

Applying Operating System Principles to SDN Controller Design

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Is a network operating system fundamentally that different from an operating system such that it requires a completely new architecture?

Current SDN Controllers

- ▶ Single, monolithic network applications
- ▶ API provided by framework
- ▶ Single programming language
- ▶ Single process



Yanc

Yanc is software-defined-networking microkernel with a file system as its primary northbound API.

- ▶ Idea: Extend Linux and its user-space software ecosystem in order to serve as a network operating system
- ▶ SDN applications run in stand-alone processes and use file I/O calls to modify the network
- ▶ Drivers read information from the filesystem and communicate with SDN-enabled networking hardware (e.g. driver for OpenFlow)

Network Configuration as a File System

```

/net
├── hosts
├── switches
│   ├── sw1
│   └── sw2
└── views
    ├── http
    └── management-net
        ├── hosts
        ├── switches
        └── views
    
```

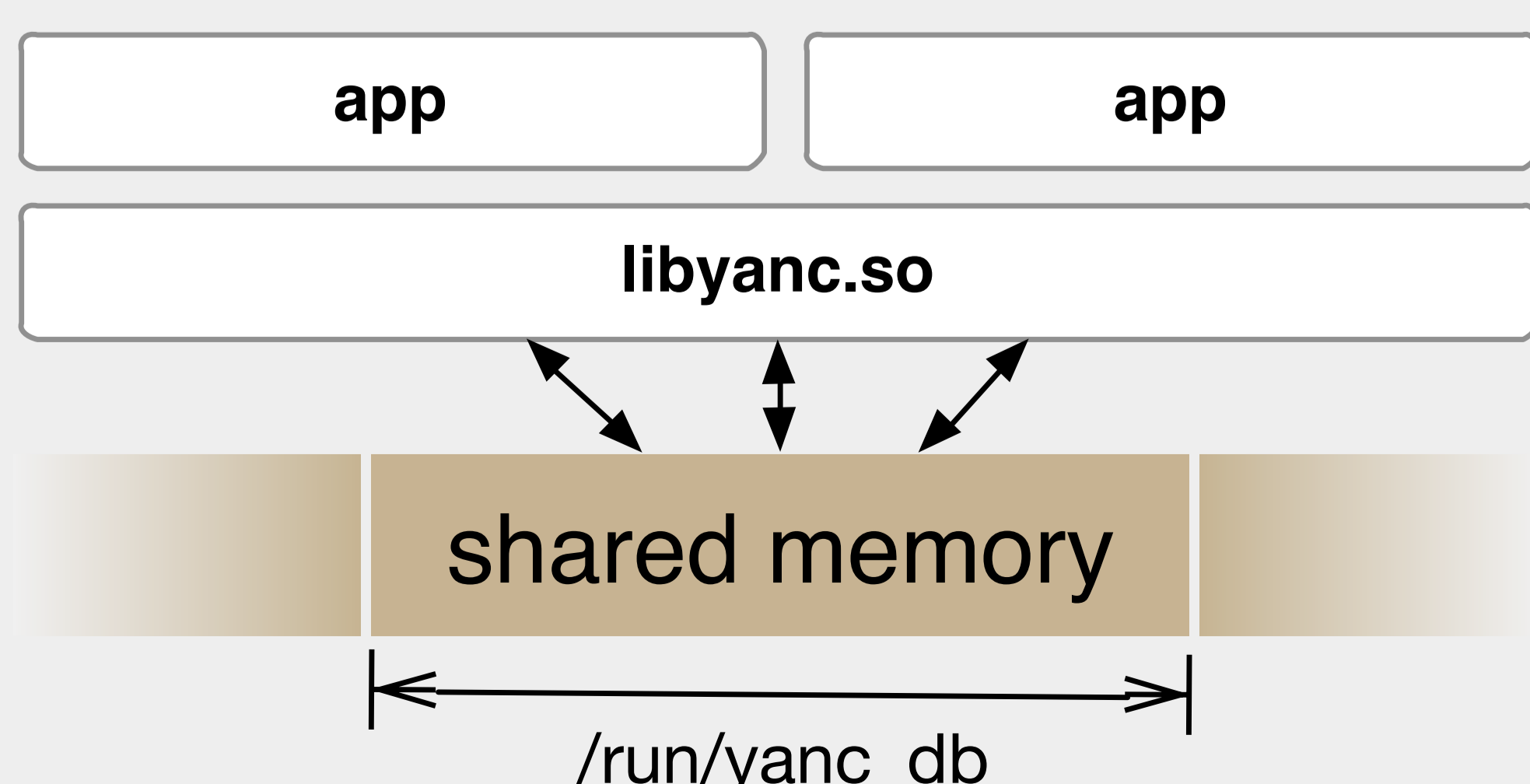
```

arp_flow
├── counters/
├── match.dl_type
├── match.dl_src
├── action.out
├── priority
├── timeout
└── version
    
```

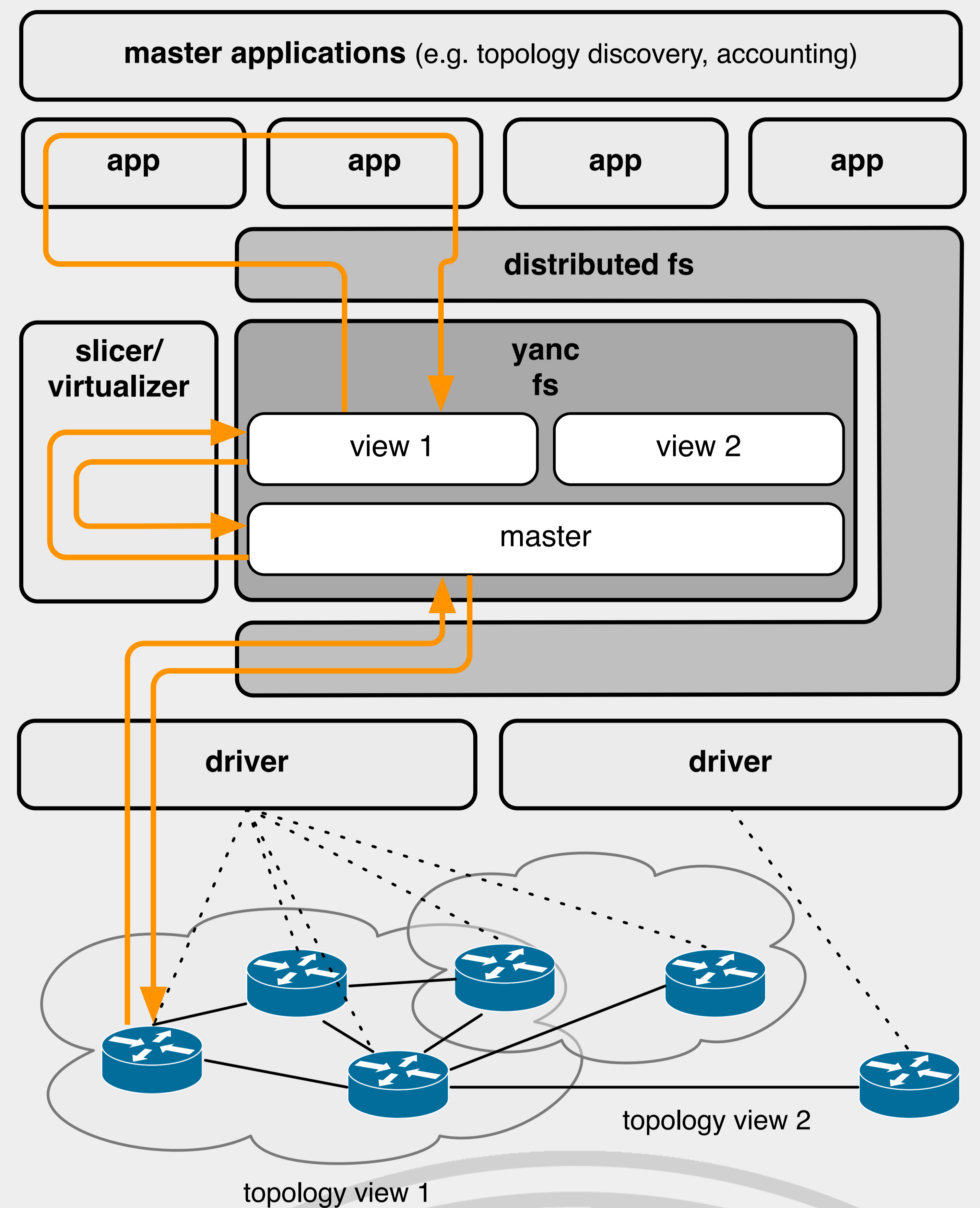
```

# echo 1 > sw1/port_1/config.port_down
# mkdir -p sw1/flows/arp_flow
# find /net -name tp.dst -exec grep 22
    
```

Shared-Memory Library as Direct Interface



Architecture



Goals

- ▶ Applications should encompass logically distinct tasks (e.g. network services like DHCP, LLDP)
- ▶ Applications may be written in any language
- ▶ Applications should come from multiple sources
- ▶ Applications should be decoupled from hardware
- ▶ Interactions between applications should be defined by the administrator
- ▶ Network application design should not be limited by the controller

Paper

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<http://ngn.cs.colorado.edu/~oliver/doc/yanc-hotnets.pdf>