Annotated Task Graph (ATG)

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Revision History

Revision	Date	${f Author(s)}$	Description
1.0	2014-06-19	ananya	Created

1 Getting the ATG

```
1 $ cd $MIR ROOT/test/fib
3 $ echo "Examining executable for names of outline and callable functions ..."
4 $ $MIR ROOT/scripts/task-graph/profiler params.py prof-build/*.o
5 Using "._omp_fn.|ol_" as outline function name pattern
6 Processing file: prof-build/fib.o
7 OUTLINE_FUNCTIONS=ol_fib_0,ol_fib_1,ol_fib_2
8 CALLABLE FUNCTIONS=fib seq,fib,get usecs,main
10 $ LD LIBRARY PATH=$LD LIBRARY PATH:$PIN ROOT/intel64/runtime \
     MIR CONF="-w=1-g-p" \
     $PIN ROOT/intel64/bin/pinbin \
     -t ${MIR_ROOT}/scripts/task-graph/obj-intel64/
      mir_outline_function_profiler.so \
     −o fib_test \
     -s ol_fib_0,ol_fib_1,ol_fib_2 \setminus
15
     −c fib,fib seq \
16
     -- ./fib-prof 10 4
19 $ mv mir—task—graph fib test—fork join task graph
21 $ echo "Summarizing fork join task graph ..."
22 Rscript ${MIR_ROOT}/scripts/task-graph/mir-fork-join-graph-info.R
      fib_test_fork_join_task_graph
24 $ echo "Plotting fork join task graph ..."
```

1.1 ATG files

See Table 2.

2 Raw format of the ATG

The ATG raw format is a csv file.

```
$\text{head fib_test-annotated_task_graph}

\text{"task","parent","joins_at","tgpid","ins_count","stack_read","stack_write","

mem_fp","ccr","clr","mem_read","mem_write","name"

$\text{1,0,0,0.0.,59,11,15,5,12,15,4,1,"ol_fib_2"}

$\text{2,1,0,"1.",60,10,15,5,12,15,4,1,"ol_fib_0"}

$\text{3,1,0,"2.",60,10,15,5,12,15,4,1,"ol_fib_1"}

$\text{4,3,0,"1.2.",60,10,15,5,12,15,4,1,"ol_fib_1"}

$\text{6,5,0,"1.2.2.",60,10,15,5,12,15,4,1,"ol_fib_0"}

$\text{7,5,0,"2.2.2.",60,10,15,5,12,15,4,1,"ol_fib_0"}

$\text{9,7,0,"1.2.2.",68,15,15,5,14,17,4,1,"ol_fib_0"}

$\text{10,8,7,0,"1.2.2.2.",68,15,15,5,14,17,4,1,"ol_fib_0"}

$\text{10,7,0,"2.2.2.2.",47,10,10,5,9,12,4,1,"ol_fib_1"}
```

Each line shows properties of an explicit task executed by the program. The first line shows names of the properties. Properties are also called annotations. See Table 3.

2.1 Property tgpid

The tgpid uniquely identifies a task irrespective of single-thread or many-thread execution. The format of tgpid is A.B.C.....

- 0. Represents the first task created. This is a special meaning.
- A. means Ath child of the first task

File name	Description	
fib_test-call_graph	Instruction-level information of tasks	
fib_test-mem_map	Memory map of program execution	
fib_test-fork_join_task_graph	Parent-child task relationship and tgpid information	
fib_test-annotated_task_graph	Raw format of the ATG combining instruction-level and parent-child information	
fib_test-annotated_task_graph.adjm	Adjacent matrix representation of the visual format of ATG	
fib_test-annotated_task_graph.dot	Dot representation of the visual format of ATG	
fib_test-annotated_task_graph.edgelist	Edgelist representation of the visual format of ATG	
fib_test-annotated_task_graph.graphml	GraphML representation of the visual format of ATG	
fib_test-annotated_task_graph.info	Summary information about visual format of the ATG. Includes work, span and critical path from Cilk theory.	
fib_test-fork_join_task_graph.adjm	Adjacent matrix representation of the visual format of ATG without instruction-level information	
fib_test-fork_join_task_graph.dot	Dot representation of the visual format of ATG without instruction-level information	
fib_test-fork_join_task_graph.edgelist	Edgelist representation of the visual format of ATG without instruction-level information	
fib_test-fork_join_task_graph.graphml	GraphML representation of the visual format of ATG without instruction-level information	
fib_test-fork_join_task_graph.info	Summary information about visual format of ATG without instruction-level information. Includes number of tasks and join degree distribution.	

Table 2: ATG files

- A.B. means Ath child of task B.
- $\bullet\,$ A.B.C. means Ath child of task B.C.

NOTE: The tgpid is an experimental feature, not fully tested and subject to change. $\,$

Field	Description		
task	Identifier of the task		
parent	Identifier of the parent task of the task		
joins_at	Indicates at which call to taskwait in the parent the task		
	synchronized. Example: 0 indicates the task synchronized		
	with the first call to taskwait in the parent. Several children		
	can synchronize at the same call.		
tgpid	Indicates the task graph position identifier. See details be-		
	low.		
ins_count	Indicates total number of instructions executed by the task.		
	Profiling parameters indicate which instructions to count.		
	Typically, instructions part of runtime system calls are ex-		
	cluded and calls to statically-linked functions are included.		
stack_read	Indicates number of read accesses to the stack while execut-		
	ing instructions		
stack_read	Indicates number of write accesses to the stack while execut-		
	ing instructions		
ccr	Computation to Communication ratio. Indicates number of		
	instructions executed per read or write access to memory		
clr	Computation to Load ratio. Indicates number of instructions		
	executed per read access to memory		
mem_read	Indicates number of read accesses to memory (excluding		
	stack) while executing instructions		
mem_write	Indicates number of write accesses to memory (excluding		
	stack) while executing instructions		
name	Indicates name of the outline function of the task		

Table 3: Raw format fields

3 Visual format of the ATG

The visual format gives shape to the raw format of the ATG. It describes task-based execution in an intuitive manner allowing the programmer to spot performance problems. The visual format can be viewed using graph visualization tools such as dot, yEd and cytoscape. See Figure 1 for visualization of the ATG on yEd and Figure 2 for visualization of the ATG on Dot.

```
1 $ echo "Visualizing annotated task graph ..."
```

^{\$} dot -Tpng fib_test-annotated_task_graph.dot > fib_testannotated_task_graph.png

^{3 \$} yed fib test—annotated task graph.dot

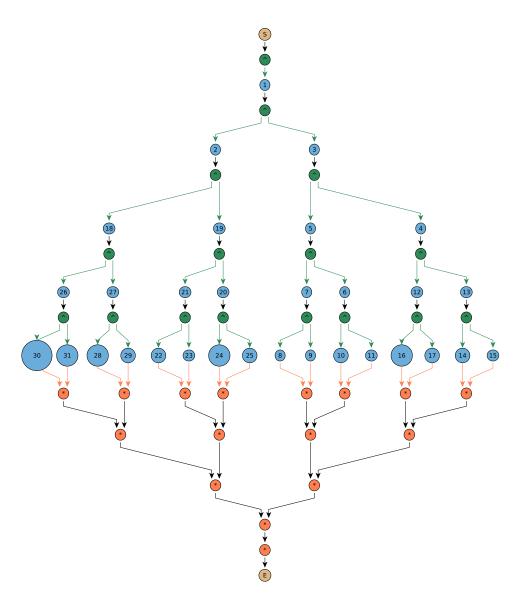
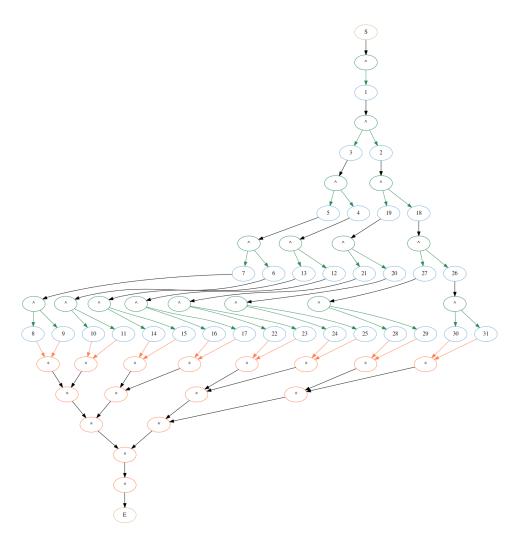


Figure 1: fib_test-annotated_task_graph.graphml viewed on yEd



 $\label{limits} \mbox{Figure 2: fib_test-annotated_task_graph.graphml\ visualized\ using\ Dot}$