WEKA.IO
Radically Simple Storage™

Announcing Mecca

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About the Weka.io product

- “Software only” storage product
- Low latency, high performance
- Written in D
- About 280,000 LoC
  - Not including 114,663 lines in a single auto-generated file.
- Compiled using waf

More About the Code

- Internally called “wekapp”
- Extremely latency sensitive
  - As little GC as possible
  - As few system calls as possible
- Performance sensitive
  - As little copying of data as possible
- Micro-threading (Fibers) based

DPDK and SPDK

- DPDK
  - Intel library for direct DMA to user-space buffer, bypassing the kernel
  - Supported by most high-end NICs
  - Allows getting network data with **zero** copying
- SPDK
  - s/network/nvme/ in the above description.

Weka Custom Infra

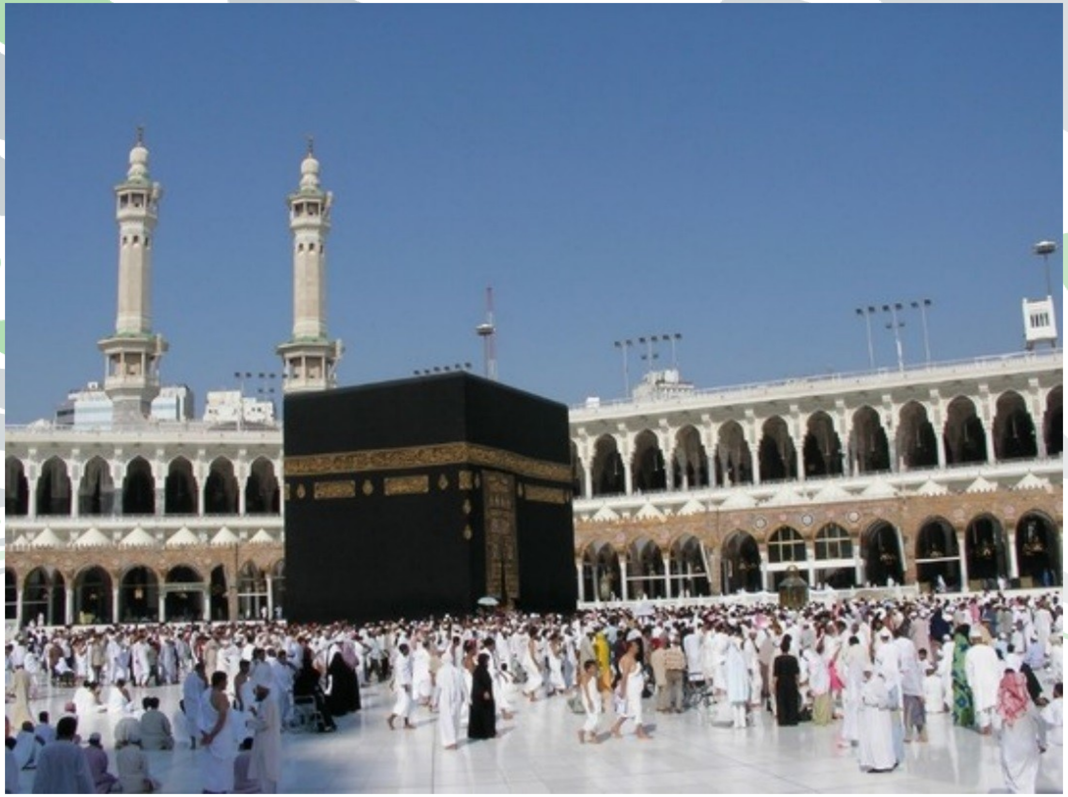
- Why?
  - Phobos relies on GC
  - No standard Fibers scheduler
  - Scheduler must support DPDK polling mode
  - Standard libraries don’t care about performance to our standards
- Weka infra:
  - Busy-polls DPDK and SPDK (optional). Occasionally calls epoll.
  - Containers: Statically allocated, non-GC
  - Time: TSC based, with further performance heuristics.

Technical Debt

- An engineer focused on fixing a bug don’t always focus on all implications of an infrastructure change.
- Decided to repay the debt before it drags us down.
- To prevent further problems: separate into a library.

Distinct Naming Philosophy

- Wekapp – the product repository
- Sir Botty McBotFace – bot for closing integrated bugs
- Teka – tool for deploying from development to AWS
- Deka – the same tool, running inside docker.



Meca

THE MOMENT I WEKAPP
BEFORE I PUT ON MY MECCAP
imgflip.com

What is Mecca?

- A support library
- Containers, libs, the Reactor
- Boost license
- Has a dub package
- Polished against a large code base

Temporary Limitations

- Only for Linux
- Only for x86_64
- API not set in stone
- Primarily aimed at supporting Weka

Where do I get it???

https://github.com/weka-io/mecca

Logging

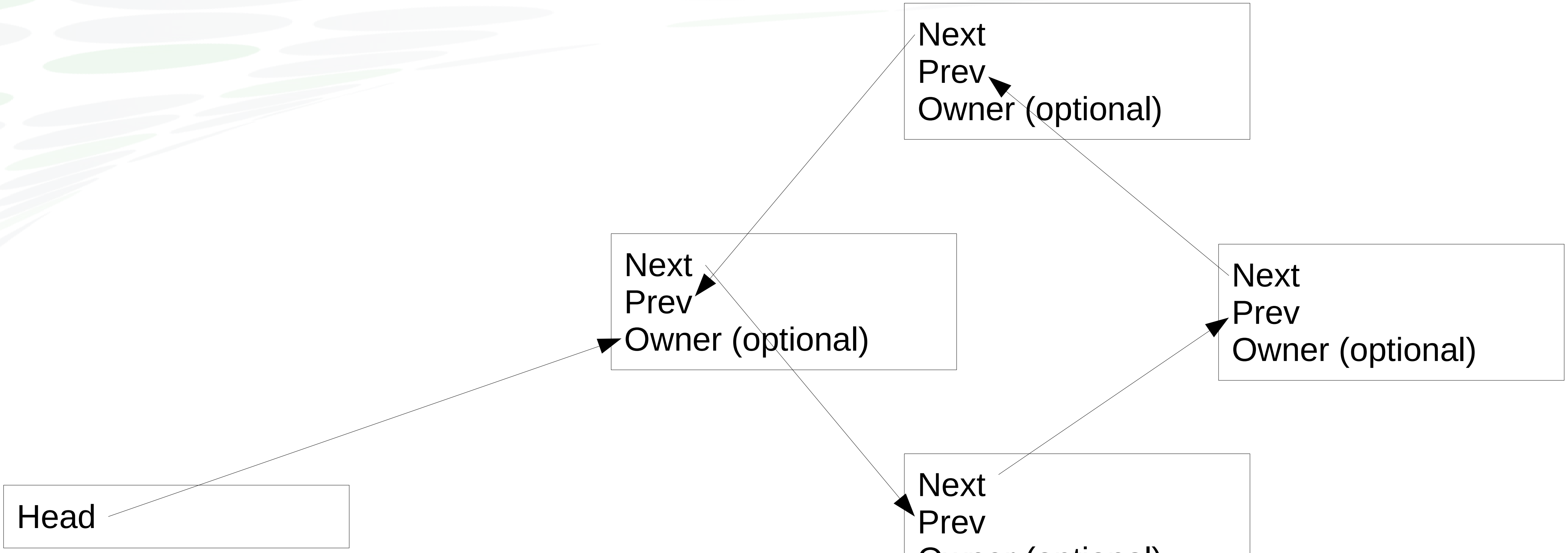
```
import mecca.log;

@notrace void someFunction(int var)
{
   DEBUG!"Format string %s"(var);
}
```

Show Me the Mo^H^H Code…

It’s About Time

- What time is it?
- Going to the kernel is expensive
- gettimeofday is better, but still expensive.
- TscTimePoint: directly querying the TSC.
  - Interface change warning: ticks per second will not remain immutable.

Linked List



Next
Prev
Owner (optional)

Next
Prev
Owner (optional)

Next
Prev
Owner (optional)

Next
Prev
Owner (optional)

Head

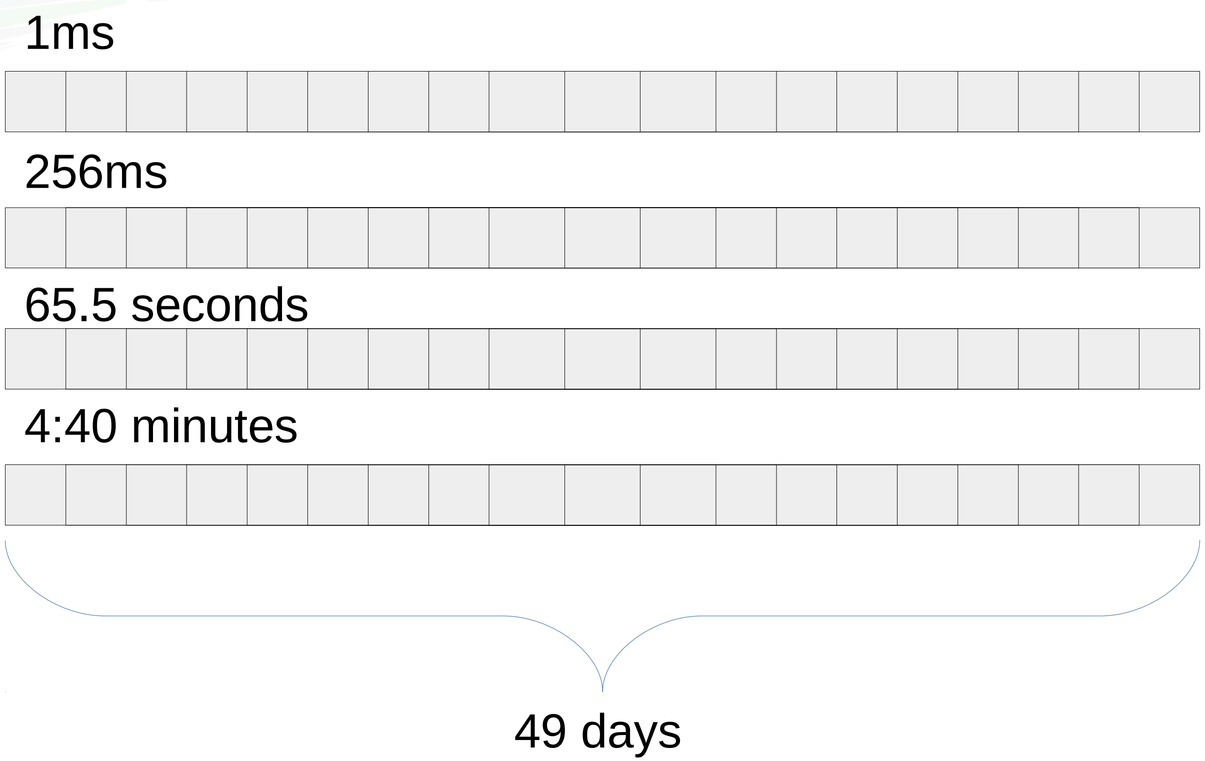
How much are 6 boys + 3 planets?

```
int someFunction()
{
    int boys = 6;
    int planets = 3;

    return boys+planets;
}
```

```
alias Boys =
   TypedIdentifier!("Boys", int);
alias Planets =
   TypedIdentifier!("Planets", int);

int someFunction()
{
    Boys boys = 6;
    Planets planets = 3;

    return boys+planets;
}
```

```
to!DiskId(diskIdx)
```

Cascaded Time Queue



□ Blue moon events

Mecca’s Fiber Implemnetation

- D’s Fiber model requires jumping into and out of the fiber.
  - Two register set switches per context switch.
- Mecca switch directly to next fiber’s context.
  - Save only those registers that are not clobbered by the ABI.
  - Does not save the floating point registers.

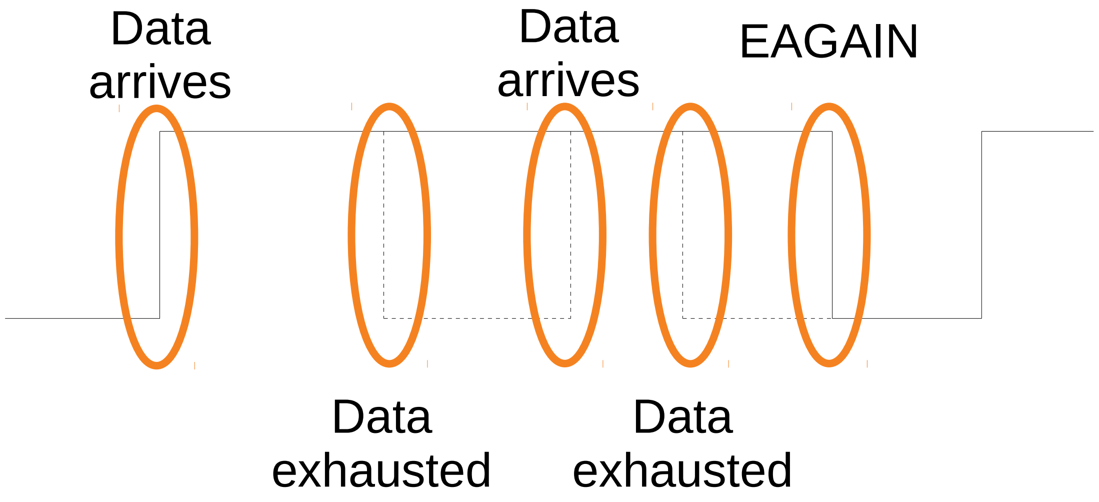
Generic Reactor Flow

```
ssize_t read(int fd, params) {
  ssize_t ret;
  while(
     (ret=read(fd, params))<0 &&
     (errno==EAGAIN || errno==EWOULDBLOCK) )
  {
     registerForRead(fd);
     yield();
     ~~unregisterForRead(fd);~~
  }

  return ret;
}
```

EPOLLONESHOT

Edge Trigger IO Switching

- Epoll has an “edge trigger” mode.
- Considered almost useless
- Actually matches the fibers’ working mode like a glove.



Generic Reactor Flow

```
ssize_t read(int fd, params) {
   ssize_t ret;
   while(
      (ret=read(fd, params))<0 &&
      (errno==EAGAIN || errno==EWOULDBLOCK) )
   {
      ~~registerForRead(fd);~~        EPOLLET
      yield();
      ~~unregisterForRead(fd);~~      EPOLLET
   }

   return ret;
}
```