New Developments and Advanced Features in the Libvirt Management API

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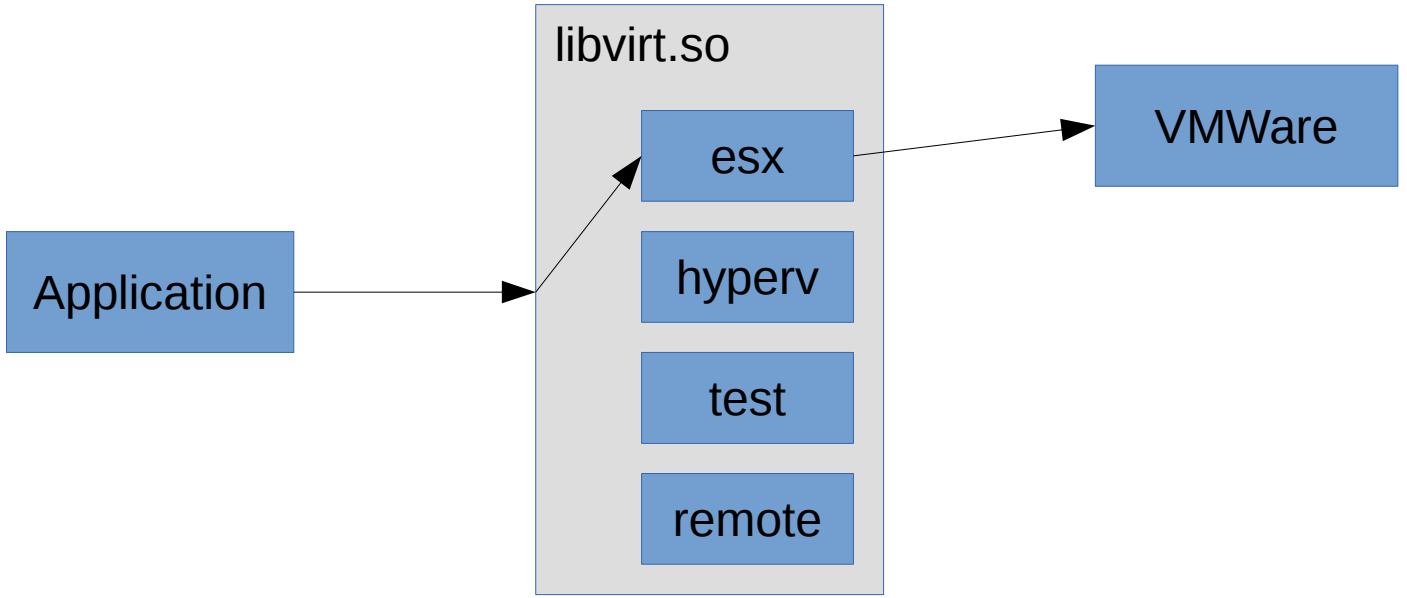
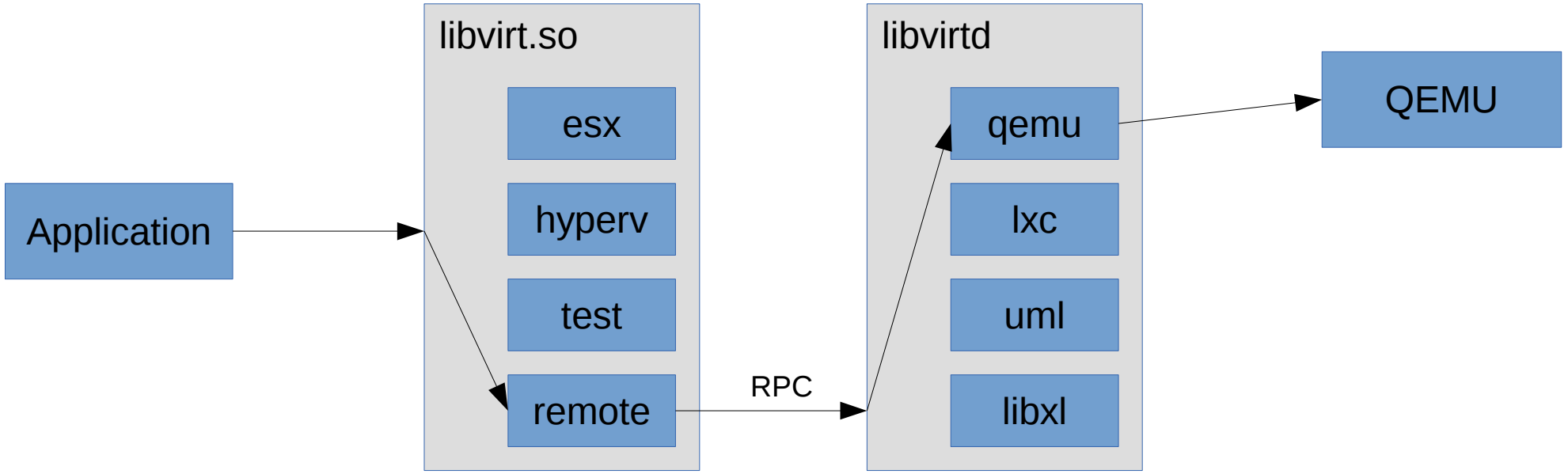
What is Libvirt ?

- C library API + language bindings
- Simple, stable, standard API
- Cross-platform, cross-hypervisor
- LGPLv2+ licensed

Stateless architecture



State-full architecture



Disk access protection

- Danger scenarios:
  - 2 guests using same disk image
  - Same guest started twice on different hosts
- Disk access modes
  - Read-only, shared (<readonly/>)
  - Read-write, shared (<shareable/>)
  - Read-write, exclusive (default)

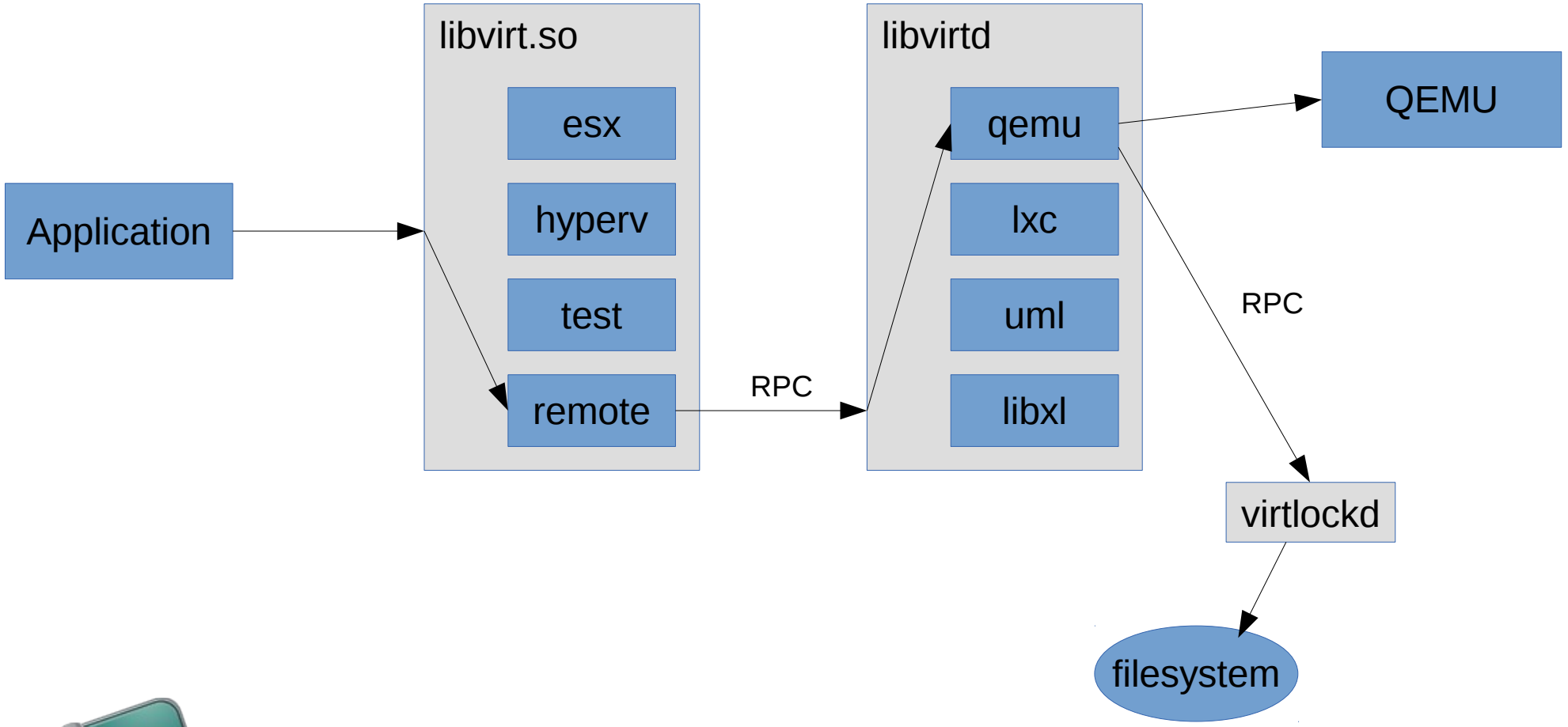
Sanlock

- Project from oVirt team
- Disk paxos algorithm
- Preferred use w/ SAN
- Discouraged use w/ shared filesystem (eg NFS)
- Manual leases
- Automatic leases
  - Indirect MD5(file path)
- Fence guests on lease failure

virtlockd

- Included with libvirt
- fcntl() based locks
- Requires use of shared filesystem
- Automatic leases
  - Direct file path
  - Indirect SHA256(file path)
  - Indirect LVM UUID
  - Indirect SCSI ID

virtlockd architecture



Fine grained access control

- Historic access read-write or read-only
  - eg Allow 'frank' to connect 'read-write'
- New ACLs on (object, subject, permission)
  - eg Allow 'frank' to 'start' guest 'apache'
- All libvirt public APIs
- All virt drivers in libvirtd (KVM, LXC, UML, etc)
- Pluggable backends (in-tree only)

Polkit ACLs

- 'polkit' is main (only) backend option
- Permissions mapped to actions
  - 'start' perm on 'domain' object
  - 'org.libvirt.api.domain.start'
- Object identifiers as properties
  - eg 'driver', 'id', 'uuid', 'name'
- Local UNIX users only
  - eg user 'fred' and group 'engineering'

Polkit rules

```
polkit.addRule(function(action, subject) {
    if (action.id == "org.libvirt.api.domain.getattr" &&
        subject.user == "berrange") {
          if (action.lookup("connect_driver") == 'LXC' &&
              action.lookup("domain_name") == 'demo') {
            return polkit.Result.YES;
          } else {
            return polkit.Result.NO;
          }
    }
});
```

sVirt: SELinux

- Default: dynamic MCS w/ 'svirt_t' or 'svirt_tcg_t'
- Static label override per guest
- Base label override per guest
  - eg replace 'svirt_t' with 'my_svirt_t'
  - Still uses dynamic MCS
- Per disk label override
  - eg disable relabelling of shared CDROM

sVirt: DAC

- Default: fixed 'qemu:qemu' user/group
- Static label override per guest
- Dynamic or static image relabelling

Audit Logging

- Guest operations using host resources
  - All resources on start / stop
  - sVirt label assignment
  - vcpu hotplug
  - Memory balloon
  - Disk/net/pci/filesystem hotplug
  - cgroup properties ACLs

General logging

- Historic: syslog plain text
  - Formatted message
- New: systemd journald structured data
  - Raw message
  - Log priority
  - Log reason (debug/audit/trace/error)
  - Source file / line / function

Control Groups Defaults

- Historic
  - $ROOT/libvirt/{qemu,lxc}/{guest-name}
- New non-systemd
  - $ROOT/machine/{guest-name}.libvirt-{qemu,lxc}
- New systemd
  - $ROOT/machine.slice/{guest-name}.libvirt-{qemu,lxc}

Control Groups Custom

- Custom grouping

```
<resource>
  <partition>/machine/production</partition>
</resource>
```

- Non-systemd:
  - $ROOT/machine/production.partition
- Systemd
  - $ROOT/machine.slice/machine-production.slice

Tuning CPU

- Scheduler tunables
  - cpu_shares
  - {vcpu,emulator}_period
  - {vcpu,emulator)_quota
- CPU models
  - Named model
  - Host model
  - Host passthrough

Tuning Memory

- NUMA policies
  - Static CPU & memory placement via XML
  - Dynamic CPU & memory placement via numad
  - Guest NUMA topology
- Allocation backing
  - Huge pages, page sharing, locked
- Memory tunables
  - hard_limit, soft_limit, swap_limit, min_guarantee

Tuning Block

- Per guest tunables
  - weight
  - device_weight (per host block dev)
- Per guest disk tunables
  - {total,read,write}_iops_sec
  - {total,read,write}_bytes_sec

Tuning Network

- Per guest NIC tunables
  - QoS with 'tc'

```
<bandwidth>
  <inbound average='1000' peak='5000' floor='200' burst='1024'/>
  <outbound average='128' peak='256' burst='256'/>
</bandwidth>
```

- Migration tuning
  - MiB/second

http://libvirt.org/