
Index

Symbols

__mp_parallel_do, 151
__mp_slave_wait_for_work, 151
_DSM_FOP environment variable, 141
_DSM_MIGRATION environment variable, 141
_DSM_OFF environment variable, 141
_DSM_PPM environment variable, 141
_DSM_ROUND_ROBIN environment variable, 141
_DSM_VERBOSE environment variable, 141

A

ABI specification, 9
affinity scheduling, 129-132
-align16 compiler option, 25
-align8 compiler option, 25
alignment, 23, 24
ANSI Fortran
 data alignment, 24
ANSI-X3H5 standard, 67, 102
archiver, ar, 13
arrays
 2 gigabyte, 14
 and data affinity, 131
 data distribution directive, 128
 declaring, 23
 processor arrays, 137
 query dimensions, 136

arrays (*continued*)
 redistributed, 131
 reshaping, 134
 reshaping and error detection, 135
 restrictions on reshaping, 134
assembly language routines, 19
atomic BOOL operation, 118
atomic fetch-and-op operations, 117
atomic lock and unlock operations, 119
atomic op-and-fetch operations, 117
atomic synchronize operation, 119
-automatic compiler option, 150

B

barrier construct, 105, 114
barrier function, 98
-bestG compiler option, 12
blocking slave threads, 93
BOOL operation, 118

C

C\$, 75
C\$&, 74
cache, 88
 improve, 93
 misses, 122

- C\$CHUNK, 75
 - C compiler option , 153
 - c compiler option , 4
 - C\$COPYIN, 99
 - C\$DOACROSS, 68
 - and REDUCTION, 70
 - continuing with C\$&, 74
 - IF clause, 69
 - LASTLOCAL clause, 69
 - loop naming convention, 100
 - nesting, 76
 - c\$dynamic directive, 133
 - CHUNK, 72, 92, 98
 - C\$MP_SCHEDTYPE, 75
 - common block reorganization, 93
 - COMMON blocks, 70, 153
 - making local to a process, 98
 - shared, 24
 - compilation, 2
 - COMPILER_DEFAULTS_PATH environment variable, 9
 - compiler.defaults* file 9
 - compiler options, 7
 - align16 , 23, 25
 - align8 , 23, 25
 - automatic , 150
 - bestG , 12
 - C , 153
 - c , 4
 - G , 12
 - jmopt , 12
 - l , 6
 - MP
 - check_reshape, 142
 - clone, 142
 - dsm, 142
 - mp , 101, 102, 149, 153
 - pfa , 102
 - static , 79, 150, 153
 - compile-time options
 - multiprocessing, 142
 - parallel programming, 142
 - COMPLEX, 23
 - COMPLEX*16, 23
 - COMPLEX*32, 23
 - computation scheduling
 - user control, 122
 - constructs
 - work-sharing, 105
 - core files 19
 - producing, 155
 - C\$PAR & directive, 114
 - C\$PAR BARRIER, 114
 - C\$PAR CRITICAL SECTION, 112
 - C\$PAR PARALLEL, 104
 - C\$PAR PARALLEL DO, 105
 - C\$PAR PDO, 105
 - C\$PAR PSECTIONS, 107
 - C\$PAR SINGLE PROCESS, 109
 - critical section, 105
 - and SHARED, 113
 - PCF construct, 112
 - critical section construct, 102
 - differences between single process, 112
- ## D
- data
 - explicit placement, 140
 - placement in memory, 140
 - placement of, 140
 - data affinity 130
 - formal parameter, 132
 - redistributed arrays, 131

- data dependencies, 78
 - analyzing for multiprocessing, 76
 - breaking, 82
 - complicated, 80
 - inconsequential, 81
 - rewritable, 80
- data distribution, 133-140
 - differences, 139
 - regular, 133
 - reshape, 134
- data distribution directives, 127-128
- data independence, 76
- data placement
 - user control, 122
- data structures
 - irregular, 140
- data types
 - alignment, 23, 24
- DATE, 60
- dbx, 155
- debugging
 - parallel Fortran programs, 152
- defaults
 - specification file
- dimensions
 - arrays, 136
 - of arrays, 136
- direct files
- directives
 - affinity scheduling 129-132
 - and data affinity 130
 - C\$, 75
 - C\$&, 74
 - C\$CHUNK, 75
- directives (*continued*)
 - C\$DOACROSS, 68
 - c\$dynamic, 133
 - C\$MP_SCHEDTYPE, 75
 - data distribution, 127-128
 - distribute, 127
 - distribute_reshape, 127, 137
 - doacross, 129
 - dynamic, 127
 - list of, 68
 - nested doacross, 129
 - ONTO clause, 132
 - overview, 66
 - redistribute, 133
 - regular data distribution, 133
 - reshape, 134
 - reshape data distribution, 134
 - see also* PCF directives
 - thread affinity 132
- disobject file tool
- distribute_reshape directive, 127, 137
- distribute directive, 127
- distributed shared memory, 141
- DOACROSS, 75
 - and multiprocessing, 100
- doacross directive, 129
- DO loops, 66, 77, 87, 154
- driver options, 7
- drivers, 1
 - defaults, 9
- dump object file tool
- dynamic directive, 127
- dynamic scheduling, 71

E

- environment variable
 - COMPILER_DEFAULTS_PATH, 9
- environment variables, 151
 - CHUNK, 97
 - f77_dump_flag, 19, 155
 - MP_BLOCKTIME, 96
 - MP_SCHEDTYPE, 97
 - MP_SET_NUMTHREADS, 96
 - MP_SETUP, 96
 - parallel programming, 141
- equivalence statements, 153
- error detection
 - reshaped arrays, 135
- error handling, 19
- error messages
 - run-time, 155
- ERRSNS, 60
- examples
 - multiprocessing, 143
- executable object, 3
- EXIT, 61
- external files 17

F

- f77
 - as driver, 1
 - supported file formats 17
 - syntax, 1
- f77_dump_flag, 19, 155
- fetch-and-op operations, 117
- file, object file to 13

fi les

- compilation specification 9
- direct, 17
- external, 17
- position when opened, 18
- preconnected, 18
- sequential unformatted, 17
- supported formats, 17
- UNKNOWN status, 19

formal parameter
and data affinity 132

formats
files 17

Fortran
ANSI, 24

functions
in parallel loops, 79- intrinsic, 62, 79
- SECNDS, 63
- library, 51, 79
- RAN, 63
- side effects, 79

G

- G compiler option , 12
- global data area
 - reducing, 12
- guided self-scheduling, 71

H

- handle_sigfpe, 20

I

IDATE, 60
 IF clause
 and C\$DOACROSS, 69
 IGCLD signal
 intercepting, 99
 interleave scheduling, 71
 interleaving, 92
 intrinsics, 116-120
 example, 120
 intrinsic subroutines
 DATE, 60
 ERRSNS, 60
 EXIT, 61
 IDATE, 60
 MVBITS, 62
 TIME, 61
 irregular data structures, 140
 ISA specification, 9

J

-jmpopt compiler option, 12

L

LASTLOCAL, 69, 77
 LASTLOCAL clause, 69
 -l compiler option, 6
 libfpe.a, 20
 libraries
 link, 6
 specifying, 6
 library
 multiprocessing library, *libmp*, 121
 library functions, 51

linking, 5
 link libraries, 6
 load balancing, 91
 LOCAL, 69, 77
 lock and unlock operations, 119
 lock example, 120
 LOGICAL, 23
 loop interchange, 87
 loops, 66
 data dependencies, 77
 transformation, 100

M

m_fork
 and multiprocessing, 100
 makefile, 49
 master processes, 67, 101
 memory
 2 gigabyte arrays, 14
 array sizes, 14
 distributed shared, 141
 placement of data, 140
 misaligned data, 24
 -MP
 check_reshape compiler option, 142
 clone compiler option, 142
 dsm compiler option, 142
 MP
 compiler options, 142
 libmp library, 121
 mp_barrier, 98
 mp_block, 93
 mp_blocktime, 94
 MP_BLOCKTIME environment variable, 96
 mp_create, 94
 mp_destroy, 94

mp_my_threadnum, 95
mp_numthreads, 95
MP_SCHEDTYPE, 70, 75, 98
MP_SET_NUMTHREADS, 96
mp_set_numthreads, 95
 and MP_SET_NUMTHREADS, 96
mp_setlock, 98
MP_SETUP, 96
mp_setup, 94
mp_simple_sched
 and loop transformations, 100
 tasks executed, 101
mp_slave_control, 101
mp_suggested_numthreads, 95
MP_SUGNUMTHD environment variable, 141
mp_unblock, 93
mp_unsetlock, 98
-mp compiler option , 101, 102, 149, 153
multi-language programs, 3
multiprocessing
 and DOACROSS, 100
 and load balancing, 91
 associated overhead, 87
 control of, 121-147
 data distribution, 133-140
 enabling, 149
 enabling directives, 101
 environment variables, 141
 libmp library, 121
 options, 142
MVBITS, 62

N

nested doacross directive, 129
nm, object file tool 13

NOWAIT clause, 106, 107, 109
NUM_THREADS, 96

O

object files
 tools for interpreting, 13
object module, 3
objects
 linking, 5
ONTO clause, 132
op-and-fetch operations, 117
optimizing programs
 -*OPT* option
 reorg_common, 93
options
 control multiprocessing, 142
 parallel programming, 142
-*OPT* option
 reorg_common option, 93
Origin2000
 memory model, 122
 parallel programming, 121-147
 performance tuning, 121-147
 programming examples, 143

P

PAGESIZE environment variables, 141
parallel DO construct, 105
parallel Fortran
 directives, 68
parallel programming
 environment variables, 141
 examples, 143
 options, 142

- parallel programming on Origin2000, 121-147
 - parallel programs
 - improving performance, 122
 - tuning, 122
 - parallel region, 91, 102, 104
 - and SHARED, 104
 - efficiency of 115
 - restrictions, 115
 - parallel sections construct, 107
 - assignment of processes, 108
 - parameter, formal
 - data affinity 132
 - PCF constructs
 - and efficiency 115
 - barrier, 105, 114
 - critical section, 105, 112
 - differences between single process and critical section, 112
 - NOWAIT, 106, 107, 109
 - parallel DO, 105
 - parallel regions, 104, 115
 - parallel sections, 107
 - PDO, 105
 - restrictions, 114
 - single process, 109
 - types of, 104
 - PCF directives
 - C\$PAR &, 114
 - C\$PAR BARRIER, 114
 - C\$PAR CRITICAL SECTION, 112
 - C\$PAR PARALLEL, 104
 - C\$PAR PARALLEL DO, 105
 - C\$PAR PDO, 105
 - C\$PAR PSECTIONS, 107
 - C\$PAR SINGLE PROCESS, 109
 - enabling, 102
 - overview, 102
 - PCF standard, 67
 - PDO construct, 105
 - performance
 - and cache behavior, 123
 - directives, 126-142
 - improving, 12, 122
 - performance tuning
 - examples, 143
 - pf compiler option , 102
 - Power Fortran, 77
 - preconnected files 18
 - processes
 - master, 67, 101
 - slave, 67, 101
 - processor
 - arrays, 137
 - topology
 - processor
 - ONTO clause, 132
 - processor specification 9
 - prof
 - and parallel Fortran, 151
 - profiling
 - parallel Fortran program, 151
 - programs
 - multi-language, 3
- Q**
- quad-precision operations, 19
 - query intrinsics
 - distributed arrays, 136
- R**
- RAN, 63
 - rand
 - and multiprocessing, 79

- REAL*16
 - range, 22
 - REAL*4
 - range, 22
 - REAL*8
 - alignment, 23
 - range, 22
 - records, 17
 - recurrence
 - and data dependency, 84
 - redistribute directive, 133
 - reduction
 - and data dependency, 84
 - listing associated variables, 70
 - sum, 86
 - REDUCTION clause
 - and C\$DOACROSS, 70
 - regular data distribution
 - vs. reshaped distribution, 139
 - reorganize common blocks, 93
 - reshaped arrays, 134
 - error detection, 135
 - restrictions, 134
 - reshaped data distribution
 - vs. regular distribution, 139
 - reshape directive, 134
 - round-to-nearest mode, 19
 - run-time error handling, 19
 - run-time scheduling, 71
- S**
- scheduling methods, 70, 93, 100
 - dynamic, 71
 - guided self-scheduling, 71
 - interleave, 71
 - run-time, 71
 - simple, 71
 - SECNDS, 63
 - self-scheduling, 71
 - sequential unformatted file
 - SHARE, 69, 77
 - SHARED
 - and critical section, 113
 - and parallel region, 104
 - shared memory
 - distributed, 141
 - SIGCLD, 94
 - simple scheduling, 71
 - single process
 - PCF construct, 109
 - single process construct, 109
 - differences between critical section, 112
 - size
 - arrays, 136
 - size, object file tool
 - slave threads, 67, 101
 - blocking, 93, 94
 - source files
 - specifying compilation mode, 9
 - spin-wait lock example, 120
 - spooled routines, 100
 - sproc
 - and multiprocessing, 99
 - associated processes, 101
 - static compiler option, 79, 150, 153
 - strip, object file tool
 - subroutines
 - intrinsic, 79
 - system
 - DATE, 60
 - ERRSNS, 60
 - EXIT, 61
 - IDATE, 60
 - MVBITS, 62

sum reduction, example, 86
symbol table information
 producing, 13
synchronization intrinsics, 116-120
synchronize operation, 119
synchronizer, 151
syntax conventions, xvii
system interface, 51

T

test&test&set, 111
thread
 master, 67
 slave, 67
thread affinity
 doacross directive, 132
threads
 and processors, 67
 number of, 67
 override the default, 67
TIME, 61
trap handling, 20

U

ussetlock, 98
unsetlock, 98

V

variables
 in parallel loops, 77
 local, 79
 to control multiprocessing, 141
VOLATILE
 and critical section, 113
 and multiple threads, 110

W

-Wl,Xlocal,data loader directive, 98
work quantum, 87
work-sharing constructs, 102
 restrictions, 114
 types of, 105