Features that we need feedback on

Integrated Roofline

• Examine memory traffic at each level of the memory hierarchy on the Roofline chart.

Roofline Compare

• Visualize multiple Roofline charts on the same chart and track your optimization progress.

New and Improved Summary

• More actionable program metrics including memory traffic statistics

Intel® Advisor customizations

• Adjust roofs for multi-socket systems and create custom reports.

Flow Graph Analyzer

• Workflows: Create, Debug, Visualize and Analyze
INTEGRATED ROOFLINE MODEL

Understand how the memory reacts to your optimizations
In the Intel® Advisor Integrated Roofline chart the Arithmetic Intensity and memory traffic for each level of the memory hierarchy is represented separately.

You can visualize the levels that need further optimization.
Visualize multiple roofline charts on the same graph.
Roofline compare

Visualize multiple roofline charts on the same graph.
Test optimization strategies and see how much progress you are making.
NEW AND IMPROVED SUMMARY
New and Improved Summary

Program metrics
- Elapsed Time: 7.71s
- Vector Instruction Set: AVX2, AVX
- Number of CPU Threads: 36

Performance characteristics
- Total CPU time
- Time in 2 vectorized loops
- Time in scalar code

Vectorization Gain/Efficiency
- Vectorized Loops Gain/Efficiency
- Program Approximate Gain

OP/S and Bandwidth

Overall metrics
- GFLOPS: 61.89
- GFLOP Count: 477.428
- FP Arithmetic Intensity: 0.30422
- GINTOPS: 1.29

Informations on Operations and Memory transfers

<table>
<thead>
<tr>
<th>Effective OP/S And Bandwidth</th>
<th>Utilization</th>
<th>Hardware Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFLOPS</td>
<td>61.89</td>
<td>4.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3%</td>
</tr>
<tr>
<td>GINTOPS</td>
<td>1.292</td>
<td>0.19%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.097%</td>
</tr>
<tr>
<td>CPU &lt;-&gt; Memory [L1+NTS GB/s]</td>
<td>203.4</td>
<td>1.6%</td>
</tr>
<tr>
<td>L2 Bandwidth [GB/s]</td>
<td>105.9</td>
<td>3.1%</td>
</tr>
<tr>
<td>L3 Bandwidth [GB/s]</td>
<td>69.07</td>
<td>5.2%</td>
</tr>
<tr>
<td>DRAM Bandwidth [GB/s]</td>
<td>14.88</td>
<td>11%</td>
</tr>
</tbody>
</table>
CUSTOMIZE INTEL® ADVISOR
## Column Configurator

### Customize view

<table>
<thead>
<tr>
<th>Function Call Sites and Loops</th>
<th>Performance Issues</th>
<th>CPU Time</th>
<th>Type</th>
<th>Why No Vectorization?</th>
<th>Vectorized Loops</th>
<th>Compute Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>([loop in main at Driver.c171])</td>
<td>1 Possible inefficiency</td>
<td>1.263s</td>
<td>Vectorized (Body)</td>
<td>inner loop was already vectorized.</td>
<td>AVX2</td>
<td>Self GFLOPS: 3.573, Self AI: 0.444</td>
</tr>
<tr>
<td>([loop in main at Driver.c158])</td>
<td></td>
<td>0.751s</td>
<td></td>
<td></td>
<td>1.189</td>
<td>2.375</td>
</tr>
<tr>
<td>([loop in main at Driver.c164])</td>
<td>1 Potential underflow</td>
<td>0.313s</td>
<td>Vectorized (Body)</td>
<td>inner loop was already vectorized.</td>
<td>AVX</td>
<td>50%</td>
</tr>
<tr>
<td>([loop in main at Driver.c163])</td>
<td>1 Data type conversion</td>
<td>0.095s</td>
<td>Vectorized (Body)</td>
<td>inner loop was already vectorized.</td>
<td>AVX2</td>
<td>0.1061</td>
</tr>
</tbody>
</table>

For more details, refer to the [Optimization Notice](#).
FLOW GRAPH ANALYZER
Flow Graph Analyzer
Workflows: Create, Debug, Visualize and Analyze

Design mode
• Allows you to create a graph topology interactively
• Validate the graph and explore what-if scenarios
• Add C/C++ code to the node body
• Export C++ code using Threading Building Blocks (TBB) flow graph API

Analysis mode
• Compile your application (with tracing enabled)
• Capture execution traces during the application run
• Visualize/analyze in Flow Graph Analyzer
• Works with TBB and OpenMP
BACKUP/HOWTO
How to configure Integrated Roofline

Before launching Intel® Advisor, run:

- $ export ADVIXE_EXPERIMENTAL=int_roofline

Run the GUI

- $ advixe-gui

Configure the GUI to enable cache simulation
How to set it up (GUI)?

Run the Roofline analysis by clicking on **Collect**
How to set it up (command line)?

Before running an analysis, run:

- $ export ADVIXE_EXPERIMENTAL=int_roofline

Run the survey

- advixe-cl -collect survey ....... -- ./my_application param1 param2 ...

Run the trip count and flop

- advixe-cl --collect tripcounts -flop -enable-cache-simulation ....... -- ./my_application param1 param2 ...
Visualisation of the result

If you ran the command line, you need to do the following.

Before running the GUI, run

- $ export ADVIXE_EXPERIMENTAL=int_roofline

Open the GUI and your project

- $ advixe-gui

Browse to your project and open it
How to display the Integrated Roofline chart

You can select which memory level you want to display. Each memory level selected display an additional dot for every kernel. Each dot of the same kernel has the same performance but different Arithmetic Intensities. Here we selected CARM, L2, L3 and DRAM.
Filtering to make it more readable

Right click on a dot and select **Filter In Selection** to filter on this kernel.

For each dot, you can see what would be the performance limitation if the kernel was completely optimized. This dot is using the DRAM AI so the maximum performance must be read on the DRAM bandwidth roofline.
How to interpret your current limitation?

Each dot must be compared to its corresponding roof

A dot can't break its corresponding roof

A first idea of potential performance can be achieved by projections

Find the minimum of all memory subsystems

Actual performance

Arithmetic intensity (Flop/Byte)

L1 GB/s
L2 GB/s
L3 GB/s
DRAM GB/s

Performance might be limited by DRAM

Peak Flop/s
Identifying a bottleneck due to bandwidth

Since no dot can break its corresponding roof, one that is pressed against it is a bottleneck limiting the performance of the loop/function.

In this example, the yellow L2 dot was the bottleneck.

Memory optimizations increase the AI, giving the dot more headroom.

This allows performance to increase until another bottleneck is encountered.

Compute bottlenecks are identified in the same way as on the CARM.
Changing the number value of the Top
Changing the number value of the Top
Changing Column Layout

Click the Customize View toggle button
Click the Gear icon next to Default button which opens the following dialogue
Changing Column Layout

- Selecting/Unselecting columns from the menu creates a new view layout
Changing Column Layout

- Unselecting the Type and CPU Time creates a new Column layout
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