



Automatic Tuning and Troubleshooting System

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Automatic Tuning and Troubleshooting

- Introduction
- Tuning
- Troubleshooting
- Conclusion

Tuning Opportunity

- Significant performance gains can be made by using appropriate compiler flags

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- Most customers are unable to get the best out of our systems
 - Too complex
 - Too interactive
 - Too slow a process
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Tuning Opportunity

- Significant performance gains can be made by using appropriate compiler flags
- Most customers are unable to get the best out of our systems
 - Too complex
 - Too interactive
 - Too slow a process
 - They end up using default compilation environment
- How complex is it?

Complexity: cc -flags

```
-#           Verbose mode
-###        Show compiler commands built by driver, no compilation
-A<name[(tokens)]>  Preprocessor predicate assertion
-B<[static|dynamic]>  Specify dynamic or static binding
-C          Prevent preprocessor from removing comments
-c          Compile only - produce .o files, suppress linking
-D<name[=token]>     Associate name with token as if by #define
-d[y|n]     dynamic [-dy] or static [-dn] option to linker
-dalign     Expands to -xmemalign=8s
-E          Compile source through preprocessor only, output to stdout
-erroff=<t>  Suppress warnings specified by tags t(%none, %all, <tag list>)
-errtags=<a> Display messages with tags a(no, yes)
-errwarn=<t> Treats warnings specified by tags t(%none, %all, <tag list>) as errors
-fast       Optimize using a selection of options
-fd         Report old-style function definitions and declarations
-features=<v> Enable/disable C language features, <v>= {[no%]extinl}
-flags      Show this summary of compiler options
-fnonstd    Initialize floating-point hardware to non-standard preferences
-fns[=<yes|no>] Select non-standard floating point mode
-fround=<r>  Select the IEEE rounding mode in effect at startup
-fsimple[=<n>] Select floating-point optimization preferences <n>
-fsingle    Use single-precision arithmetic (-Xt and -Xs modes only)
-fttrap=<t>  Select floating-point trapping mode in effect at startup
```

Complexity: cc -flags (2)

-G	Build a dynamic shared library
-g	Compile for debugging
-H	Print path name of each file included during compilation
-h <name>	Assign <name> to generated dynamic shared library
-I<dir>	Add <dir> to preprocessor #include file search path
-i	Passed to linker to ignore any LD_LIBRARY_PATH setting
-keeptmp	Keep temporary files created during compilation
-KPIC	Compile position independent code with 32-bit addresses
-Kpic	Compile position independent code
-L<dir>	Pass to linker to add <dir> to the library search path
-l<name>	Link with library lib<name>.a or lib<name>.so
-mc	Remove duplicate strings from .comment section of output files
-misalign	Expands to -xmemalign=1i
-misalign2	Expands to -xmemalign=2i
-mr	Remove all strings from .comment section of output files
-mr,"string"	Remove all strings and append "string" to .comment section
-mt	Specify options needed when compiling multi-threaded code
-native	Optimize for the host system (-xtarget=native)
-O	Use default optimization level (-xO2)
-o <outputfile>	Set name of output file to <outputfile>
-P	Compile source through preprocessor only, output to .i file
-p	Compile for profiling with prof
-Q[y n]	Emit/don't emit identification info to output file

Complexity: cc -flags (3)

```

-qp           Compile for profiling with prof
-R<dir[:dir]> Build runtime search path list into executable
-S           Compile and only generate assembly code (.s)
-s           Strip symbol table from the executable file
-U<name>     Delete initial definition of preprocessor symbol <name>
-V           Report version number of each compilation phase
-v           Do stricter semantic checking
-W<c>,<arg>  Pass <arg> to specified component <c> (a,c,l,m,p,0,2,o)
-w           Suppress compiler warning messages
-Xa          Compile assuming ANSI C conformance, allow K & R extensions (default mode)
-Xc          Compile assuming strict ANSI C conformance
-Xs          Compile assuming (pre-ANSI) K & R C style code
-Xt          Compile assuming K & R conformance, allow ANSI C
-xalias_level=<a> Enable optimizations based on the specified alias_level
-xarch=<a>    Specify target architecture instruction set
-xautopar    Enable automatic loop parallelization
-xbuiltin[=<b>] When profitable inline, or substitute intrinsic functions for system functions,
  b={%all,%none}
-xc99[=<a>]  Enable ISO C99 features, <a>={all,none,[no_]lib}
-xcache=<c>  Define cache properties for use by optimizer
-xCC         Accept C++ style comments
-xcg89       Expands to -xarch=v7 -xchip=old -xcache=64/32/1
-xcg92       Expands to -xarch=v8 -xchip=super -xcache=16/32/4:1024/32/1

```

Complexity: cc -flags (4)

```

-xchar=<v>          Treat type char as signed (<v> = s or signed) or unsigned (<v> = u or unsigned).
-xchar_byte_order=<o>  Specify multi-char byte order <o> (default, high, low)
-xcheck[=<a>[,<a>]]    Generate runtime checks for error condition <a>={%all|%none|stkovf|no%stkovf}
-xchip=<c>           Specify the target processor for use by the optimizer
-xcode=<c>           Generate different code for forming addresses
-xcrossfile[=<n>]      Enable optimization and inlining across source files, n={0|1}
-xcsi               Allow C source code using non-ISO C compliant locales
-xdebugformat=<a>     Selects the format of debugging information; <a>={dwarf|stabs}
-xdepend[=<yes|no>]   Analyze loops for data dependencies
-xdryrun            The same as -###
-xe                 Perform only syntax/semantic checking, no code generation
-xexplicitpar       Parallelize loops explicitly marked with directives
-xF=<a>[,<a>]        Compile for later mapfile reordering and data fragmentation, <a>={%no%func|
                    [%no%]gbldata|%all|%none}
-xhelp=<f>           Display on-line help information f(flags, readme)
-xhwcprof[=<a>]      Enable/disable program annotation for hardware counter profiling <a>={enable|disable}
-xildoff            Cancel -xildon
-xildon             Enable use of the incremental linker, ild
-xinline=[<a>,...,<a>] Attempt inlining of specified user routines, <a>={%auto,func,no%func}
-xipo[=<n>]          Enable optimization and inlining across source files, n={0|1|2}
-xipo_archive=<a>    Enable crossfile optimization including archive files,
                    <a>={none|readonly|writeback}
-xjobs=<n>           Maximum number of components compiler will fork in parallel

```

Complexity: cc -flags (5)

```

-xldscope=<a>    Indicates the appropriate linker scoping within the source program;
                 <a>={global|symbolic|hidden}
-xlibmieee      Force IEEE 754 return values for math routines in exceptional cases
-xlibmil        Inline selected libm math routines for optimization
-xlibmopt       Link with optimized math library
-xlic_lib=sunperf    Link in the Sun supplied performance libraries
-xlicinfo       Show serial number information
-xlinkopt[={0,1,2}] Perform optimizations on relocatable object files
-xloopinfo      Show loops that parallelized
-xM             Generate makefile dependencies
-xM1            Generate makefile dependencies, but exclude /usr/include
-xmaxopt=[off,1,2,3,4,5] maximum optimization level allowed on #pragma opt
-xmemalign[=<a><b>] Controls memory alignment, <a>={1|2|4|8|16}, b={f|i|s}.
-xMerge         Merge data segment into text segment
-xnativeconnect[=<n>] Generate interface descriptors for component design tools
                  (n={interface|%all|%none})
-xnolib         Do not link with default system libraries
-xnolibmil      Cancel -xlibmil on command line
-xnolibmopt     Cancel -xlibmopt on command line
-xnorunpath     Do not build a runtime search path into the executable
-xO<n>          Generate optimized code (n={1|2|3|4|5})
-xopenmp=<a>     Enable OpenMP language extension <a>={noopt|parallel|stubs|none}
-xP             Print prototypes for function definitions

```

Complexity: cc -flags (6)

```

-xpagesize_heap=<a>      Controls the preferred page size for the heap,
                        a={8K|64K|512K|4M|32M|256M|2G|16G|default}
-xpagesize_stack=<a>    Controls the preferred page size for the stack,
                        a={8K|64K|512K|4M|32M|256M|2G|16G|default}
-xpagesize=<a>          Controls the preferred page size for the stack and for the heap,
                        a={8K|64K|512K|4M|32M|256M|2G|16G|default}
-xparallel              Perform parallel compilation
-xpch=<p>                Enable precompiled headers. Collect data for, or use existing,
                        PCH file <p>={auto|autofirst|{collect,use}:<file>[.cpch]}
-xpchstop=<file>        Specified include file marks end of initial common sequence of
                        pre-processing directives for precompiled headers.
-xpg                    Compile for profiling with gprof
-xprefetch[=<p>]        Specify instruction prefetch p (auto,no%auto,explicit,
                        no%explicit,latx:<n>.<n>)
-xprefetch_auto_type=<a> Specify automatic indirect prefetch insertion for loops;
                        <a>=[no%]indirect_array_access
-xprefetch_level[=<n>] Controls the aggressiveness of the -xprefetch=auto option (n={1|2|3})
-xprofile=<p>           Collect data for a profile or use a profile to optimize
                        <p>={{collect,use}[:<path>],tcov}
-xprofile_ircache[=path] Path to intermediate file cache used with -xprofile option
-xprofile_pathmap=<collect-path>:<use-path> Map object file path from <collect-path> to <use-path>
-xreduction             Recognize reduction operations in parallelized loops
-xregs=<r>              Specify the usage of optional registers

```

Complexity: cc -flags (7)

```

-xrestrict[=<f>]          Treat pointer valued function parameters as restricted
                          f(%none,%all,<function-name list>)
-xs                       Allow debugging without object (.o) files
-xsafe=mem                Assume that no memory based traps will occur
-xsb                      Compile for use with the WorkShop source browser
-xsbfast                  Generate only WorkShop source browser information, no compilation
-xsfpcnst                 Represent unsuffixed floating point constants as single precision
-xospace                 Do not do optimizations that increase code size
-xstrconst                Place string literals into read-only data segment
-xtarget=<t>              Specify target system for optimization
-xtmp=<dir>                Set directory for temporary files to <dir>
-xthreadvar=<a>[,<a>]     Control code generation for thread variables
                          <a>={ [no%]dynamic|[no%]stack|%all|%none}
-xtime                    Report the execution time for each compilation phase
-xtransition              Emit warnings for differences between K&R C and ANSI C
-xtrigraphs[=<yes|no>]    Enable|disable trigraph translation
-xunroll=n                Enable unrolling loops n times where possible
-xustr=<a>                 Recognize sixteen-bit string literals <a>={no|ascii_utf16_usshort}
-xvector<=yes|no>        Automatic Generation of calls to vector library functions
-xvis[=<yes|no>]          Enable the use of VIS inline templates
-xvpara                   Verbose parallelization warnings
-Y<c>,<dir>                Specify <dir> for location of component <c> (a,c,l,m,p,0,2,o)

```

Complexity: cc -flags (8)

```
-YA,<dir>      Change default directory searched for components
-YI,<dir>      Change default directory searched for include files
-YP,<dir>      Change default directory for finding libraries files
-YS,<dir>      Change default directory for startup object files
-Zll          Create lock_lint database files (.ll)
```

Complexity: cc -flags (8)

```
-YA,<dir>      Change default directory searched for components  
-YI,<dir>      Change default directory searched for include files  
-YP,<dir>      Change default directory for finding libraries files  
-YS,<dir>      Change default directory for startup object files  
-Zll          Create lock_lint database files (.ll)
```

- But wait ... we have more!
 - Hundreds of internal tuning options!

Can we simplify it?

```
% ats a.out
```

```
% ats a.out
```

Source Not Needed

What is ATS?

- Automatic reoptimization and recompilation tool

```
% ats -i '-x03' a.out
```

What is ATS?

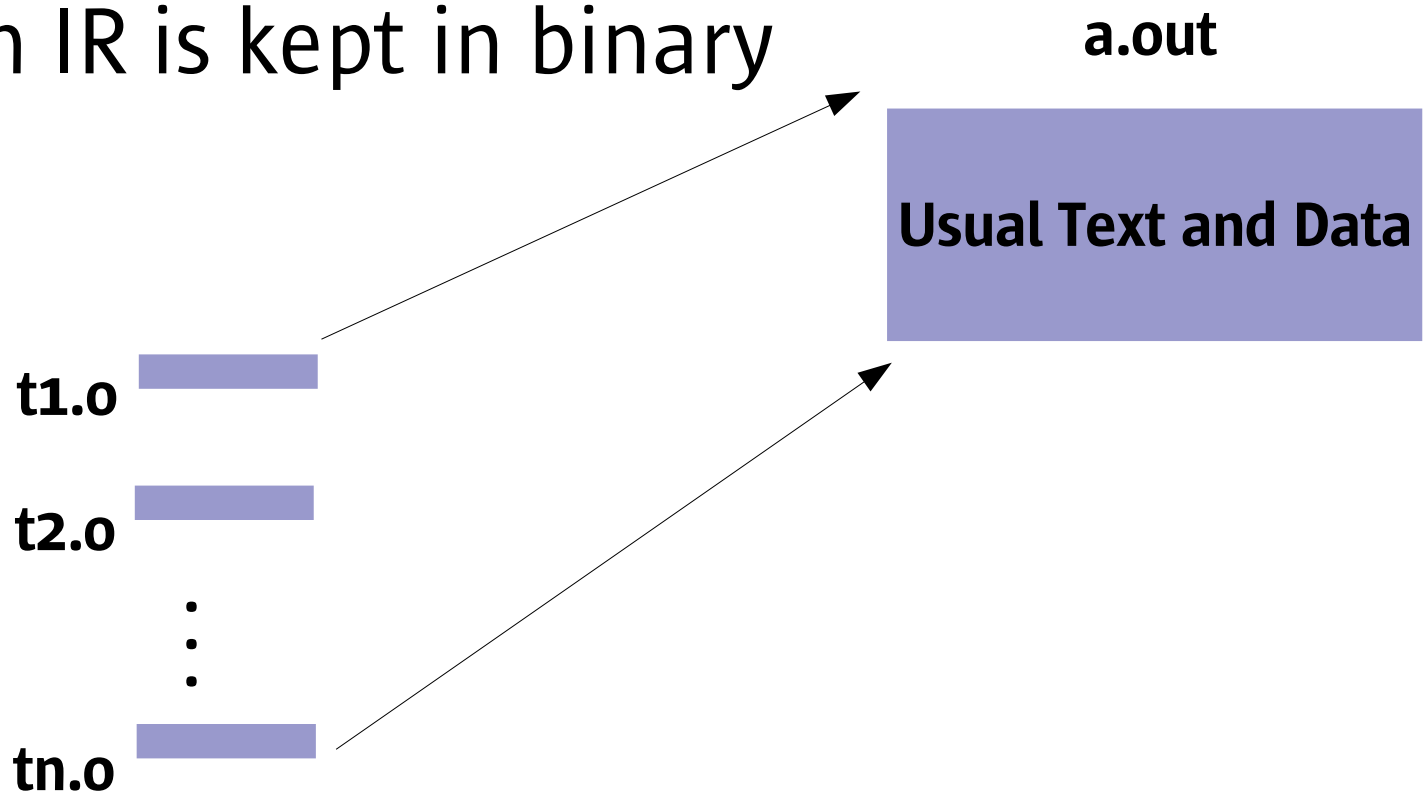
- Automatic reoptimization and recompilation tool

```
% ats -i '-x03' a.out
```

```
% ats -i '-fast -xprofile=collect'  
-i '-fast -xprofile=use' a.out
```

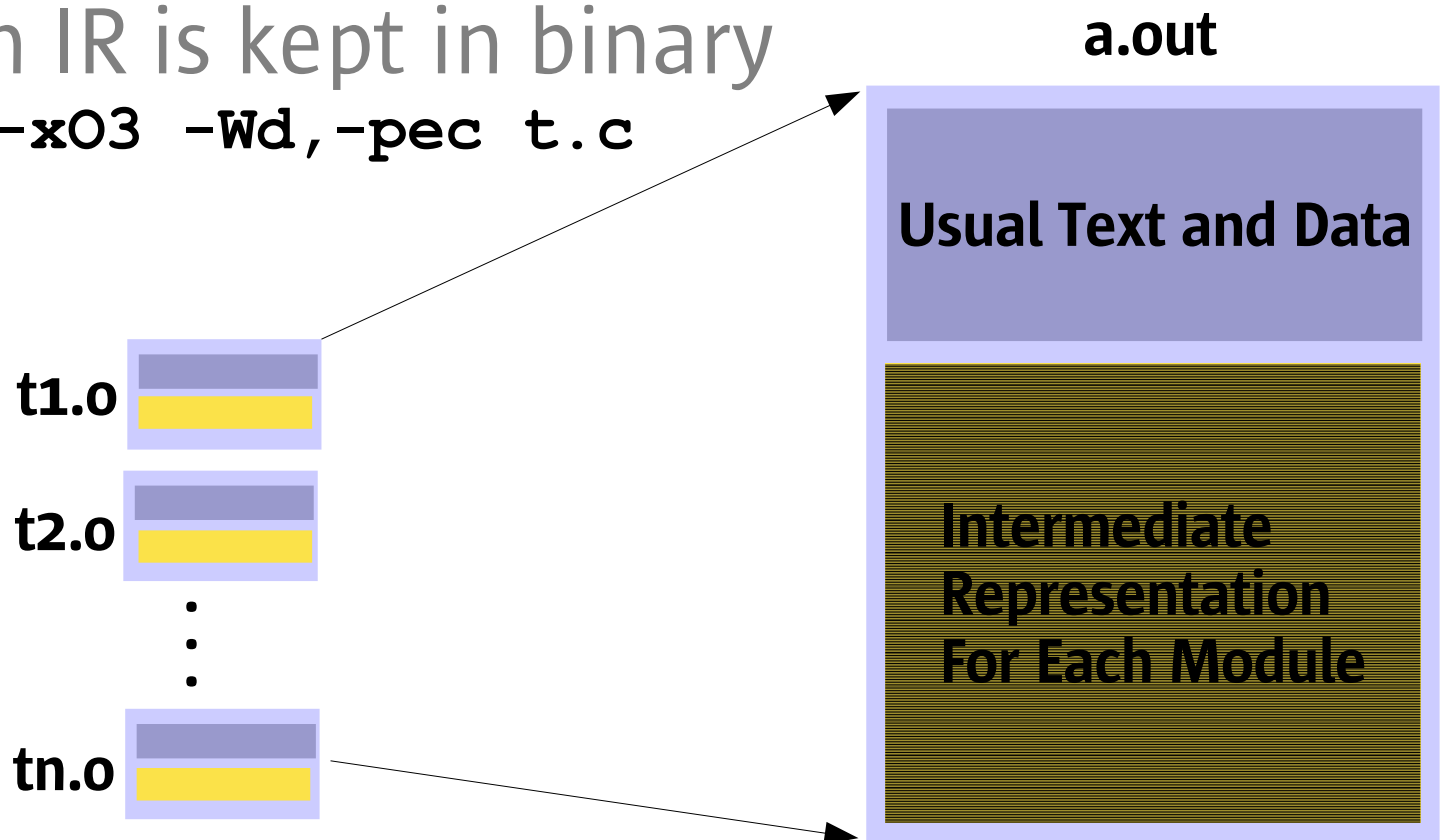
PEC: recompilable binaries

- Portable Executable Code
 - Sun IR is kept in binary



PEC: recompilable binaries

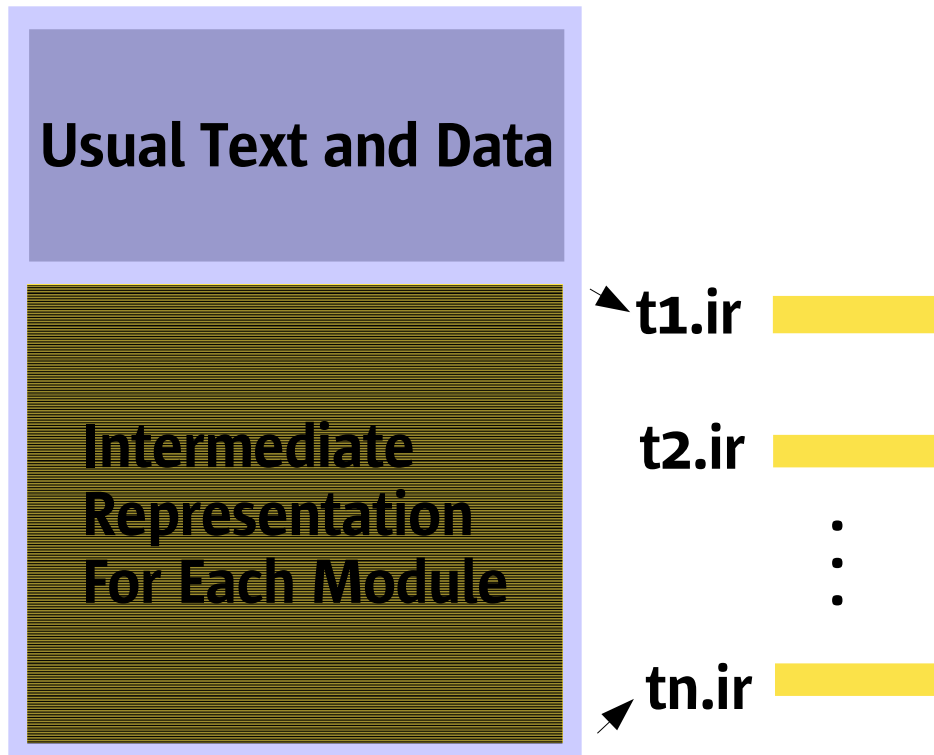
- Portable Executable Code
 - Sun IR is kept in binary
`cc -xO3 -Wd,-pec t.c`



Recompiling Binaries

- IR is extracted

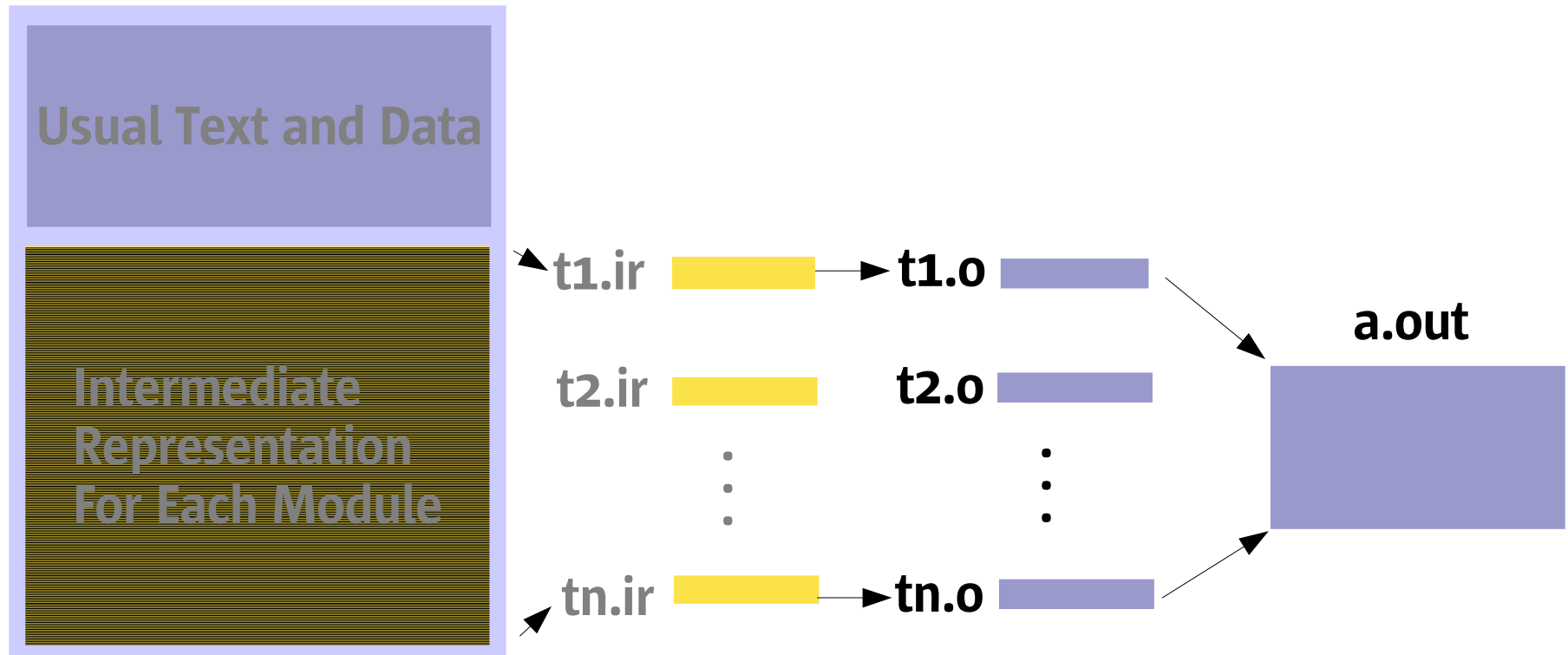
a.out



Recompiling Binaries

- IR is extracted and reprocessed

a.out



ATS Results Host:sctgo pec.out - Mozilla Firefox

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- [Log File](#)
- [Spreadsheet \(csv file\)](#)

Host: sctgo /import/go-saraswati/prak/demo/ats_mcf/pec.out			
Number ↓	Compiler flags	Status	Runtime
1	-fast	Verification Failed	1.58
2	-fast -fsimple=0 -fas=no	Passed	1.60
3	-xO4	Passed	1.58
4	-xO3	Passed	1.65
5	-xO3 -xprofile=collect	Passed	2.02
6	-xO4 -xprofile=use	Passed	1.57
7	-xO4 -xprofile=use -xipo=1	Passed	1.57
8	-xO4 -xprofile=use -xipo=2	Passed	1.58
9	-xO4 -xprofile=use -xlinkopt=1	Passed	1.59
10	-xO4 -xprofile=use -xlinkopt=2	Passed	1.58
11	-xO4 -xprofile=use -xpagesize=64K	Passed	1.58
12	-xO4 -xprofile=use -xpagesize=512K	Passed	1.58
13	-xO4 -xprofile=use -xprefetch_level=1	Passed	1.60

Other examples

```
% ats a.out -r 'setup.sh ; run.sh'
```

Other examples

```
% ats a.out -r 'setup.sh ; run.sh'
```

```
% ats a.out b.out -r run.sh
```

Other examples

```
% ats a.out -r 'setup.sh ; run.sh'
```

```
% ats a.out b.out -r run.sh
```

```
% ats a.out libx.so
```

Other examples

```
% ats a.out -r 'setup.sh ; run.sh'
```

```
% ats a.out b.out -r run.sh
```

```
% ats a.out libx.so
```

```
% ats libx.so liby.so -r a.out
```

Other examples

```
% ats a.out -r 'setup.sh ; run.sh'
```

```
% ats a.out b.out -r run.sh
```

```
% ats a.out libx.so
```

```
% ats libx.so liby.so -r a.out
```

```
% ats a.out -c 'validate.sh'
```

Results - Mozilla Firefox

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Results for
/export/home/tomk/cpu2000,0204/benchspec/CFP2000/301.apsi/exe/apsi_peak.v\$plus

Number	Compiler flags (Right click and save to download binary)	Status	SPECfp
1	-fast - xipo=2 - xprofile=collect	Passed	0.00
2	-fast - xipo=2 - xprofile=use	Passed	622
3	-fast	Passed	650
4	-xO4	Passed	560
5	-xO3	Passed	502
6	-fast - xprofile=use	Passed	632
7	-fast - xipo=1	Passed	650
8	-fast - xipo=2	Passed	644
9	-fast - xlinkopt=2	Passed	655
10	-fast - xlinkopt=2 - xprefetch_level=2	Passed	655
11	-fast - xlinkopt=2 - xprefetch_level=3	Passed	653
12	-fast - xlinkopt=2 - xpagesize=64K	Passed	648
13	-fast - xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level]	Passed	656
14	-fast - xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level] -xinline=	Passed	569
15	-fast - xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level] -xlib=swperf	Passed	647

Results - Mozilla Firefox

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Results for
/export/home/tomk/cpu2000_0204/benchspec/CFP2000/301.apsi/exe/apsi_peak.v\$plus

Number	Compiler flags (Right click and save to download binary)	Status	SPECfp
68	-fast -xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level] -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qms_pipe-prefst	Passed	666
132	-fast -xipo=1 -xlinkopt=2 -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qeps:do_spec_load=1 -Wc,-Qms_pipe-prefst	Passed	666
196	-fast -xipo=1 -xlinkopt=2 -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qeps:do_spec_load=1 -Wc,-Qiselect-funcalign=32 -Wc,-Qms_pipe-prefst	Passed	666
133	-fast -xipo=1 -xlinkopt=2 -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qeps:do_spec_load=1 -Wc,-Qms_pipe-prefst -Wc,-Qpeep-Sh0	Passed	665
197	-fast -xipo=1 -xlinkopt=2 -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qeps:do_spec_load=1 -Wc,-Qiselect-funcalign=32 -Wc,-Qms_pipe-prefst -Wc,-Qpeep-Sh0	Passed	665
69	-fast -xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level] -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qms_pipe-prefst -Wc,-Qpeep-Sh0	Passed	664
51	-fast -xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level] -Wc,-Qdepgraph-early_cross_call=1	Passed	658
64	-fast -xlinkopt=2 cc[-xalias_level=strong]CC[-xalias_level] -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qms_pipe+unoovf	Passed	658
116	-fast -xipo=1 -xlinkopt=2 -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qeps:do_spec_load=1	Passed	658
124	-fast -xipo=1 -xlinkopt=2 -Wc,-Qdepgraph-early_cross_call=1 -Wc,-Qeps:do_spec_load=1 -Wc,-Qiselect-funcalign=32	Passed	658

Automatic Tuning

```
% ats a.out
```

```
% ats -i 'script:autotuning' a.out
```



Same

- Up to 7% improvement in previously tuned SPEC benchmarks

Dynamic Control of ATS

```
% ats -i -x03 a.out
```

```
% ats -i 'script:your_script' a.out
```

- Script prints the flags to be used to recompile
- Checks the result
- Prints new flags
- Exits when done

Basic Troubleshooting

- Find the problematic option

```
% ats -i 'script:sweep -x03 -fsimple=2 -xlinkopt'  
a.out
```

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- [Log File](#)
- [Spreadsheet \(csv file\)](#)

Host: sctgo
/import/go-saraswati/rprak/demo/ats_mcf/pec.out

Number ↓	Compiler flags	Status	Runtime
1	-xO3 -fsimple=2 -xlinkopt	Verification Failed	1.70
2	-xO3 -fsimple=2	Verification Failed	1.66
3	-xO3	Passed	1.66

sweep

```
#!/bin/perl
# usage:  sweep options....

while (@ARGV) {
  for (@ARGV) {
    print " $_";
  }
  print "\n";
  pop @ARGV;
}
```

Module Search

- Find the problematic module

```
% ats -i 'script:modulesearch "-x03" "-x03 -fsimple=2" '  
a.out
```

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• [Faulty modules \(1 found\)](#)

- [Log File](#)
- [Spreadsheet \(csv file\)](#)

Host: sctgo /import/go-saraswati/rprak/demo/ats_mcf/pec.out			
Number ↓	Compiler flags	Status	Runtime
1	-xO3 -WO,-pec keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/pass -WO,-no_dependency_variables	Passed	1.66
2	-xO3 -fsimple=2 -WO,-pec keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/fail -WO,-no_dependency_variables	Verification Failed	1.66
3	-xO3 -WO,-pec use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/fail,6,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/pass,1,5	Verification Failed	1.69
4	-xO3 -WO,-pec use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/fail,9,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/pass,1,8	Verification Failed	1.69
5	-xO3 -WO,-pec use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/fail,10,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/pass,1,9	Verification Failed	1.68
6	-xO3 -WO,-pec use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/fail,11,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/pass,1,10	Verification Failed	1.67
7	-xO3 -WO,-pec use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/fail,1,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run20/pass,11,11	Passed	1.67

Faulty modules (1 found) - Mozilla Firefox

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Faulty modules (1 found)

	Working Options -xO3	Faulty Options -xO3 -fsimple=2	
mcf.o	Working	Faulty	Difference

Find bug

- Automate even more
 - Combine sweep and modulesearch in one

Find bug

- Automate even more
 - Combine sweep and modulesearch in one

```
% ats -i 'script:findbug -x03 -fsimple=2 -xlinkopt'  
-r 'pec.out < input.txt > output.txt'  
-c 'cmp output.txt output.gold'  
  
pec.out
```

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◆ [Faulty modules \(1 found\)](#)

- [Log File](#)
- [Spreadsheet \(csv file\)](#)

Host: setgo /import/go-saraswati/rprak/demo/ats_mcf/pec.out			
Number ↓	Compiler flags	Status	Runtime
1	-xO3 -fsimple=2 -xlinkopt	Verification Failed	1.65
2	-xO3 -fsimple=2	Verification Failed	1.66
3	-xO3 -fsimple=1	Passed	1.66
4	-xO3 -fsimple=1 -WO,-pec_keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass -WO,-no_dependency_variables	Passed	1.67
5	-xO3 -fsimple=2 -WO,-pec_keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail -WO,-no_dependency_variables	Verification Failed	1.68

ATS Results Host.sctgo pec.out - Mozilla Firefox

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4	-xO3 -fsimple=1 -WO,-pec_keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass -WO,-no_dependency_variables	Passed	1.67
5	-xO3 -fsimple=2 -WO,-pec_keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail -WO,-no_dependency_variables	Verification Failed	1.68
6	-xO3 -fsimple=1 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail,6,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass,1,5	Verification Failed	1.67
7	-xO3 -fsimple=1 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail,9,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass,1,8	Verification Failed	1.66
8	-xO3 -fsimple=1 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail,10,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass,1,9	Verification Failed	1.67
9	-xO3 -fsimple=1 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail,11,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass,1,10	Verification Failed	1.68
10	-xO3 -fsimple=1 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/fail,1,11 -WO,-pec_use,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run21/pass,11,11	Passed	1.68

Faulty modules (1 found) - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

Faulty modules (1 found)

	Working Options -xO3 -fsimple=1	Faulty Options -xO3 -fsimple=2	
mcf.o	Working	Faulty	Difference

Why stop now! fixbug

- Build a binary with a workaround

```
% ats -i 'script:fixbug -x03 -fsimple=2 -xlinkopt'  
-r 'pec.out < input.txt > output.txt'  
-c 'cmp output.txt output.gold'  
pec.out
```

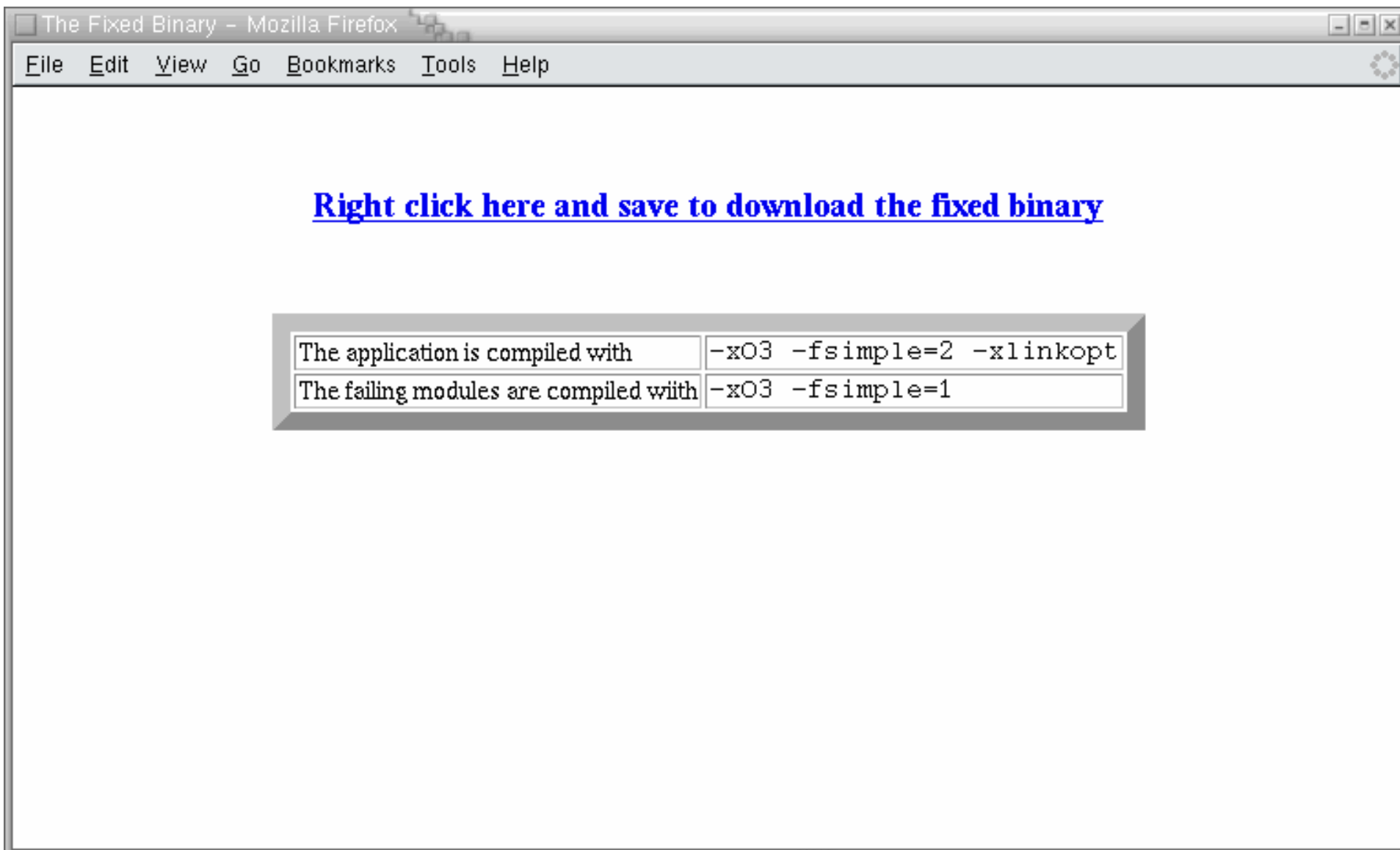
Sun Proprietary/Confidential Copyright Mon Sep 19 09:16:25 PDT 2005

- [The Fixed Binary](#)
- [Faulty modules \(1 found\)](#)

- [Log File](#)
- [Spreadsheet \(csv file\)](#)

Host: sctgo
/import/go-saraswati/rprak/demo/ats_mcf/pec.out

Number ↓	Compiler flags	Status	Runtime
1	-xO3 -fsimple=2 -xlinkopt	Verification Failed	1.66
2	-xO3 -fsimple=2	Verification Failed	1.68
3	-xO3 -fsimple=1	Passed	1.66
4	-xO3 -fsimple=1 -WO,-pec_keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run22/pass -WO,-no_dependency_variables	Passed	1.67
5	-xO3 -fsimple=2 -xlinkopt -WO,-pec_keep,/import/go-saraswati/rprak/demo/ats_mcf/ATS/run22/fail -WO,-no_dependency_variables	Verification Failed	1.66



Conclusion

- Available on OpenSPARC.net under Cool Tools

`http://cooltools.sunsource.net/ats`

- Discussion
Cool Tools Forum
(link at bottom of ATS web page)



Automatic Tuning and Troubleshooting System

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