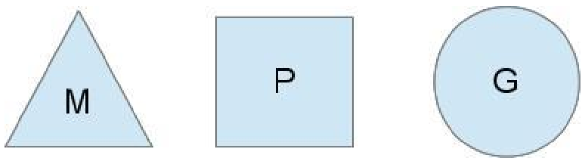
Goroutine

PMG

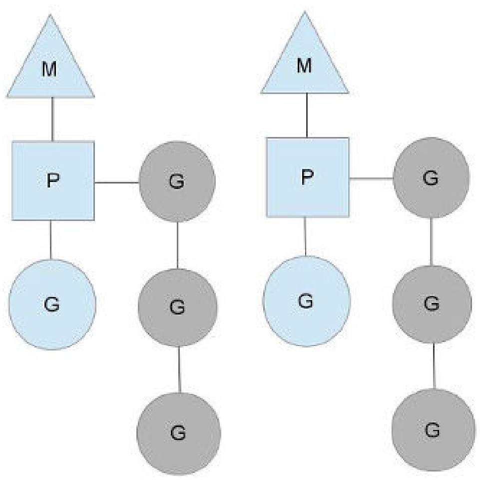
GoschedulerOSscheduler
POSIX APIPOSIXUnix process ThreadCPU affinityGo contextGogoroutineOSscheduler

GoCPU

N:11:1M:N
N:1Ncontext
1:1switch
M:N goroutine

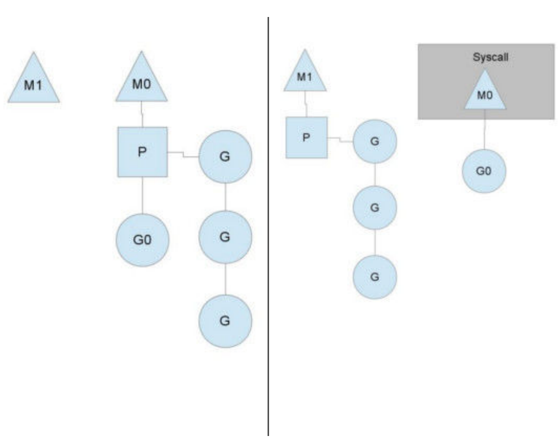


Go**MPG**
MOSPOSIXthread
Ggoroutineinstruction pointerchannel
PgoN:1N:M



2MMcontextPgoroutine**P**runtime.GOMAXPROCS()goroutinegoroutinereadyP**runqueue**Gogoroutinego function gorunqueuegoroutinerunqueuegoroutinegoroutine

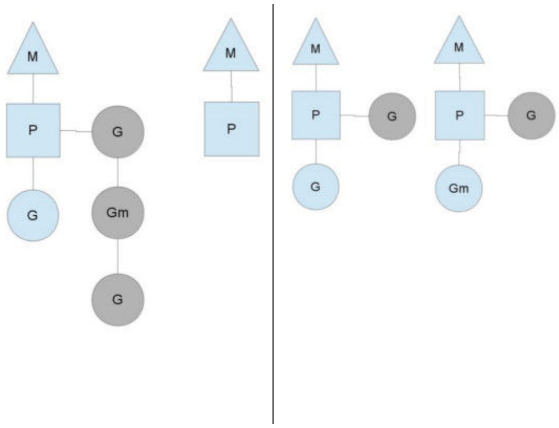
POS**P**OS
OSM0POSM1context P



Content Menu

- PMG
-
  -
  - goroutine(G)
  - (M)
  -
  -
  -
-

M1M0context PgoroutineOSstealcontext
goroutineglobal runqueueContextsglobal runqueueglobal runqueuegoroutine



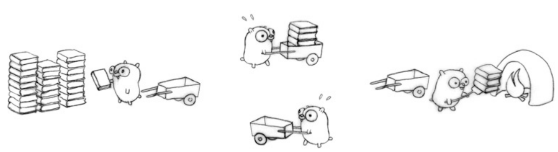
PGPglobal runqueue**GPPGPP**""runqueueOS

GogoroutinegoroutineGo""""goroutinegoroutinegoroutineCPUCPU

4**PMGSched**runtime.h**Sched**proc.c

- **SchedMG**
- **M**MgoroutineMMcache(mcache)goroutine
- **P**ProcessorgoroutinegoroutinegoroutinePM
- **G**goroutine**G**goroutine**M**

MPG



MPG

asm_amd64.s_rt0_amd64

```
CALL        runtime.args(SB)
CALL        runtime.osinit(SB)
CALL        runtime.hashinit(SB)
CALL        runtime.schedinit(SB)

// create a new goroutine to start program
PUSHQ        $runtime.main.f(SB)                // entry
PUSHQ        $0                        // arg size
CALL        runtime.newproc(SB)
POPQ        AX
POPQ        AX

// start this M
CALL        runtime.mstart(SB)
```

runtime.schedinitruntime.newprocgoroutinegoroutineruntime.maingoroutinegorouti
neGohelloworldgoroutineGogoroutineruntime.mstartgoroutine

runtime.schedinitGOMAXPROCS(P)GOMAXPROCS**256(P)**(**P**)(**Sched**)pidle runtime.maingoroutine(**M**)——(**sysmon**)GomainGo

GoGogoroutineGogoroutinegoroutine

goroutine(G)

Go

```
go do_something()
```

gogoroutinegoroutinego runtime.newprocruntime.newproc(**G**)(**G**)(**M**)(**P**)

goroutine**G**schedgoroutinecpucpucpu

goroutnegoroutine

(M)

Gogoroutineruntimeruntime(**G**)(**M**)(**P**)(**M**)(**P**)(**M**)(**M**)(**M**)M:

```
void newm(void (*fn)(void), P *p)
```

newmcloneruntime.mstartp(**P**)runtime.mstart

newm**MP**(**M**)——"11"(**M**)(**P**) acquirepruntime.mstart schedule**MP**runtime.mstart

```
} else if(m != &runtime.m0) {
        acquirep(m->nextp);
        m->nextp = nil;
}
schedule();
```

if**MP** nextpnewm(**P**)**PM**goroutineacquirepreleasep**MP**

(**M**)(**P**) scheduleschedule

```
static void schedule(void) {
        G *gp;

        gp = runqget(m->p);
        if(gp == nil)
                gp = findrunnable();

        if (m->p->runqhead != m->p->runqtail &&
                runtime.atomicload(&runtime.sched.nmspinning) == 0 &&
                runtime.atomicload(&runtime.sched.npidle) > 0)  // TODO:
fast atomic
                wakep();

        execute(gp);
}
```

schedule4

1. runqget, (**M**)(**P**)(**G**)
2. findrunnable, () sleep
3. wakep, “”——””
4. execute

 "" work stealing

goroutine

channelchannel runtime.park goroutineparkgoroutinewaiting**CPU**parkgoroutinewaitinggoroutine(**P**)runtime.ready**channelpollpark goroutine**

parkcpu runtime.gosched goroutine**CPU**parkgoschedgoroutinerunnable(**G**)

Goentersyscallexitsyscall entersyscall(**P**)syscallsysmon(**P**)(**P**)syscall(**P**)goroutine(**M**)syscall(**G**)goroutine

goroutine

goroutine

1. goroutine(waiting)
2. runtime.gosched()
3. system call

1.2goroutinescheduler1.2goroutineschedulerCPU

goroutine**CPU** goroutine**CPU**goroutine**CPU**

goroutine**CPU**(park/gosched)runtime.mcallgoroutine**G**schedmcallruntime.gogocallexecutegoroutine

- https://johng.cn/goroutine1-pmg/
- https://johng.cn/goroutine-scheduler-brief/
- https://www.zhihu.com/question/20862617
- http://morsmachine.dk/go-scheduler