SMB3 Multichannel with Samba/CTDB and Gluster

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Agenda

- Samba/CTDB Clustering with GlusterFS
- SMB3 Multichannel
- Oplock/Lease break failures and Multichannel
  - Demo
- Multichannel and testing
- IP failover with Multichannel and CTDB
- Further reading & Q/A
Samba/CTDB clustering with GlusterFS
Red Hat Gluster Storage (RHGS)

- "Red Hat Gluster Storage provides an open, software-defined storage solution across physical, virtual, and cloud resources."
- SMB storage on top of GlusterFS using Samba
- CTDB for clustering
- vfs_glusterfs module for Samba
  - (uses libgfapi for storage I/O)
- Current Release:
  - RHGS 3.3.1 with Samba 4.7.3 offering SMB3 features
- SMB Multichannel only as "Tech Preview"
What was SMB Multichannel again?
SMB Multichannel

- SMB3 performance and reliability feature
- Available since Windows 2012
- Maximize throughput
  - Multiple TCP transport connections aggregated in one session
  - Multiple NICs (NIC teaming, RDMA)
  - Multiple CPU Cores with RSS (Receive Side Scaling)
- Increase fault tolerance
  - Multichannel setups compensate TCP failures on channels
- Automatic configuration
  - Feature is automatically and transparently enabled when prerequisites are met:
    - Client and Server support SMB3
    - Automatic detection of matching interfaces
SMB Multichannel

- Single NIC with RSS
SMB Multichannel

- Multiple NICs
### SMB Multichannel

- **Overview ((c) Microsoft)**

<table>
<thead>
<tr>
<th>NIC Configuration</th>
<th>Throughput</th>
<th>Fault Tolerance for SMB</th>
<th>Fault Tolerance for non-SMB</th>
<th>Lower CPU utilization</th>
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<tbody>
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<td>Multiple NICs (no RSS) + NIC Teaming</td>
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SMB Multichannel in Samba

- **First implementation in Samba 4.4 (2016)**
  - “server multi channel support = yes”
  - Uses fd-passing so all channels point to one smbd
  - Experimental feature, since not all scenarios are covered

- **Current limitations:**
  - Oplock and lease break not Multichannel aware and does not attempt to retry
  - Multichannel not testable in autobuild
  - No interaction with ctdb’s failover ip management
Oplock/Lease break failures and Multichannel
Oplock/Lease Break with Multichannel

- Oplock/Lease Break are issued by the Server

  - “The SMB2 Oplock Break Notification packet is sent by the server when the underlying object store indicates that an opportunistic lock (oplock) is being broken, representing a change in the oplock level.”

  - “The SMB2 Lease Break Notification packet is sent by the server when the underlying object store indicates that a lease is being broken, representing a change in the lease state.”

- Multiple channels can be available for sending break notifications

- Which one is chosen?

- What happens on channel failure?
Oplock/Lease Break with Multichannel

- What happens when a channel fails?
Oplock/Lease Break with Multichannel

- What happens when a channel fails?
Oplock/Lease Break with Multichannel

- Microsoft Interop Lab 2016/2017 research oplock and lease behavior with multichannel on Windows
  - smbtorture testsuite
- How to simulate channel failure?
  - iptables to drop packets
- Testing results for oplock break:
  - smbtorture //server/share -U user%password smb2.multichannel.oplock
  - Oplock break is sent on the last created channel
  - Retry is not attempted at all
- Testing results for lease break:
  - smbtorture //server/share -U user%password smb2.multichannel.leases
  - Lease break is sent on the first created channel
  - Retry is attempted on the first connected channel
Oplock/Lease Break with Multichannel

- TCP properties during retry:
  - Windows 2012 and 2016 will start retrying 10 times after inactivity of 10 seconds with a 1 second interval
Oplock/Lease Break with Multichannel

- Samba does currently not deal with Oplock/Lease Break retries with multichannel
- Samba implementation prototype demo
- TODO:
  - Make sure we calculate and verify delivery of break responses (compare send and receive queue packet counters)
  - Cleanup disconnected/failed channels
  - TCP settings to speed up discovery of failed channels (just as on Windows)
  - Why are oplock break notifications never retried?
Multichannel and testing
Selftest support for Multichannel

- Every commit in Samba is run through automated testing during autobuild
- For enabling SMB Multichannel by default it must be tested permanently and automatically
- Samba automated testing uses abstraction libraries (cwrap.org):
  - `socket_wrapper`, `nss_wrapper`, `uid_wrapper`, `resolv_wrapper`, `pam_wrapper`, etc.
- Fd-passing?
- Present scenario
  - hard coded hack (lets `socketwrapper` work w/o fd-passing)
Selftest support for Multichannel

- Support for fd-passing worked on by Annop C S, Andreas Schneider and Michael Adam

- Future developments to socket_wrapper
  - make socket_wrapper thread-safe => done and merged
  - switch to mmap-ed file for shared memory among processes => done
  - protection with pthread robust mutexes => done
  - implement fd-passing => wip
    - (plan) send socket_info array indexes as the fd array instead of actual fds via pipe and create new fd structure based on the corresponding indexes received at the other end.
Multichannel and CTDB
Multichannel and CTDB

- Typically: multiple public ip addresses per cluster
- Ip addresses can be moved within the cluster
- Ip addresses can spawn over multiple nodes
- With multichannel and fd-passing all ip addresses of one multichannel session *must* reside on the same node

Current solutions:
- No /etc/ctdb/public_addresses file and hard coded ip addresses
- Individual /etc/ctdb/public_addresses files per node

Requirement: automatic configuration and transparent failover
Multichannel and CTDB

- Query for FSCTL QUERY NETWORK INTERFACE INFO on IP1
Multichannel and CTDB

- Multiple channels (IP1, IP2, IP3) bound to same SMB3 session
Multichannel and CTDB

- Interface/Channel failure for IP1
Multichannel and CTDB

- CTDB would migrate IP1 to another Node...
Multichannel and CTDB

- .. and failover the client! Multichannel could not be re-established
Multichannel and CTDB

Possible future solution for automatic configuration:

- Monitor all NICs in the cluster using CTDB and move all channels on failure
- Transparent failover Witness interface (RPC server dependencies)
- SMB 3.1.1 tree connect context redirection
- TBD
Further reading

- Microsoft Protocol Documentation:
  - MS-SMB2, MS-SWN
- Various Microsoft Technet articles
Questions and answers

- Mail gd@samba.org, sprabhu@redhat.com
- #samba-technical on irc.freenode.net
Thank you for your attention!

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