Intel Software tools: Advisor, VTune™, ITAC

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FZ Jülich, June 6th 2016

Agenda

- Advisor XE : enable and improve Vectorization
- VTune™ Amplifier XE: single node performance analysis
- Intel Trace Analyzer and Collector (ITAC): MPI analysis

Vectorization Advisor: getting started

Before you analyze

Run GUI or Command Line

Set-up environment

- Linux: source <install-dir>/advixe-vars.sh

Run GUI or Command Line:

- **advixe-gui**
- **advixe-cl** –collect survey –project-dir C:\myadvisor mult.exe

Intel Compiler 16 or 17 – enables more data in Survey

Min compilation switches (ICC example):

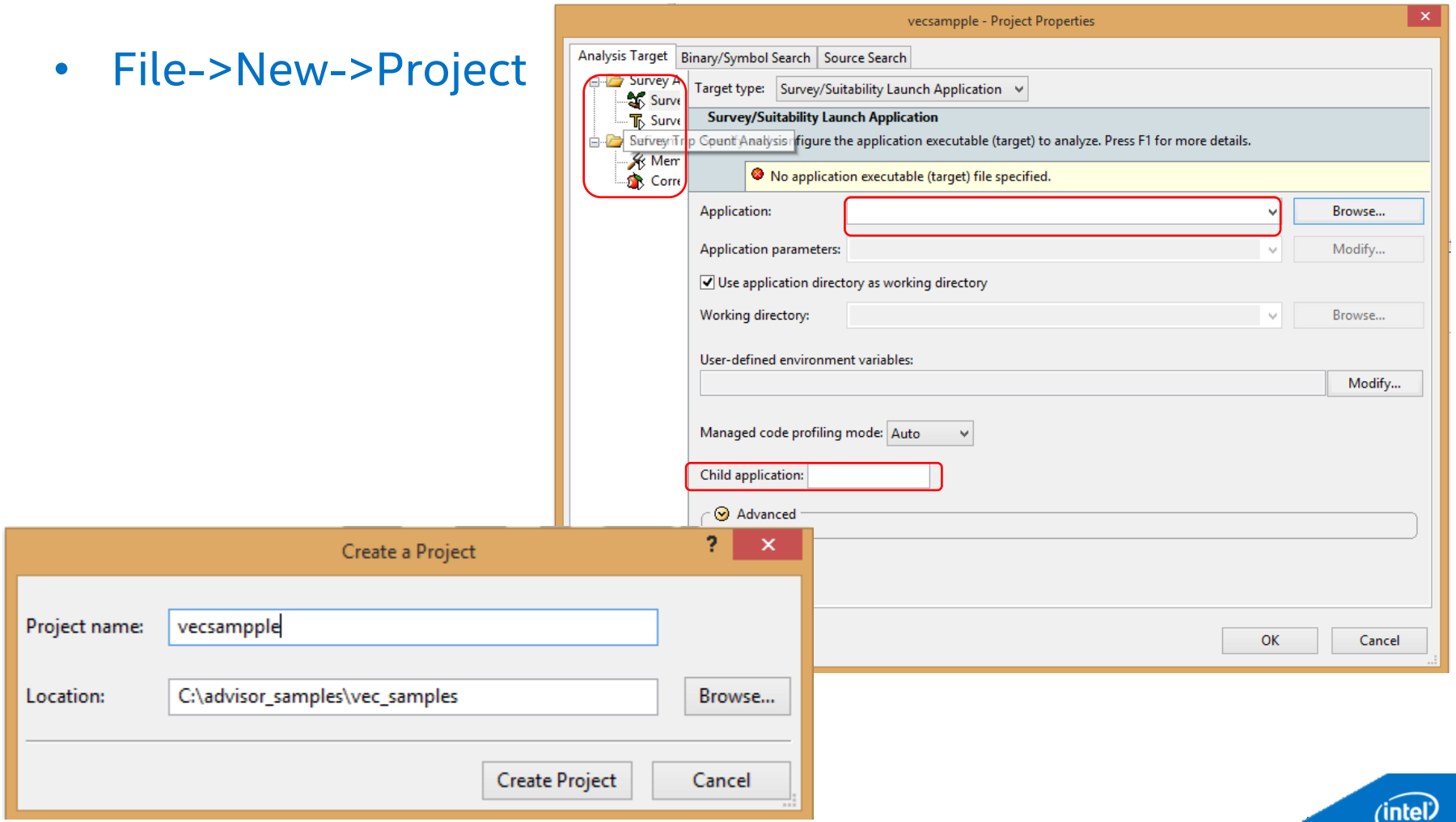
-O2 –g –xHost

More aggressive optimization**: -O3**

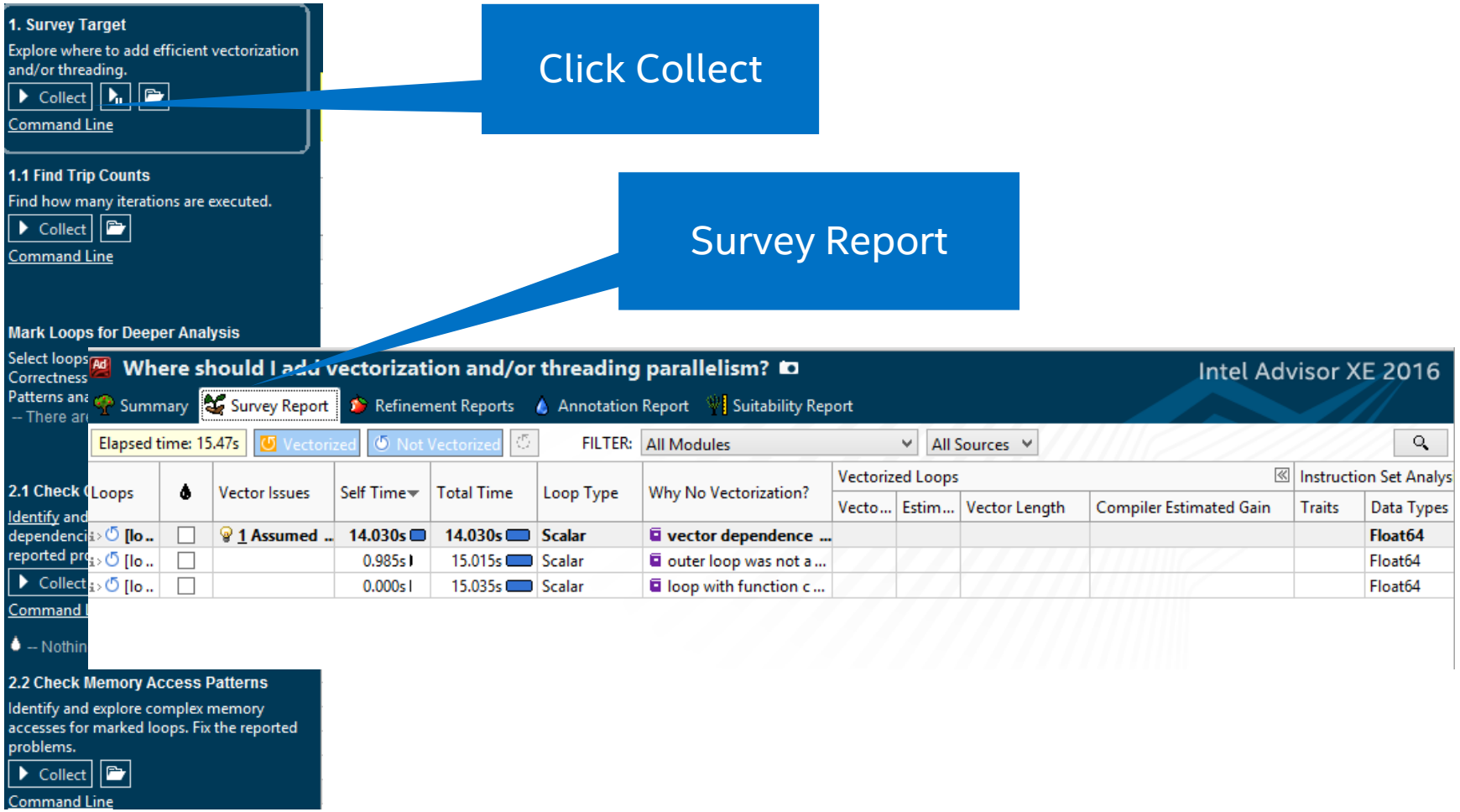
GUI: Before you analyze

Create Project

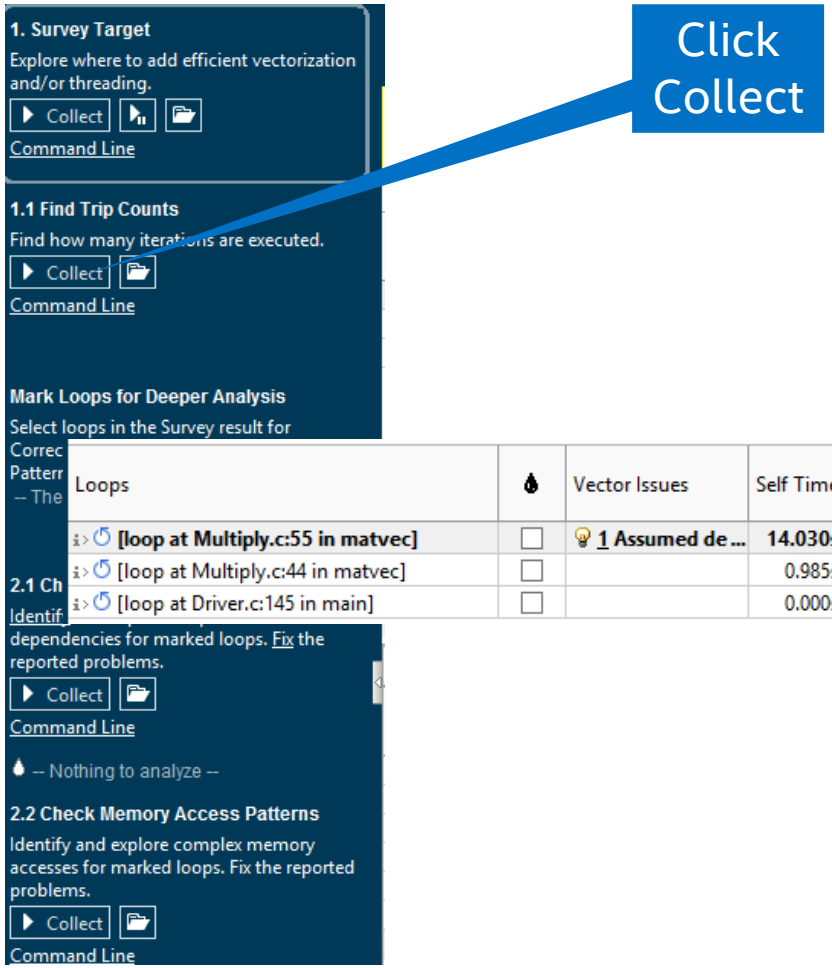
- File->New->Project



Analyze what loops you are spending your time in and how they have been vectorized



Same approach for trip counts

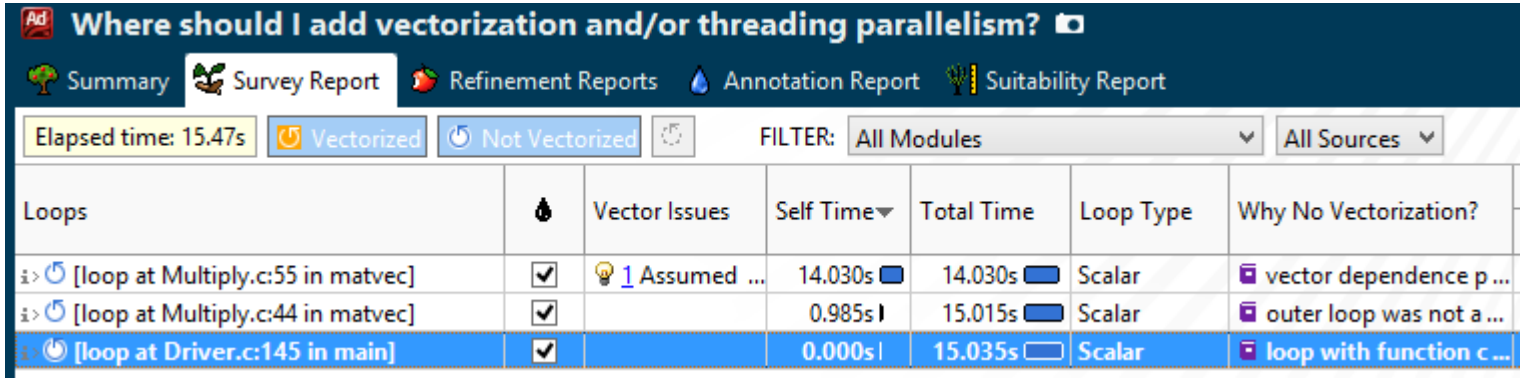


Click Collect

Trip Counts				
Median	Min	Max	Call Count	Iteration Duration
50	**50**	**50**	**101000000**	**< 0.0001s**
101	101	101	1000000	< 0.0001s
1000000	1000000	1000000	1	< 0.0001s

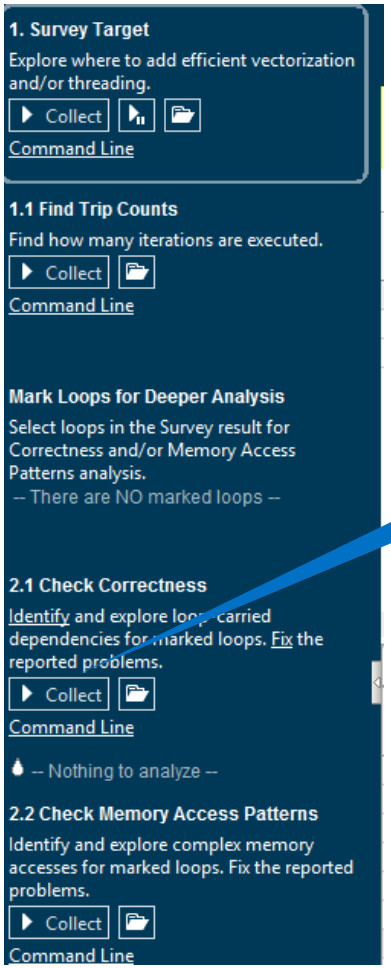
Loops		Vector Issues	Self Time	Total Time	Trip Counts					Loop Type
					Median	Min	Max	Call Count	Iteration Duration	
[loop at Multiply.c:55 in matvec]		**1 Assumed de ...**	**14.030s**	**14.030s**	**50**	**50**	**50**	**101000000**	**< 0.0001s**	**Scalar**
[loop at Multiply.c:44 in matvec]			0.985s	15.015s	101	101	101	1000000	< 0.0001s	Scalar
[loop at Driver.c:145 in main]			0.000s	15.035s	1000000	1000000	1000000	1	< 0.0001s	Scalar

Specify loops for deeper analysis



Deeper analysis

Check dependencies



Click Collect

We marked 3 loops for a dependency analysis. Two of the loops had no dependencies. One of the loops has Read-After-Write dependency and can't be vectorized.

Check memory access patte in your application

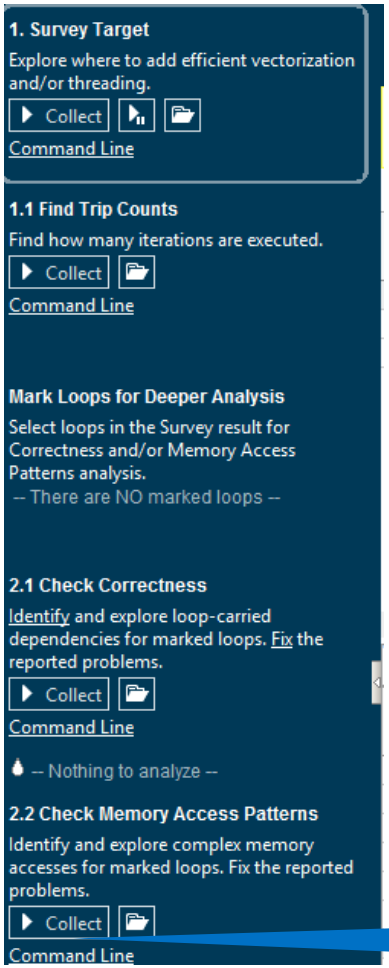
Summary | Survey Report | Refinement Reports | Annotation Report | Suitability Report

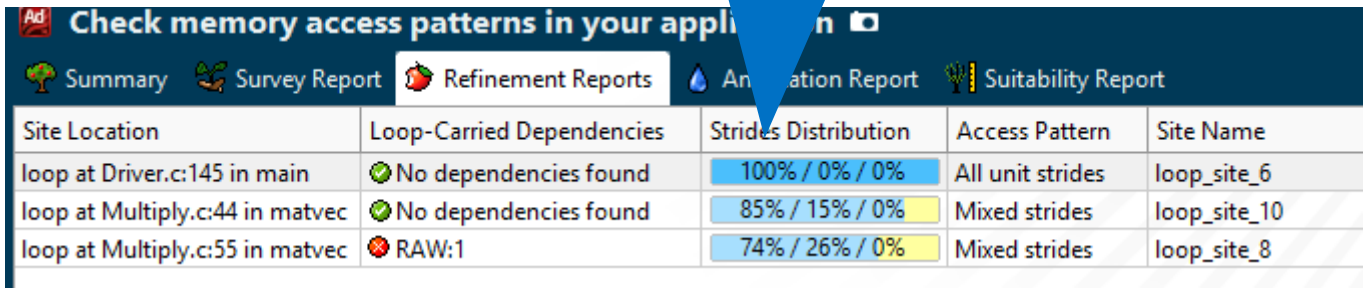
Site Location	Loop-Carried Dependencies	Strides Distribution	Access Pattern	Site Name
loop at Driver.c:145 in main	No dependencies found	No information available	No information available	loop_site_6
loop at Multiply.c:44 in matvec	No dependencies found	No information available	No information available	loop_site_10
loop at Multiply.c:55 in matvec	RAW:1	No information available	No information available	loop_site_8

Deeper analysis

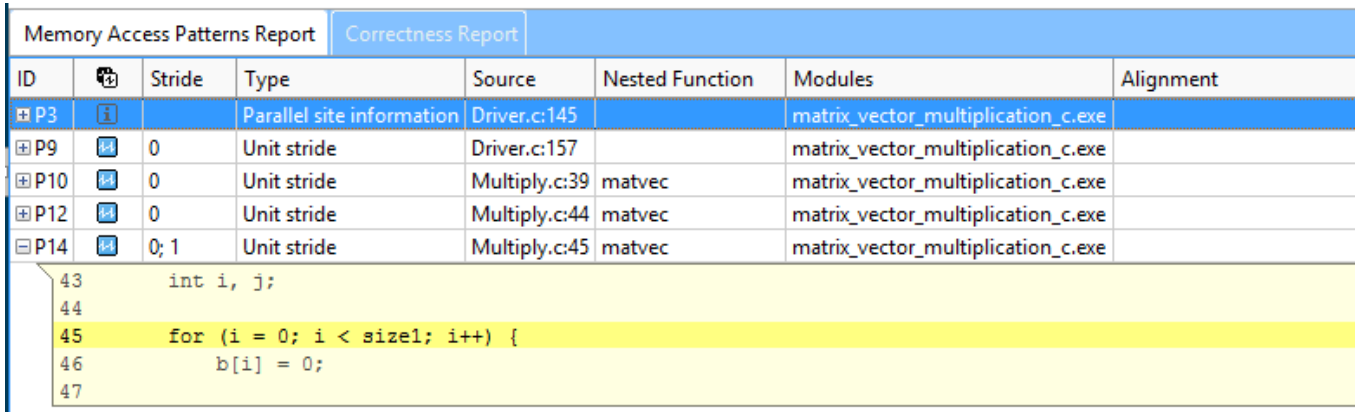
Memory Access Pattern analysis

Stride distribution





Site Location	Loop-Carried Dependencies	Strides Distribution	Access Pattern	Site Name
loop at Driver.c:145 in main	No dependencies found	100% / 0% / 0%	All unit strides	loop_site_6
loop at Multiply.c:44 in matvec	No dependencies found	85% / 15% / 0%	Mixed strides	loop_site_10
loop at Multiply.c:55 in matvec	RAW:1	74% / 26% / 0%	Mixed strides	loop_site_8



ID	Stride	Type	Source	Nested Function	Modules	Alignment
P3		Parallel site information	Driver.c:145		matrix_vector_multiplication_c.exe	
P9	0	Unit stride	Driver.c:157		matrix_vector_multiplication_c.exe	
P10	0	Unit stride	Multiply.c:39	matvec	matrix_vector_multiplication_c.exe	
P12	0	Unit stride	Multiply.c:44	matvec	matrix_vector_multiplication_c.exe	
P14	0; 1	Unit stride	Multiply.c:45	matvec	matrix_vector_multiplication_c.exe	

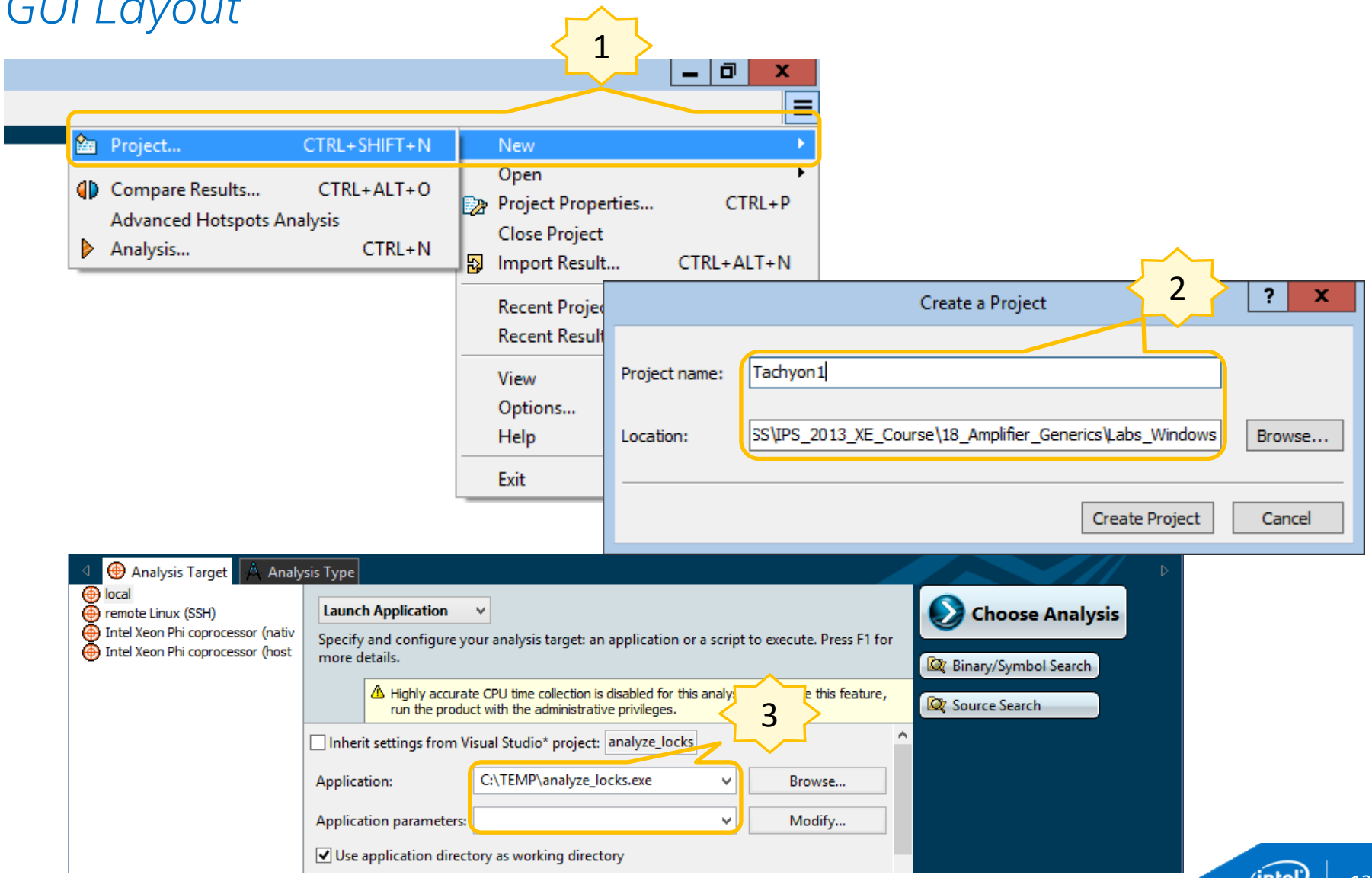
```
43      int i, j;
44
45      for (i = 0; i < size1; i++) {
46          b[i] = 0;
47
```

Click Collect

VTune™ Amplifier XE: getting started

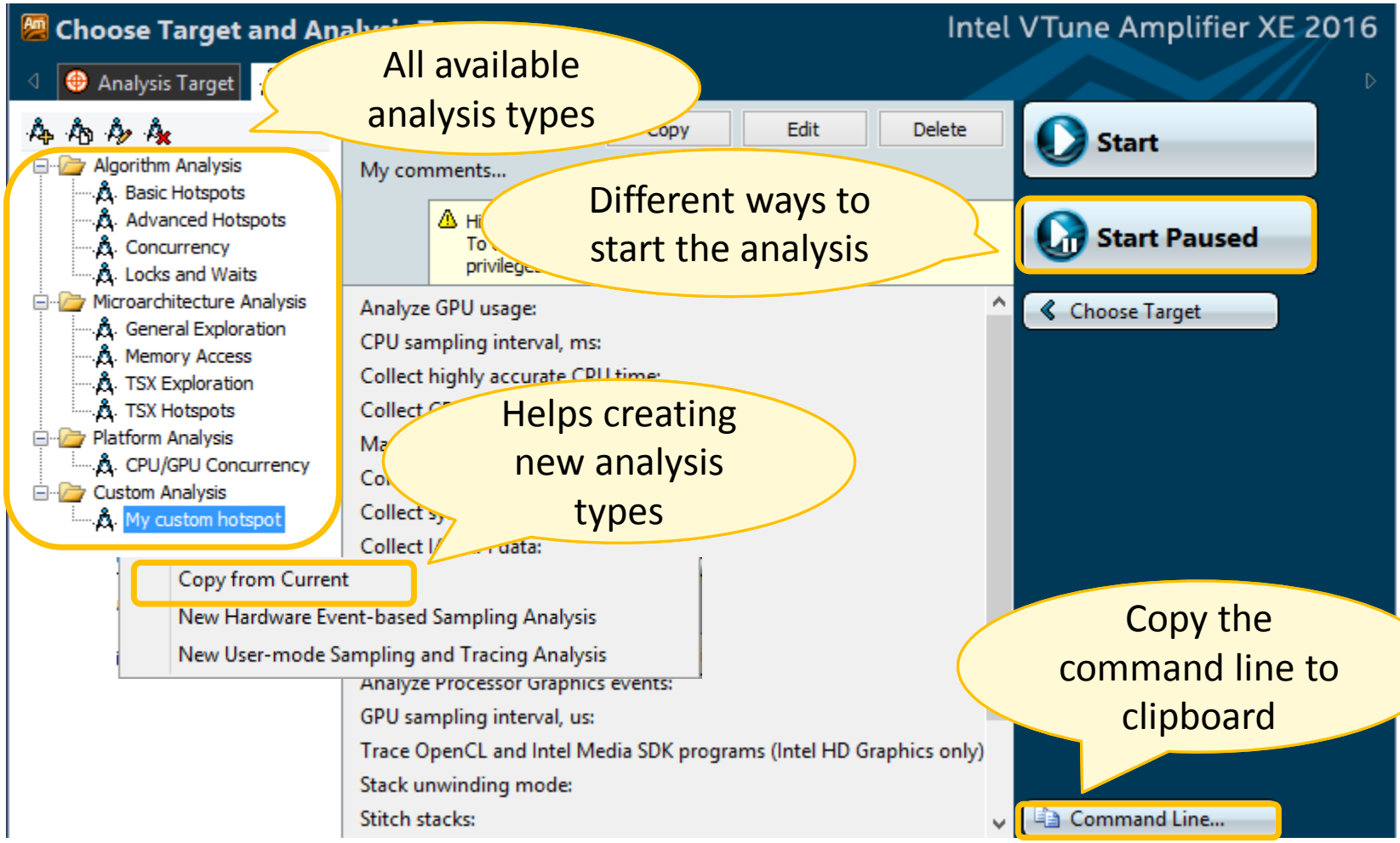
Creating a Project

GUI Layout



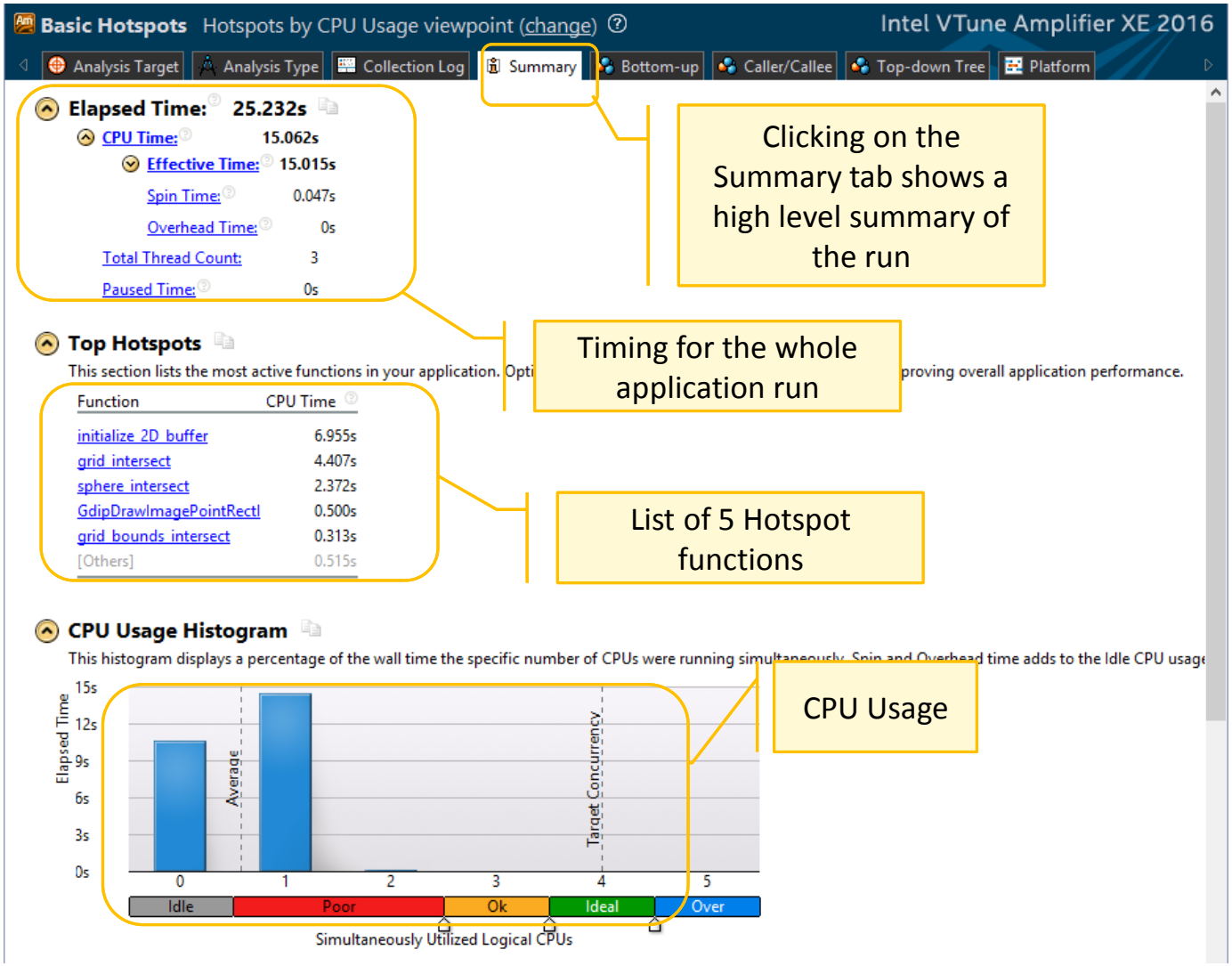
Selecting type of data collection

GUI Layout



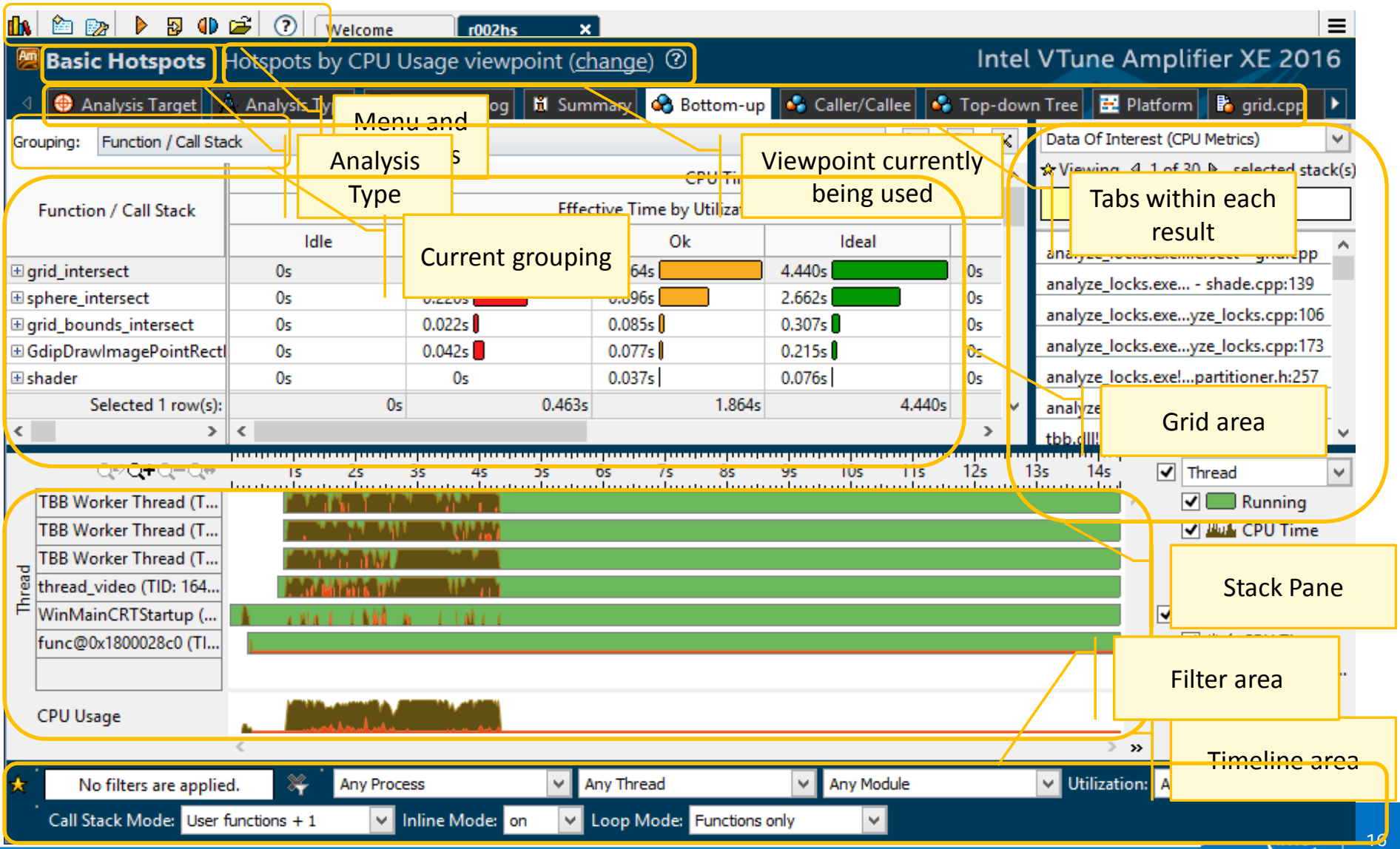
Summary View

GUI Layout



Bottom-Up View

GUI Layout

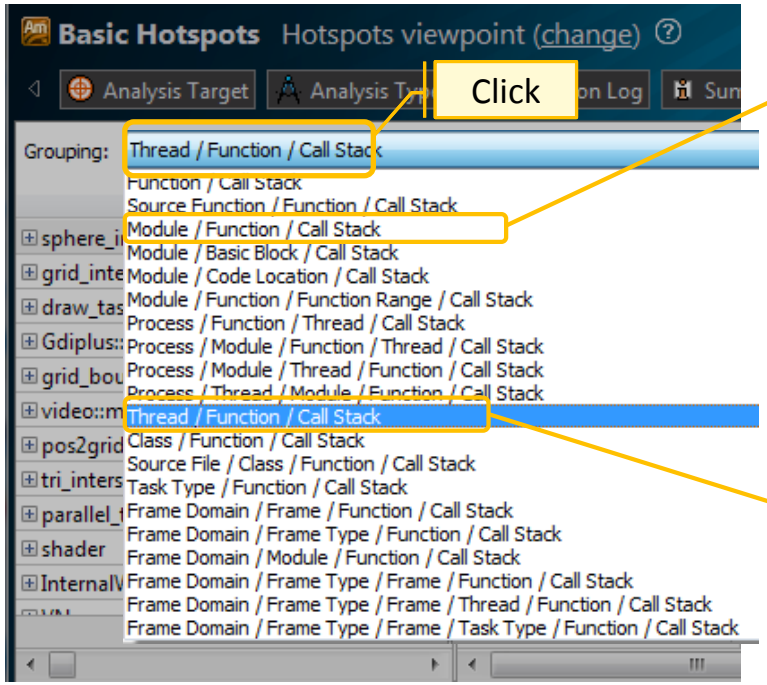


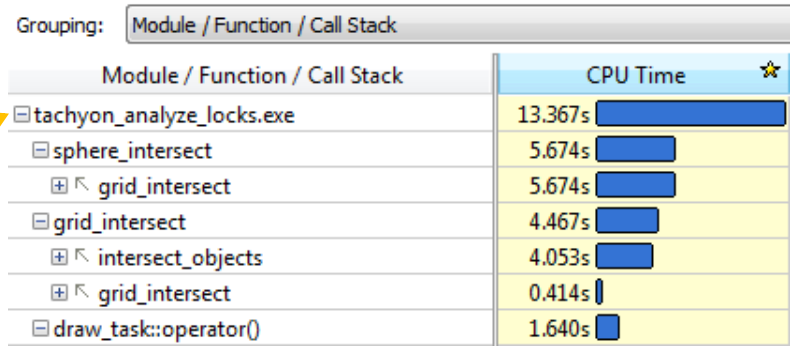
Result Analysis

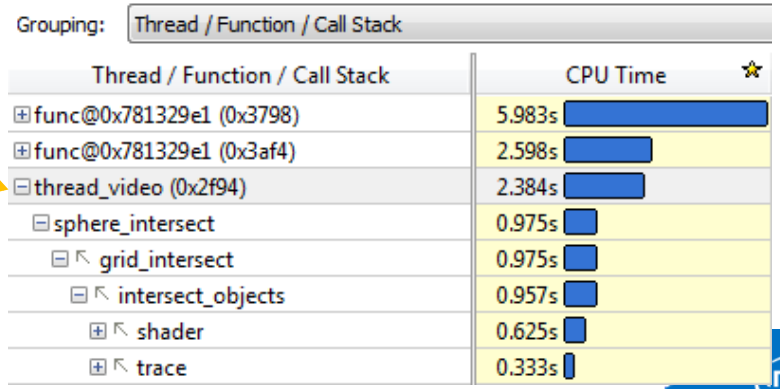
GUI Concepts

Groupings

- Each analysis type has many viewpoints
- Each viewpoint has pre-defined groupings
- Allows you to analyze the data in different hierarchies and granularities

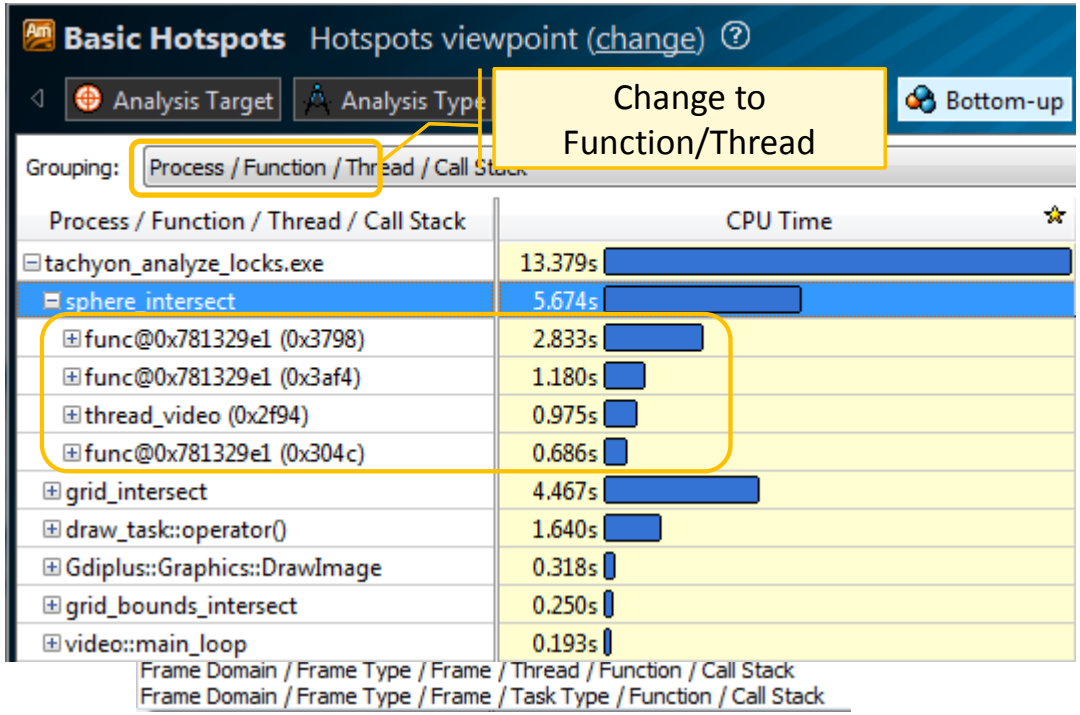






Viewpoints and Groupings

For example, pre-defined groupings can be used to determine load imbalance



ITAC: getting started

Intel® Trace Analyzer and Collector

ITAC may be applied without touching the program or environment. One way to get a first trace is:

```
$ mpirun -trace  -n <nprocs> ./test.x
```

Alternatively, just set the preload library and run without the –trace flag:

```
$ export LD_PRELOAD=libVT.so
$ mpirun -f <hostfile> -n <nprocs> ./test.x
```

this is actually what the flag does internally. This methodology may be applied to situations with complex run scripts not knowing where the mpirun is actually executed.

Note: this does not work for statically linked Intel® MPI (not recommended).

Viewing the trace file

ITAC will generate several files inside the directory where you started mpirun. Just start traceanalyzer in this directory:

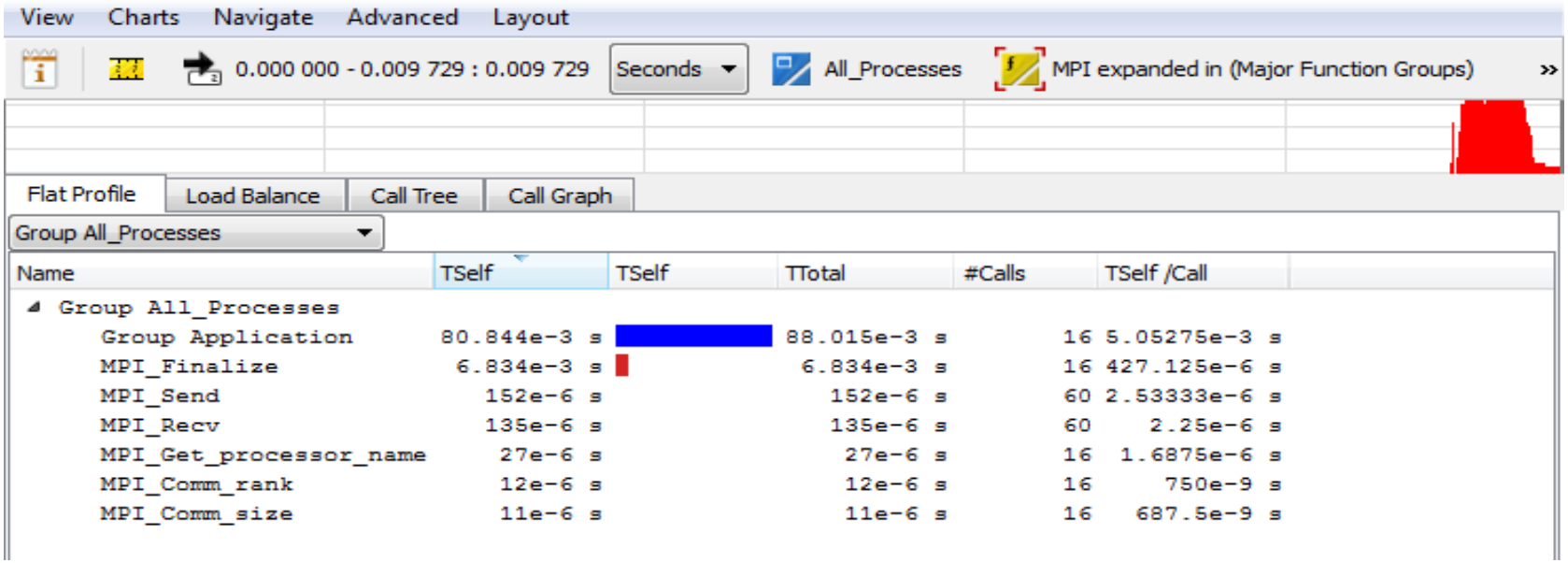
```
$ traceanalyzer test.x.stf
```

Alternatively there is a Windows version of traceanalyzer contained in the Linux ICS package.

ITAC Function Profile

After starting ITAC a window showing a basic timing profile for MPI and Application will be displayed. Right click on the red MPI bar to show the profiling for each used MPI routine:

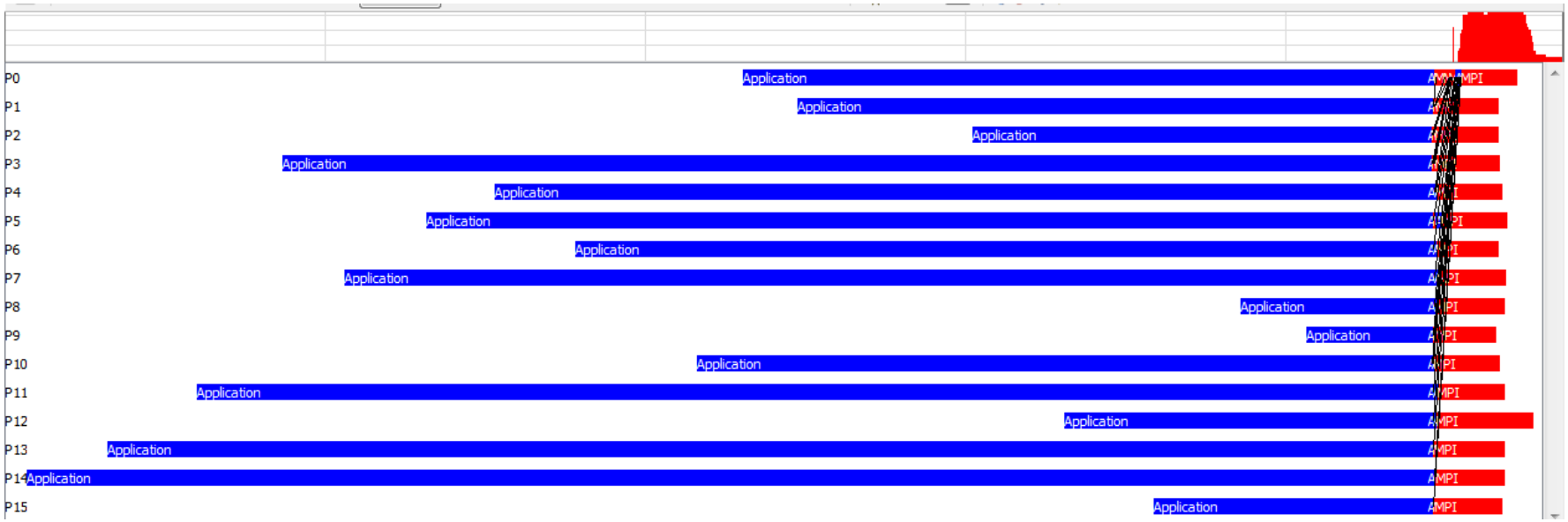
```
ungroup MPI
```



ITAC Event Timeline

Most important view of ITAC is the Event Timeline. This shows the temporal development of MPI routines and messages:

```
Charts -> Event Timeline
```



ITAC MPI Correctness Checker

Correctness Checker validates MPI correctness. It uses another library but may be started like the ordinary ITAC:

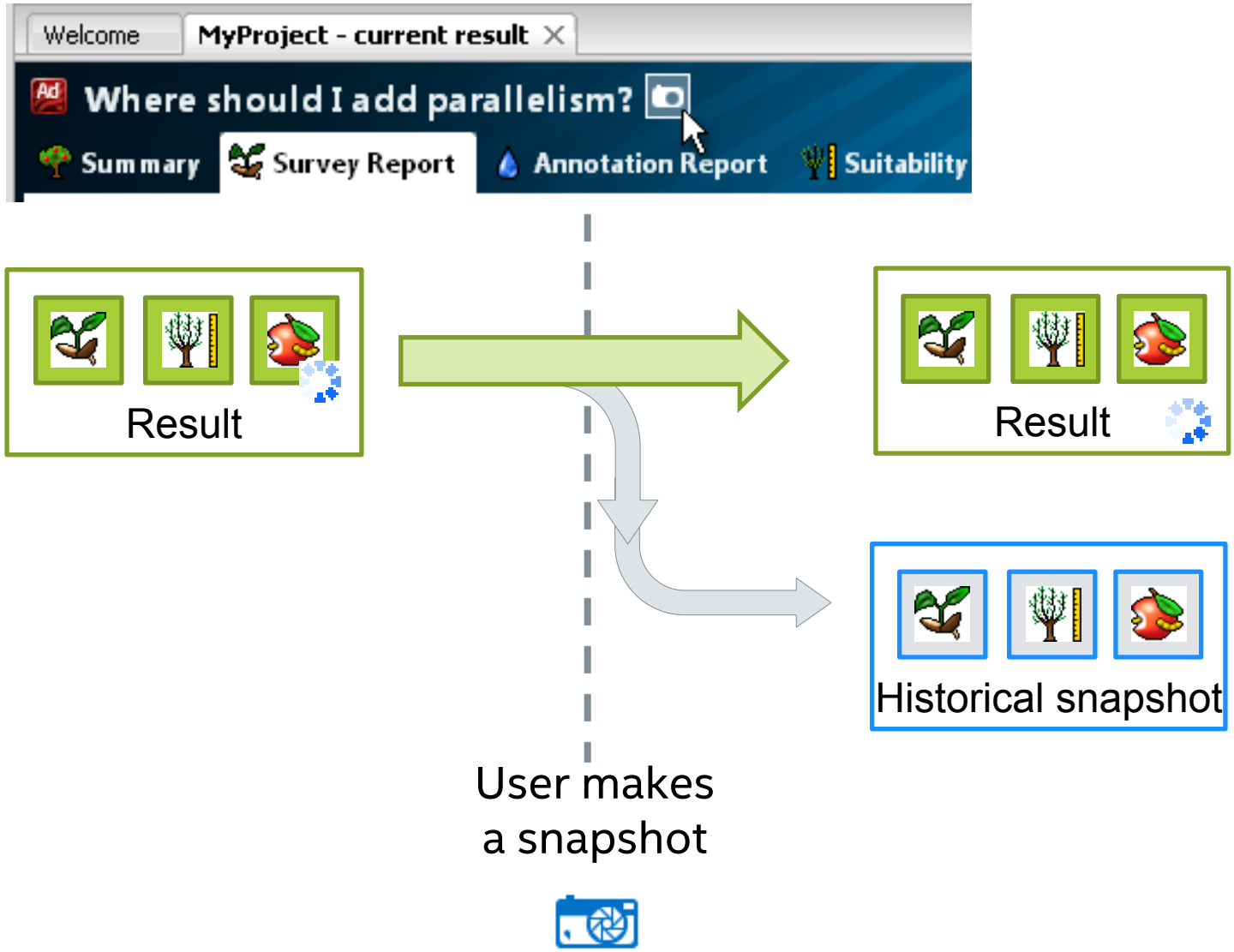
```
$ mpirun -check -n <nprocs> ./test.x
```

or

```
$ export LD_PRELOAD=libVTmc.so
$ mpirun -n <nprocs> ./test.x
```

Vectorization Advisor: Backup

Snapshot concept



Command Line: Intel® Advisor XE

Collect

advixe-cl –-collect STEP –-project-dir PROJ EXE

Report

advixe-cl –-report STEP –-project-dir PROJ

Where ***PROJ*** is your Intel Advisor XE project

STEP is the specific type of report or collection you are trying to run. Could be: survey, tripcounts, map, dependencies

Need helps? -

advixe-cl --help

advixe-cl --help report

Command Line: Intel® Advisor XE

Collecting survey and tripcounts

advixe-cl –collect survey –project-dir ./advi – mult.exe

advixe-cl –collect tripcounts –project-dir ./advi mult.exe

Creating snapshot in command line, e.g:

advixe-cl --snapshot --project-dir ./advi --pack --cache-sources **--** cache-binaries **--** /tmp/new_snapshot

Viewing the results

advixe-gui ./advi

advixe-cl –-report survey –-project-dir ./advi

Important notes

Reporting (exporting) spreadsheet data to csv/xml/txt : example

advixe-cl --report survey -show-all-columns -format=csv --project-dir ./advi

- - Csv file will be created automatically and location will be reported

Enabling experimental features (e.g. FLOPs)

$ export ADVIXE_EXPERIMENTAL=FLOPS

Running Intel Advisor XE on a cluster

mpirun -n 10 **advixe-cl** -collect survey --project-dir ./my_proj ./your_app

mpirun -n **R** advixe-cl -collect survey --project-dir ./my_proj ./your_app : -np 9 ./your_app

Intel MPI-specific:

mpirun –n N **–gtool** “advixe-cl –collect STEP C:\myadvisor:R,R,R” mult.exe

Where STEP is the type of collection, N is the number of processes and R are ranks you want to run.

Running dependency analysis using the command-line

1) First run a survey to get the ID of the loop you want to analyze

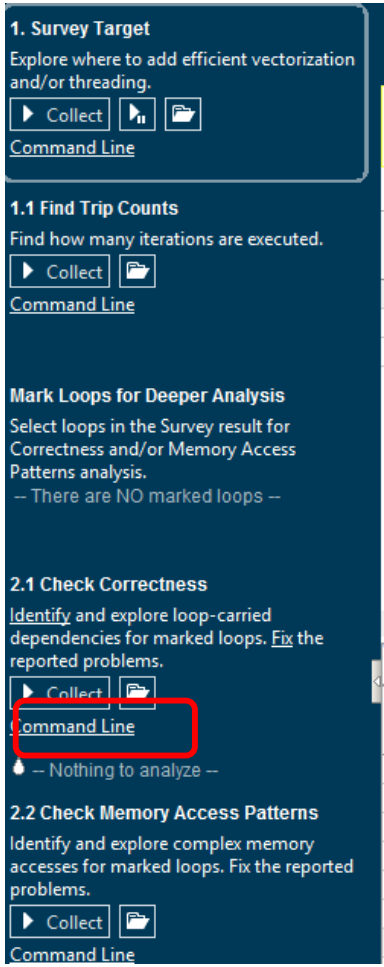
2) Then run

advixe-cl –collect dependencies

–mark-up-list ID –project-dir C:\myadvisor mult.exe

3) To display the results you can use the GUI or the command-line

advixe-gui C:\myadvisor



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