

7. Simulação com AnyLogic



<https://www.anylogic.com/downloads/>

1

1

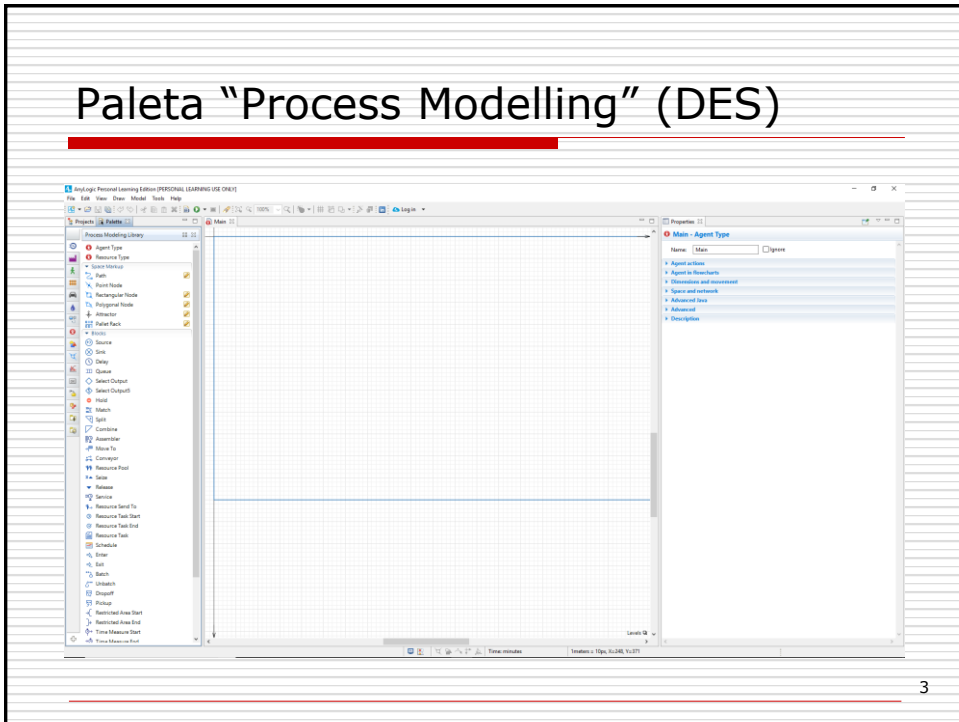
M/M/c em AnyLogic



2

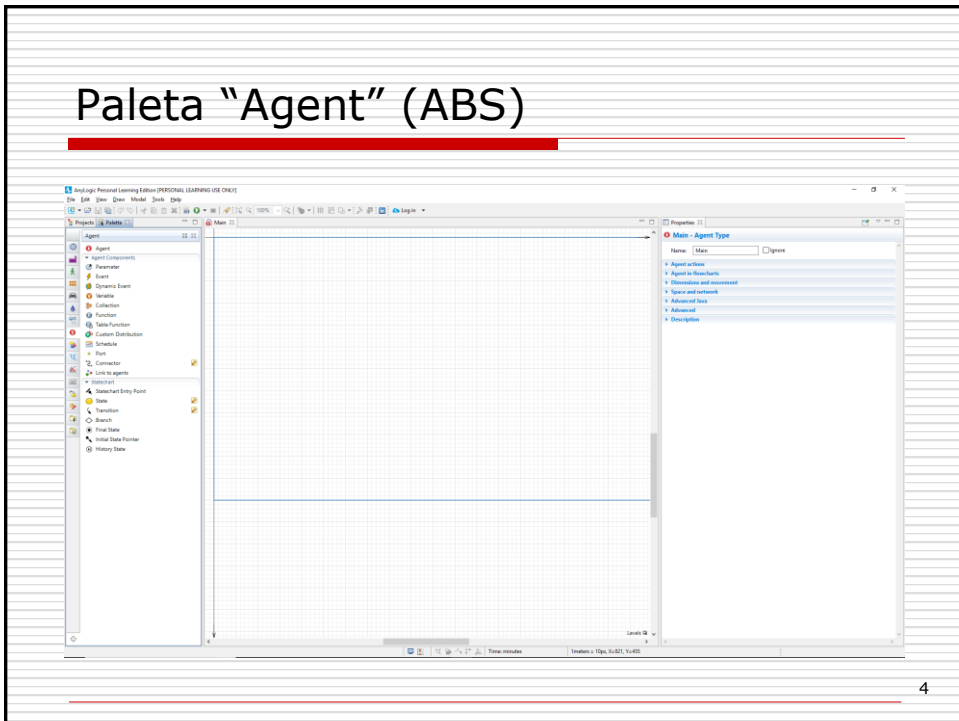
2

Paleta "Process Modelling" (DES)



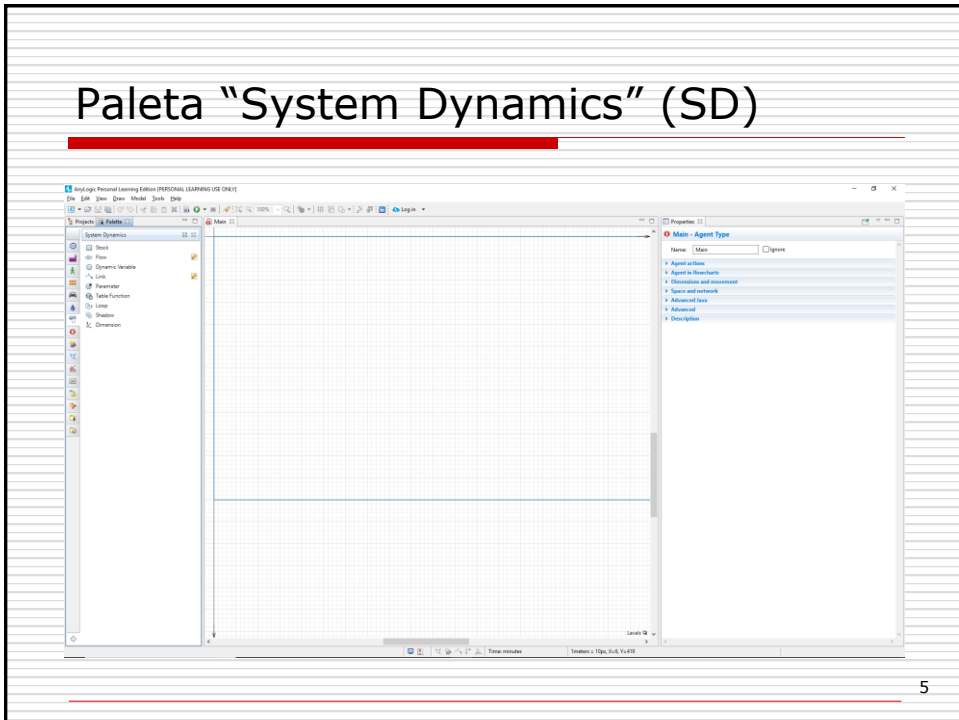
3

Paleta "Agent" (ABS)



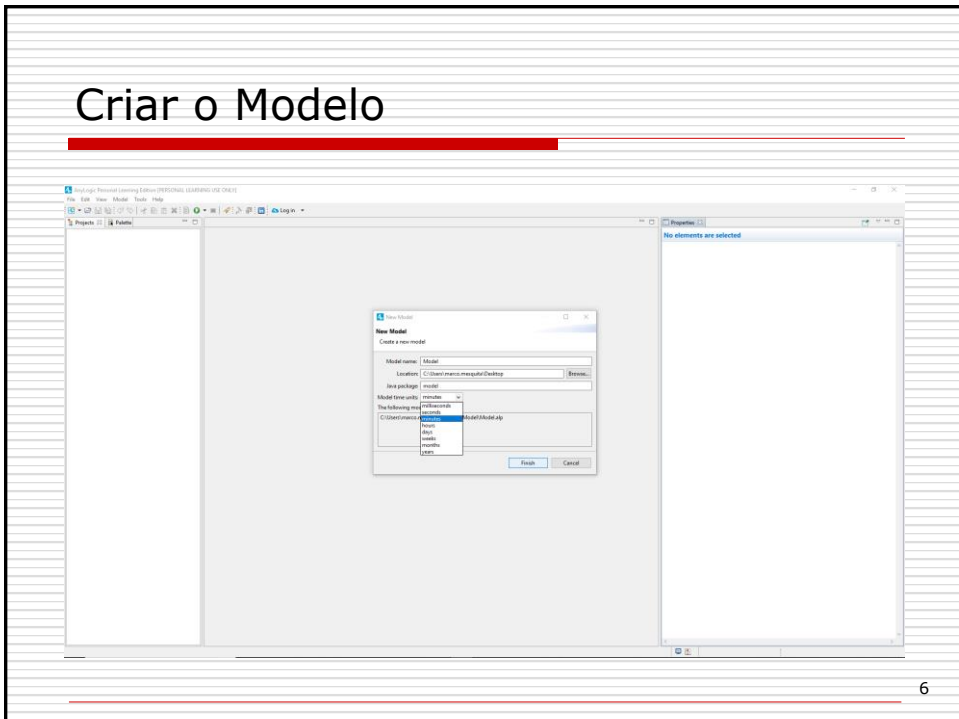
4

Paleta "System Dynamics" (SD)



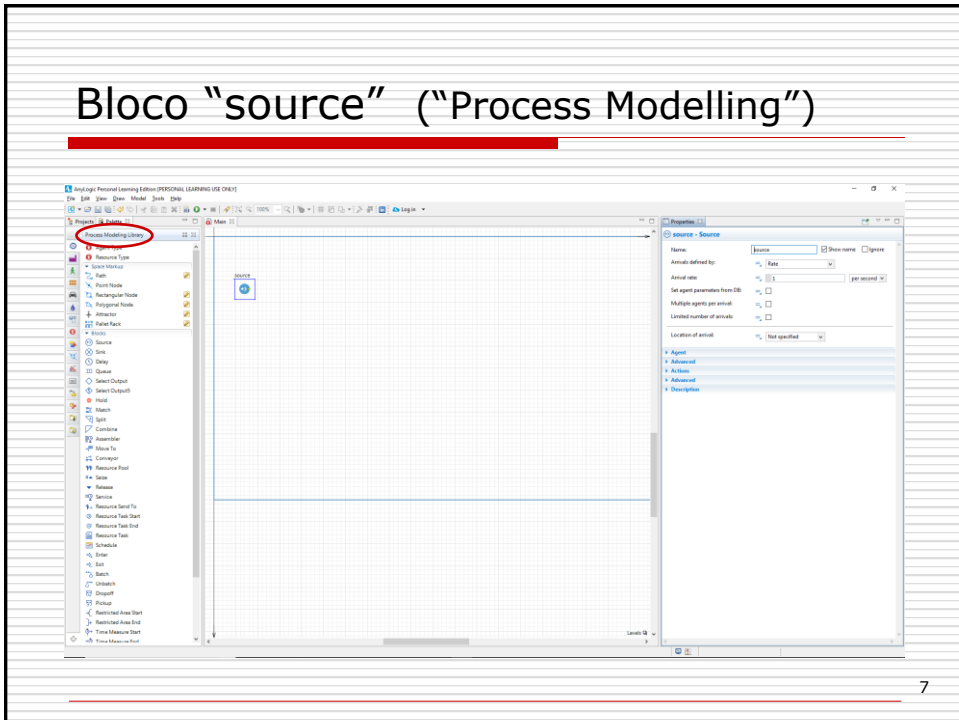
5

Criar o Modelo



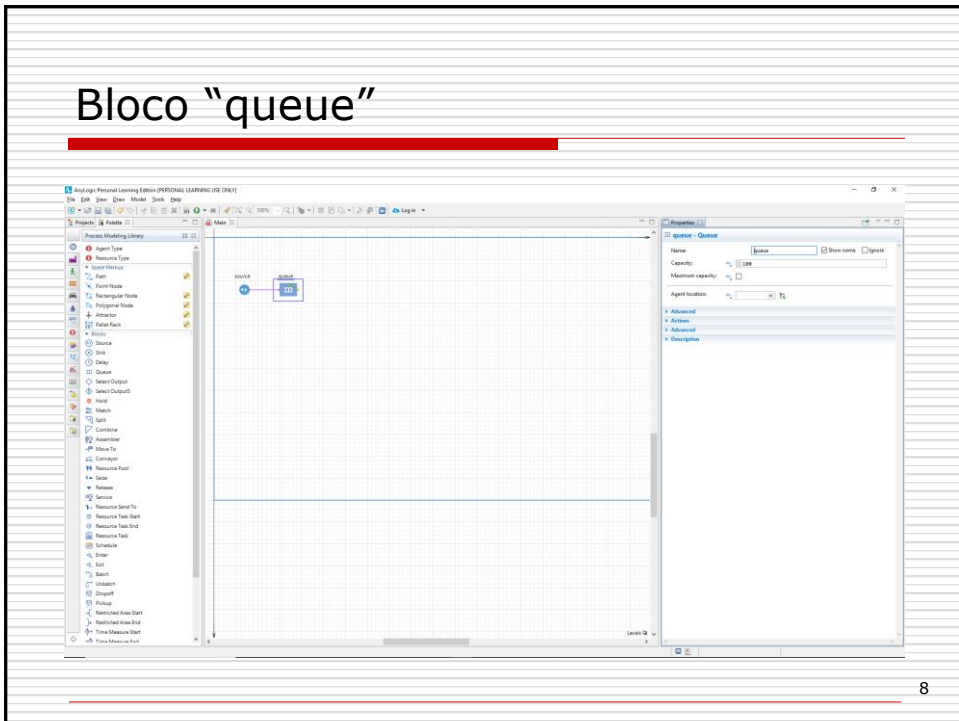
6

Bloco "source" ("Process Modelling")



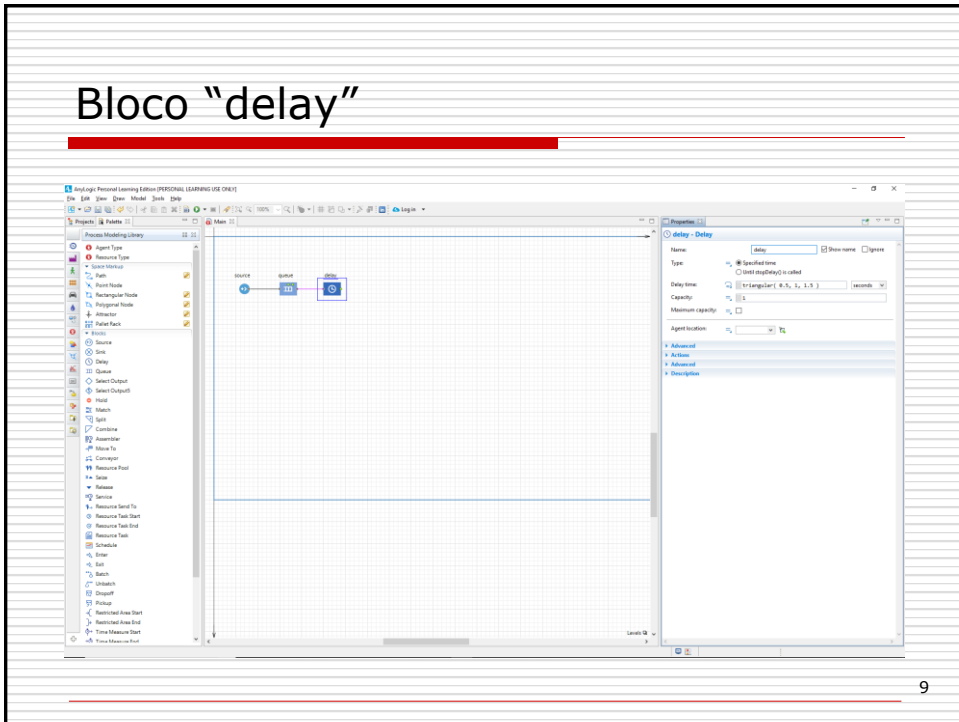
7

Bloco "queue"



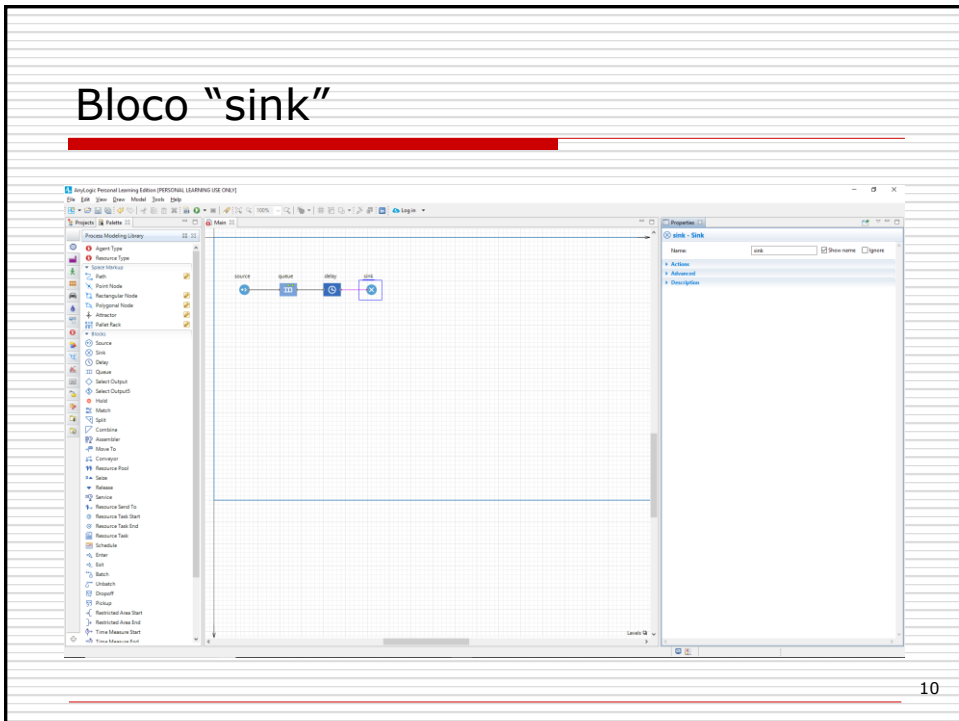
8

Bloco "delay"



9

Bloco "sink"



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Dados

- Unidade de tempo: minutos
- Chegada – Poisson com taxa 10 cl/h
- Serviço – Exponencial, 15 min, $c=3$ servidores
- Tempo de Simulação – 10 h

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Bloco "source"

The screenshot displays the AnyLogic interface with a 'source' block selected in the main workspace. The Properties window for the 'source' block is open, showing the following configuration:

- Name: source
- Arrivals defined by: rate (circled in red)
- Arrival rate: 10 (circled in red)
- Use hour: checked (circled in red)
- Location of arrival: Not specified
- Agent type: Agent
- Model/library: Process Modeling Library

The main workspace shows a flow diagram with blocks labeled 'source', 'queue', 'delay', and 'sink' connected in sequence.

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Bloco "delay"

Ctrl + Space

The screenshot shows the AnyLogic interface with a simulation model on the left and the 'Properties' window for a 'delay' block on the right. The model consists of a 'source' block connected to a 'sink' block via a 'delay' block. The 'Properties' window for the 'delay' block is open, showing the following settings:

- Name: delay
- Type: Specified time
- Delay time: exponential (1/s)
- Capacity: 1
- Agent location: 1
- Advanced options: Forceful pushing, Restore agent location on exit, Force statistics collection.

A yellow callout box highlights the 'exponential' distribution function, showing its signature: `public double exponential(double lambda)`. The text below the signature reads: "Generates a sample of the exponential distribution with a λ set to 1. It is equivalent to `exponential(1, lambda)`. For more details see [exponential\(1, lambda, double\)](#)." The return value is "the generated sample."

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Bloco "delay" (cont.)

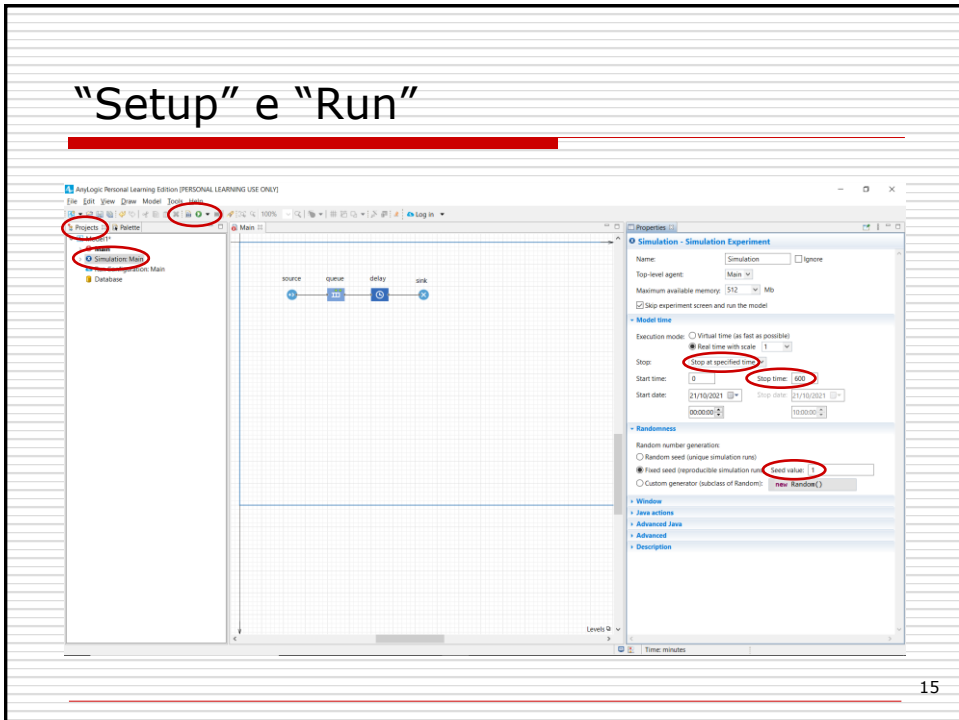
The screenshot shows the AnyLogic interface with the 'Process Modeling Library' on the left and the 'Properties' window for a 'delay' block on the right. The 'Process Modeling Library' is open, showing various blocks like 'Agent Type', 'Resource Type', 'Path', 'Pool Node', etc. The 'Properties' window for the 'delay' block is open, showing the following settings:

- Name: delay
- Type: Specified time
- Delay time: exponential(11, 0.15) minutes
- Capacity: 1
- Agent location: 1
- Advanced options: Forceful pushing, Restore agent location on exit, Force statistics collection.

The 'Delay time' field is highlighted with a red circle, and the 'minutes' unit is also circled in red.

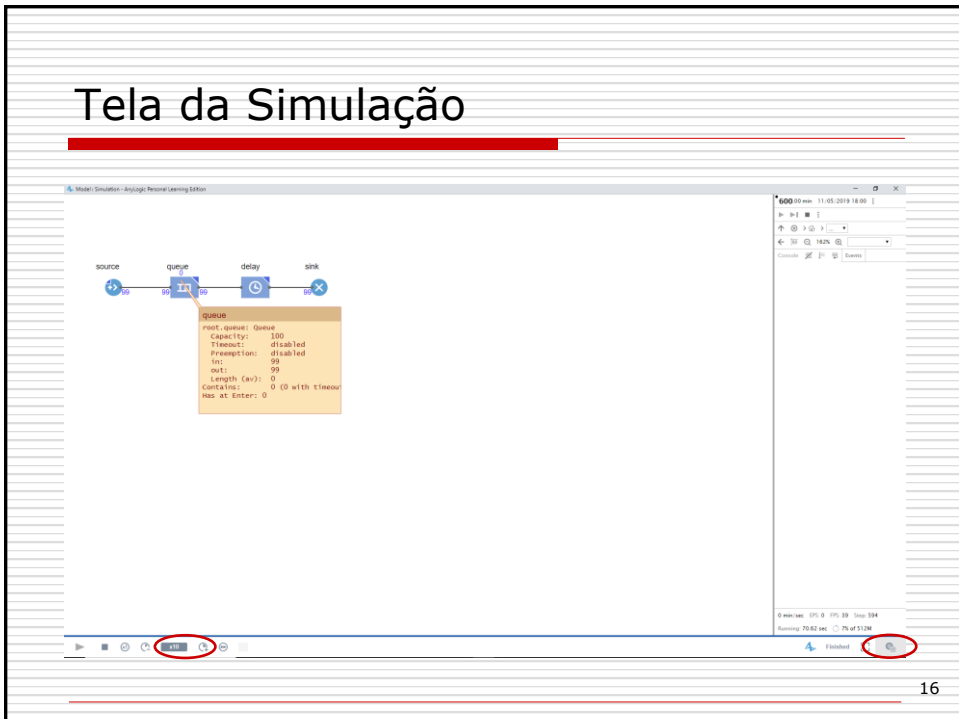
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“Setup” e “Run”



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Tela da Simulação



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Parâmetros e Variáveis

The screenshot shows the AnyLogic modeling environment. On the left is a project tree with categories like Agent, Agent Components, Parameter, Event, Dynamic Event, Interface, Collection, Function, Table Function, Custom Distribution, Schedule, Port, Connector, Link to agents, Interrupt, Interrupt Entry Point, State, Transition, Branch, Final State, and Initial State Function. The main workspace contains a model diagram with blocks labeled 'source', 'sink', 'delay', and 'sink'. Two red arrows point to the 'source' and 'sink' blocks. On the right, the 'Properties' window for a 'Parameter' is open, showing fields for Name, Visible, Type, Default value, and a 'Value editor' section.

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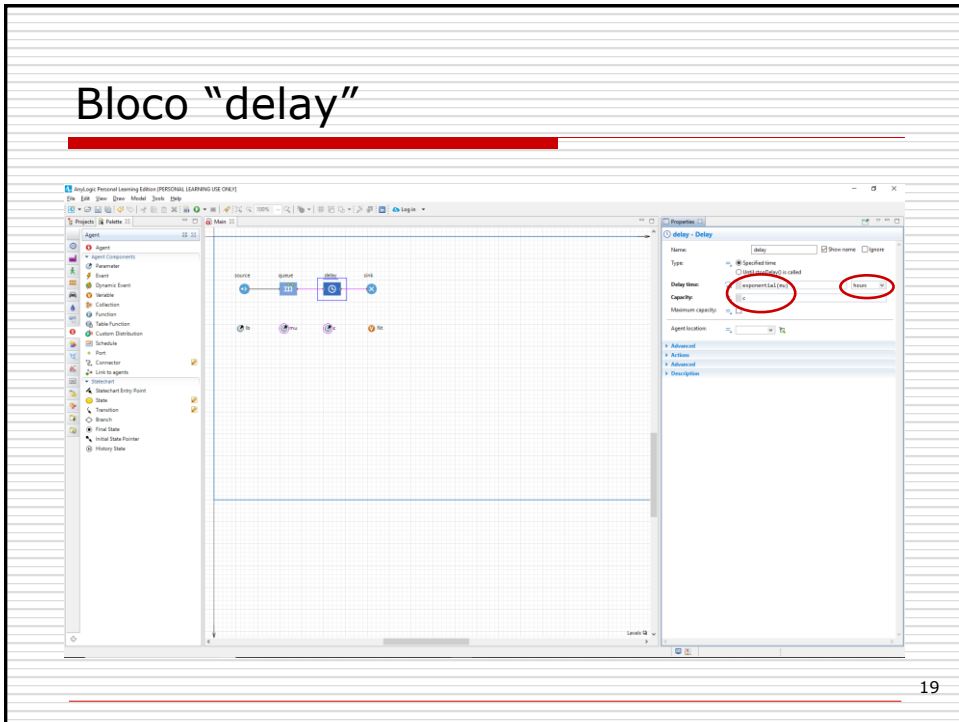
Bloco "source" – "Actions"

Nt-- no bloco Sink

The screenshot shows the AnyLogic modeling environment. On the left is a project tree with categories like Agent, Agent Components, Parameter, Event, Dynamic Event, Interface, Collection, Function, Table Function, Custom Distribution, Schedule, Port, Connector, Link to agents, Interrupt, Interrupt Entry Point, State, Transition, Branch, Final State, and Initial State Function. The main workspace contains a model diagram with blocks labeled 'source', 'sink', 'delay', and 'sink'. Two red arrows point to the 'source' and 'sink' blocks. On the right, the 'Properties' window for a 'Source' block is open. The 'Activation rate' field is set to '1/30' and circled in red. The 'Set agent parameters from ID' field is set to '1' and circled in red. The 'Location of arrival' field is set to 'List specified' and circled in red. The 'On arrival' field is set to '1' and circled in red. The 'On exit' field is set to '1' and circled in red.

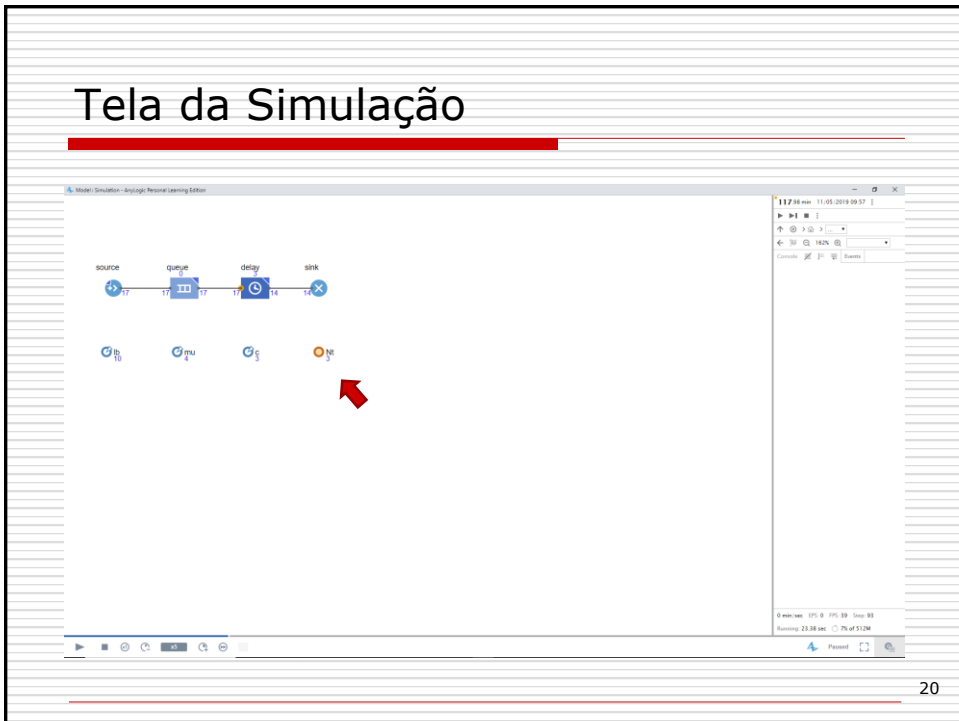
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Bloco "delay"



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Tela da Simulação



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Gráfico N(t) (série temporal)

The screenshot displays the AnyLogic Personal Learning Edition interface. In the center, a Time Plot shows a step function representing the number of jobs in the system over time. The plot is titled 'Jobs no Sistema'. To the right, the 'Properties' window for the 'plot - Time Plot' is open. Several options are circled in red: the 'Show' checkbox is checked; the 'Data source' dropdown is set to 'Jobs no Sistema'; the 'Line style' dropdown is set to 'Step'; and the 'Interpolation' dropdown is set to 'Linear'. The 'Background color' is set to 'No fill', and the 'Border color' is set to 'No line'. The 'Time axis format' is set to 'Model time units'.

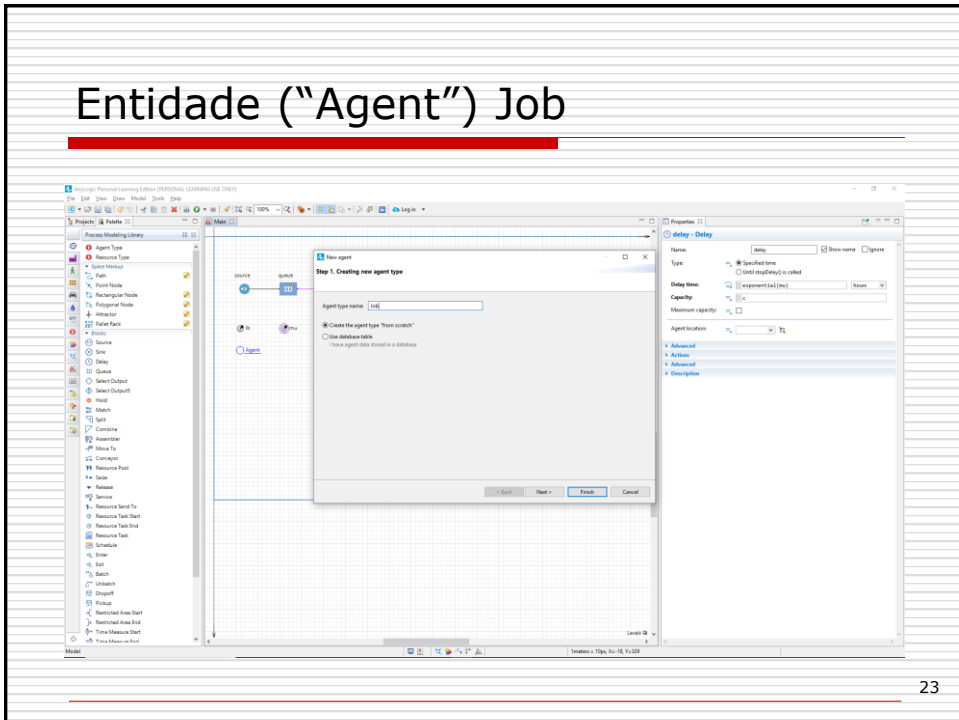
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Tela da Simulação

The screenshot shows the AnyLogic simulation environment. At the top, a process flow diagram consists of four blocks: 'source' (a blue circle with a plus sign), 'queue' (a blue rectangle with a queue icon), 'delay' (a blue rectangle with a clock icon), and 'sink' (a blue circle with an X). Below the flow diagram, there are four icons representing different types of plots: 'N(t)', 'GPU', 'G', and 'N'. At the bottom, a Time Plot is displayed, showing a step function for 'Jobs no Sistema' over time. The plot has a red arrow pointing to it. The plot's y-axis ranges from 0 to 4, and the x-axis ranges from 500 to 800. The plot is titled 'Jobs no Sistema'. At the bottom of the simulation window, there is a control bar with a play button, a stop button, a refresh button, and a 'Finished' status indicator.

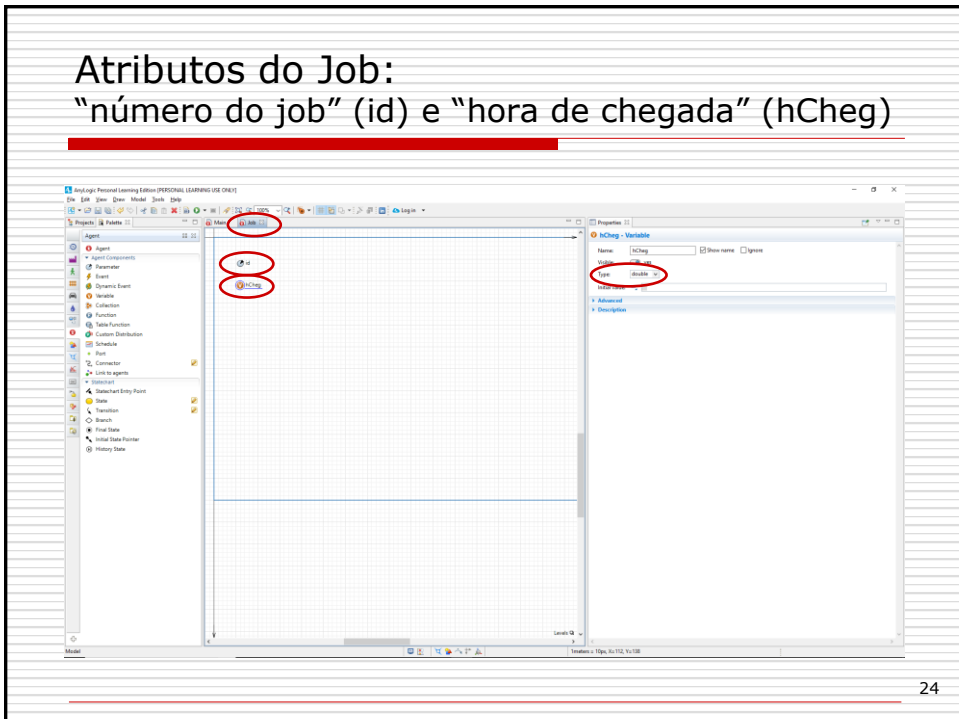
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Entidade ("Agent") Job



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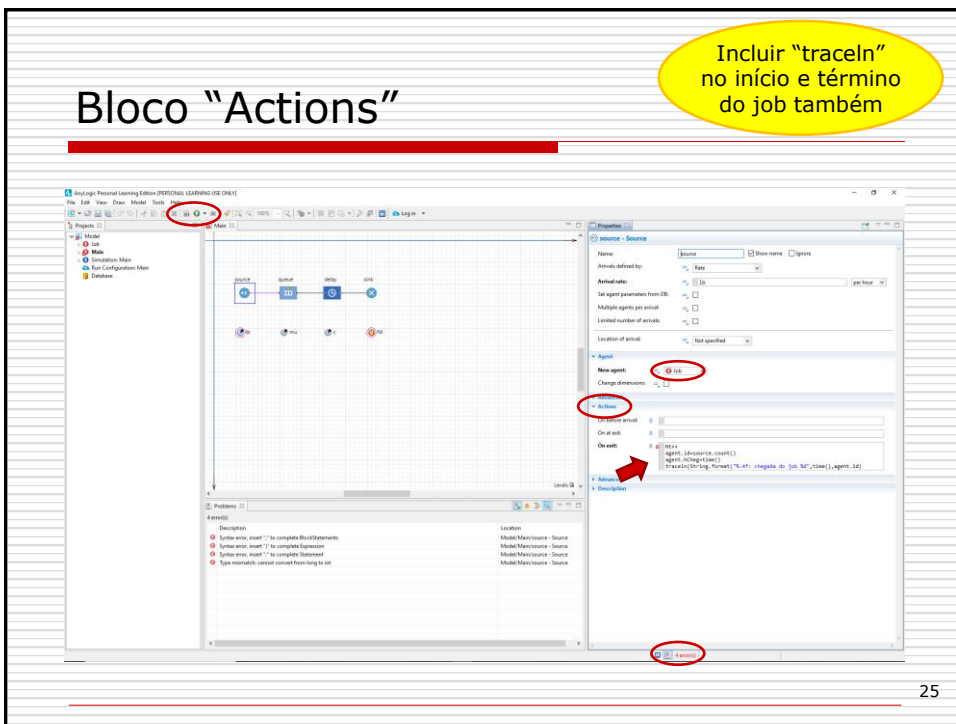
Atributos do Job: "número do job" (id) e "hora de chegada" (hCheg)



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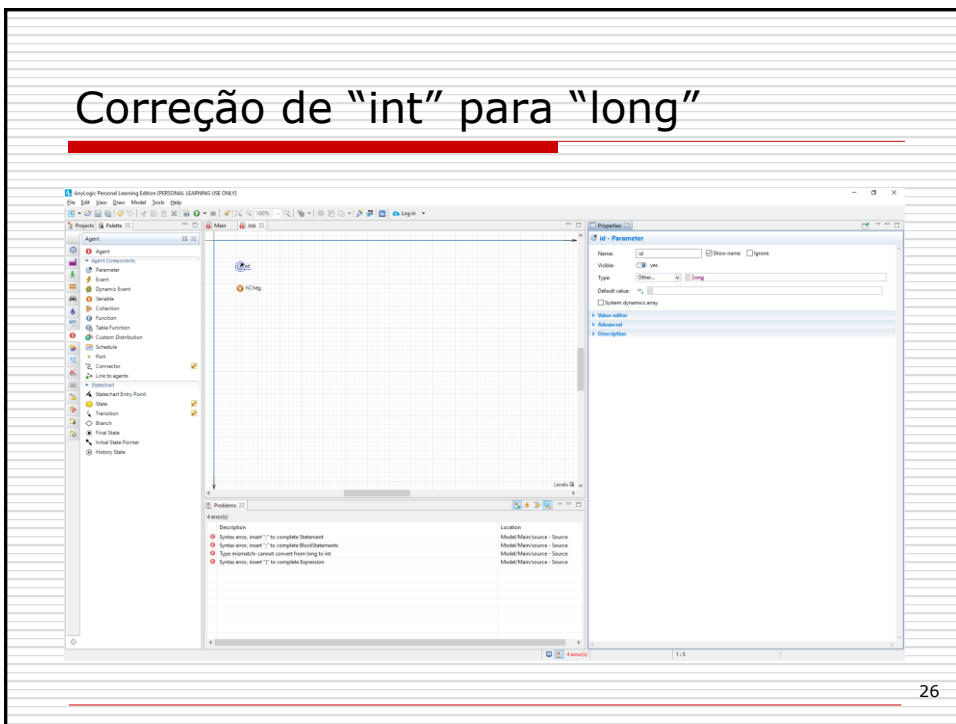
Bloco "Actions"

Incluir "traceln" no início e término do job também



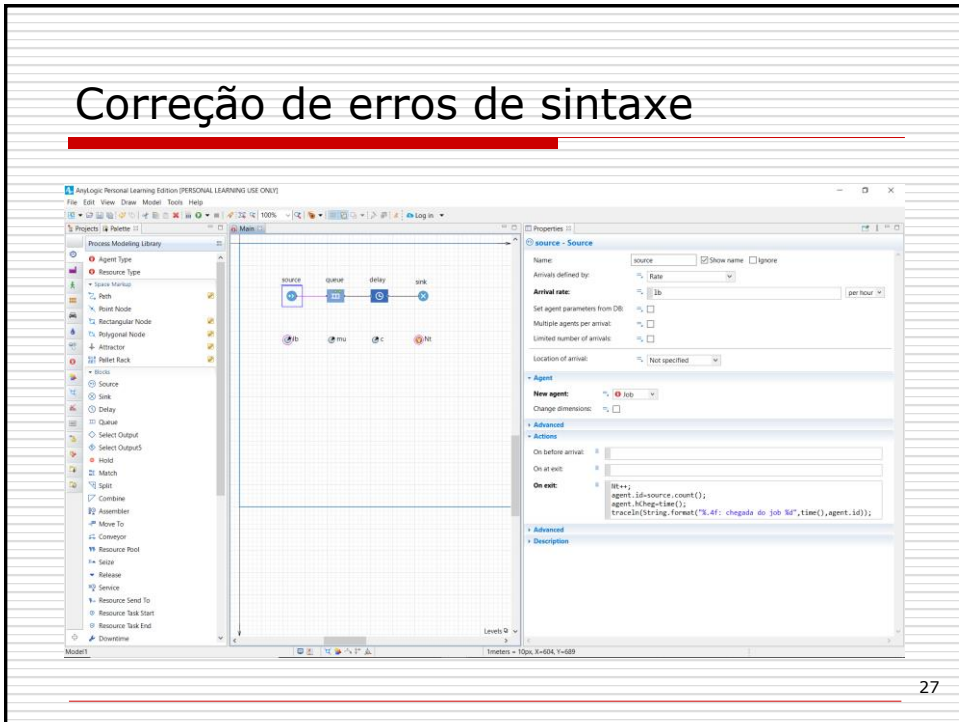
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Correção de "int" para "long"



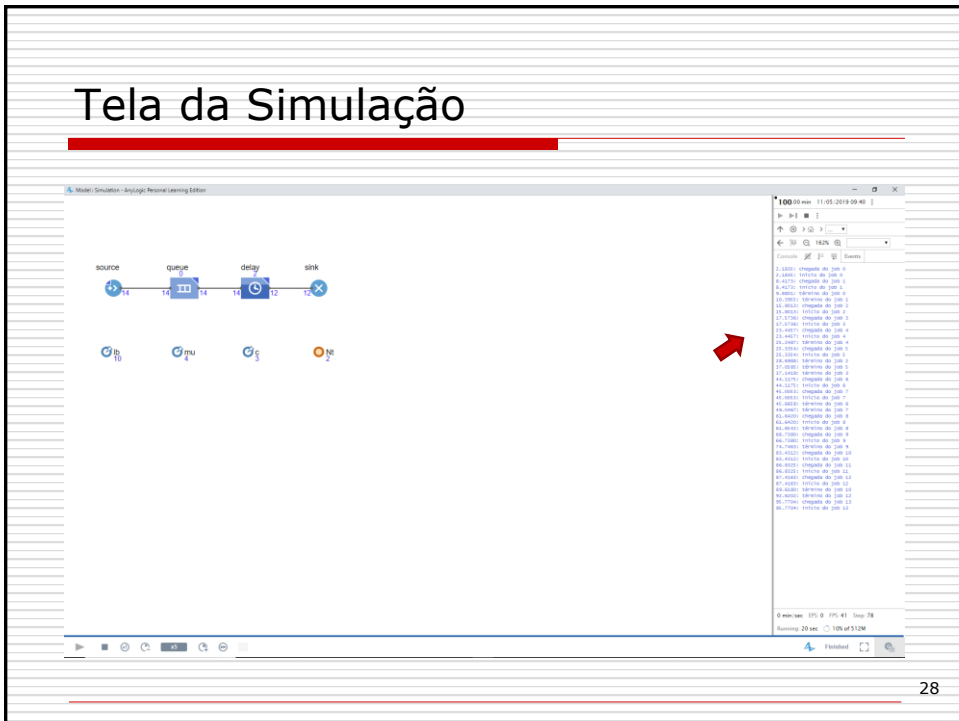
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Correção de erros de sintaxe



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Tela da Simulação



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Amostragem – Tempos de Fluxo

The screenshot shows the AnyLogic software interface. On the left, a sidebar contains various chart types, with 'Histogram' selected and circled in red. The main workspace displays a simulation model with a flow diagram and two charts: a step function chart and a histogram. The histogram is titled 'Tempos de Fluxo'. On the right, the 'Properties' window for the 'chart - Histogram' is open. The 'Data' section is expanded, and the 'Histogram' property is circled in red. Other properties like 'Name', 'Show PDF', and 'Show mean' are also visible.

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Apontamento do Tempo de Fluxo

This screenshot shows the same AnyLogic simulation model as in slide 29. The 'Properties' window for the 'chart - Sim' is open. The 'Actions' section is expanded, and the expression `h.setValues(agent.getTime())` is circled in red. The 'Name' property is also circled in red. The main workspace shows the simulation model and the two charts, with the histogram now titled 'Tempos de Fluxo'.

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Tela da Simulação

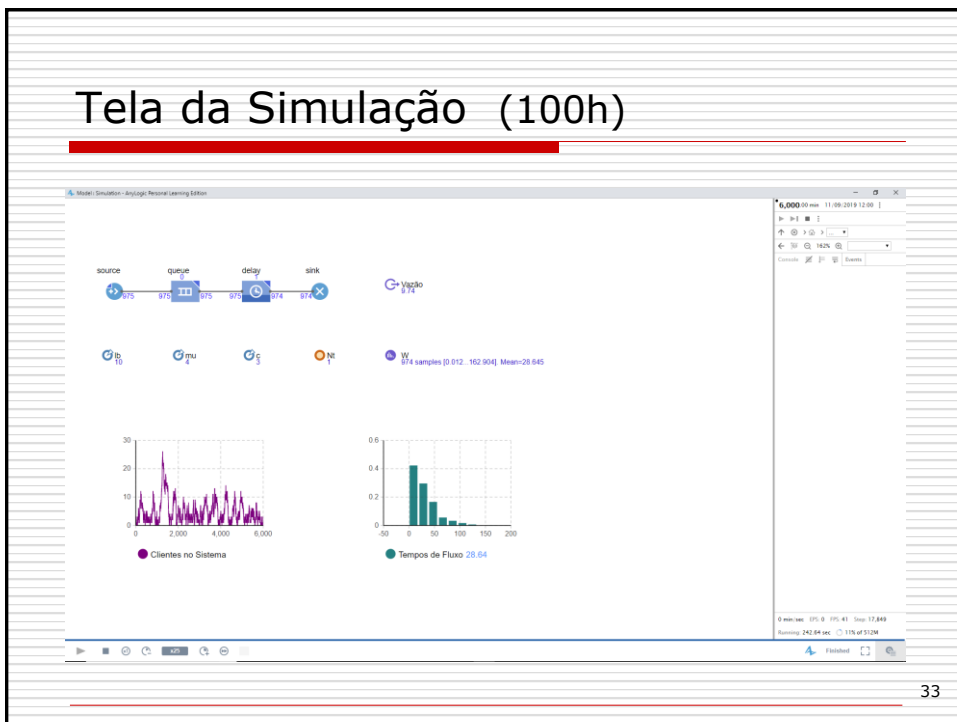
The screenshot displays the AnyLogic simulation environment. At the top, a process flow diagram shows a sequence: source (S1) → queue (Q1) → delay (D1) → sink (S2). Below the diagram, there are two charts: a line chart on the left labeled 'Jobs no Sistema' showing fluctuations over time, and a bar chart on the right labeled 'Lead times 24.32' showing a distribution of lead times. A red arrow points to a 'W' sample icon with the text 'W samples [0.237, 83.182] Mean=24.324'. On the right side, a log window titled '600.00 min 10/21/2021 10:00' displays a list of simulation events such as 'início do job 83', 'chegada do job 84', etc. The bottom status bar indicates 'Running: 66.9 sec' and '4% of 512M'.

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Saídas da Simulação – “output”

This screenshot shows the 'Monitor - Output' window in AnyLogic. The main area contains a process flow diagram similar to the previous slide, but with a 'Monitor' block added. Below the diagram are two charts: a line chart labeled 'Custo em Sistema' and a bar chart labeled 'Tempo de Fluxo'. The right-hand pane is titled 'Monitor - Output' and contains configuration options: 'Name' (set to 'custo'), 'Units' (set to 'custo'), 'Type' (set to 'double'), and 'Value' (set to 'sum(Load_count(L)/Time)'). Under the 'Calculated' section, 'On simulation end' is selected. The 'Description' field is empty.

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Modelagem em AL

1. Criar o modelo (unidade de tempo, nome e pasta)
2. Fluxograma do Processo
3. Dados ("inputs")
4. "Set up" e "Run" da simulação
5. Parâmetros & Variáveis
6. Blocos "Actions" ("on enter", "on exit",... Códigos Java)
7. Agente (job, parâmetros e variáveis)
8. Gráfico Nt (série temporal)
9. Histograma W (lista, gráfico, comando "add")
10. Variável "output" (cálculo no fim da simulação)

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