Unlimited Fileserver with Samba CTDB and CephFS

Who?

Robert Sander

→ Linux since 1995

→ @gurubert

Heinlein Support GmbH

→ 20+ years experience and knowledge around Linux servers and E-Mail

→ IT Consulting and 24/7 Linux-Support with > 30 employees

→ Incorporated ISP since 1992

  → jpberlin.de & mailbox.org

→ Daily insights into the IT of small, medium and large businesses

Motivation

- need to store „unstructured“ file data
- desktop environment
- archival system / cold storage
- no user will ever delete any file
- regulatory provisions to keep data for 10 years
- budget constraints

- storage space growth and reliability more important than speed

Solutions

- NAS box
  - limited number of disk slots
  - second, third & fourth NAS box?
- SAN
  - block devices do not span multiple controllers → size limited
  - Fibre Channel
- DRBD
  - block devices with clustered filesystem…
  - multiple filesystems for growth
- Scale vertically has limits

Solution

- Scale horizontally
- GlusterFS
  - file based replication on the GlusterFS client
  - complicated volume setup
  - suitable for smaller installations
- Ceph to the rescue!
  - suitable for larger installations
  - needs at least 5 nodes to perform

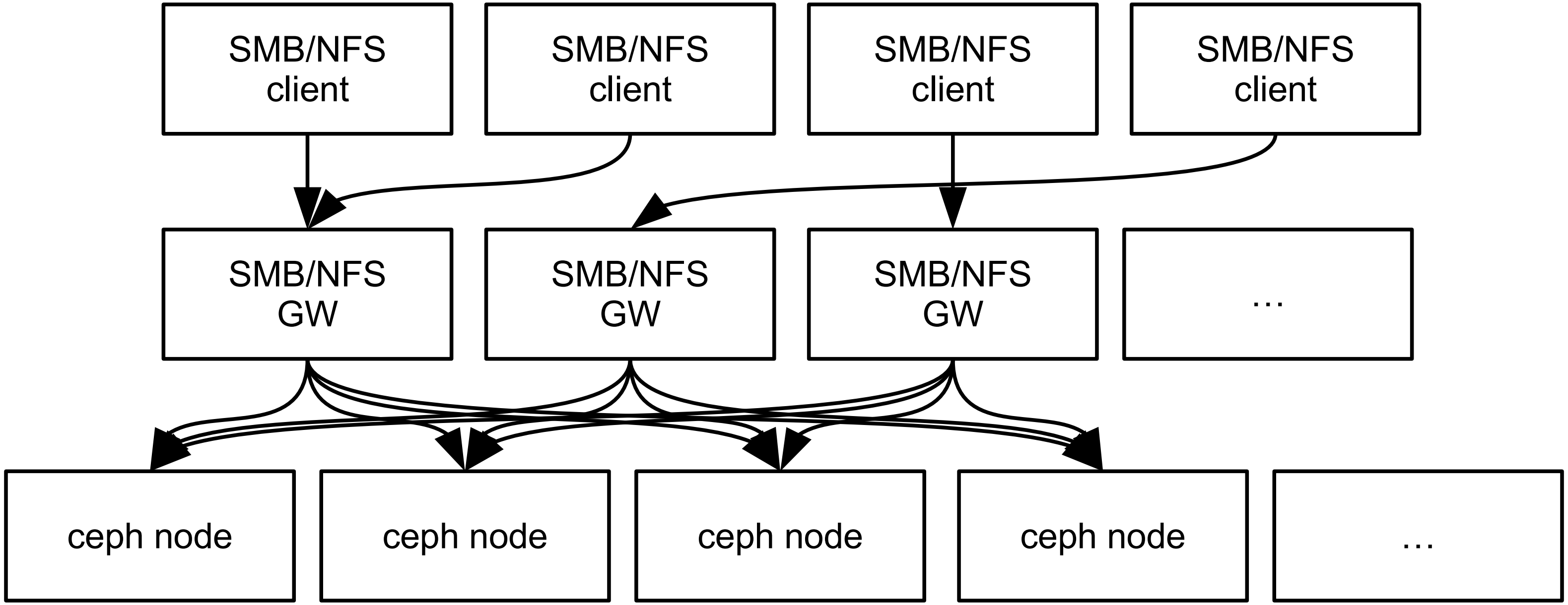
Concept

- multiple Samba gateways in front of Ceph cluster
- CephFS used for data + CTDB sync
- Samba config in CTDB "registry"

- Only file service covered
  - not for Samba AD servers
  - multiple AD servers form their own „cluster"

- CTDB can also manage NFS kernel service

Concept


SMB/NFS client
SMB/NFS client
SMB/NFS client
SMB/NFS client
SMB/NFS GW
SMB/NFS GW
SMB/NFS GW
…
ceph node
ceph node
ceph node
ceph node
…

Ceph Setup

→ A working cluster with CephFS

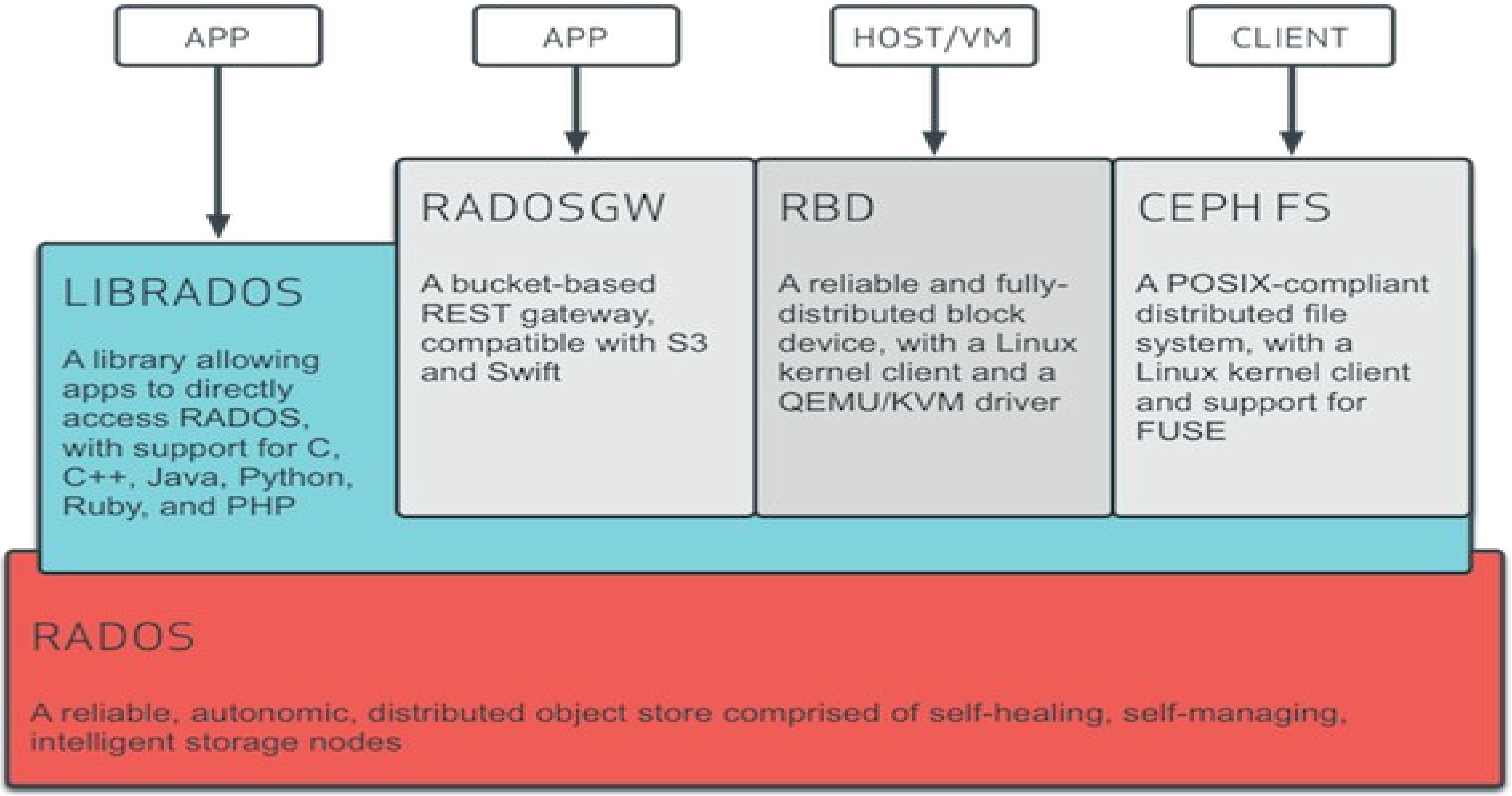
What is Ceph?

- Ceph is an
  - open-source,
  - massively scalable,
  - software-defined storage system
- which provides
  - object,
  - block and
  - file system storage in a single platform.
- It runs on commodity hardware – saving you costs, giving you flexibility
- and because it's in the Linux kernel, it's easy to consume.

Advantages

- Self-managing and self-healing
- No Single Point of Failure
- Super efficient placement algorithm
- No need for RAID

- Unified Storage
  - Only one system to scale
  - Easier capacity management
  - Adapt to changing demands
- Open & Extensible
  - S3, SWIFT APIs & RESTful management API
  - 100% open-source technology



APP

APP

HOST/VM

CLIENT

RADOSGW

A bucket-based REST gateway, compatible with S3 and Swift

RBD

A reliable and fully-distributed block device, with a Linux kernel client and a QEMU/KVM driver

CEPH FS

A POSIX-compliant distributed file system, with a Linux kernel client and support for FUSE

LIBRADOS

A library allowing apps to directly access RADOS, with support for C, C++, Java, Python, Ruby, and PHP

RADOS

A reliable, autonomic, distributed object store comprised of self-healing, self-managing, intelligent storage nodes

Object Storage

- The basis for the unified storage system
- Objects have
  - a name in a flat namespace
  - metadata attributes
  - payload data
- Distributed
- Replicated
- Parallel access
- APIs: S3, SWIFT, librados

Block Storage: RBD

- Block device
  - attached direct to Linux host
  - qemu+rbd for virtual guests
- Data striped over multiple objects
  - fast parallel access
  - performs better than a single server
- Snapshots (copy on write)
- Thin provisioning

File System: CephFS

- → POSIX compliant
- → Files mapped to objects
  - → direct data path
- → Ceph Metadata Server (MDS)
  - → directories
  - → ownership
  - → access modes
- → metadata itself stored as objects
- → active / passive / ... setup
  - → immediate switch-over

Ceph Releases

- Mimic LTS 13.2.5 (March 2019)
  - first release June 2018
- Luminous LTS 12.2.11 (January 2019)
  - first release August 2017
- Kraken 11.2.1 (August 2017 EOL)
- Jewel LTS 10.2.11 (July 2018) ← CephFS production ready
  - first release April 2016
- Hammer LTS 0.94.10 (August 2017 EOL)
  - first release Apr 2015
- a stable release every 9 months
  - x.0.z - development releases, x.1.z - release candidates, x.2.z - stable/bugfix releases

Gateway Setup

- CephFS-Clients are SMB/NFS servers
- Samba CTDB
- Samba smbd
- NFS kernel server
- CentOS Issue with testparm in Samba 4.8.3:
  - https://bugs.centos.org/view.php?id=15916
  - Showstopper
- Debian/Ubuntu issues with /etc/ctdb scripts:
  - https://bugs.launchpad.net/ubuntu/+source/ctdb/+bug/722201
  - Patch for NFS service available

CephFS configuration

- → at least one Meta Data Server
  - → `ceph-deploy mds create {host-name}`
- → two pools needed: data & meta-data
  - → ceph osd pool create cephfs_data <pg_num>
  - → ceph osd pool create cephfs_metadata <pg_num>
  - → meta-data pool on fast OSDs (SSD, NVMe) recommended
- → `ceph fs new cephfs cephfs_metadata cephfs_data`

CephFS mount

- cephx key for cephfs access
  - caps: [mds] allow rw
  - caps: [mon] allow r
  - caps: [osd] allow rw pool=fs

- /etc/ceph/ceph.conf

  -
    ```
    [client]
    client_acl_type = posix_acl
    fuse_default_permissions = false
    client reconnect stale = true
    ```

- FUSE with /etc/ceph/ceph.client.clientid.keyring:

  ```
  id=clientid   /ceph   fuse.ceph   _netdev   0 0
  ```

- or kernel client with mount.ceph:

  ```
  mon1:6789,mon2:6789,mon3:6789:/   /cephfs   ceph   name=clientid,secretfile=/etc/ceph/ceph.client.clientid.secret,_netdev   0 0
  ```

Multiple CephFS filesystems

- experimental feature
- at least one MDS per filesystem
- two pools per filesystem (data & metadata)
- „no known bugs“

- mount option `mds_namespace`

- erasure coded CephFS possible for cold storage
  - `ceph osd pool set cephfs_data allow_ec_overwrites true`
  - only with BlueStore OSDs

CTDB
clustered trivial database

- provides a TDB that has
  - consistent data and
  - consistent locking

  across all nodes in a cluster.
- In case of node failures,
  CTDB will automatically recover and repair TDBs
- provides HA features such as
  - node monitoring,
  - node failover and
  - IP takeover.
- flexible with application specific management scripts

CTDB configuration

- /etc/systemd/system/ctdb.service.d/override.conf

  -
    ```
    [Unit]
    After=cephfs.mount
    RequiresMountsFor=/cephfs
    ```
- /etc/ctdb/ctdbd.conf

  -
    ```
    CTDB_RECOVERY_LOCK=/cephfs/ctdb/lock
    CTDB_NODES=/etc/ctdb/nodes
    CTDB_PUBLIC_ADDRESSES=/etc/ctdb/public_addresses
    CTDB_MANAGES_SAMBA=yes
    CTDB_MANAGES_WINBIND=yes
    # CTDB_MANAGES_NFS=yes
    CTDB_MAX_OPEN_FILES=65536
    CTDB_LOGGING=file:/var/log/log.ctdb
    ```

ctdb configuration

- /etc/ctdb/nodes
  - list of host IPs
- /etc/ctdb/public_addresses
  - list of service IPs
  - one for each host
- Service IPs in round-robin DNS
  - fileserver.example.com IN A 10.0.1.11
                           IN A 10.0.1.12
                           IN A 10.0.1.13
  - SMB clients pick a random IP at mount time
- CLI: `ctdb status`

Samba configuration

- /etc/samba/smb.conf

  -
    ```
    [global]
      clustering = yes
      include = registry
    ```
- net conf
  - net conf addshare
  - net conf setparm
  - net conf list
  - net conf import
- share paths on CephFS mount

Samba Ceph VFS

- userspace CephFS client for smbd
- Pro:
  - one Ceph client per SMB connection
  - better parallelism
- Con:
  - does not handle symbolic links in CephFS

- https://www.samba.org/samba/docs/4.7/man-html/vfs_ceph.8.html

SMB3 witness protocol

- → server can pro-actively tell client to connect to other IP

- → can be used to drain cluster node before maintenance
- → can be used to load balance clients between nodes

- → active failover instead of client TCP reconnect

- → implemented in future Samba CTDB release

NFS configuration

- /etc/sysconfig/nfs

  -
    ```
    NFS_HOSTNAME="fileserver"
    RPCNFSDARGS="-N 4"
    RPCNFSDCOUNT=32
    STATD_PORT=595
    STATD_OUTGOING_PORT=596
    STATD_HOSTNAME="$NFS_HOSTNAME"
    STATD_HA_CALLOUT="/etc/ctdb/statd-callout"
    GSS_USE_PROXY="yes"
    MOUNTD_PORT=597
    RQUOTAD_PORT=598
    LOCKD_UDPPORT=599
    LOCKD_TCPPORT=599
    ```
- /etc/exports
  - `/ceph/files *(rw,fsid=1235,async,crossmnt,no_subtree_check)`
  - identical on all gateway hosts, filesystem ID is a small integer != 0 or UUID

- same port numbers on every host

Ganesha NFS

- userspace NFS server
- CephFS file system abstraction layer (FSAL)
- NFSv4.1+
- only one Ceph filesystem per Ganesha daemon
- HA only in active/passive mode
  - active/active may work
- Ganesha 2.7 will have clustering support
  - does not need CTDB
  - recovery via RADOS objects
- may replace kernel NFSd soon
  - but no POSIX ACLs over NFSv4

SMB client configuration

- no special config needed
- Important: use RRDNS hostname as fileserver name
- /etc/fstab examples:
  - //fileserver/data /mnt/smb cifs guest,iocharset=utf8,_netdev 0 0
  - fileserver:/ceph/files /mnt/nfs nfs rw,vers=3,_netdev 0 0

Demo

Summary

- → Ceph and Samba fit
- → Ceph and NFS fit
- → endless storage capacity possible in one setup

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