xyratex

Advancing Digital Storage Innovation

MDSim - Load Simulator

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Agenda

- Project ideas
- Conceptual design
- Userland application structure
- Kernel module structure
  - MD extension
  - Data extension

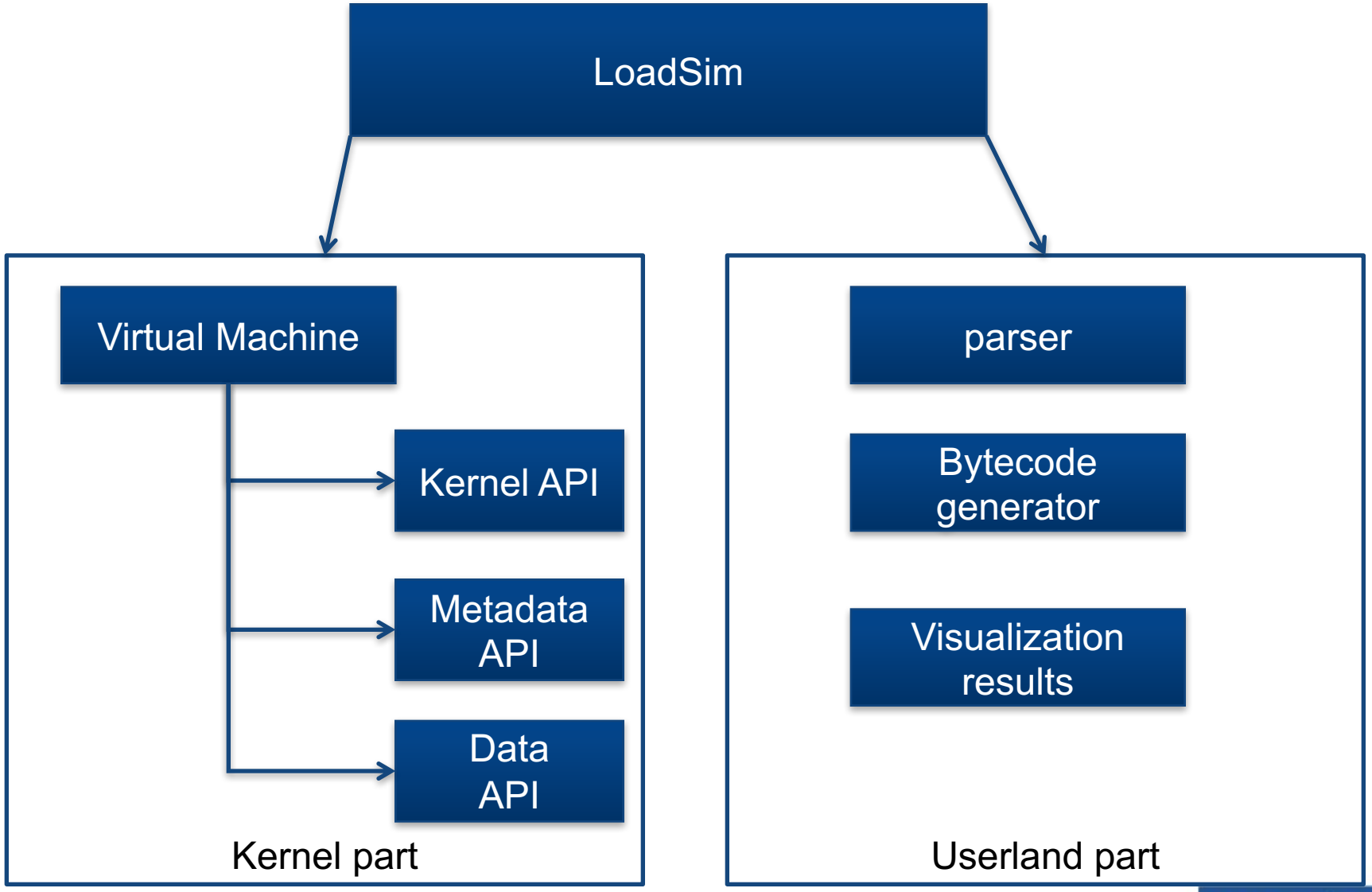
Project ideas

Testing various FS aspects we frequently find it difficult for applications to provide a replicable workload. To solve this we need a tool to generate a more direct load.

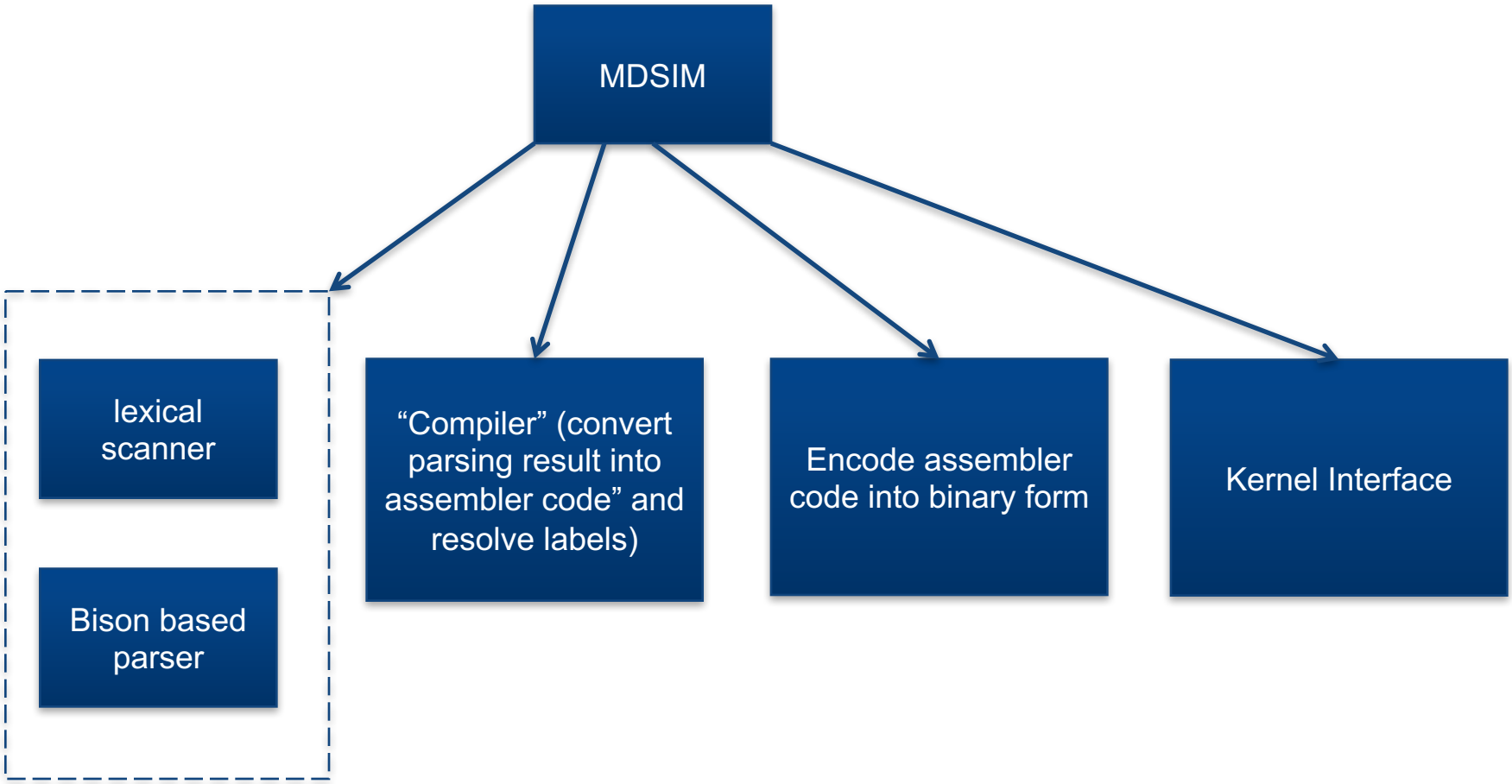
Advantages of project

- Flexible
- Extensible

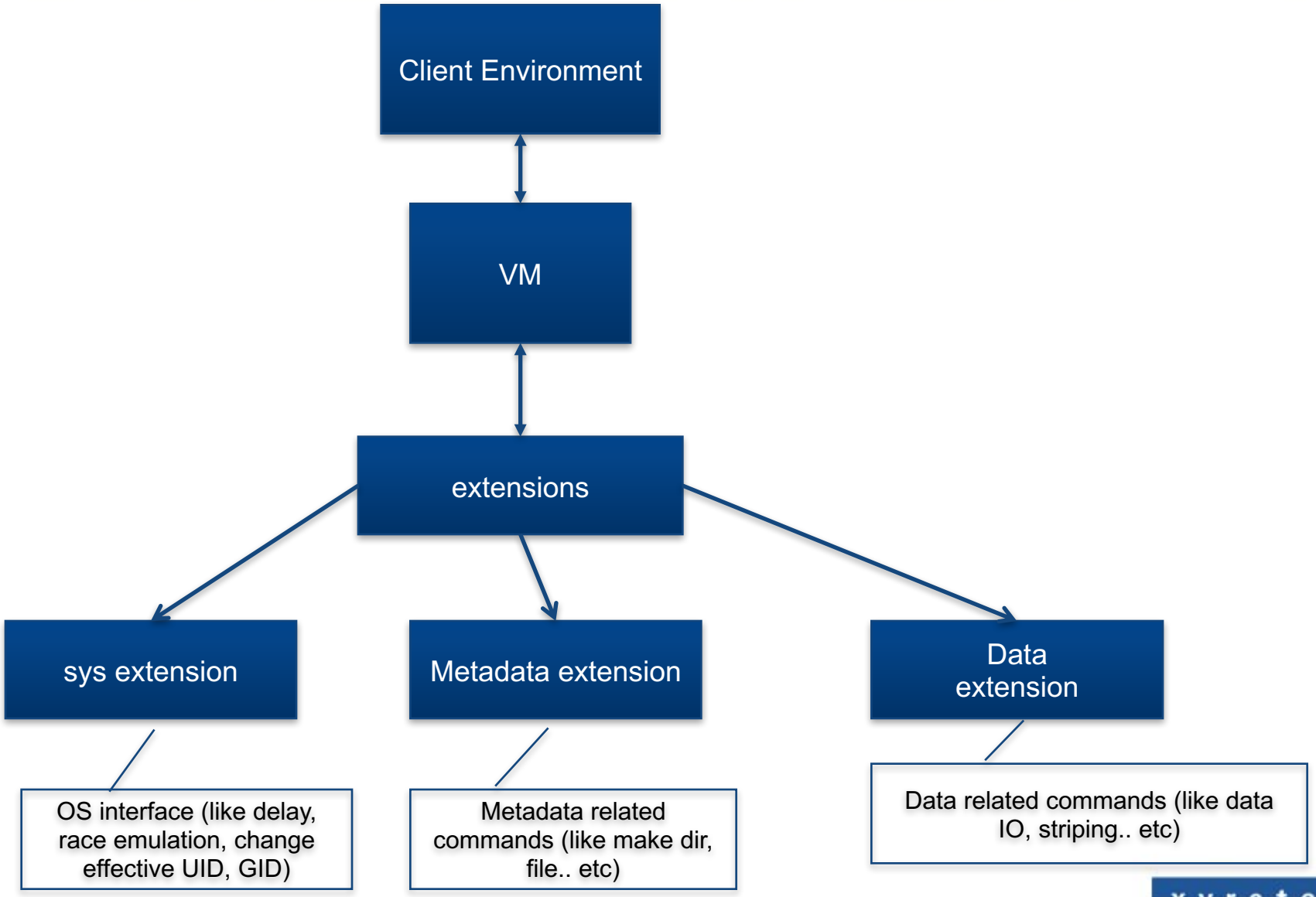
Conceptual design



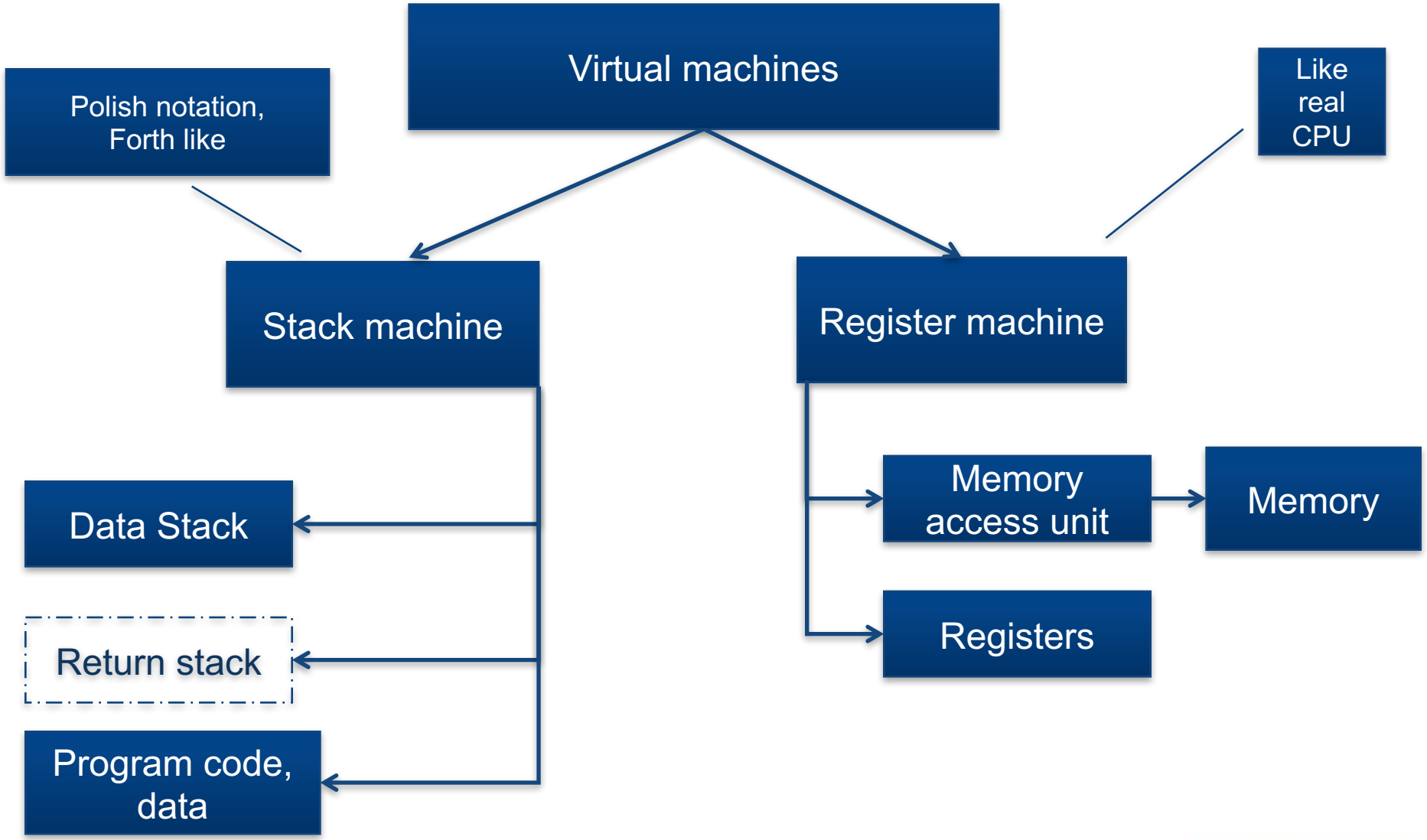
Userland application structure



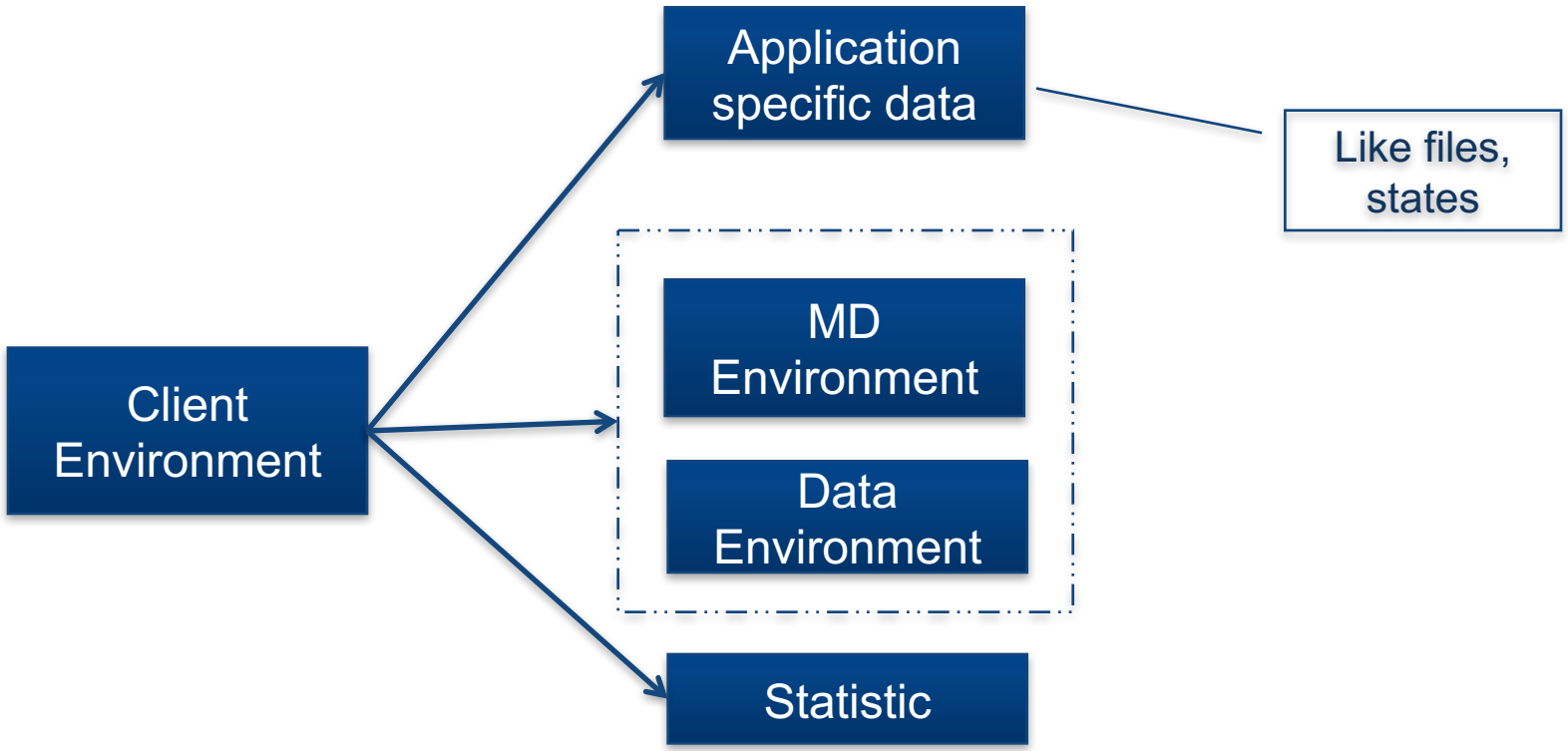
Kernel module structure



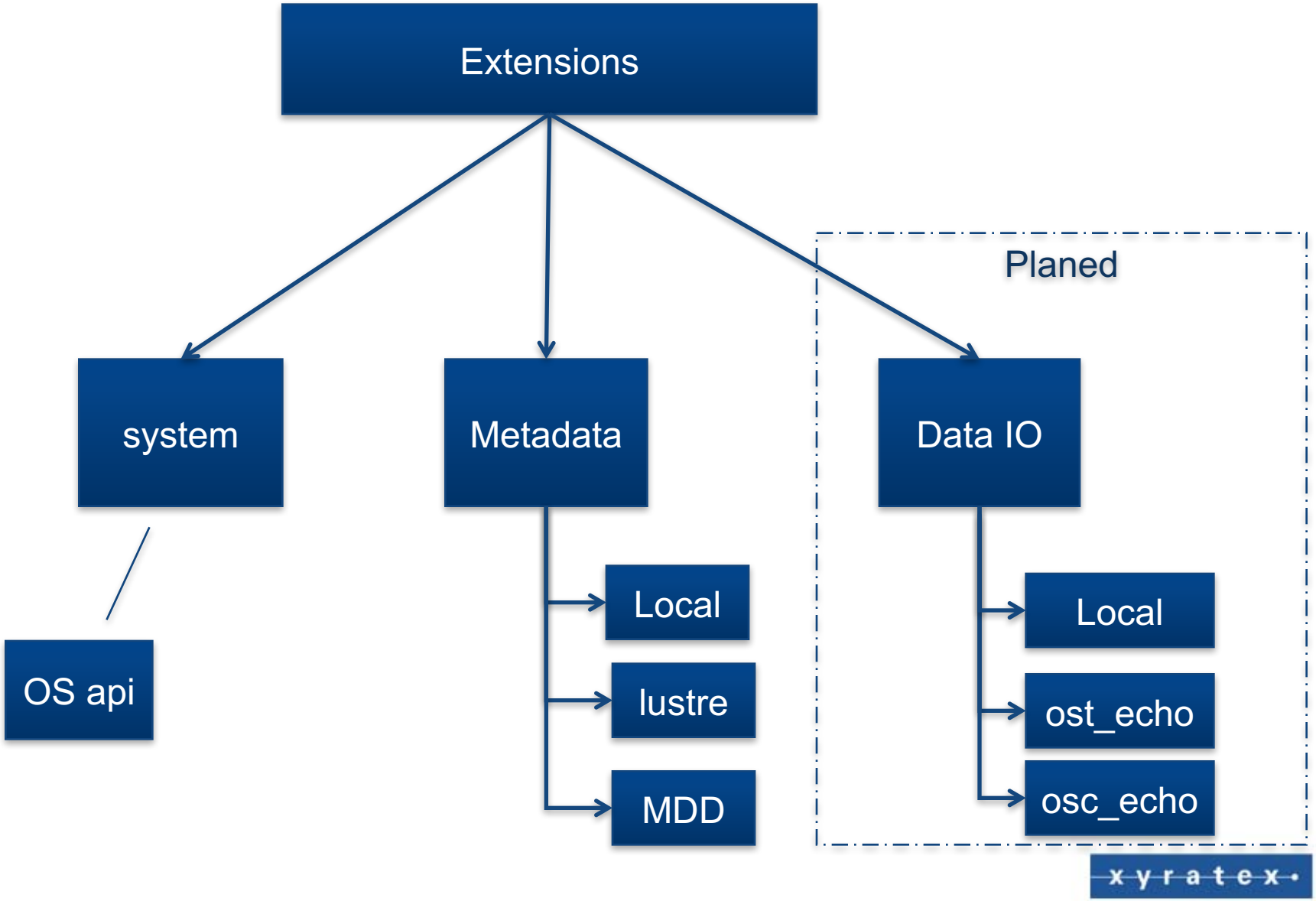
Virtual machines



Kernel module: environment



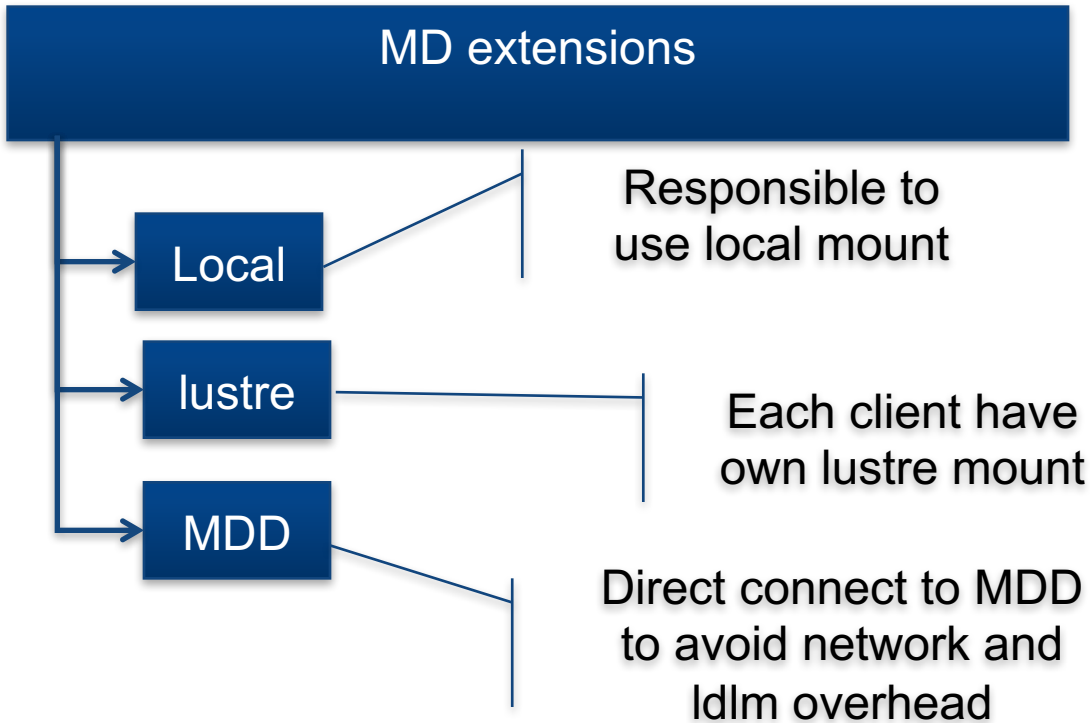
VM Extensions



MD extensions

MD (metadata) extensions – plugin API to enable simulator use with different filesystem types via native functions.

Plugins are responsible for executing any metadata modification operations atomically.



MD Program example

```
procedure test1
        make_work_dir 0777
        cd "test1" expected FAIL
        mkdir "test1" 0666 expected OK
        cd "test1" expected OK
        open "test-file1" O_CREAT|O_RDWR 0666 20 expected OK
        close 20 expected OK
        stat "test-file1" expected OK
        chmod "test-file1" 0666 expected OK
        chtime "test-file1" 222 expected OK
        chown "test-file1" 999:999 expected OK
        truncate "test-file1" 2000 expected OK
        softlink "test-file1" "soft-1" expected OK
        hardlink "test-file1" "hard-1" expected OK
        readlink "soft-1" expected OK
        rename "hard-1" "hard-2" expected OK
endproc

server MDS0 192.168.69.3@tcp "lustre”
client "CLI[0-800]" test1
```

MD Program example 2

```
procedure test1
        $R1 = 5
        while ($R1 != 0)
            $R0 = printf "file-%s-%d-%d" [ $$cli_name, $R1, $$pid ]
            open $R0 O_CREAT|O_RDWR 0666 20 expected OK
            close 20 expected OK
            $R1 = $R1 - 1
        endw
endproc

server local "/mnt/tmp"

client "CLI0" test1
```

That example creates a 5 files with names ‘file-CLI0-[5 .. 0]-$process_pid

MD Results example

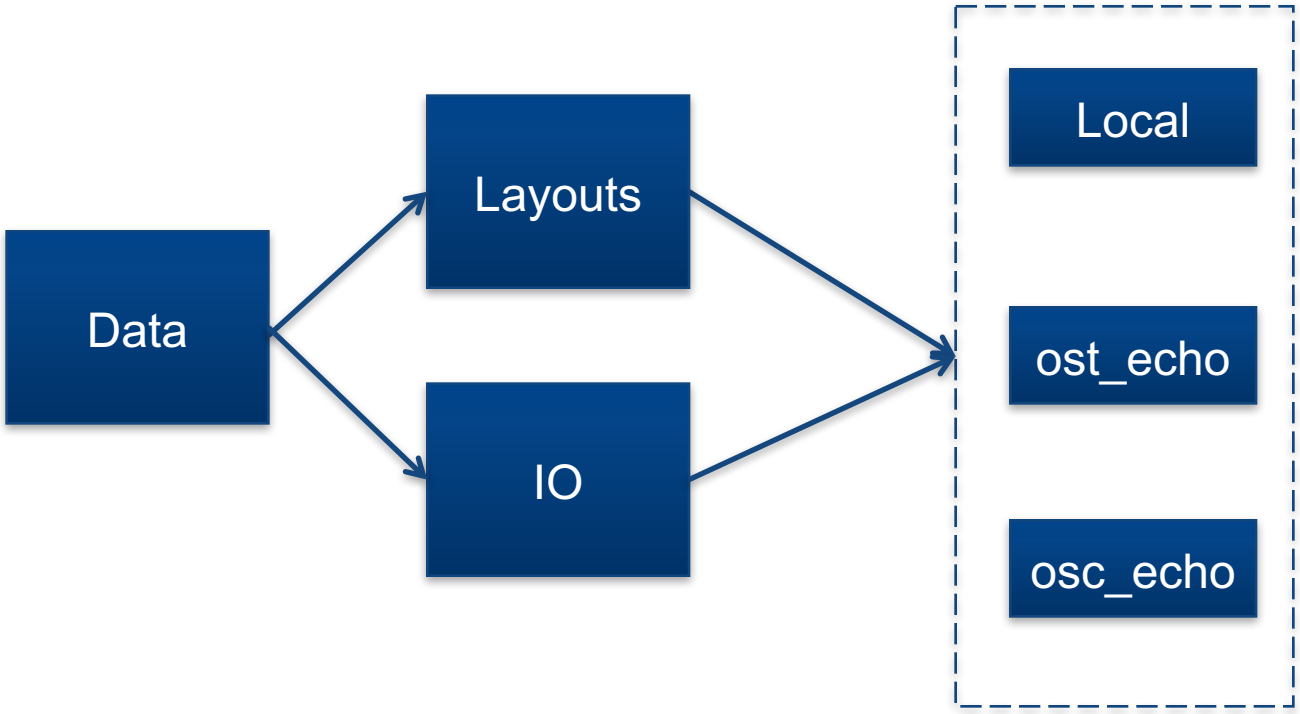
cli CLI0_0 : last op 279 total 279 rc -2

VM_MD_CALL_CD : 999/53997/27498
VM_MD_CALL_MKDIR : 2999/2999/2999
VM_MD_CALL_READDIR : 1000000000/0/0
VM_MD_CALL_UNLINK : 1000000000/0/0
VM_MD_CALL_OPEN : 999/999/999
VM_MD_CALL_CLOSE : 1000000000/0/0
VM_MD_CALL_STAT : 1000000000/0/0
VM_MD_CALL_CHMOD : 1000000000/0/0
VM_MD_CALL_CHOWN : 1000000000/0/0
VM_MD_CALL_CHTIME : 1000000000/0/0
VM_MD_CALL_TRUNCATE : 1000000000/0/0
VM_MD_CALL_SOFTLINK : 1000000000/0/0
VM_MD_CALL_HARDLINK : 1000000000/0/0
VM_MD_CALL_READLINK : 1000000000/0/0
VM_MD_CALL_RENAME : 1000000000/0/0

Client executed all op's (total == last) last operation result -2 (ENOENT)

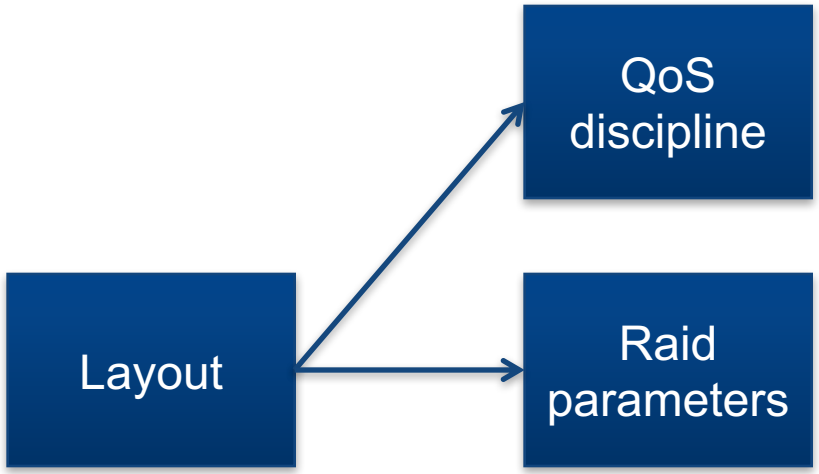
Time of executing for each supported operation (min, avg, max)

Data extensions

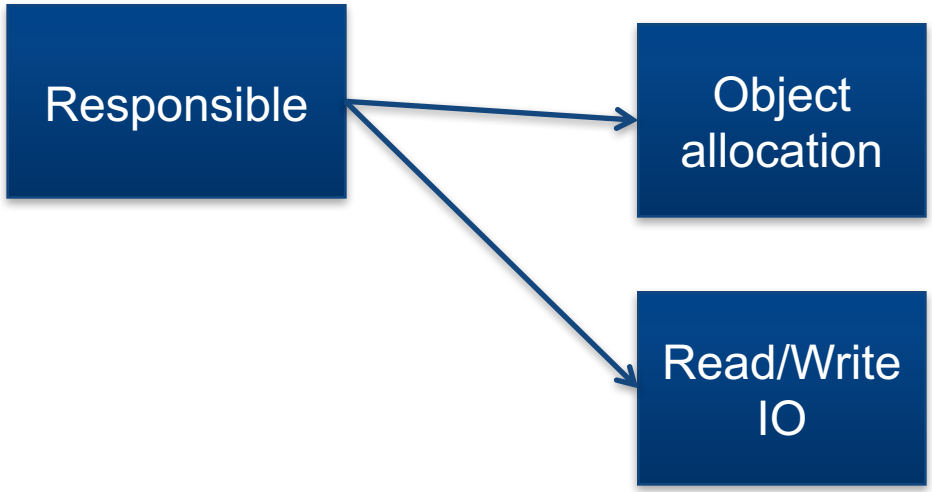


Layouts

Layout module designed for testing different QoS disciplines and controls low level data object allocations and striping parameters.



data access extensions



DATA program example

```
targets
OSC1 ....
OSC2 ....
endtarget

layouts
layout 1 { LOV_RAID0, stripe size, ... }
layout 2 { PDCLUST, start target, ... }
endlayout

objects
object 1 layout1
endobj
```

```
procedure test1
create 1
seek 1 YYYYY
write 1 size YYYYY
seek 1 0
read 1 EOF
destroy 1
endproc

client ... test1
client ... test2
```

Conclusions

MDSim useful for testing because:

- May simulate many clients on single host
- Has flexible language to describe any type of workload
- Has plugin API to create connectors to any FS
- May be possible to create a tool to convert a Lustre log to test program

Final

Thanks!

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