CTDB Performance

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Samba Team
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CTDB Project

Motivation: Support for clustered Samba

- Multiple nodes active simultaneously
- Communication between nodes (heartbeat, failover)
- Distributed databases between nodes

Features:

- Volatile and Persistent databases
- Cluster-side messaging for Samba
- IP failover and load balancing
- Service monitoring

Community:

- `http://ctdb.samba.org`
- `git://git.samba.org/ctdb.git`, `git://git.samba.org/samba.git`

Overview

- Current Status
- Performance Issues
  - Parallel database recovery
  - Improving database recovery
  - Socket handling
  - Database performace

Current Status

CTDB Releases

- 2.5.6 (February 2016) - 84 patches
  - Support volatile databases in tmpfs
  - Fix vlan interface monitoring
  - Numerous resource leak fixes

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  - Support volatile databases in tmpfs
  - Fix vlan interface monitoring
  - Numerous resource leak fixes
- End of development in ctdb tree!

Developers

Contributions in 2015

295	Martin Schwenke
242	Amitay Isaacs
21	Volker Lendecke
16	Michael Adam
6	Christof Schmitt
6	Stefan Metzmacher
3	Mathieu Parent
3	Rajesh Joseph
2	Günther Deschner
2	Thomas Nagy
1	David Disseldorp, Jelmer Vernooij
1	Jose A. Rivera, Led
1	Paul Wayper, Ralph Boehme

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Contributions since Jan 2016

150	Martin Schwenke
102	Amitay Isaacs
6	Volker Lendecke
2	Günther Deschner
2	Michael Adam
1	Christof Schmitt
1	Jose A. Rivera
1	Karolin Seeger
1	Robin Hack
1	Steven Chamberlain

Parallel database recovery

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Why parallel database recovery?

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Why parallel database recovery?

Observation

- Clustered samba running with SMB workload
- A node goes down (overload, admin action, ...)
- CTDB starts recovery, starts freezing databases on all nodes
- Fails to freeze database repeatedly, bans **culprit** node
- Eventually CTDB bans all the nodes in the cluster

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Cause

- Samba is holding a lock on a record
- Samba needs another record lock
- Samba asks CTDB to migrate the record
- The *dmaster* node goes down
- Deadlock!

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Solution

- Recover each database independently and in parallel

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- Improve testability

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Next steps

- Replace CTDB tool code (`ctdb2.c`)

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- Replace CTDB tool code (`ctdb2.c`)
- Replace all test code (`tests/src/*.c`)

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- Combine database records
- `PUSH_DB` control to send database records to all nodes

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- `PULL_DB` and `PUSH_DB` use a single marshall buffer
- What is the database size is large? (`MAX_TALLOC_SIZE`)
- What's wrong with sending 1GB of data in a single packet?

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New control `DB_PULL`

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New control DB_PULL

- Recovery helper sends control DB_PULL with *srvid*
- Ctdbd sends chunked database records with *srvid*
- Recovery helper collects all records received with *srvid*
- Ctdbd sends reply to DB_PULL with number of records

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- Ctdbd starts listening for messages with *srvid*
- Ctdbd replies to DB_PUSH_START
- Recovery helper sends chunked database records with *srvid*
- Recovery helper sends control DB_PUSH_CONFRIM
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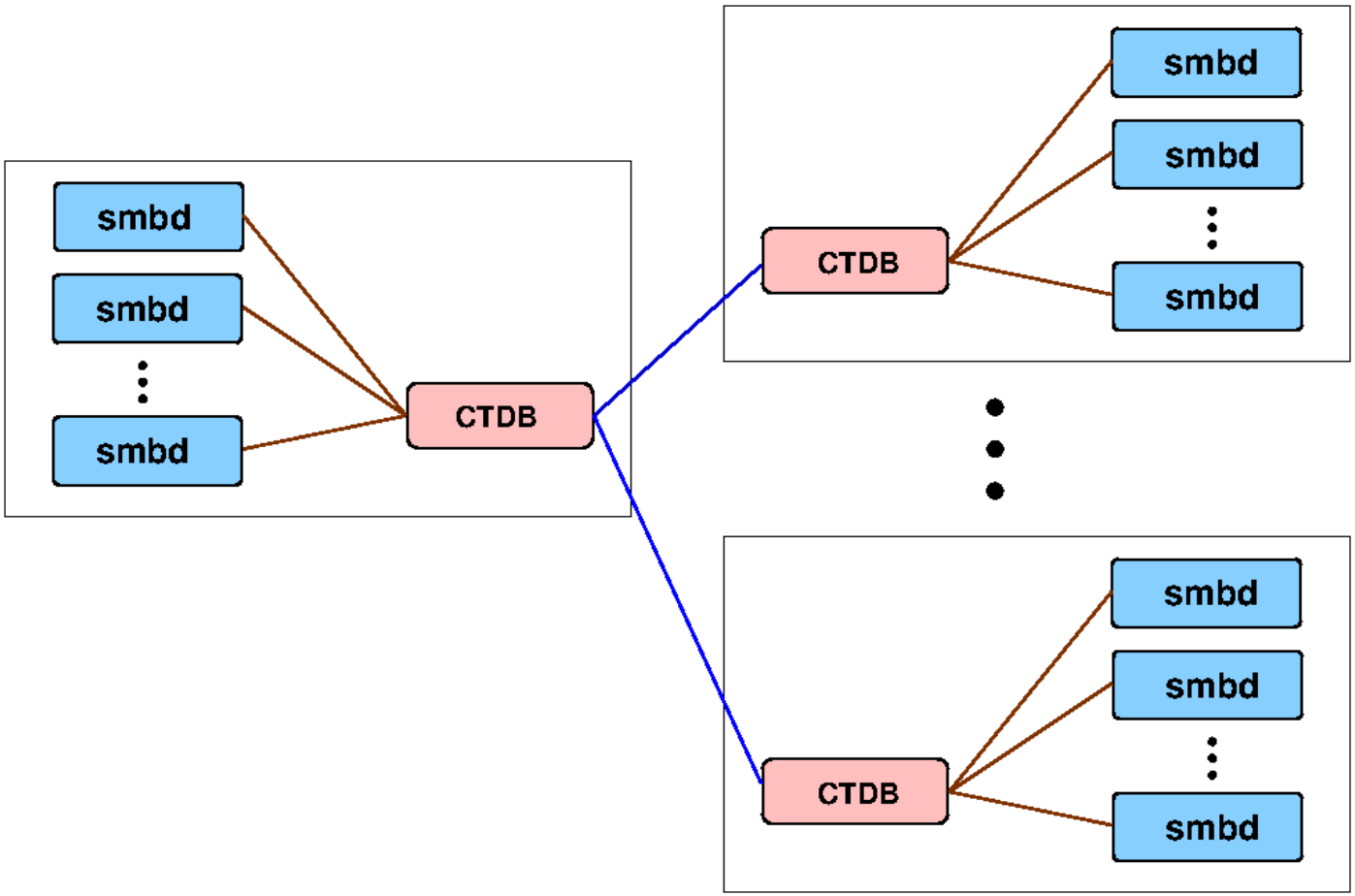

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- TCP connections (few)
- Unix domain connections (thousands!)
- Child pipe fds (tens, sometimes hundreds)

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- Scheduling of fds dependent on event system (`epoll`)

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Original approach

```
static void queue_io_read(struct ctdb_queue *queue)
{
    if (ioctl(queue->fd, FIONREAD, &num_ready) != 0) { return; }

    to_read = MIN(sz_bytes_req, num_ready);
    nread = read(queue->fd, data + queue->partial.length, to_read);
    queue->partial.length += nread;

    if (nread < sz_bytes_req) { return; }
    num_ready -= nread;

    pkt_size = *(uint32_t *)data;
    pkt_bytes_remaining = pkt_size - queue->partial.length;
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Problem

- Pending data on TCP sockets

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    if (ioctl(queue->fd, FIONREAD, &num_ready) != 0) { return; }

    if (queue->buffer.data == NULL) {
        queue->buffer.data = talloc_size(queue, QUEUE_BUFFER_SIZE);
        queue->buffer.size = QUEUE_BUFFER_SIZE;
    }

    navail = queue->buffer.size - queue->buffer.length;
    if (num_ready > navail) { num_ready = navail; }

    if (num_ready > 0) {
        nread = sys_read(queue->fd, queue->buffer.data + queue->buffer.length,
                         num_ready);
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shared access	client-server access

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  - ...
- Unless there is contention!
- `CTDB_DBDIR=tmpfs`

	fcntl	**mutexes**
single record	305k	555k
contention	165k	300k
tmpfs	176k	312k

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- `fdatasync()`!
- Concurrent transactions on different databases

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Questions / Comments