DRAM VisTool User Manual

Program Installation

Extract all the files into the same directory (should be VisTool by default) then compile and run "VisTool.java". The data file "DDR400.txt" and parameter file "DDR400_para.txt" are provided for immediate program exploration.

Operation Window

Here is the main operation window (figure 1) where all the graphical interactions take place. The welcome page provides a brief description of the options available in the tool bar.

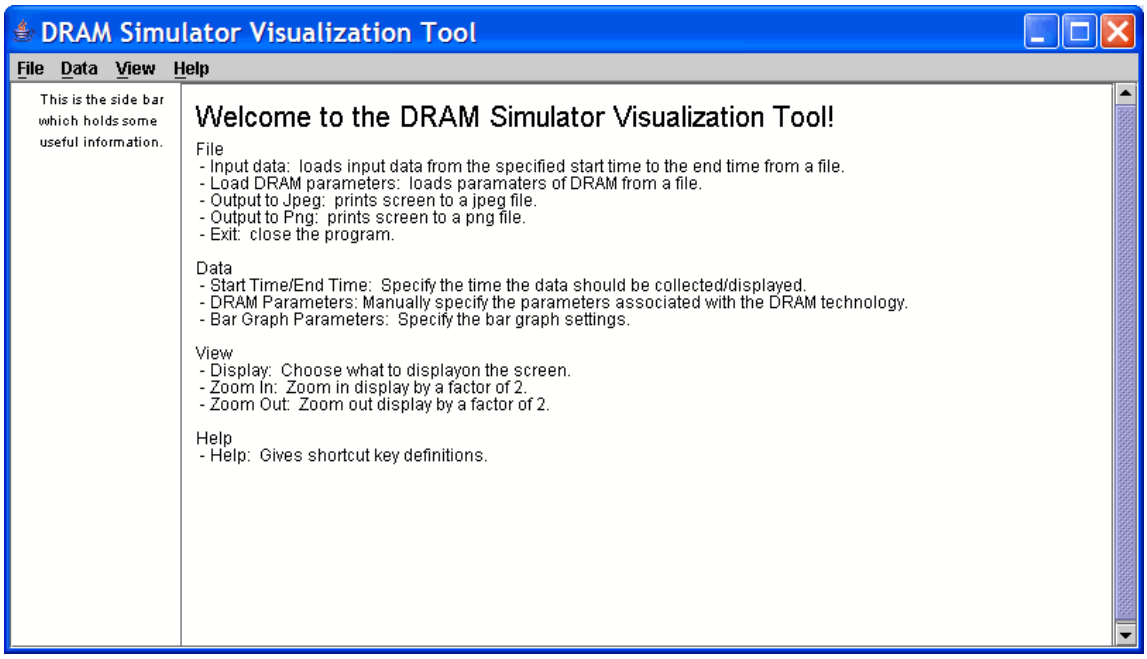

Figure 1: Main Operation Window

Input and Output File Managements

The File Menu option (figure 2) controls all importing and exporting functions of the visualization tool. The memory access data is imported via output data generated by DRAMsim that is formatted to our tool's specification. The text contains a line of text for each DRAM activity consisting of the following information separated by a space: start time of the activity, command type (read, write, row activation, etc), transaction id, rank number, bank number, row id, and column id. Figure 3 is an example of how the input data file may look.

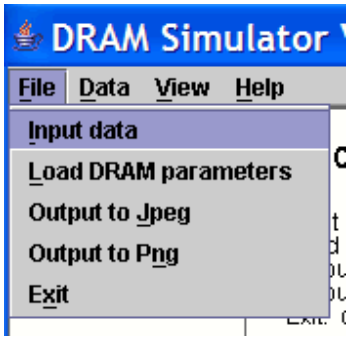

Figure 2: File Menu options

```
.
.
1386 READ 23 3 3 8191 2047
1382 ROWACT 22 3 0 3670 1125
1414 WRITE 22 3 0 3670 1125
1430 WRITE 24 3 3 8191 2047
1573 READ 26 3 3 8191 2047
1563 PRECHARGE 25 3 0 2455 1483
.
.
```

Figure 3: Sample input data

Figure 4 shows the dialog that pops up prompting for which data file to import.

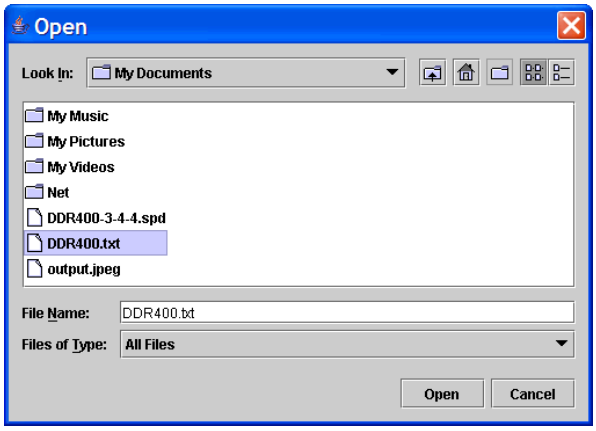

Figure 4: Open Dialog for data input

The parameters of the DRAM technology (DRAM type, rank and bank count, timing parameters, etc) can be loaded from a parameter file (figure 5) or entered manually (see following section on Data Options).

```
type                DDR2
clockPeriod         1
burstLength         16
tRC                 14.0
tRAS                10.0
tCAS                10.0
tRCD                10.0
tFAW                0.0
tDQS                2.0
tWR                 2.0
tRP                 4.0
num_rank            4
num_bank            4
```

Figure 5: Parameter File sample

The user can record the currently displayed graphics to a jpeg or png file (figure 6) using the two output options.

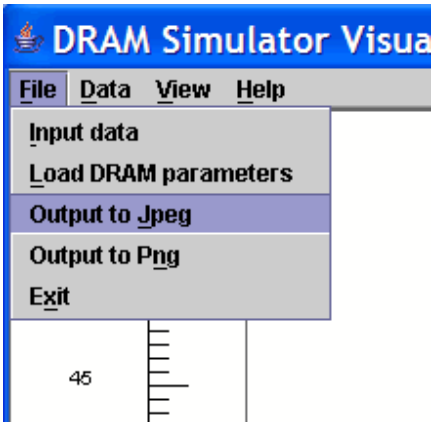

Figure 6: Output options in the File Menu

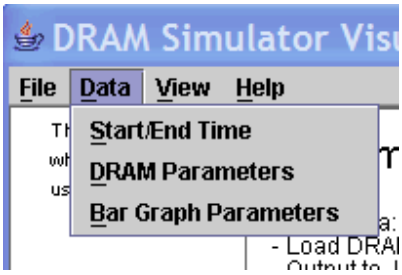

Figure 7: Data Menu options

Data Options

The data menu option (figure 7) allows the user the options to specify the range of time the tool should be concerned with, modify of the DRAM parameters (figure 8), and adjust the Bar Graph parameters (figure 9).

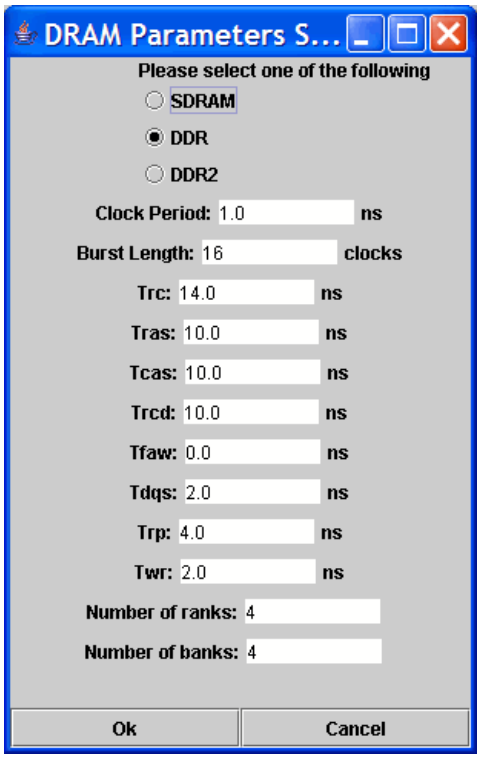

Figure 8: DRAM Parameters dialog box

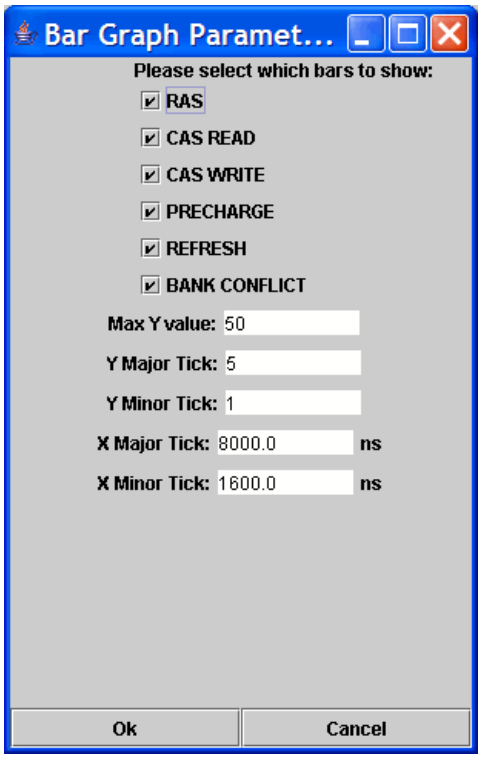

Figure 9: Bar Graph Parameters dialog box

View Options

One of the most useful features in the program is the ability to zoom-in on the timing diagrams (figure 10) to inspect transactions in details or zoom-out (figure 11) to observe several transactions concurrently. Applying to the statistic bars as well, this function can be used via the View Menu option (figure 12) or by using the combination of keys suggested in the Help Menu dialog.

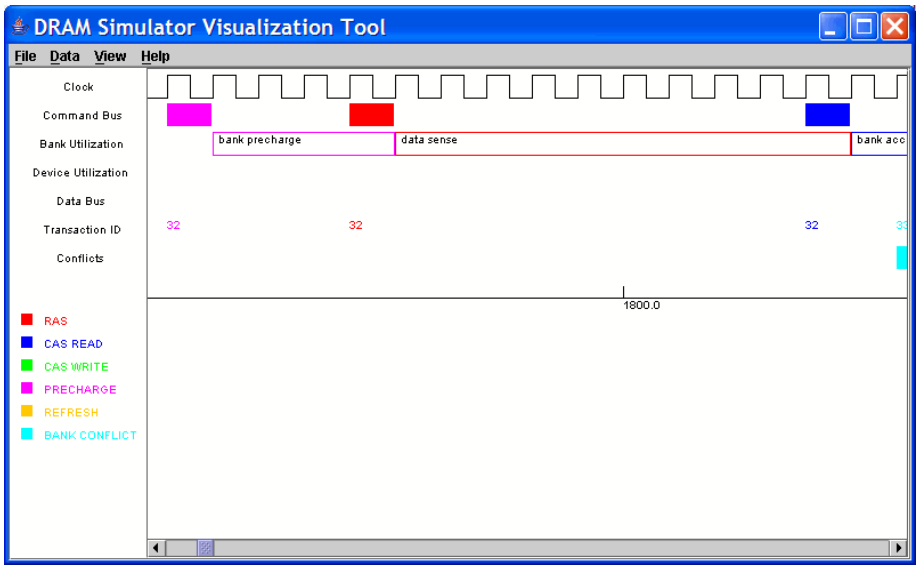

Figure 10: Microscopic view of 3 memory access commands by zooming in.

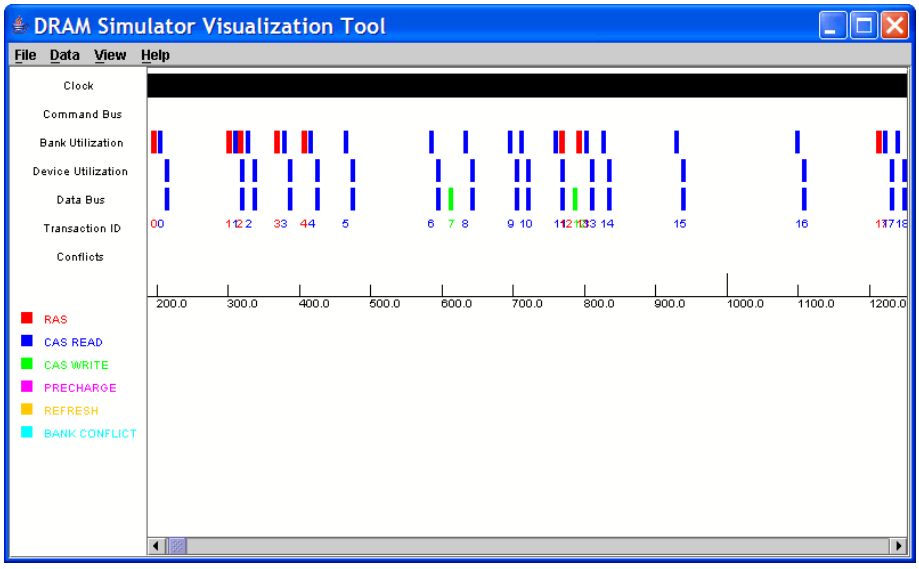

Figure 11: Macroscopic view of many memory access commands by zooming out.

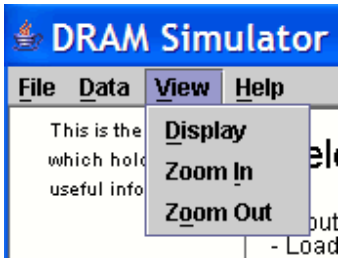

Figure 12: View Menu options

Timing Diagram Mode and Stats Bar Graph

The heart of the visualization tool is the display modes which can be accessed by selecting "Display" (figure 13):

1) Timing Diagram Modes: Allows the user to view all the data transactions over time. The DRAM commands from the input are used to generate timing information for:
    - Command and address bus utilization.
    - Bank utilization: the data movement within a bank between DRAM cells and the sense amplifiers.
    - Device utilization: the data movement through shared I/O gating, read latches, and write drivers.
    - Data bus utilization.
    - Bank conflicts
2) Bar Graph Mode: Statistics of the DRAM commands are displayed visual so that the user can see how the statistics change over time, and compare DRAM commands side-by-side.

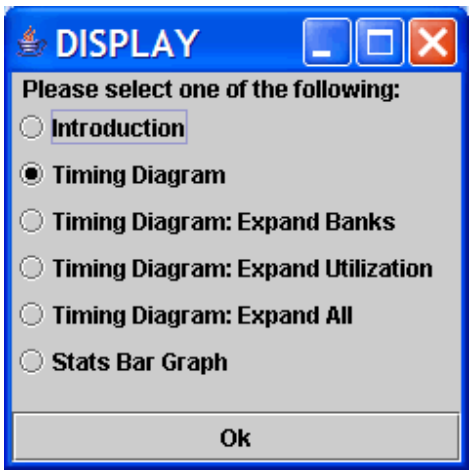

Figure 13: Display dialog for timing diagrams

The user has the option to expand either the bank or device utilization or both to explicitly see which areas each DRAM command is accessing and clearly shows where conflicts or contentions may occur. Figure 14 shows an example of when the device utilization is expanded.

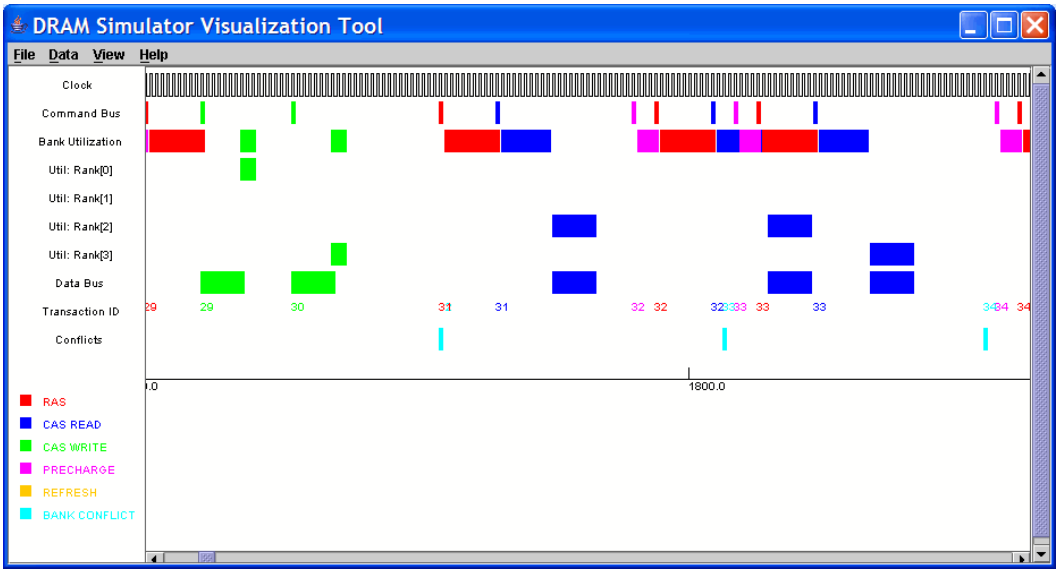

Figure 14: The expansion of the device utilization.

The user can also click on any of the blocks for a popup with the transaction information for that command (figure 15). Transaction information includes the transaction start and end time, the clicked block's start and end time, the rank, bank, row, and column information.

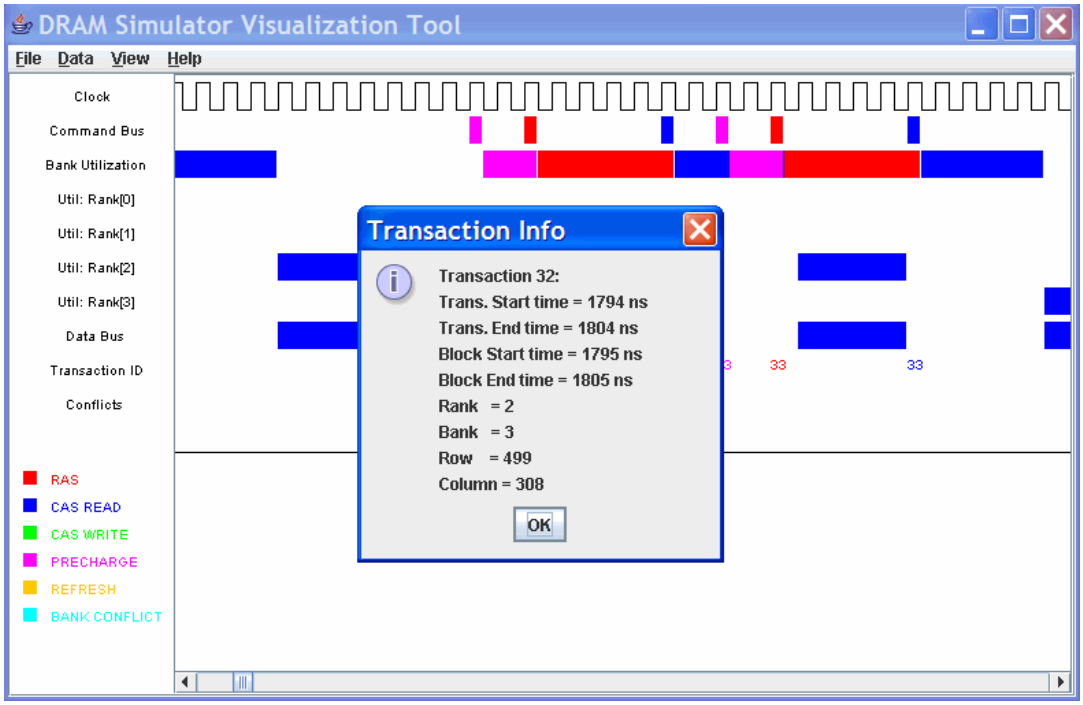

Figure 15: Transaction Info popup

The Bar Graph Mode (figure 16) display statistics of the data in bar graphs so that the user can visually see the number of specific DRAM commands, how it changes over time, and how they compare to other DRAM commands. The user can specify with commands they wish to examine and change the granularity of the x-axis and y-axis.

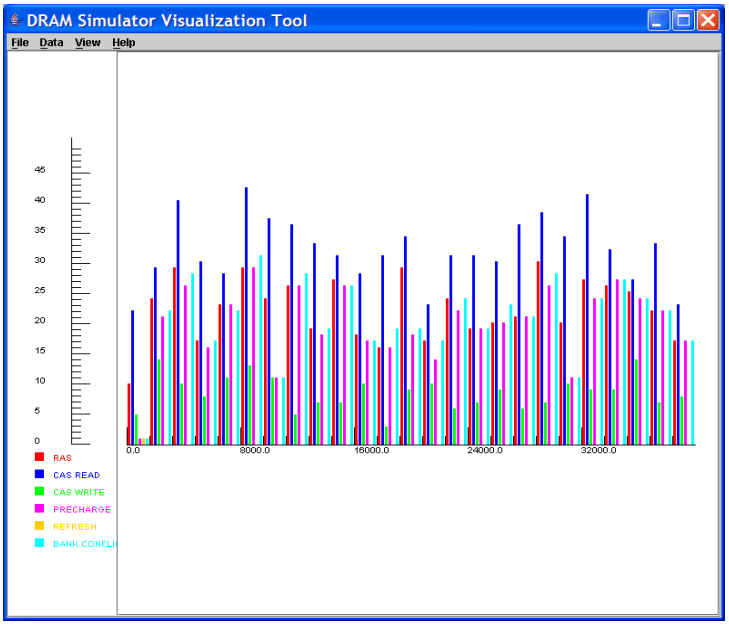

Figure 16: Bar Graph Mode