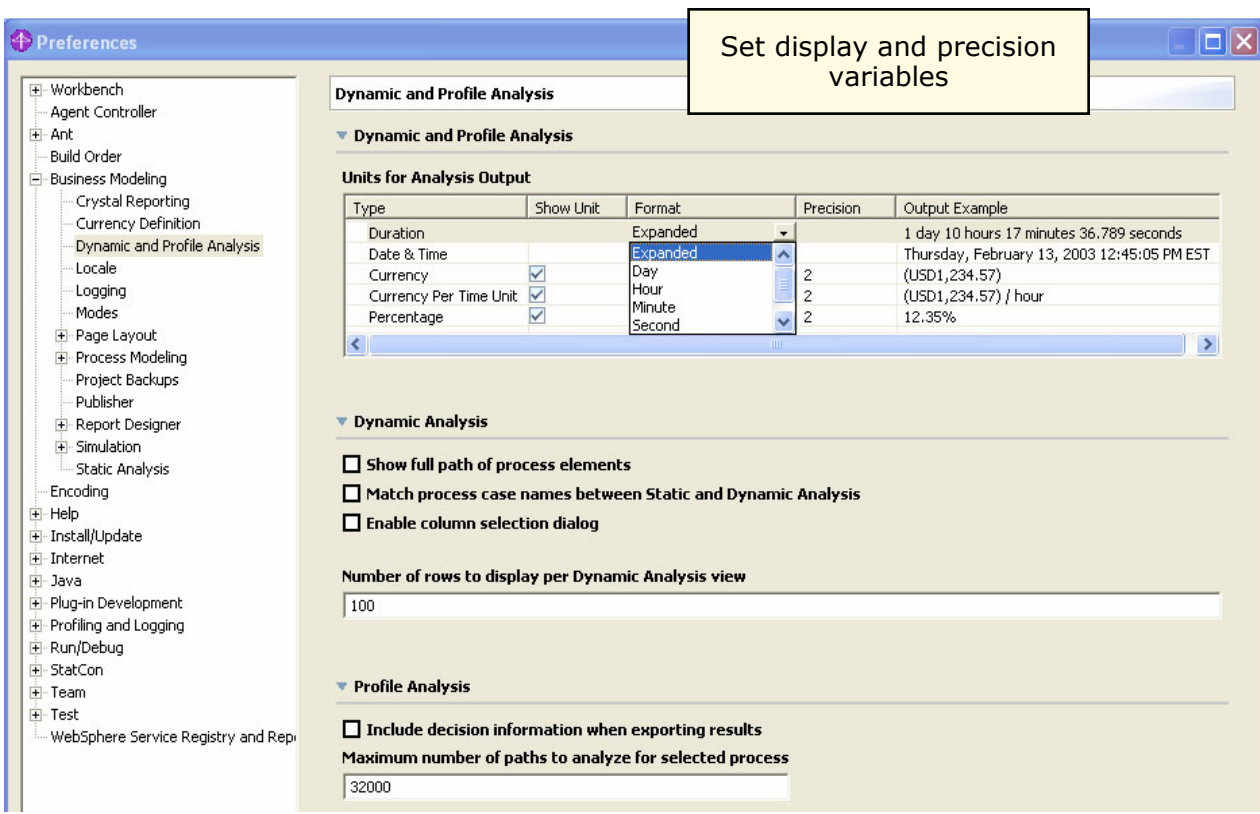
Processes comparison analysis (2)

- Processes duration comparison analysis
  - Compares the average duration and throughput of two processes
- Processes activities total time comparison analysis
  - Compares the average duration of two processes
- Processes cost comparison analysis
  - Compares the average cost and revenue results
- Processes NPV and IRR comparison analysis
  - Compares process net present value (NPV) and internal rate of return (IRR) analysis results that use the same input parameters
- Processes break-even comparison analysis
  - Compares the break-even analysis results

Processes comparison analysis (3)

- Processes resources time comparison analysis
  - Compares the average resource allocation durations based on the same simulation snapshot
  - Can be results from different profiles, or two sets of results from the same profile
- Processes resources cost comparison analysis
  - Compares the average resource allocation costs based on the same simulation snapshot
  - Can be results from different profiles, or two sets of results from the same profile
- Processes classifier duration comparison analysis
  - Compares the average classifier elapsed duration results that use the same input parameters
- Processes classifier cost comparison analysis
  - Compares the average classifier cost results that use the same input parameters

Dynamic analysis: Preferences



Use of statistical distributions in simulation

- Simulation provides an opportunity to understand how a process will behave once implemented.
- Statistical distributions allow a model to reflect more accurately the real world behavior of the business process.
- Distributions help build randomness into a model, something averages cannot do.
- Measured data may be limited, and making decisions with small sample sizes increases the risk of incorrect forecasts or decisions.

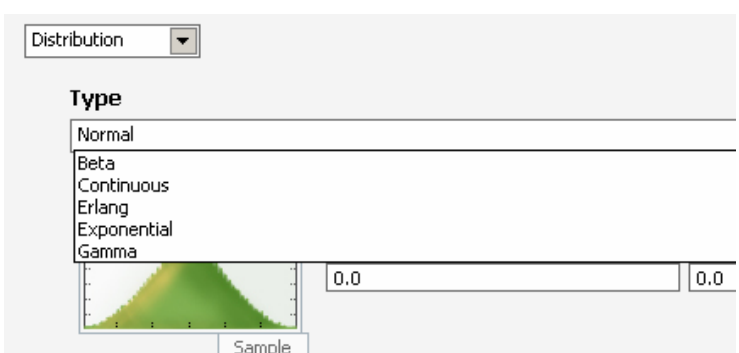
Where are distributions used?

- In Modeler, probability distributions can be assigned to:
  - Token creation
  - Task completion times
  - Task costs
  - Task revenue

- Applying distribution settings to a model in the appropriate places enables greater accuracy in the representation of the process.

Distributions in WebSphere Business Modeler (1 of 2)

- **Beta**: Degree to which results can be believed to be valid
- **Continuous**: Values generated are evenly distributed
- **Erlang**: Useful for representing waiting times in queuing systems
- **Exponential**: Fits time-series data, like arrival times — a constant rate
- **Gamma**: Useful for continuous random variables constrained ≥ 0



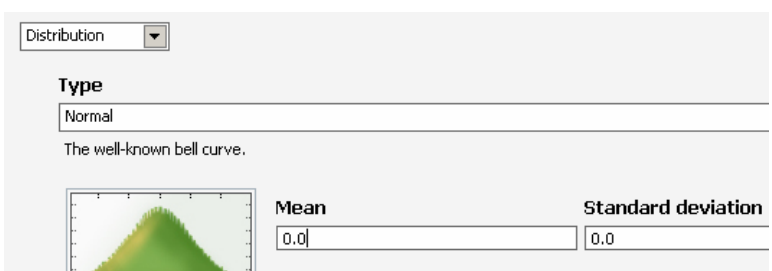
Distributions in WebSphere Business Modeler (2 of 2)

- **Johnson**: Best fit distribution
- **Lognormal**: For random variables > 0
- **Normal**: Useful for a large variety and type of data
- **Poisson**: Used when probability is small and opportunities are large
- **Random list**: All equal probability
- **Triangular**: Defines most likely value
- **Uniform**: Distributes values evenly
- **Weibull**: Useful in modeling reliability
- **Weighted list**: Weighted probability for each value

Distribution parameters

- The settings that you can specify depend on the type of distribution you select, as shown in the following table:

Distribution type	Settings
Exponential	Mean
Gamma	Mean, Standard Deviation
Lognormal	Mean, Standard Deviation
Normal	Mean, Standard Deviation
Poisson	Mean
Uniform	Minimum, Maximum
Weighted list	Probabilities, Values
Random list	Values



Checkpoint: Profile and dynamic analysis

Your instructor will review these questions with you as a group. If time permits, the instructor may provide you time to answer the questions on your own before the group discussion.

1. What is profile specification?
2. What is the function of Process Cases Summary?
3. What is dynamic analysis?
4. Which analysis shows the differences and similarities in simulation results between two different simulation runs?
5. What is the advantage of using statistical distributions in simulation?

Checkpoint solutions: Profile and dynamic analysis

1. Profile specification provides a way of reviewing, documenting, and validating the values that are used during the run of a simulation.

2. Process Cases Summary shows each of the process cases (paths) through the process.

3. Analysis of the results of a process simulation from different perspectives: Time, money, and statistics

4. Processes Comparison Analysis

5. Build randomness into a model

Unit summary

Having completed this unit, you should be able to:

- Conduct profile analysis:
  - Profile specification
  - Cases summary
- Conduct dynamic analysis:
  - Aggregated
  - Process instance
  - Process cases
  - Process comparison

Exercise overview

In this exercise you will:

- Use profile analysis
- Use dynamic analysis and aggregated analysis
- Use dynamic analysis — process analysis
- Generate and export reports
- Set up a simulation
- Run a simulation and generate analysis