„DRBD 9“

Linux Storage Replication

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YOUR WAY TO HIGH AVAILABILITY

What this talk is about

- What is replication
- Why block level replication
- Why replication
- What do we have to deal with
- How we are dealing with it now
- Where development is headed

Linux Storage Replication

Replication Basics

DRBD 8 Overview

DM-Replicator

DRBD 9

Other Ideas

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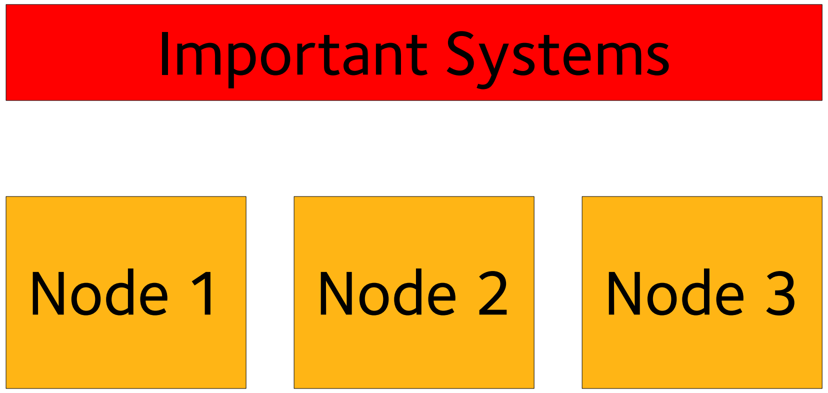
Standalone Servers



Important Systems

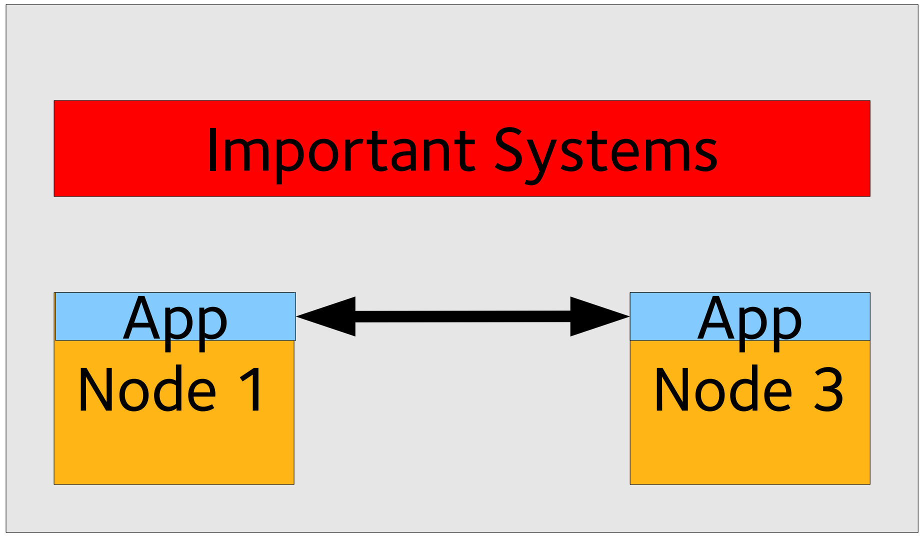
Node 1

Node 2

Node 3

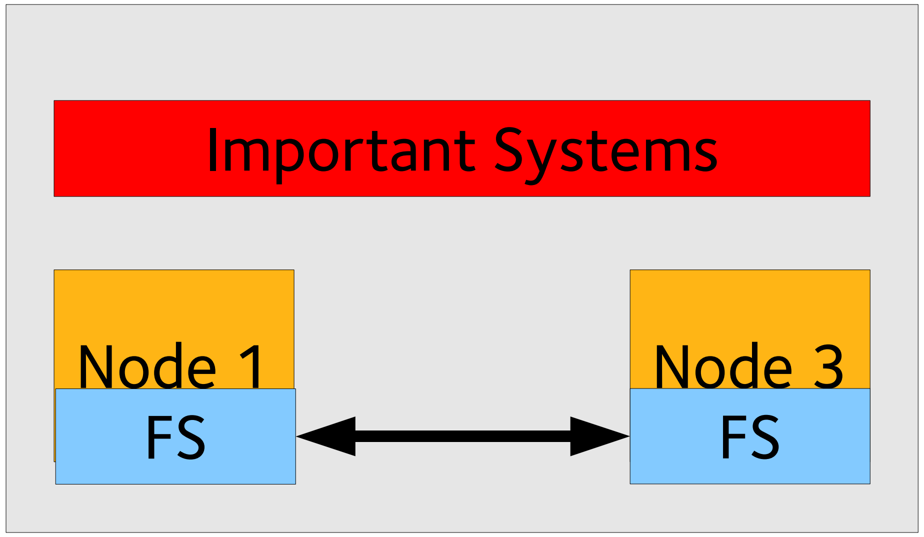
- No System Level Redundancy
- Vulnerable to Failures

Application Level Replication



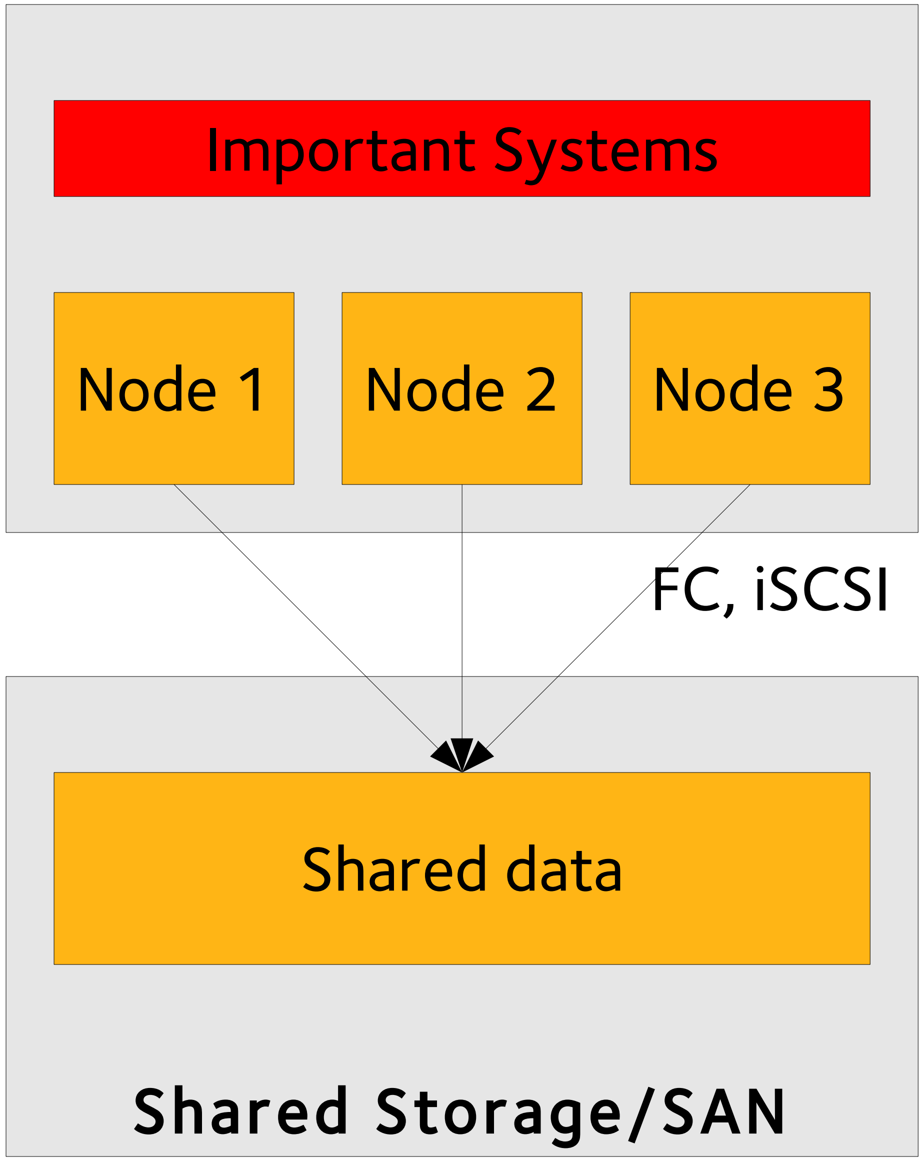
- Special Purpose Solution
- Difficult to add to an application after the fact

Filesystem Level Replication



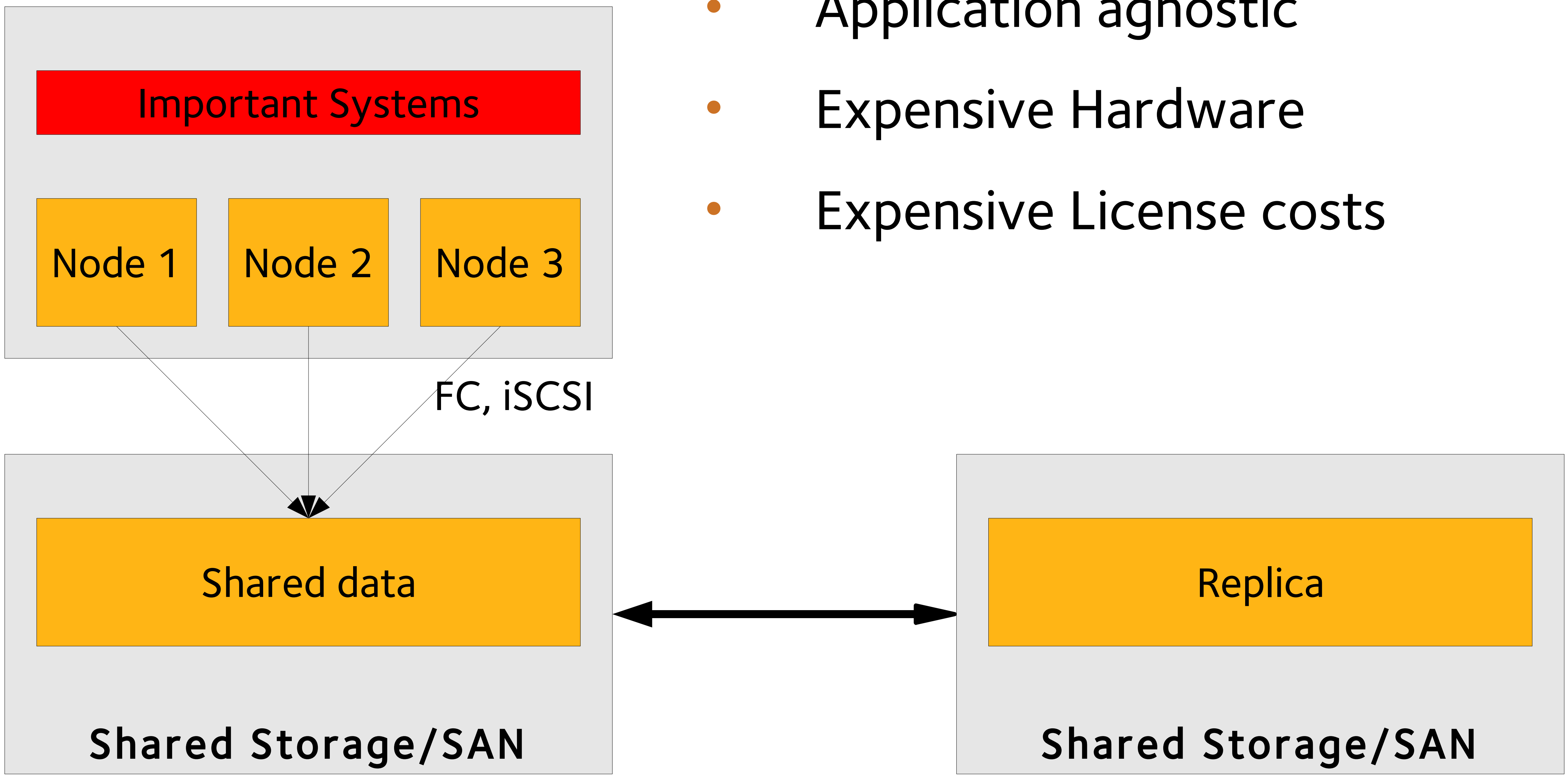
- Special Filesystem
- Complex
- Replicate on dirty?
- ... on writeout?
- ... on close?
- What about metadata?
- Resilience?

Shared Storage (SAN)



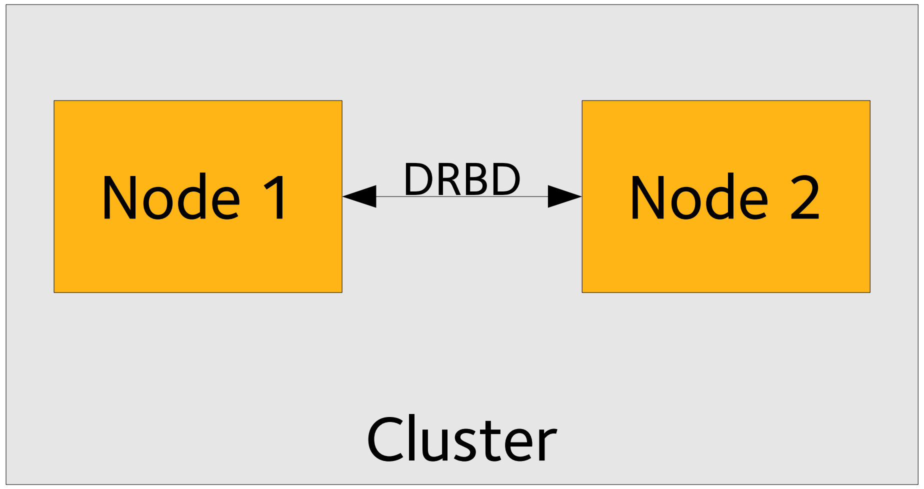
- No Storage Redundancy

Replication capable SAN



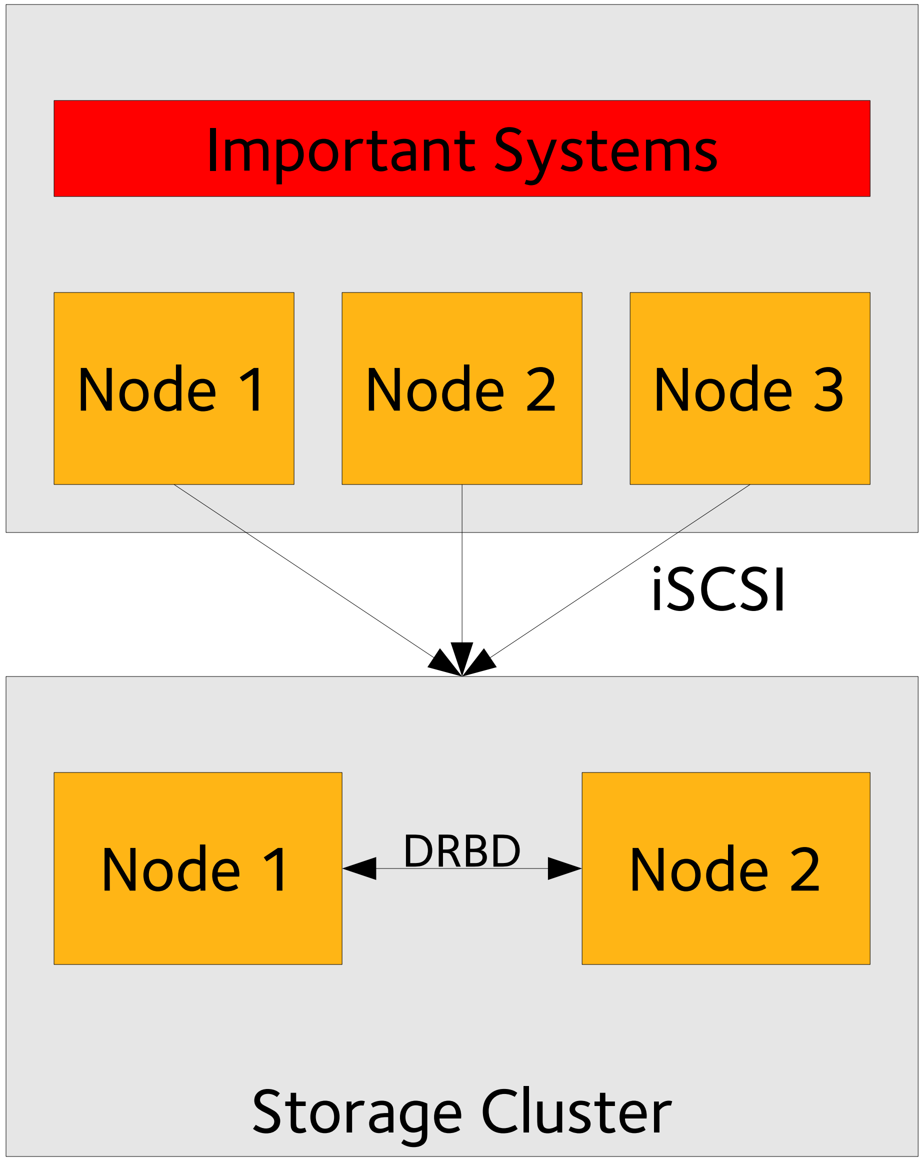
- Application agnostic
- Expensive Hardware
- Expensive License costs

Block Level Replication



- Storage Redundancy
- Application Agnostic
- Generic
- Flexible

SAN Replacement Storage Cluster



- Storage Redundancy
- Application Agnostic
- Generic
- Flexible

Linux Storage Replication

- Replication Basics
- **DRBD 8 Overview**
- DM-Replicator
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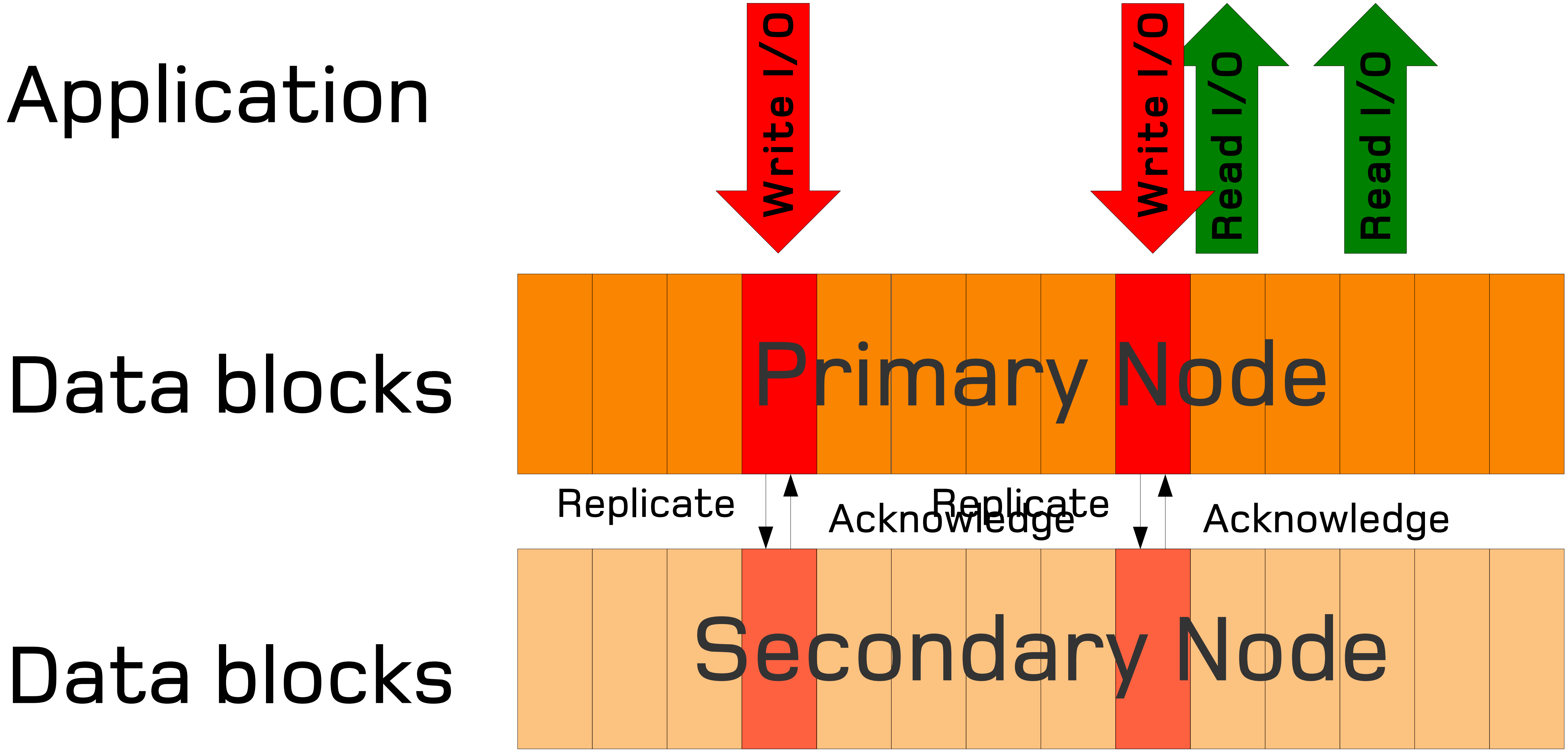
- Other Ideas

How it works: Normal operation



Application

Write I/O

Write I/O

Read I/O

Read I/O

Data blocks

Primary Node

Replicate

Acknowledge

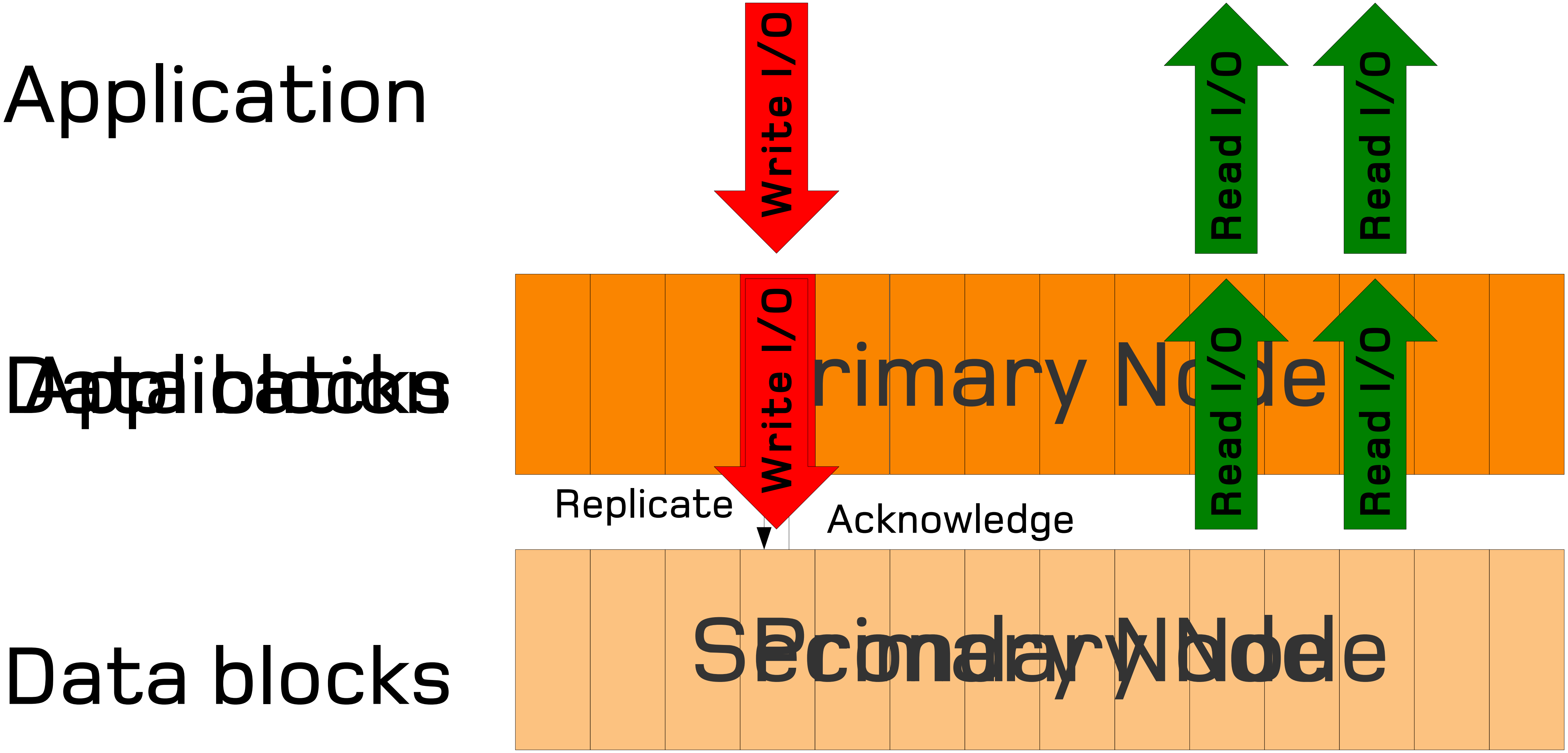
Replicate

Acknowledge

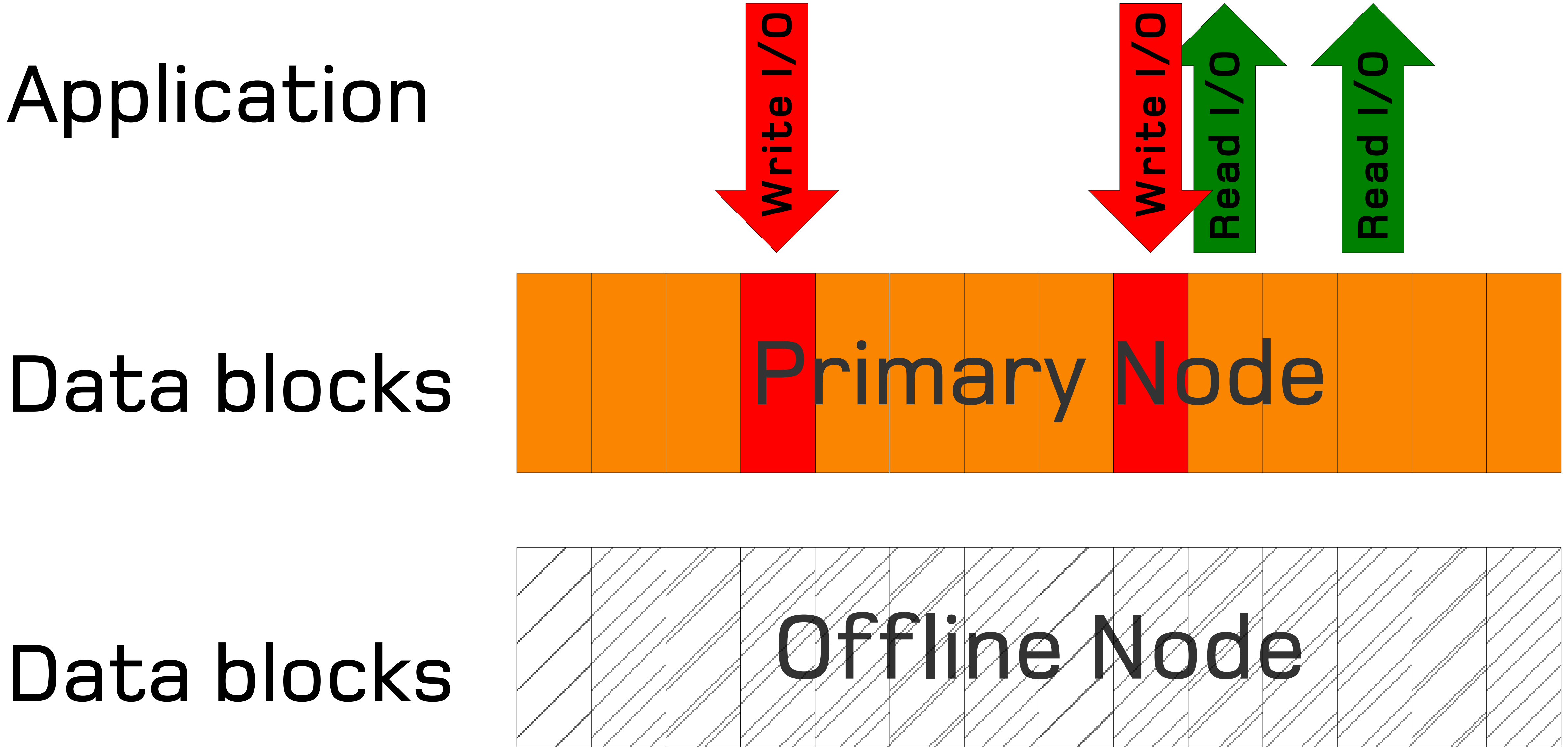
Data blocks

Secondary Node

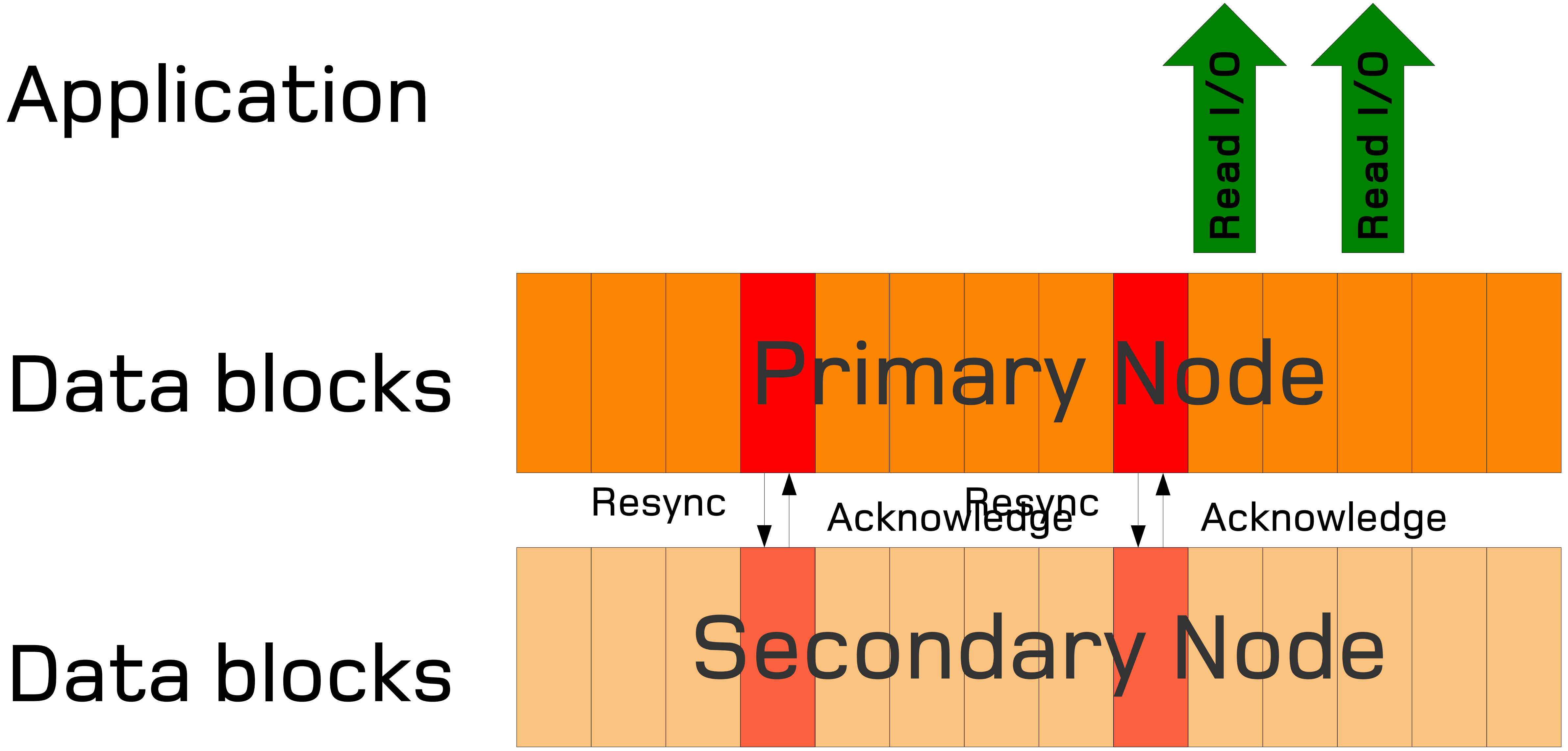
How it works: Primary Node Failure



How it works: Secondary Node Failure



How it works: Secondary Node Recovery



YOUR WAY TO HIGH AVAILABILITY

What if ...

- We want additional replica for desaster recovery
  - we can stack DRBD
- The latency to the remote site is too high
  - stack DRBD for local redundancy,
run the high latency link in asynchronous mode,
add buffering and compressing with DRBD proxy
- Primary node/site fails during resync
  - Snapshot before becoming sync target

It Works.

- Though it may be ugly.

- Can we do better?

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Generic Replication Framework

- Track Data changes
  - Persistent (on Disk) Data Journal
  - “global” write ordering over multiple volumes
  - Fallback to bitmap based change tracking
- Multi-node.
  - many “site links” feed from the journal
- Flexible Policy
  - When to report completion to upper layers
  - (when to) do fallback to bitmap

Current „default“ reference implementation

- Only talks to “dumb” block devices
- “Software RAID1”
  allowing some legs to lag behind
- No concept of “data generation”
- Cannot communicate metadata
- Not directly suitable for failover solutions
- Primary objective: cut down on “hardware” replication licence costs, replicate SAN-LUNs in software
  to desaster recovery sites.

DRBD 9

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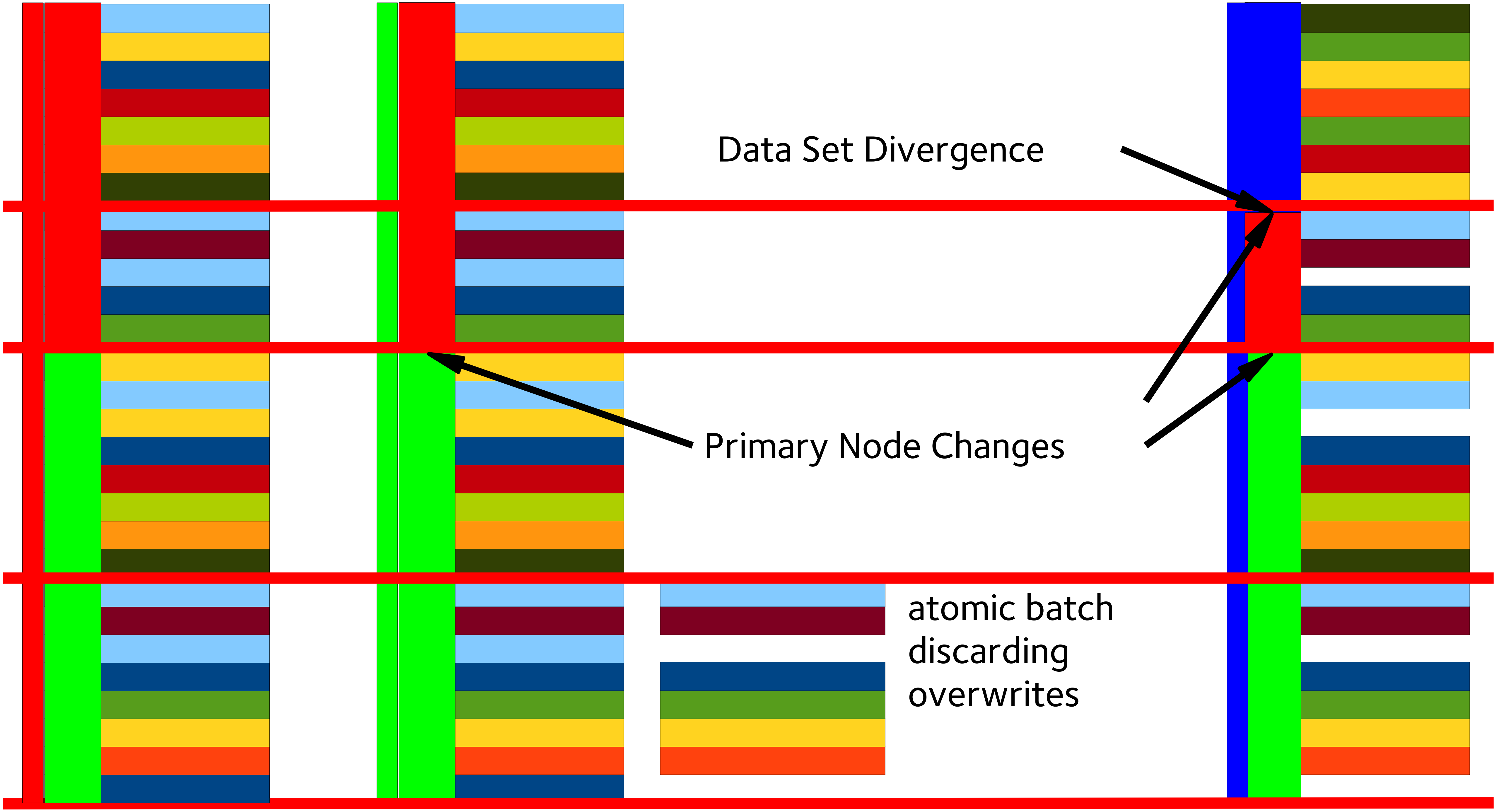
Replicating smarter, asynchronous

- Detect and discard overwrites
  - shipped batches must be atomic
- Compress
- Compress XOR-diff
- Side effects
  - Can be undone
  - Checkpointing of generic block data
  - Point in time recovery

Replicating smarter, synchronous

- Identify a certain Data Set Version
- Start from scratch
- continuous stream of changes
- Data Generation Tags, ***dagtag***
  - which clone (node name)
  - which volume (label)
  - who modified it last (committer)
  - modification date (position in the change stream)

Colorful Replication Stream



Data Set Divergence

Primary Node Changes

atomic batch
discarding
overwrites

Advantages of the Data Generation Tag scheme

- On handshake, exchange *dagtag*s
  - Trivially see who has the best data
    even on primary site failure
    with multiple secondaries possibly lagging behind
- Communicate dagtags with atomic (compressed, xor-diff) batches
  - allows for daisy chaining
- keep dagtag and batch payload
  - Checkpointing: just store the *dagtag*.

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Stretched cluster file systems?

- Multiple branch offices
- One cluster filesystem
- Latency would make unusable
- But when
  - keeping leases and
  - inserting lock requests into the replication data stream
  - while having mostly self-contained access in the branch offices
- It may feel like low latency most of the time, with occasional longer delays on access.
- Tell me why I'm wrong :-)

Comments?

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http://www.drbd.org

If you think you can help,

we are Hireing!