Simulation Software

Chapter 3

Jiang Li, Ph.D.
Department of Computer Science

3.1 Introduction

- Many features common to most simulation programs
- Special-purpose simulation packages incorporate these common features
- Packages discussed in this chapter
  - Arena
  - ExtendSim
  - Simio

Jiang Li, Ph.D.
Department of Computer Science

3.2 Comparing Simulation Packages with Programming Languages

- Advantages of using a simulation package
  - Many of the needed features have been incorporated, reducing programming time
  - Easier to modify and maintain system models
  - Better, automatic error detection
- Advantages of using a general purpose programming language
  - Most modelers already know a programming language

Jiang Li, Ph.D.
Department of Computer Science

Comparing Simulation Packages with Programming Languages

- Advantages of using a general purpose programming language (cont'd.)
  - Generally faster execution time
  - Greater programming flexibility
  - Object-oriented languages considered better by many analysts and programmers
    - Simulation packages not truly object-oriented
  - Software cost generally lower

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Department of Computer Science

3.3 Classification of Simulation Software

- General-purpose simulation package
  - Can be used for any application
- Application-oriented simulation package
  - Designed for a certain class of applications
  - Examples: manufacturing, health care, telecommunications

Jiang Li, Ph.D.
Department of Computer Science

Classification of Simulation Software

- Process
  - Time-ordered sequence of interrelated events, separated by intervals of time
- Most packages use process approach to simulation modeling
  - Process routine explicitly contains the passage of simulated time
    - Multiple entry points

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Department of Computer Science

Process Approach Example

- Entry points
  - 1: Arrival event
  - 5,9: Departure event

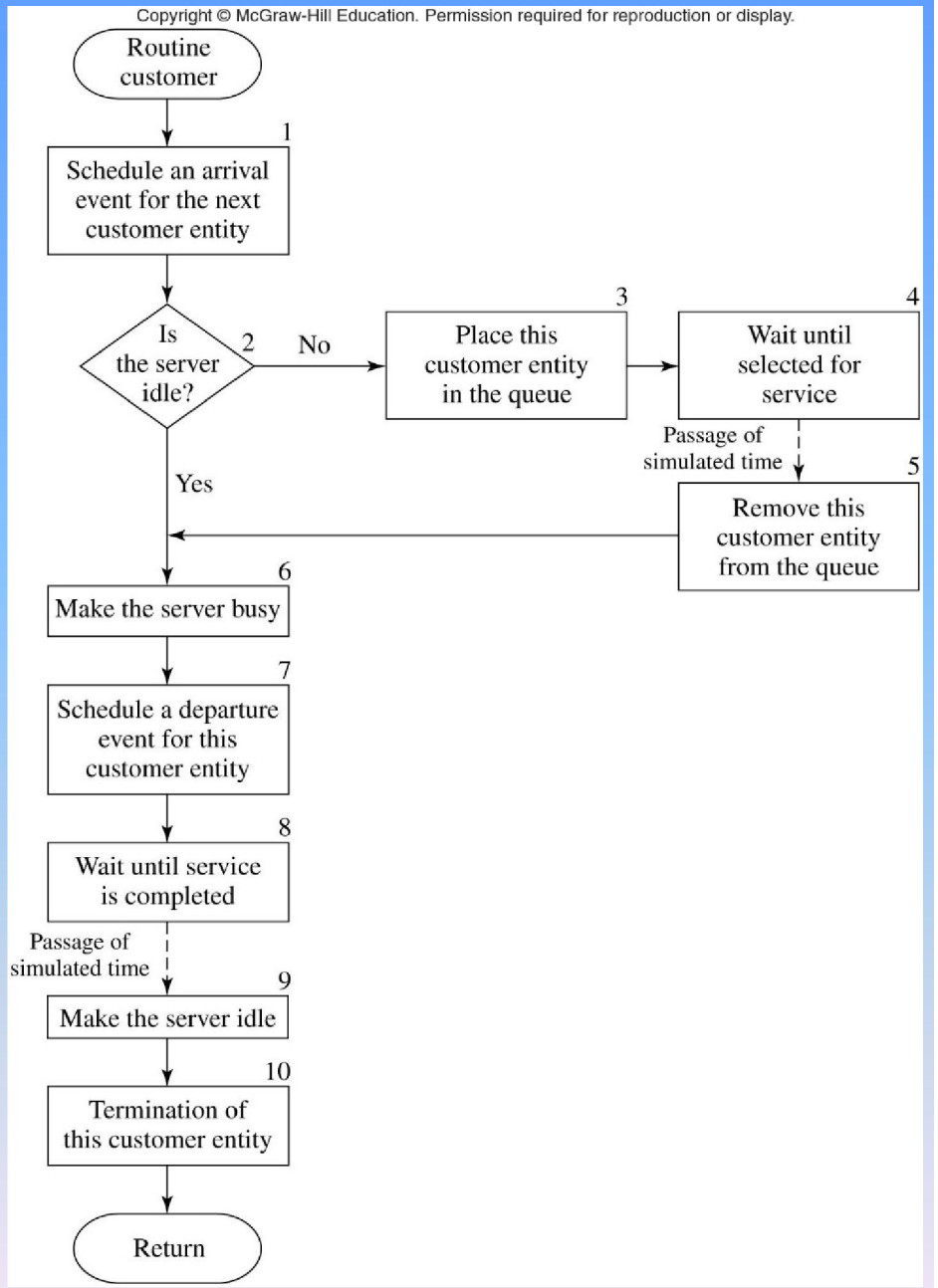

Figure 3.2 Prototype customer-process routine for a single-server queuing system

Classification of Simulation Software

- Common modeling elements
  - Entity
    - Created, moves through the system, and then usually destroyed
  - Attributes
    - Pieces of information stored within the entity
  - Resources
    - Entity requests their use while moving through the system
  - Queues

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3.4 Desirable Software Features

- Feature groups
  - General capabilities
  - Hardware and software considerations
  - Animation
  - Statistical features
  - Customer support and documentation
  - Output reports and plots

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Department of Computer Science

Desirable Software Features

- General capabilities
  - Modeling flexibility, including the ability to:
    - Define and change attributes for entities and global variables, and use both in decision logic
    - Use mathematical expressions and functions
    - Create new modeling constructs and modify existing ones
  - Ease of use
  - Hierarchy
  - Good debugging aids

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Desirable Software Features

- General capabilities (cont'd.)
  - Ability to import/export data
  - Fast execution speeds
  - Cost module
  - Ability to initialize to nonempty and idle state
  - Ability to save simulation states after run
  - Cost of software package

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Desirable Software Features

- Animation and dynamic graphics
  - Icons change position, color, and/or shape
  - Helps communicate details to nontechnical people
  - Useful in debugging and training
  - Ability to create high resolution icons and save for later use

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Department of Computer Science

Desirable Software Features

- Statistical capabilities
  - Random number generator should have at least 100 different streams
  - Each source of randomness should be represented by a probability distribution
  - Statistically sound method for constructing a confidence interval for the mean
  - Statistical experimental designs
  - Optimization capability

Jiang Li, Ph.D.
Department of Computer Science

Desirable Software Features

- Customer support and documentation
  - Documented well enough to allow use without taking a training class
- Output reports and graphics
  - Standard and customized reports
  - Histograms
  - Time plots
  - Correlation plots

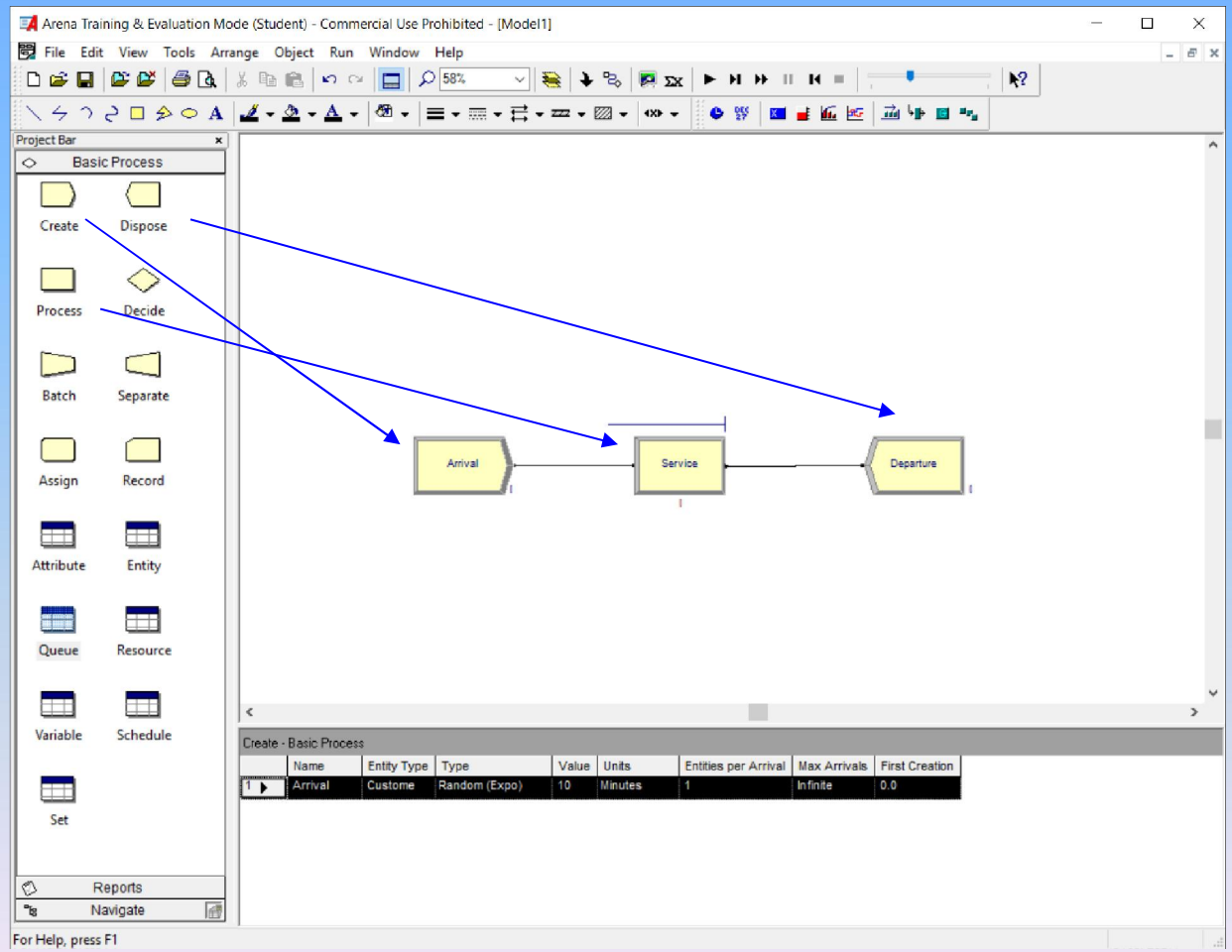
3.5 General-Purpose Simulation Packages

- Arena by Rockwell Automation
  - Standard and Professional Editions available
  - Modules arranged into a number of templates
  - Examples of templates: basic process, advanced process, advanced transfer, and flow process
  - Virtual designer used to create concurrent 3-D animations

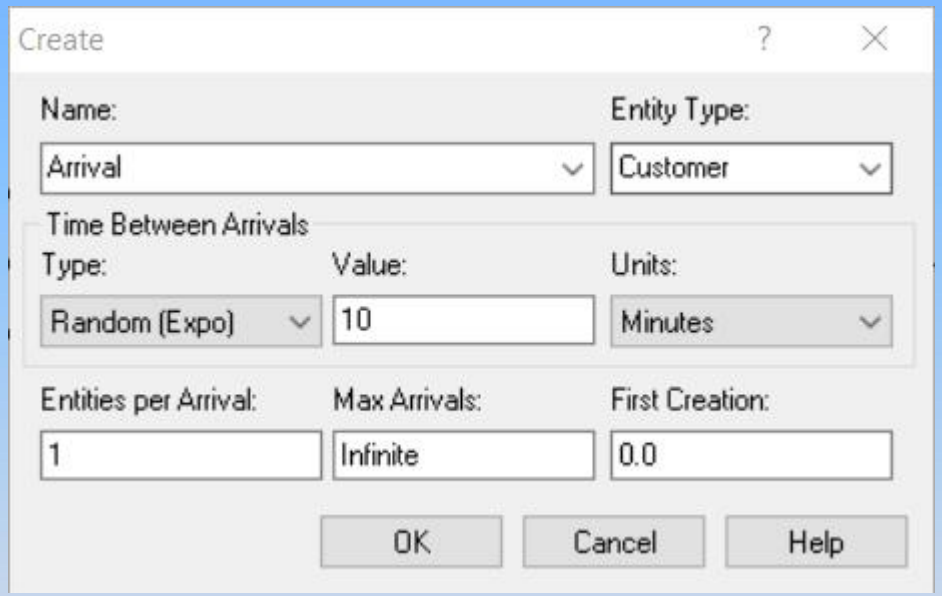
General-Purpose Simulation Packages

- Arena features
  - Unlimited number of random number streams
  - Twelve standard theoretical probability distributions and empirical distributions
  - Includes activity-based costing
  - Microsoft VBA and complete ActiveX object model are available

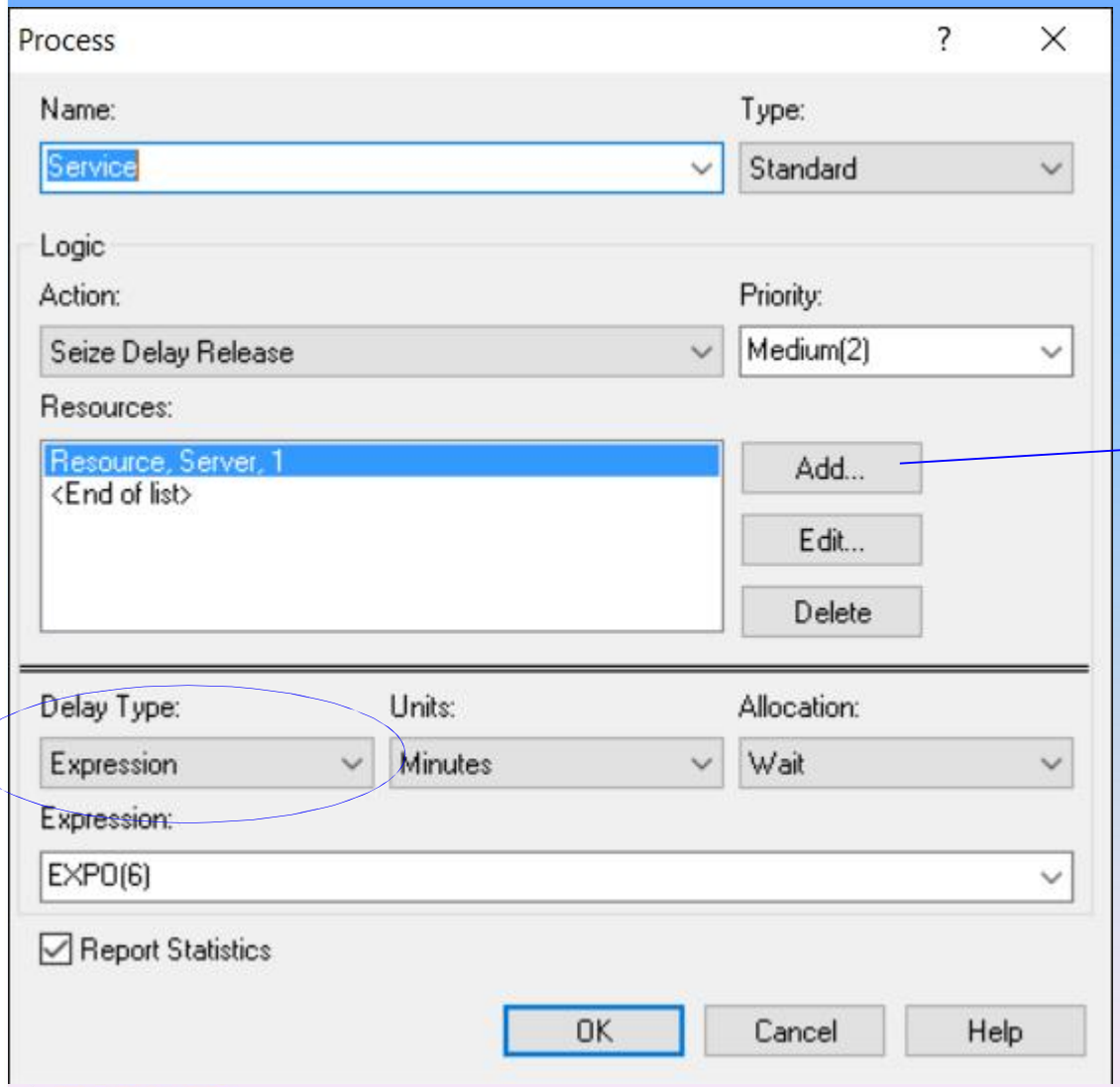
Arena Example – Project View

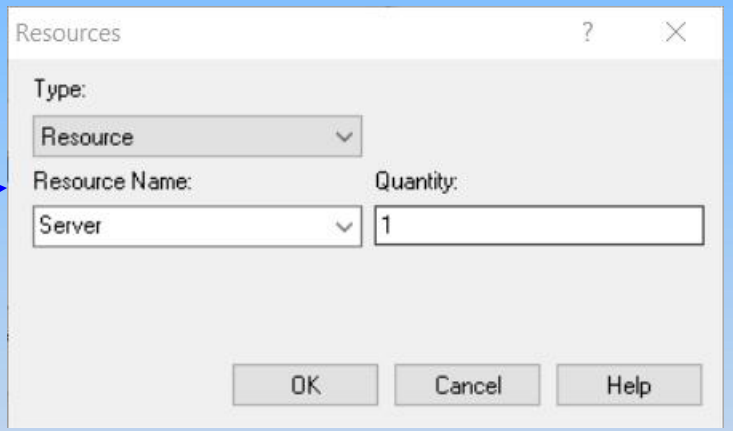


Arena Example - Arrival

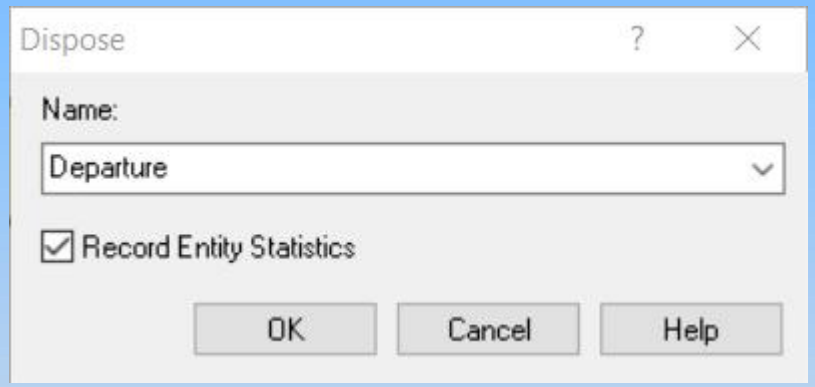


Arena Example - Service

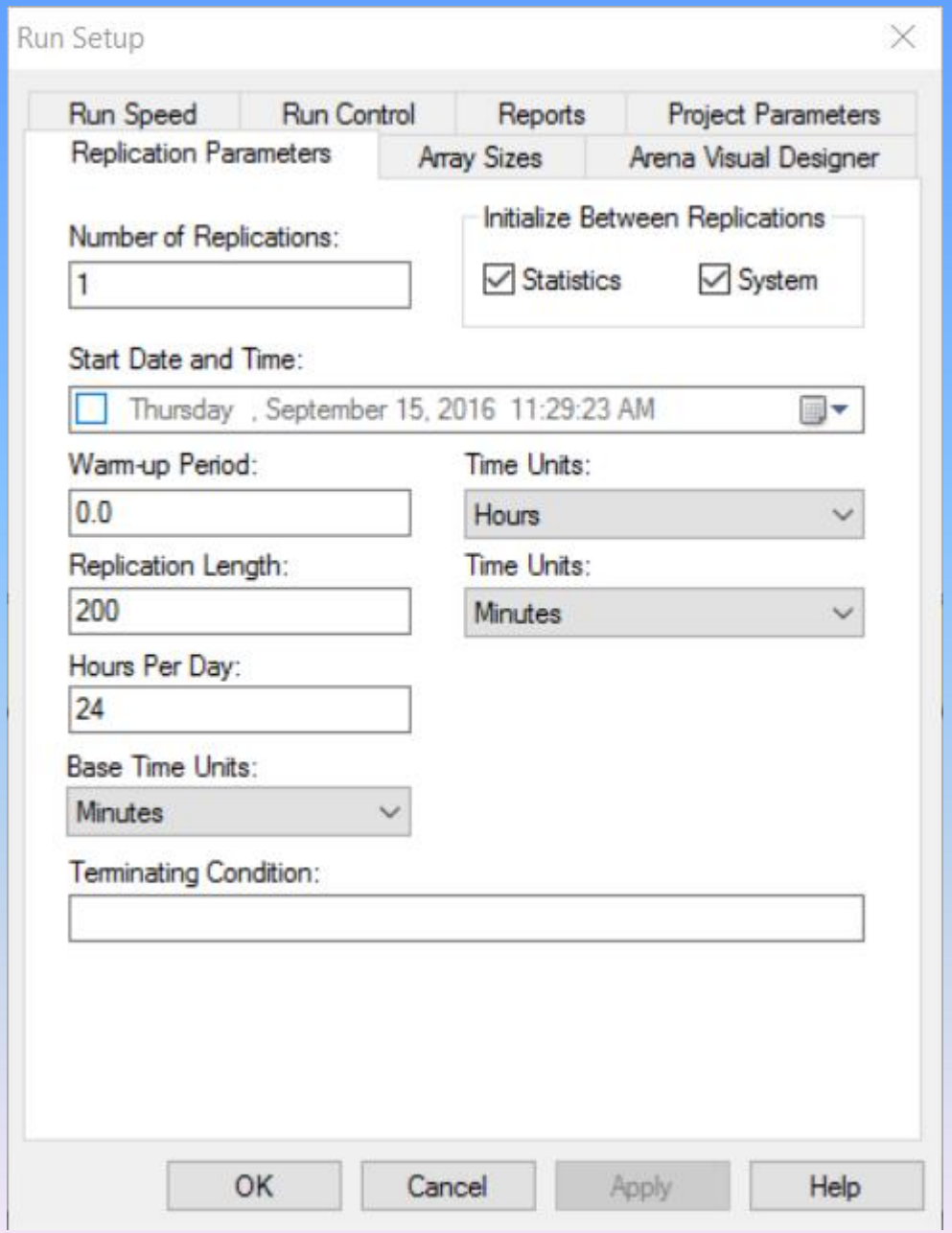




Arena Example - Departure



Arena Example - Run Setup



Arena Example - Report