Be on the lookout for this fellow: The call-outs are ACTIONs for you to do!

When you see the check mark, compare your work to the marked element
Exercise 3: Learning Objectives

- Compare different L1 Cache configurations
  - Automatically using OCCAM
- Plotting the results using a script
  - The script is part of the workflow
Exercise 2: Overview of Steps

1. Instantiate a simulator
   - With Prospero, DRAMSim2, L1 and L2 Cache
2. Exploring L1 Configurations
   - Variable space exploration using OCCAM
3. Automatic plots
   - Using an automated script to generate the plots
Instantiate a simulator

Estimated time: 10 minutes
Instantiate a simulator

Accessing OCCAM

Use your laptop’s web browser to access your OCCAM instance for exercise 3

- Follow instructions in the handout on exercise 3 access

Click login
Then input your username & password
① Instantiate a simulator

Create a new workset

- Create a new workset named “Ex 3 workset”
  - Used to create and maintain OCCAM objects

(a) click here to access all worksets
(b) give new workset a name
(c) click to make workset!
① Instantiate a simulator

*Instantiate a simulator with cache*

- Create an experiment workflow
  - Use the workflow to instantiate another simulator

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(a) go to bottom of workset page

(b) give workflow a good descriptive name

(c) click to add the workflow
1. Instantiate a simulator

*Instantiate a simulator with cache*

- Add the SST block
  - To instantiate the SST simulator

(a) Select the empty block

(b) And then click on the top section of the box
1. Instantiate a simulator

*Instantiate a simulator with cache*

- Add the SST block
  - To instantiate the SST simulator

(a) Type “simulator-instantiator”

(b) Select the “simulator-instantiator” option
1 Instantiate a simulator

Instantiate a simulator with cache

- Add the SST block
  - To instantiate the SST simulator

(a) Add SST as the framework on the middle section

(b) Click Attach
① Instantiate a simulator

*Instantiate a simulator with cache*

- Add a block to the simulator
  - Block specifies configuration to instantiate simulator

Click plus sign to add a new block
① Instantiate a simulator

*Instantiate a simulator with cache*

- Add the SST configuration block
  - We’ve prepared some for the tutorial
  - Configures SST for prospero + Cache + DRAMSim2

(a) Click top section and search for “configuration”

(b) Click configuration
1 Instantiate a simulator

Instantiate a simulator with cache

- Add the SST configuration block
  - We’ve prepared some for the tutorial

(a) Click middle section and search for “SST Tutorial Configuration”

(b) Select “SST Tutorial Configuration”

(c) Click attach (hidden)
1 Instantiate a simulator

**Instantiate a simulator with cache**

- Let’s name the instantiated simulator

(a) Click the SST configuration tab
   Careful: check that you are using the “General Options” subtab

(b) Name simulator: “Simulator DRAMSim2+Cache”

(c) Click Update (scroll down)
1. Instantiate a simulator

*Instantiate a simulator with cache*

- And select the configuration file
  - Configures SST for prospero + Cache + DRAMSim2

(a) Click the SST Tutorial configuration tab

(b) Select `config_ProsperoCacheDRAMSIM2.py`

(c) Click Update (Scroll down)
1. Instantiate a simulator

*Instantiate a simulator with cache*

- Instantiate simulator by executing workflow
  - Extracts specifications & objects for OCCAM
  - Associates SST simulator with the named object

(a) Select the Run tab

(b) Click Run
<table>
<thead>
<tr>
<th>Workflow</th>
<th>Run</th>
<th>Metadata</th>
<th>Files</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>Log</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1 Instantiate a simulator

Check your work!

- Verify that we have generated the simulator

(a) Refresh web page (not shown)

(b) Click Output tab

(c) Check for new simulator
2 Exploring L1 Configurations
Estimated time: 10 minutes
We will now create an experiment that compares different L1 Cache configurations

- **Cache size:**
  - A bigger cache can store more information
  - A smaller cache has smaller lookup times

- **Associativity:**
  - Lower associativity has higher lookup times
  - Higher associativity has potentially more cache conflicts
2. Exploring L1 Configurations

Create new experiment

- First we must setup the experiment

Go back to “Ex 3 workset”
Click on the link on the top left of the page
Exploring L1 Configurations

Create new experiment

- Create a new experimental workflow

We just created this experiment to instantiate a simulator.
2 Exploring L1 Configurations

Create new experiment

• Create a new experimental workflow
  ◦ Compare different L1 Cache configurations

(a) Add an experiment object
(b) Give experiment a name
(c) Add the experiment
Exploring L1 Configurations

Add simulator to workflow

- Use the simulator that you just created

(a) Select empty block and select “simulator” in top section (not shown)

(b) Click middle section and search for “Simulator DRAMSim2+Cache” (the name we gave the instantiated sim)

(c) Click Attach (hidden)
2 Exploring L1 Configurations

Add traces for simulator

- We’ll use the same traces as before

Click plus to add an input (trace) to the instantiated simulator
Exploring L1 Configurations

Add traces for simulator

- Insert trace object as the simulator’s input

(a) Type “trace” in top section

(b) Click middle section and search for “Prospero Traces”

(c) Click Attach to add a trace object into the workflow
Exploring L1 Configurations

Add traces for simulator

- Check your work – does it match?

(a) Select the bottom plus

Does your workflow look like this?

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27
2 Exploring L1 Configurations

Add configuration for DRAMSim2

- Add a DRAMsim2 configuration to the workflow

(a) Type “configuration” in top section

(b) Select “new configuration” in the middle section

(c) Click Attach (not shown)
② Exploring L1 Configurations

Add configuration for DRAMSim2

- Add a DRAMsim2 configuration to the workflow

(a) Select the bottom plus

Does your workflow look like this?
2. **Exploring L1 Configurations**

*Add configuration for DRAMSim2*

- Add the DRAMSim2 configuration generator

(a) Type “configuration-generator” in the top section

(b) Select “DRAMSIM2-config-generator” in the middle section

(c) Click Attach (hidden)
② Exploring L1 Configurations

Check your workflow

Does your workflow look like this?
Exploring L1 Configurations

Setup the traces in workflow

- Specify the traces to run with simulator

(a) Click “Prospero Traces” tab

(b) Select all traces to add each one for a separate simulation run

(c) Click Update to save parameters for the trace object
2 Exploring L1 Configurations

Setup the L1 Cache configuration

(a) Click “Simulator DRAMSim2+Cache” tab

(b) Select General

(c) Select “L1 cache”
Setup the L1 Cache configuration

(a) Change the cache size to “16,32”

(b) Change the associativity to “1,8”

(c) Click Update
Exploring L1 Configurations

Setup the L1 Cache configuration

<table>
<thead>
<tr>
<th>cache_size</th>
<th>associativity</th>
</tr>
</thead>
<tbody>
<tr>
<td>16,32</td>
<td>1,8</td>
</tr>
</tbody>
</table>

Note that these configurations will go through all the possible permutations, thus generate 4 outputs:

- size = 16, associativity=1
- size = 16, associativity=8
- size = 32, associativity=1
- size = 32, associativity=8
Exploring L1 Configurations

Run the experiment

(a) Click “Run” tab

(b) Click “Run” to dispatch workflow. You should see it executing.
Exploring L1 Configurations

Run the experiment

Example of output from the running experiment

Wait until the run finishes
Exploring L1 Configurations

Check your work!

(a) Refresh web page (not shown)

(b) Click Output tab
③ Automatic plots
Estimated time: 10 minutes
Now we will create an experiment that generates a plot with the outputs of the previous run

- The results (outputs) of the previous experiment are the inputs of the script
3 Automatic plots

Create new experiment

- Go back to the Ex 3 workset

Go back to “Ex 3 workset”
Click on the link on the top left of the page
3 Automatic plots

Create new experiment

- Create a new experiment

(a) Add an experiment object

(b) Give experiment a name

(c) Add the experiment
Put the “plotter” script in the workflow

(a) Select empty block and select “script” in top section (not shown)

(b) Click middle section and search for “plotter”

(c) Click Attach (hidden)
Then we need to add all the four outputs of the experiment we just ran.
3 Automatic plots

Add the results as inputs

- Add the first input

(a) Type “application/json” in top section

(b) Select “application/json”
3 Automatic plots

Add the results as inputs

- Add the first input

(a) Search the middle section for the first output of the previous experiment

(b) The name is not completely visible: “Simulator_DRAMSim2+Cache...”

WARNING: There are four outputs with the same name. Make sure you select the first one!

(d) Click Attach (not shown)
③ Automatic plots

Add the results as inputs

- Add the second input

Does your workflow look like this?

Click the plus
3 Automatic plots

Add the results as inputs

- Add the second input

(a) Select “application/json”
3 Automatic plots

Add the results as inputs

- Add the second input

(a) Search the middle section for the first output of the previous experiment

(b) The name is not completely visible: “Simulator_DRAMSim2+Cache...”

(c) Click Attach (not shown)

WARNING: There are four outputs with the same name. Make sure you select the second one!
3 Automatic plots

Add the results as inputs

- We have the first two inputs
3 Automatic plots

Add the results as inputs

- Repeat the process to add the third and fourth inputs

(a) Add the remaining two outputs of the previous experiment

(b) The name is not completely visible: “Simulator_DRAMSim2+Cache...”

WARNING: There are four outputs with the same name. Make sure you select the third and fourth ones!
③ Automatic plots

Run the experiment

- All that is left is to run the workflow

(a) Click “Run” tab

(b) Click “Run” to dispatch workflow. You should see it executing.
③ Automatic plots

Run the experiment

Example of output from the running experiment

Wait until the run finishes
③ Automatic plots

Check your work!

(a) Refresh web page (not shown)

(b) Click Output tab

(c) Click on the output name to open it
Check your work!

(a) If the results do not show as expected try refreshing the page

Impact of L1 Cache Parameters

Simulation time (ns)

Trace file
Side note:
Future release of OCCAM
Future release of OCCAM

- This process is not scalable
  - If we need to explore tens or hundreds of variable combinations

- We are working in an improved approach
  - Simplifies the process
  - Merges the two steps (run experiment and plotting)
Future release of OCCAM

- Specifically we plan to introduce an aggregator object
  - It will collect all the outputs of the previous object
  - Presents them as a single input to the next object
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