LINBIT

LINSTOR

Resilient and Fast Persistent Container Storage Leveraging Linux's Storage Functionalities

Philipp Reisner, CEO LINBIT

LINBIT - the company behind it

COMPANY OVERVIEW

- **Developer** of **DRBD**
- **100% founder owned**
- Offices in **Europe and US**
- Team of **30 highly experienced Linux experts**
- Partner in **Japan**

TECHNOLOGY OVERVIEW

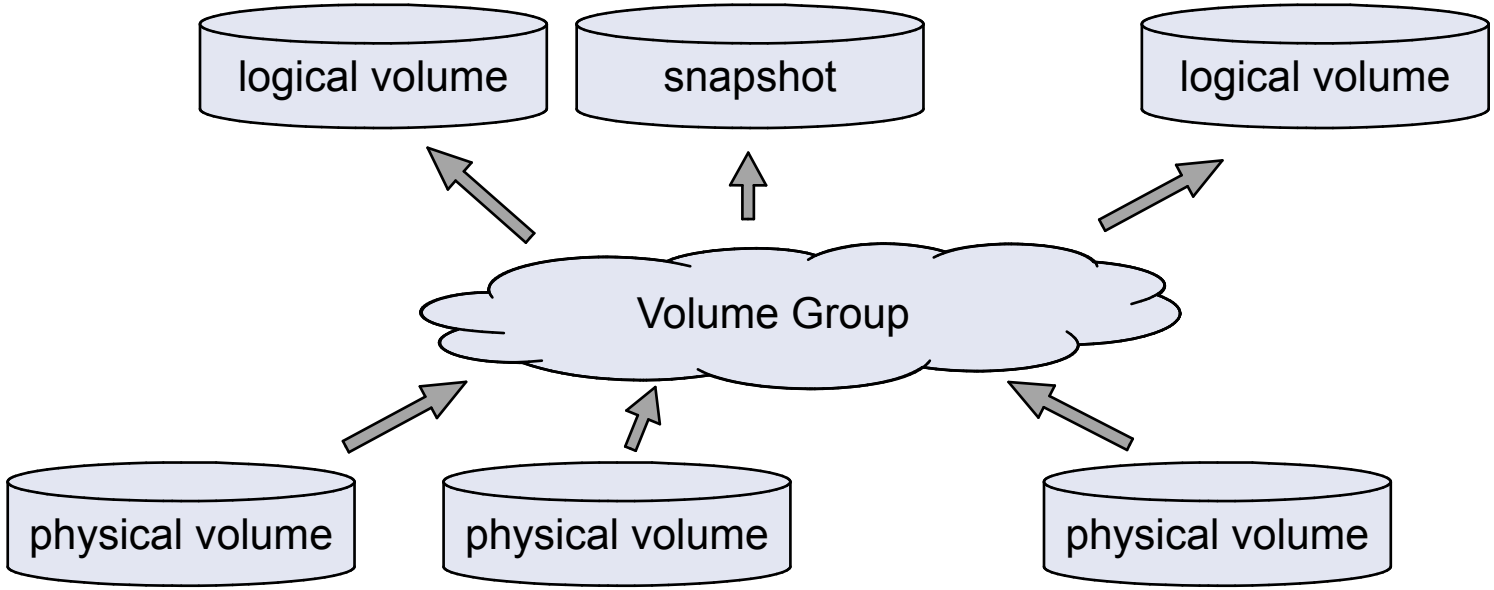
REFERENCES

Google SanDisk intel cisco IBM MICRO FOCUS redhat NTT

Linux Storage Gems

LVM, RAID, SSD cache tiers, deduplication, targets & initiators

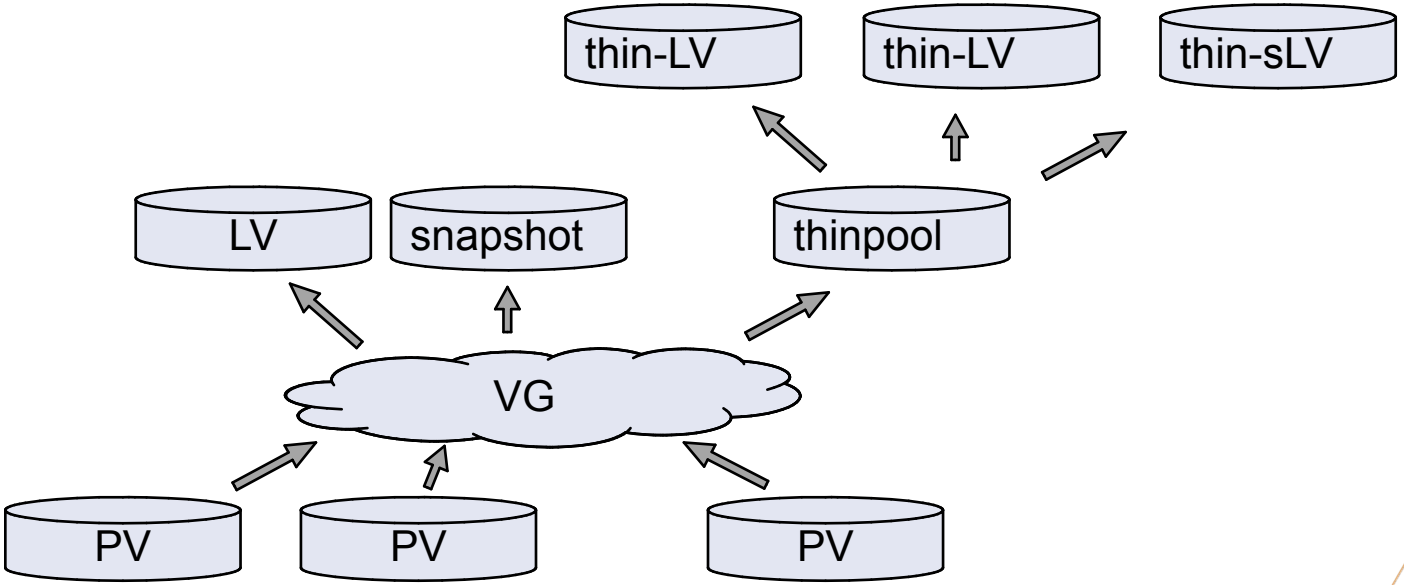
Linux's LVM


logical volume
snapshot
logical volume
Volume Group
physical volume
physical volume
physical volume

Linux's LVM

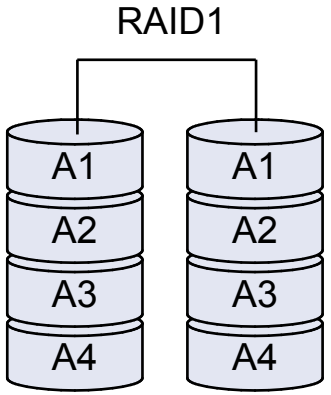
- based on device mapper
- original objects
  - PVs, VGs, LVs, snapshots
  - LVs can scatter over PVs in multiple segments
- thinlv
  - thinpools = LVs
  - thin LVs live in thinpools
  - multiple snapshots became efficient!

Linux's LVM



Linux's RAID

- original MD code
  - `mdadm` command
  - Raid Levels: 0,1,4,5,6,10
- Now available in LVM as well
  - device mapper interface for MD code
  - do not call it ‘dmraid’; that is software for hardware fake-raid
  - `lvcreate --type raid6 --size 100G VG_name`



SSD cache for HDD

- dm-cache
  - device mapper module
  - accessible via LVM tools
- bcache
  - generic Linux block device
  - slightly ahead in the performance game

Linux's DeDupe

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- Virtual Data Optimizer (VDO) since RHEL 7.5
  - Red hat acquired Permabit and is GPLing VDO
- Linux upstreaming is in preparation
- in-line data deduplication
- kernel part is a device mapper module
- indexing service runs in user-space
- async or synchronous writeback
- Recommended to be used below LVM

Linux's targets & initiators

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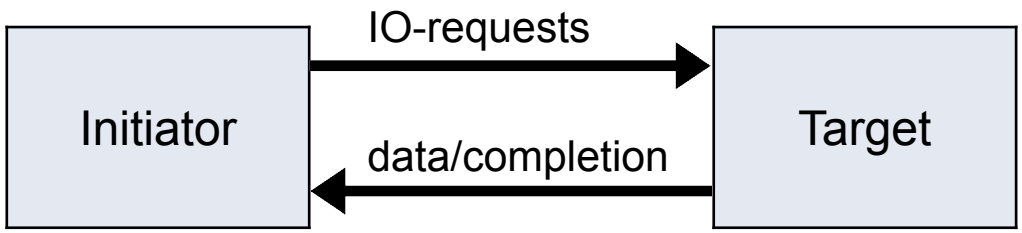
- Open-ISCSI initiator
- Ietd, STGT, SCST
  - mostly historical
- **LIO**
  - iSCSI, iSER, SRP, FC, FCoE
  - SCSI pass through, block IO, file IO, user-specific-IO
- NVMe-OF
  - target & initiator

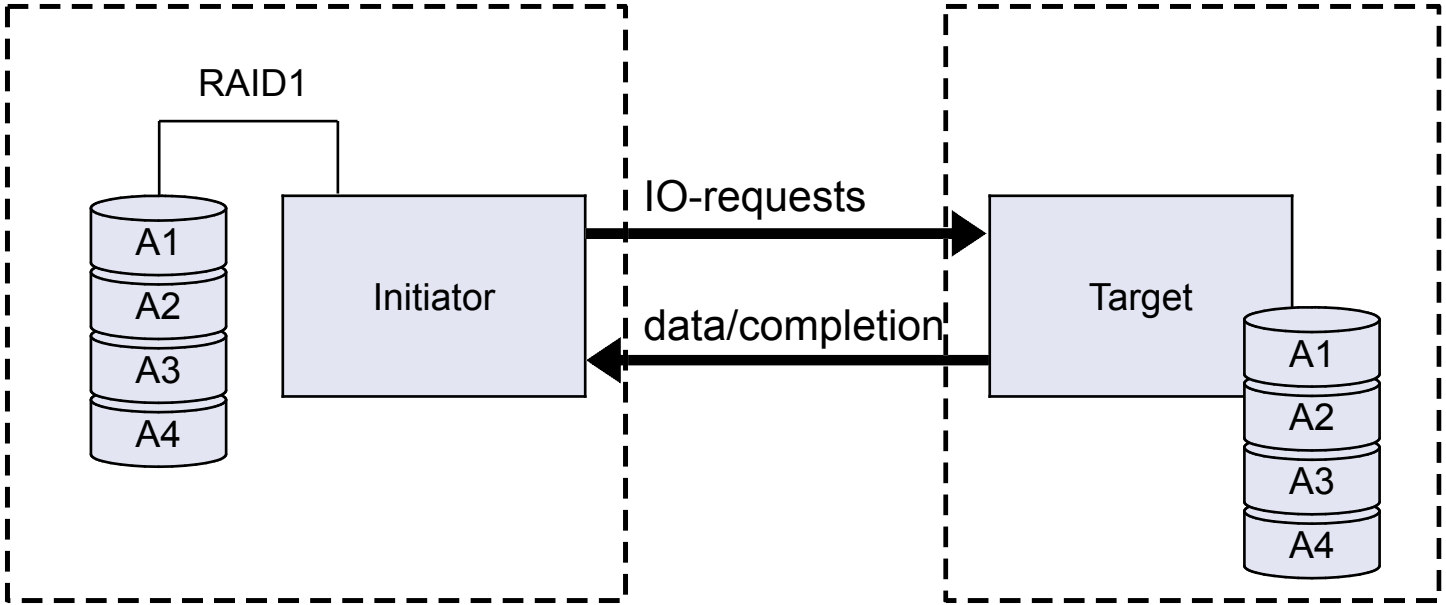


ZFS on Linux

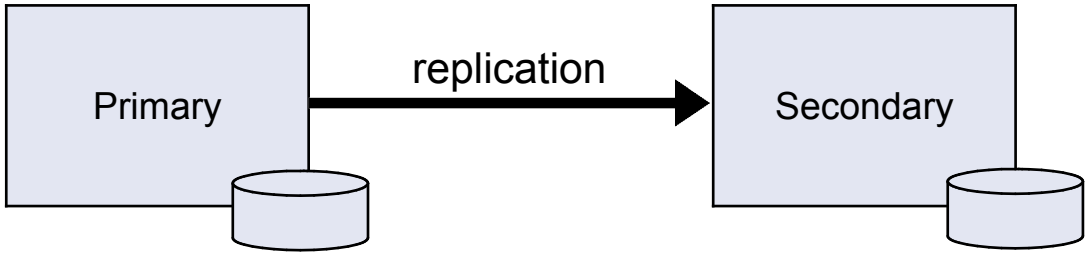
- Ubuntu eco-system only
- has its own
  - logic volume manager (zVols)
  - thin provisioning
  - RAID (RAIDz)
  - caching for SSDs (ZIL, SLOG)
  - and a file system!

Put in simplest form

DRBD – think of it as …

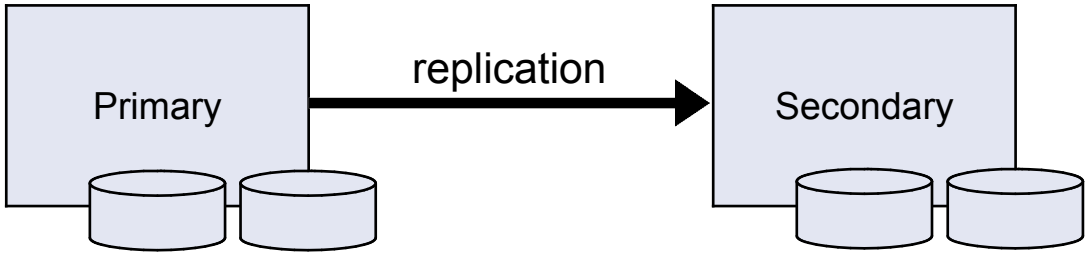


DRBD Roles: Primary & Secondary



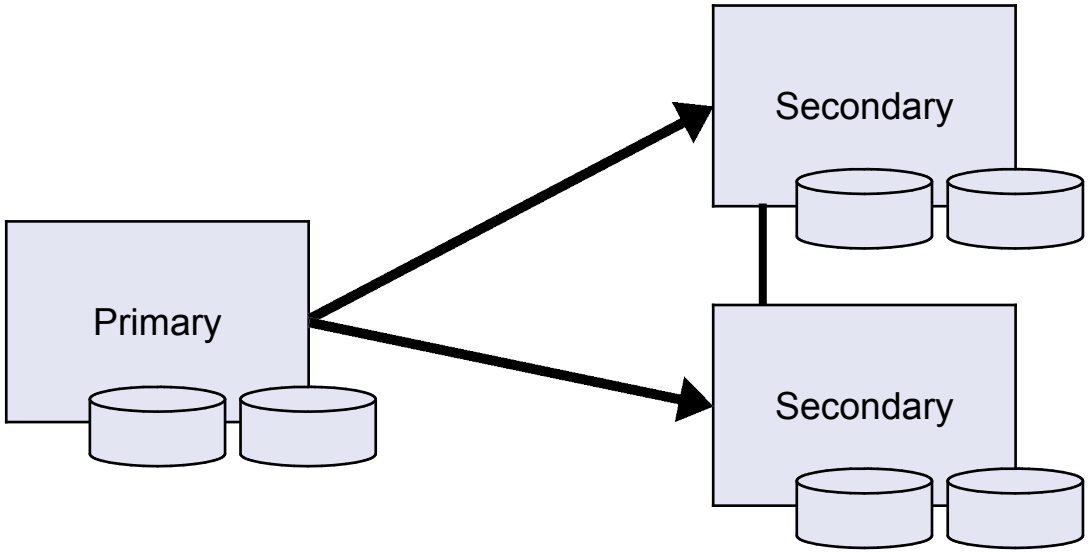
DRBD – multiple Volumes

- consistency group



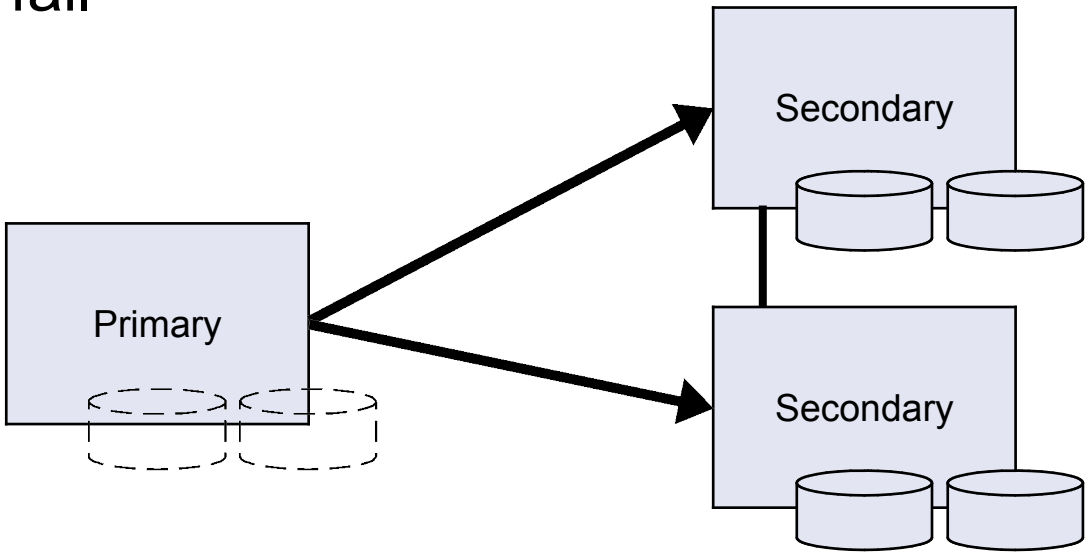
DRBD – up to 32 replicas

- each may be synchronous or async



DRBD – Diskless nodes

- intentional diskless (no change tracking bitmap)
- disks can fail



DRBD - more about

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- a node knows the version of the data is exposes
- automatic partial resync after connection outage
- checksum-based verify & resync
- split brain detection & resolution policies
- fencing
- quorum
- multiple resouces per node possible (1000s)
- dual Primary for live migration of VMs only!

DRBD Roadmap

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- performance optimizations (2018)
  - meta-data on PMEM/NVDIMMS
  - zero copy receive on diskless (RDMA-transport)
  - no context switch send (RDMA & TCP transport)
- Eurostars grant: DRBD4Cloud
  - erasure coding (2019)

The combination is more than the sum of its parts

LINSTOR - goals

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- storage build from generic (x86) nodes
- for SDS consumers (K8s, OpenStack, OpenNebula)
- building on existing Linux storage components
- multiple tenants possible
- deployment architectures
  - distinct storage nodes
  - hyperconverged with hypervisors / container hosts
- LVM, thin LVM or ZFS for volume management (stratis later)
- **Open Source, GPL**

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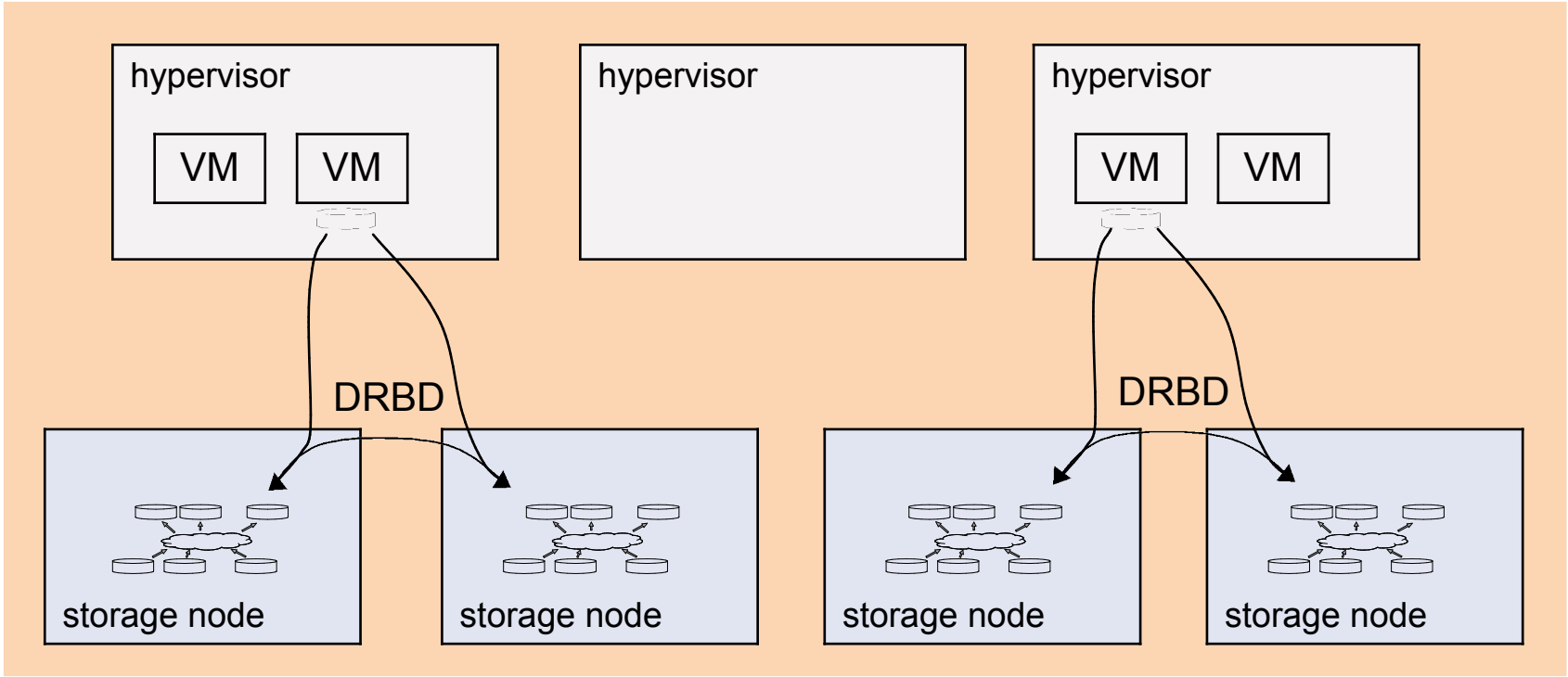
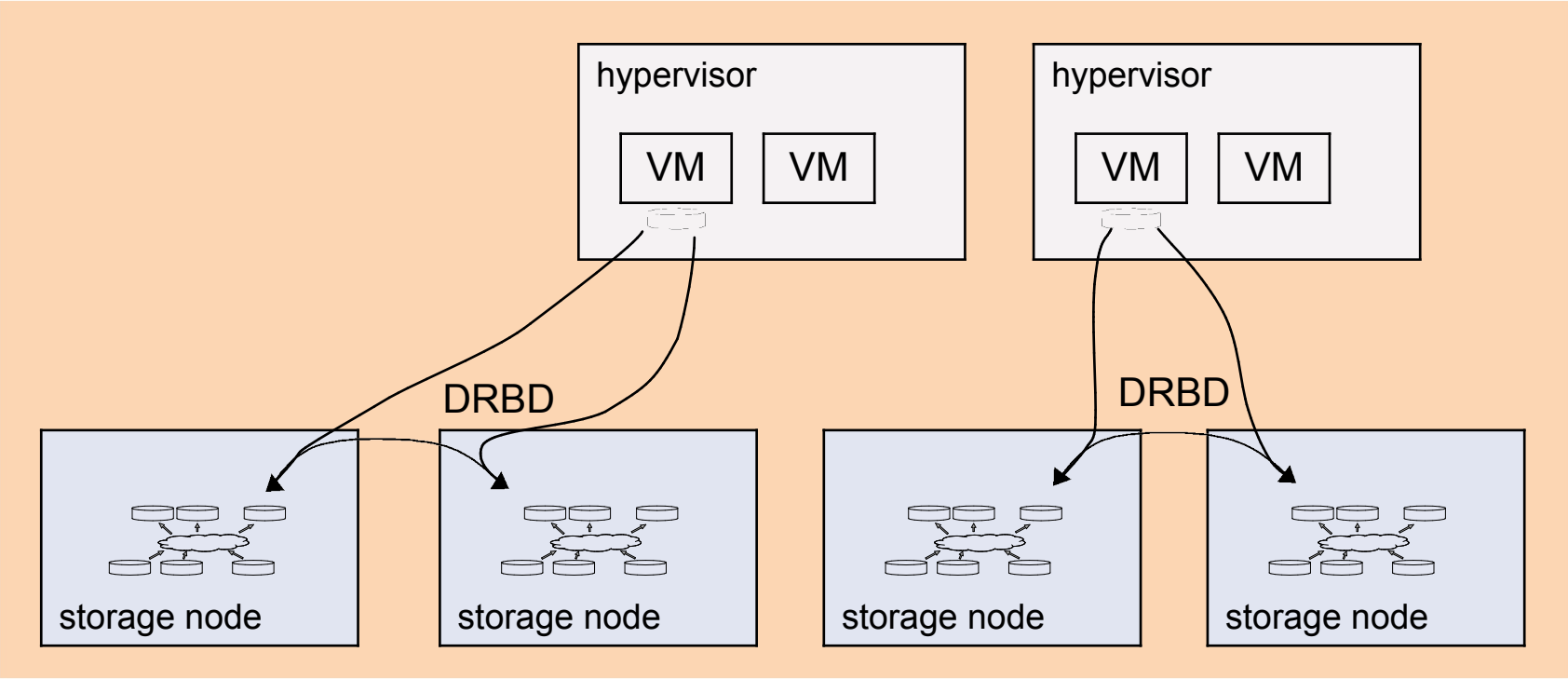
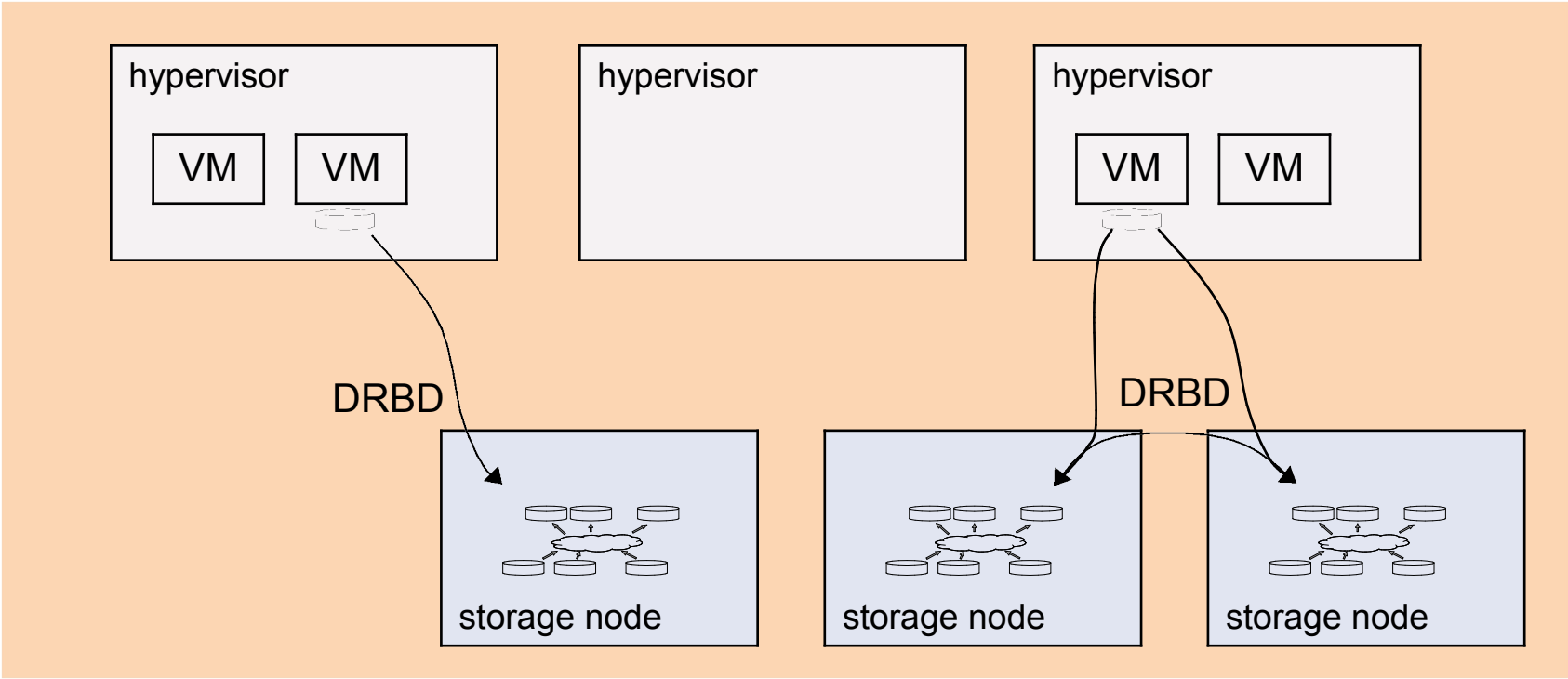


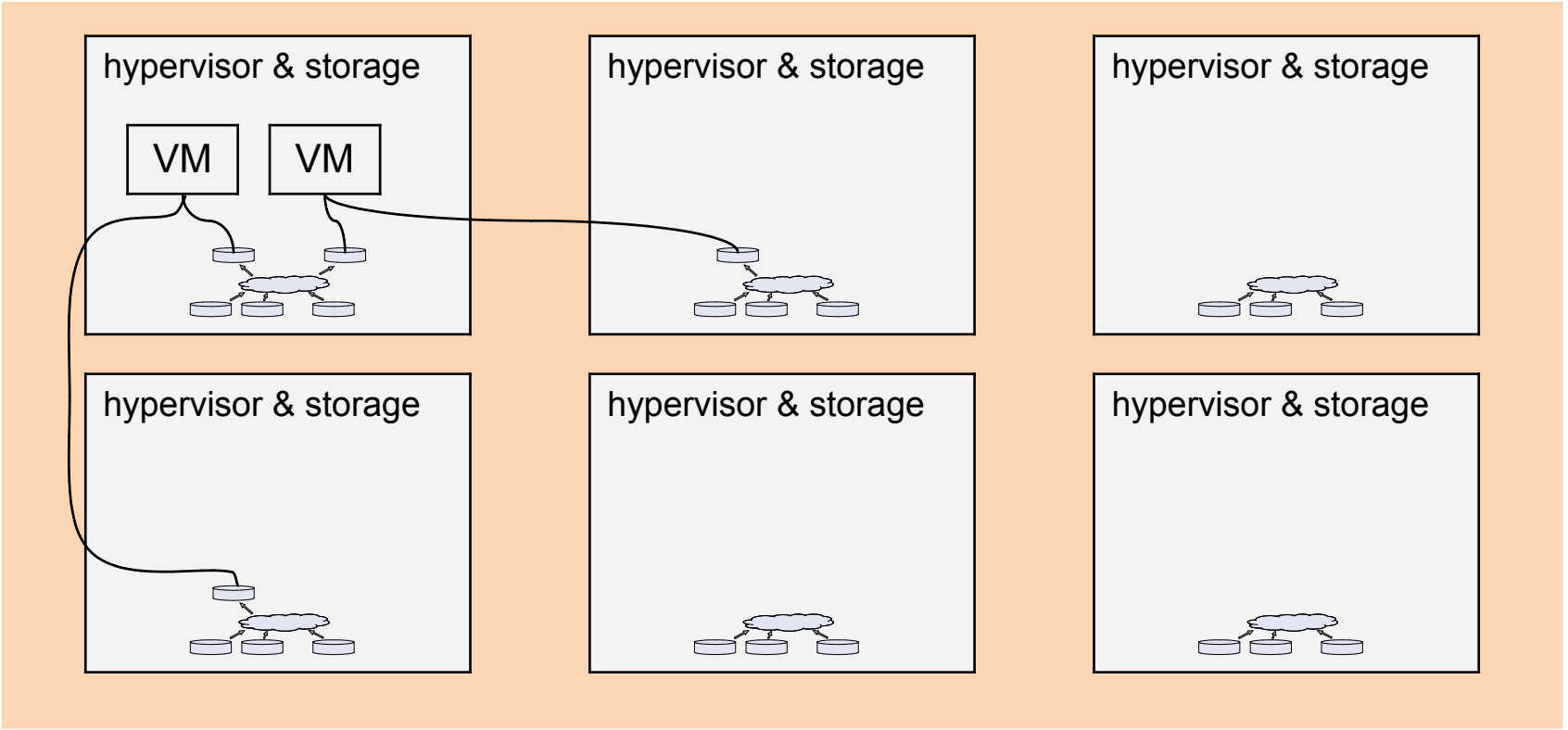
LINSTOR w. failed Hypervisor



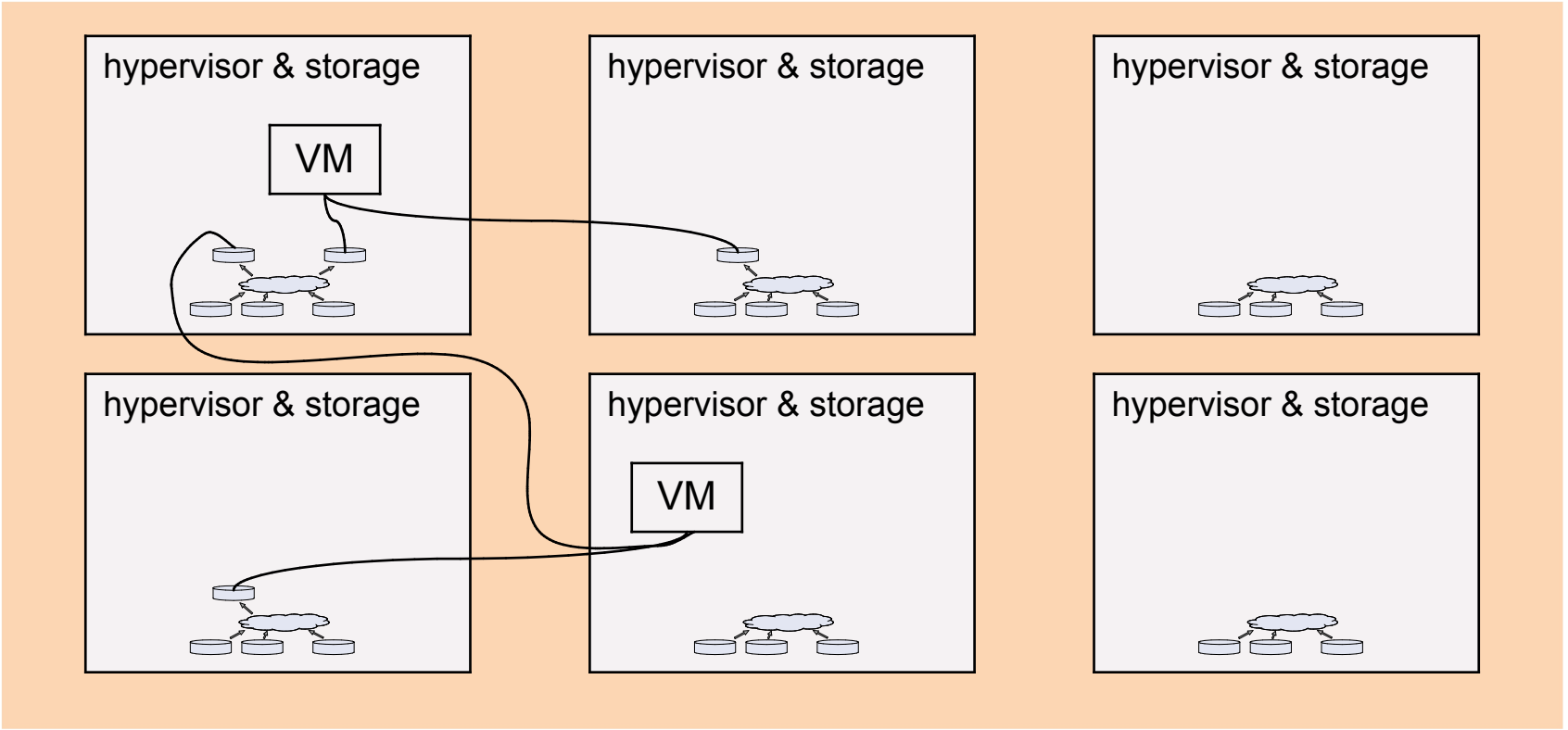
LINSTOR w. failed storage node



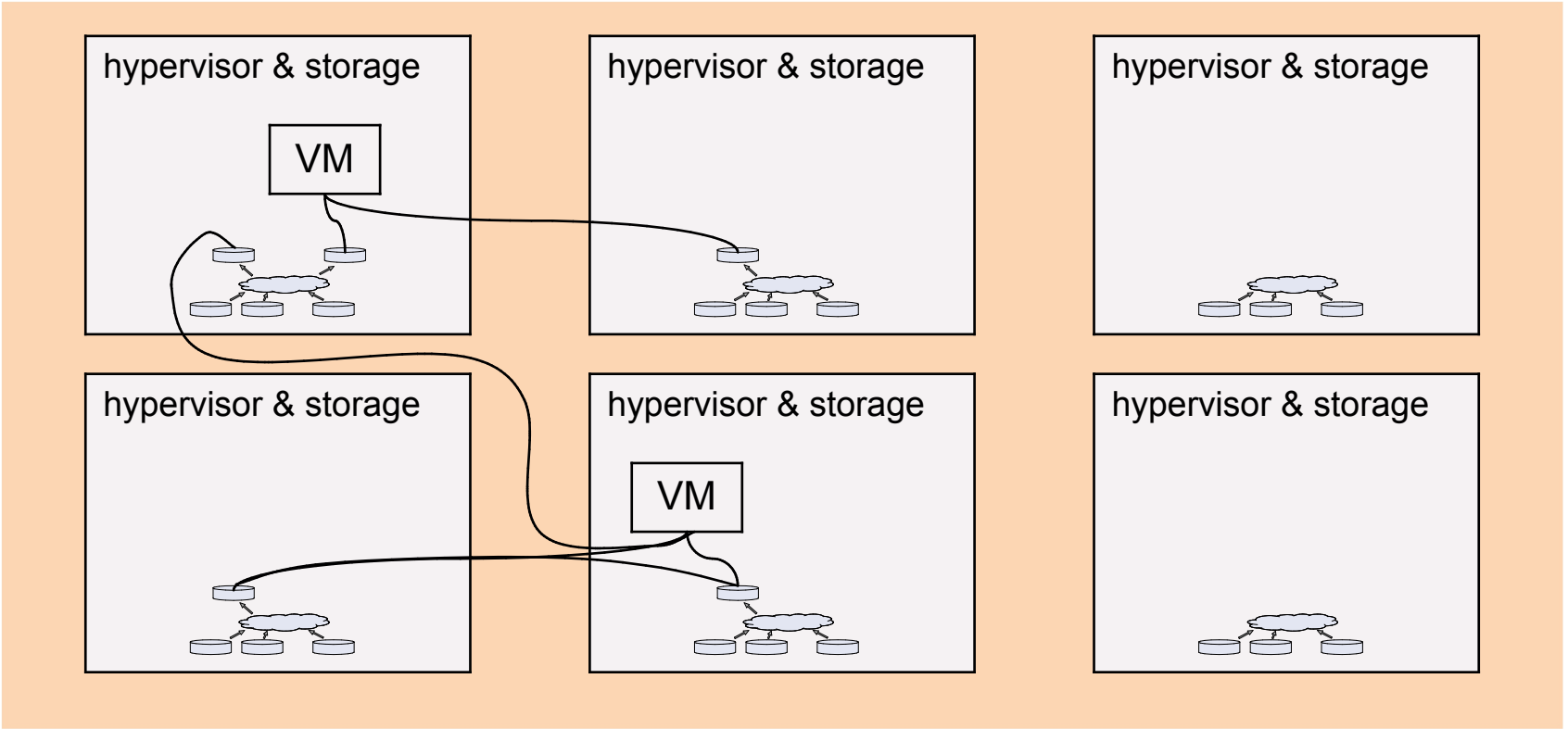
LINSTOR - Hyperconverged



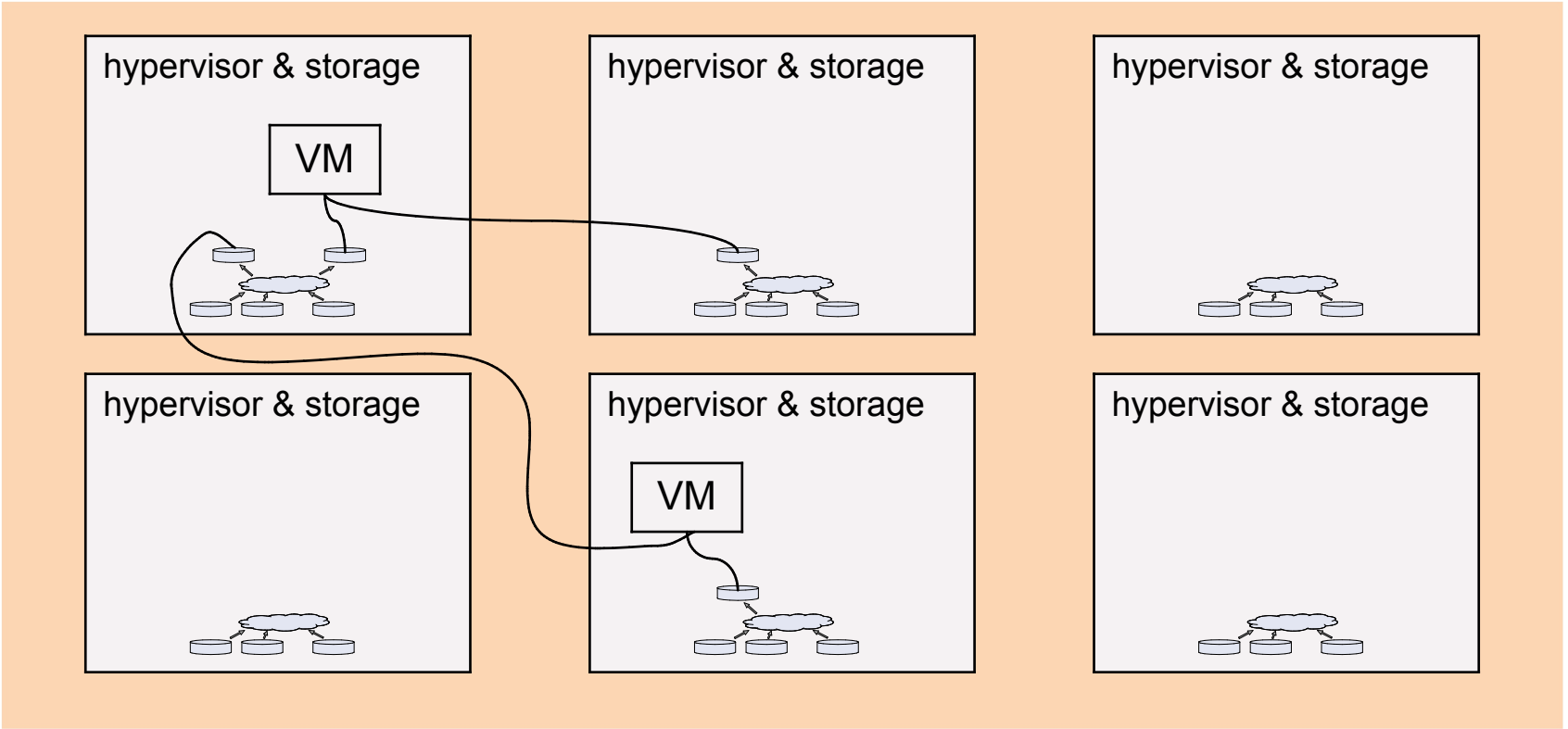
LINSTOR - VM migrated



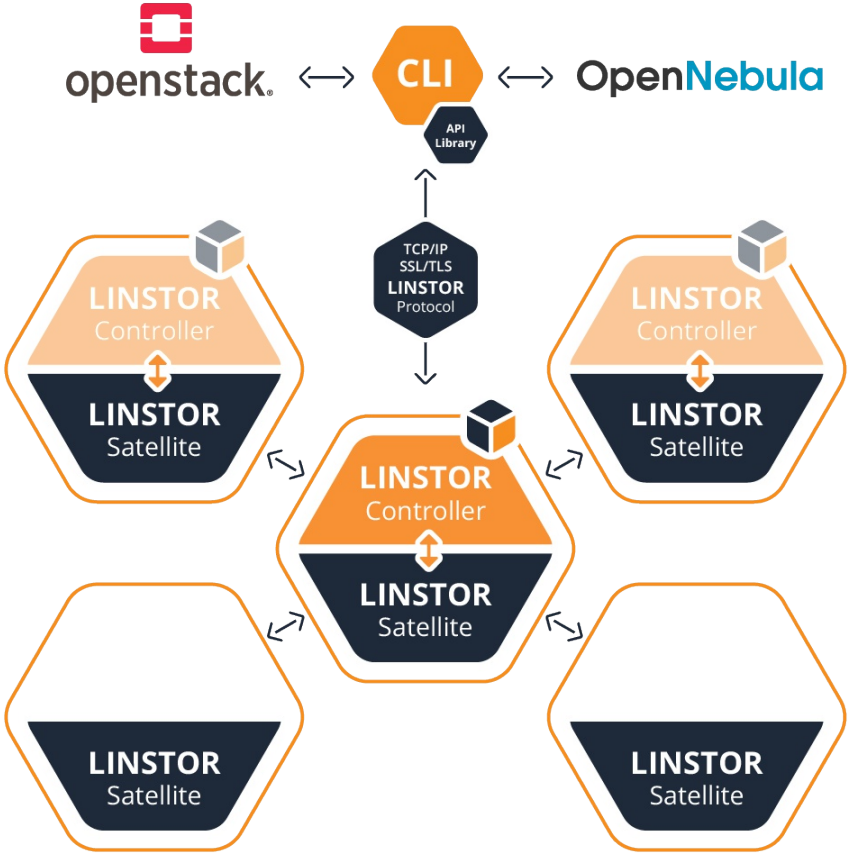
LINSTOR - add local storage



LINSTOR - remove 3rd copy



LINSTOR Architecture



LINSTOR Roadmap

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- Swordfish API
  - volume management
  - access via NVMe-oF
  - inventory sync from Redfish/Swordfish
- support for multiple sites & DRBD-Proxy (Dec 2018)
- north bound drivers
  - Kubernetes, OpenStack, OpenNebula, Proxmox, XenServer

Case study - intel

Intel® Rack Scale Design (Intel® **RSD**)
is an industry-wide architecture for disaggregated, composable infrastructure that fundamentally changes the way a data center is built, managed, and expanded over time.

LINBIT working together with Intel

LINSTOR is a storage orchestration technology that brings storage from generic Linux servers and SNIA Swordfish enabled targets to containerized workloads as persistent storage. LINBIT is working with Intel to develop a Data Management Platform that includes a storage backend based on LINBIT's software. LINBIT adds support for the SNIA Swordfish API and NVMe-oF to LINSTOR.

Thank you

https://www.linbit.com