

ConfD Debugging Basics

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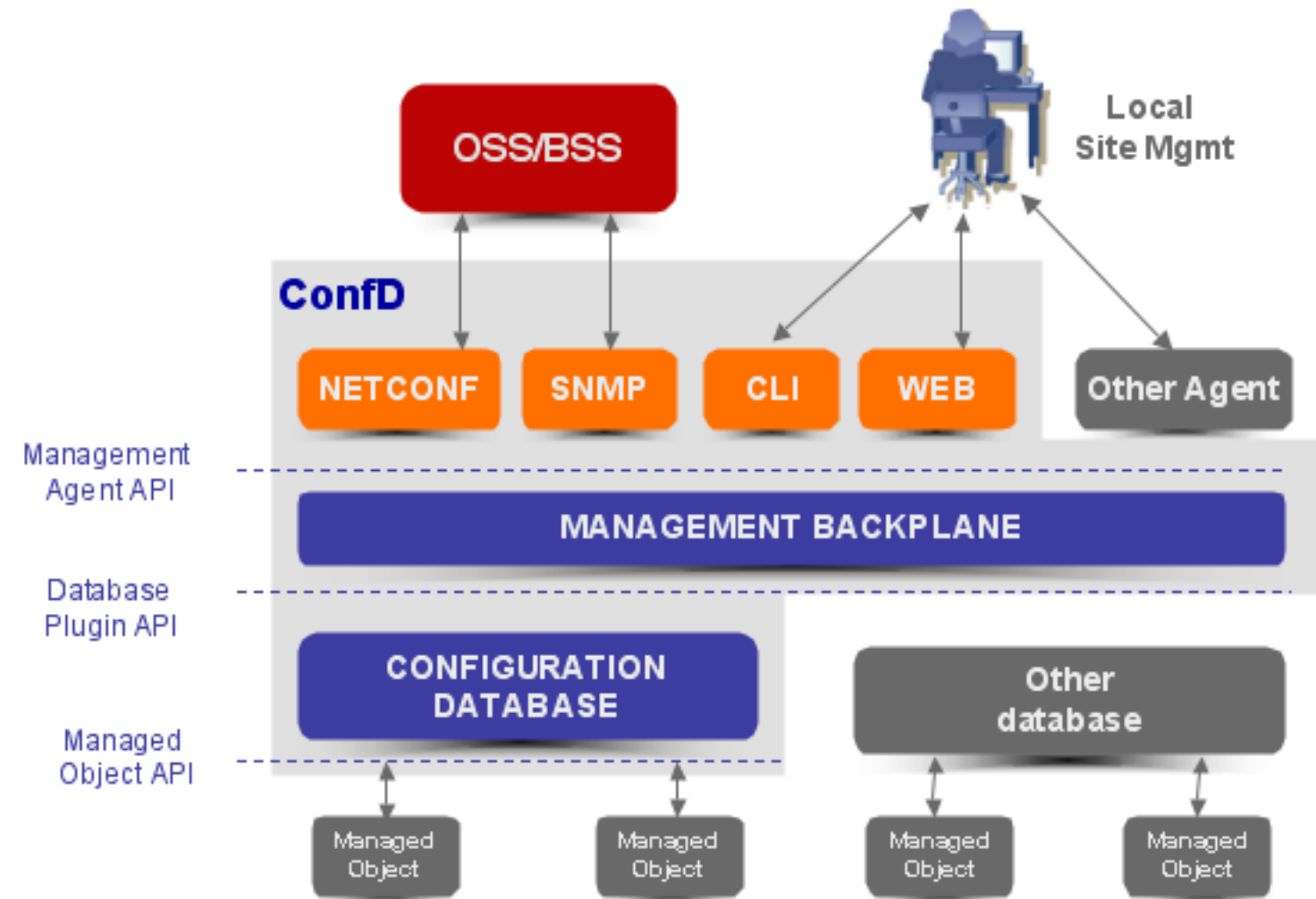
ConfD Debugging Basics

- ConfD and libconfd application logs and traces
- How to run ConfD examples
- Debugging tools
- How to reproduce a bug

What is ConfD?

Network Configuration Server

- Northbound Interfaces
- Management Agent API (MAAPI)
- Transaction Engine
- Database (CDB)
- Schema language (YANG)



libconfd applications

Different types of libconfd applications

Communicates with ConfD via the CDB/MAAPI/HA APIs

- CDB subscribers
- Data Providers
 - External databases
 - Transformations
- Hooks
- External validation
- Actions/RPCs
- HA clients
- ConfD event notification subscribers
- Free running CDB/MAAPI clients

libconfd applications

devel.log & libconfd trace

libconfd trace

ConfD Logs

Northbound logs and traces

audit.log (CLI, authentication, config changes), netconf.log, netconf.trace, snmp.log, snmpgw.log, jsonrpc.log, localhost:*.access, trace_*/trace.*.traffic.

confd.log

confd.log is ConfD's daemon log. Check this log for startup problems of the ConfD daemon itself.

devel.log

Developer log is a log for troubleshooting user written C code, transaction progress, AAA rules (authorisation), HA, etc. The developer log is ConfD's view of the ConfD <-> application communication.

libconfd trace

libconfd trace is enabled in each application, it reports messages received from and sent to ConfD.

confderr.log.*

The error log reports unhandled errors, such as (unexpected) erlang crashes. It is stored in a binary disklog format and can be extracted with:

```
$ confd -printlog confderr.log >confderr.log
```

Verbosity level

Developer log

In `confd.conf(5)`:

```
<logs>
  <developerLogLevel>trace</developerLogLevel>
</logs>
```

Levels: error | **info** | trace

libconfd trace

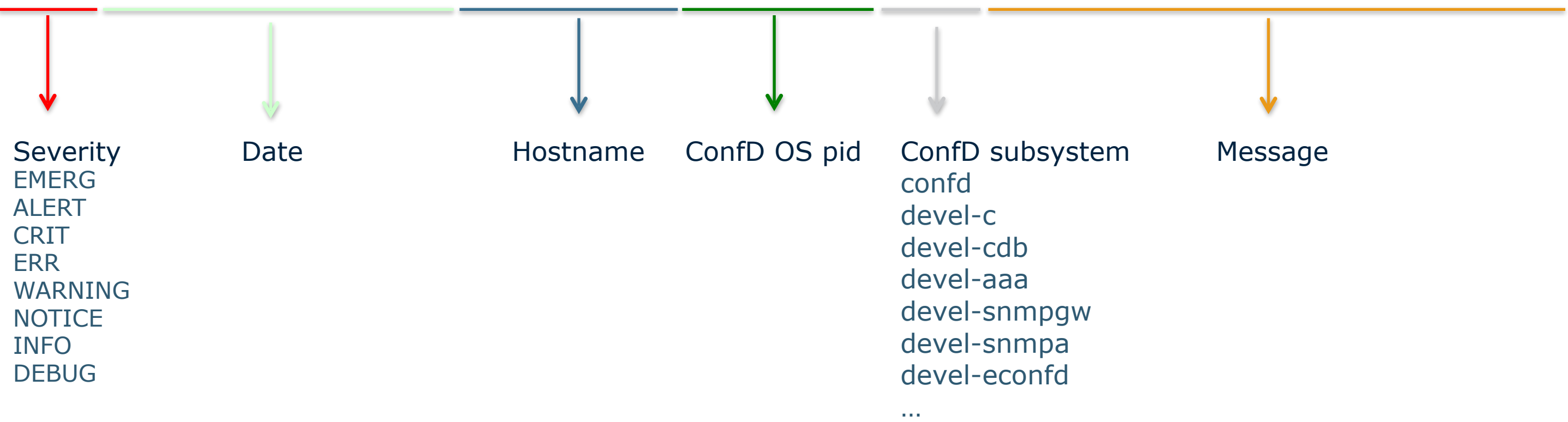
```
void confd_init(const char *name, FILE *estream,
                 const enum confd_debug_level debug);
```

```
void confd_set_debug(enum confd_debug_level debug,
                     FILE *estream);
```

```
enum confd_debug_level {
    CONFD_SILENT = 0,
    CONFD_DEBUG  = 1,
    CONFD_TRACE  = 2,      /* trace callback calls */
    CONFD_PROTO_TRACE = 3 /* tailf internal protocol trace */
};
```

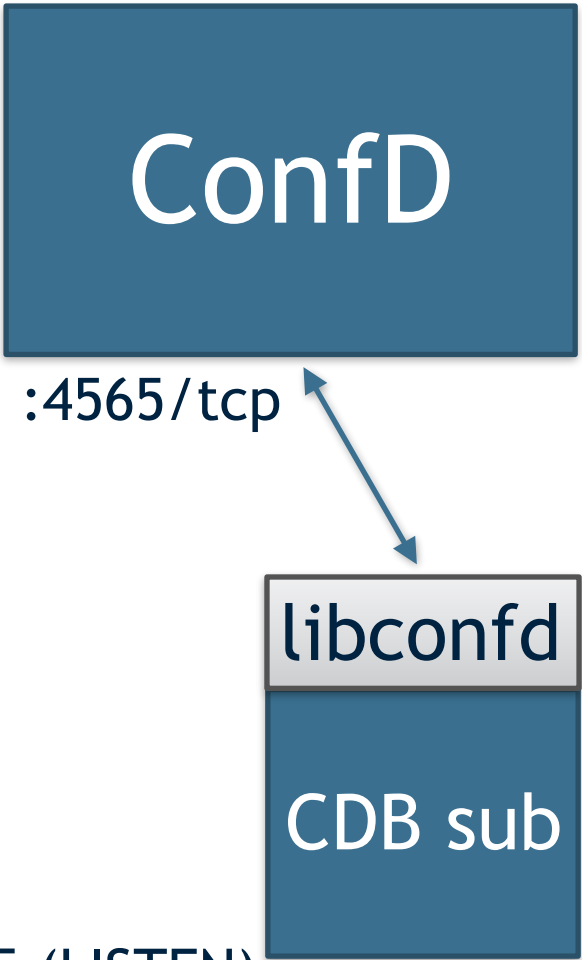
Logging format

```
<DEBUG> 21-Oct-2019::01:59:03.044 EMH0LMST-M-G2WZ confd[48147]: confd commit progress db=running usid=30  
thandle=21: entering validate phase for running...  
...  
<INFO> 21-Oct-2019::02:01:43.637 EMH0LMST-M-G2WZ confd[48147]: devel-c Worker closed daemon id: 0, worker id: 4,  
socket: {socket,<0.263.0>}
```



The application and ConfD

The application connect(2) 's to ConfD on port 4565. And communicates over an IPC protocol.



```
$ lsof -i :4565 -Pn
```

COMMAND	PID	USER	FD	TYPE	DEVICE	SIZE/OFF	NODE	NAME
confd	16381	emholmst	46u	IPv4	0x3f2c3c614bb26cd	0t0	TCP	127.0.0.1:4565 (LISTEN)
confd	16381	emholmst	57u	IPv4	0x3f2c3c6095e3ccd	0t0	TCP	127.0.0.1:4565->127.0.0.1:60882 (ESTABLISHED)
dhcpd_con	16392	emholmst	3u	IPv4	0x3f2c3c6121076cd	0t0	TCP	127.0.0.1:60882->127.0.0.1:4565 (ESTABLISHED)

intro/1-2-3-start-query-model

```
$ make all # compiles YANG modules and C code  
confdc --fail-on-warnings -c -o dhcpd.fxs dhcpd.yang
```

```
...
```

```
cc -c -o dhcpd_conf.o dhcpd_conf.c ...
```

```
cc -o dhcpd_conf dhcpd_conf.o $CONFD_DIR/lib/libconfd.a -lpthread -lm -L/opt/local/lib
```

```
$ make start # starts ConfD (in the background) and a CDB subscriber  
confd -c confd.conf --addloadpath $CONFD_DIR/etc/confd  
./dhcpd_conf
```

intro/1-2-3-start-query-model

```
$ confd_cli -u admin -g admin
admin@EMHOLMST-M-G2WZ> conf
Entering configuration mode private
admin@EMHOLMST-M-G2WZ% set dhcp subnets subnet 192.168.1.0 255.255.255.128
admin@EMHOLMST-M-G2WZ% show|compare
dhcp {
    subnets {
+       subnet 192.168.1.0 255.255.255.128 {
+       }
    }
}
admin@EMHOLMST-M-G2WZ% commit
Commit complete.
```

intro/1-2-3-start-query-model confd_init(...,..., CONFD_TRACE)

```
TRACE CDB_SUBSCRIPTION_EVENT --> 7
TRACE Connected (cdb) to ConfD
TRACE CDB_NEW_SESSION --> CONFD_OK
TRACE Established new CDB session to ConfD
TRACE CDB_SET_NAMESPACE --> CONFD_OK
TRACE CDB_GET /dhcp/default-lease-time --> CONFD_OK
TRACE CDB_GET /dhcp/max-lease-time --> CONFD_OK
TRACE CDB_GET /dhcp/log-facility --> CONFD_OK
TRACE CDB_NUM_INSTANCES /dhcp/subnets/subnet --> CONFD_OK
TRACE CDB_CD /dhcp/subnets/subnet[0] --> CONFD_OK
TRACE CDB_GET net --> CONFD_OK
TRACE CDB_GET mask --> CONFD_OK
...
Read new config, updating dhcpd config
TRACE CDB_SYNC_SUB CDB_DONE_PRIORITY --> CONFD_OK
```

intro/1-2-3-start-query-model /confdConfig/developerLogLevel=info

audit.log:

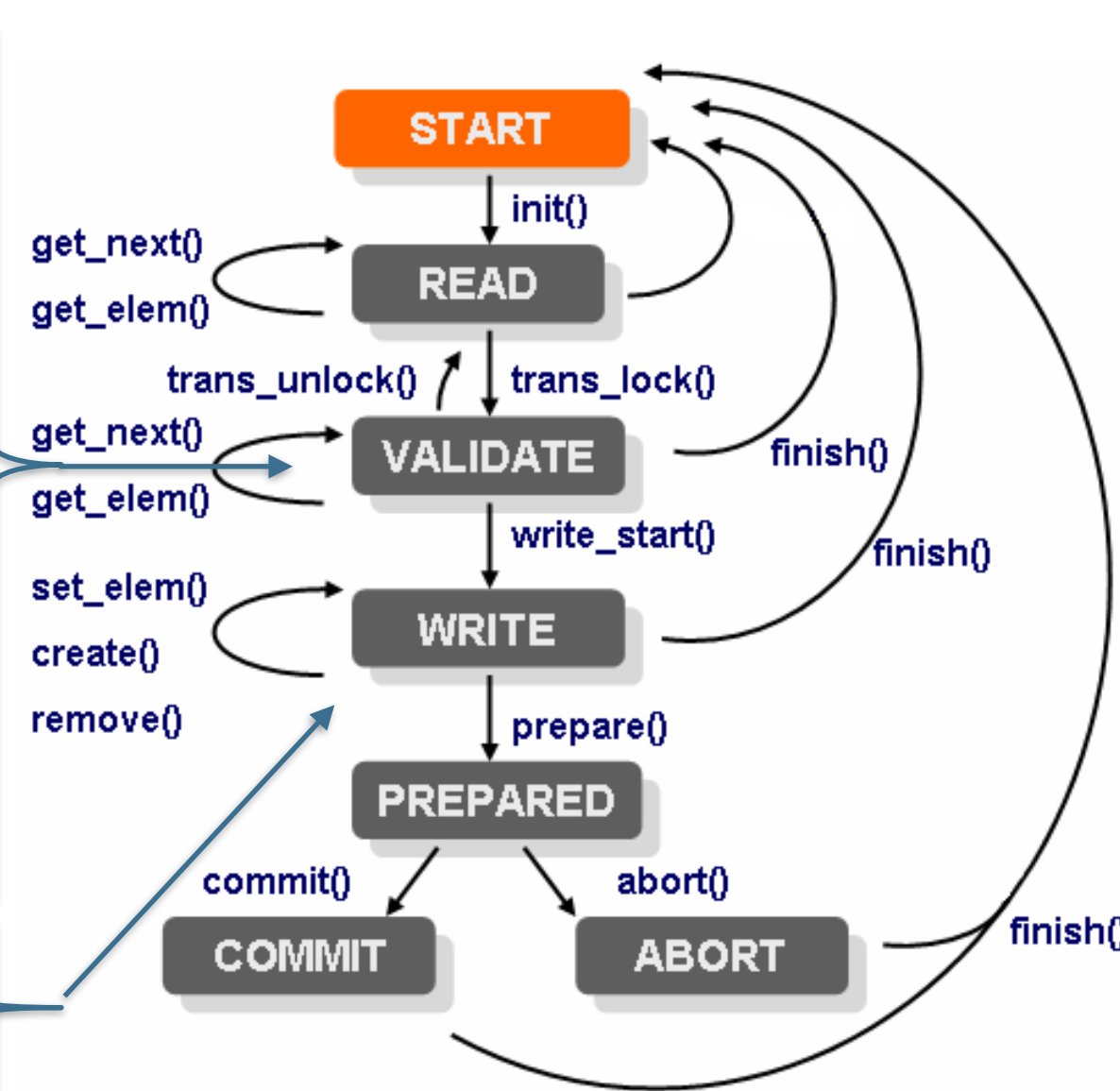
```
... admin/13 CLI 'set dhcp subnets subnet 192.168.1.0 255.255.255.128'  
... admin/13 CLI done  
... admin/13 CLI 'show'  
... admin/13 CLI done  
... admin/13 CLI 'commit'  
... admin/13 CLI done
```

devel.log:

<no change>

intro/1-2-3-start-query-model /confdConfig/developerLogLevel=trace

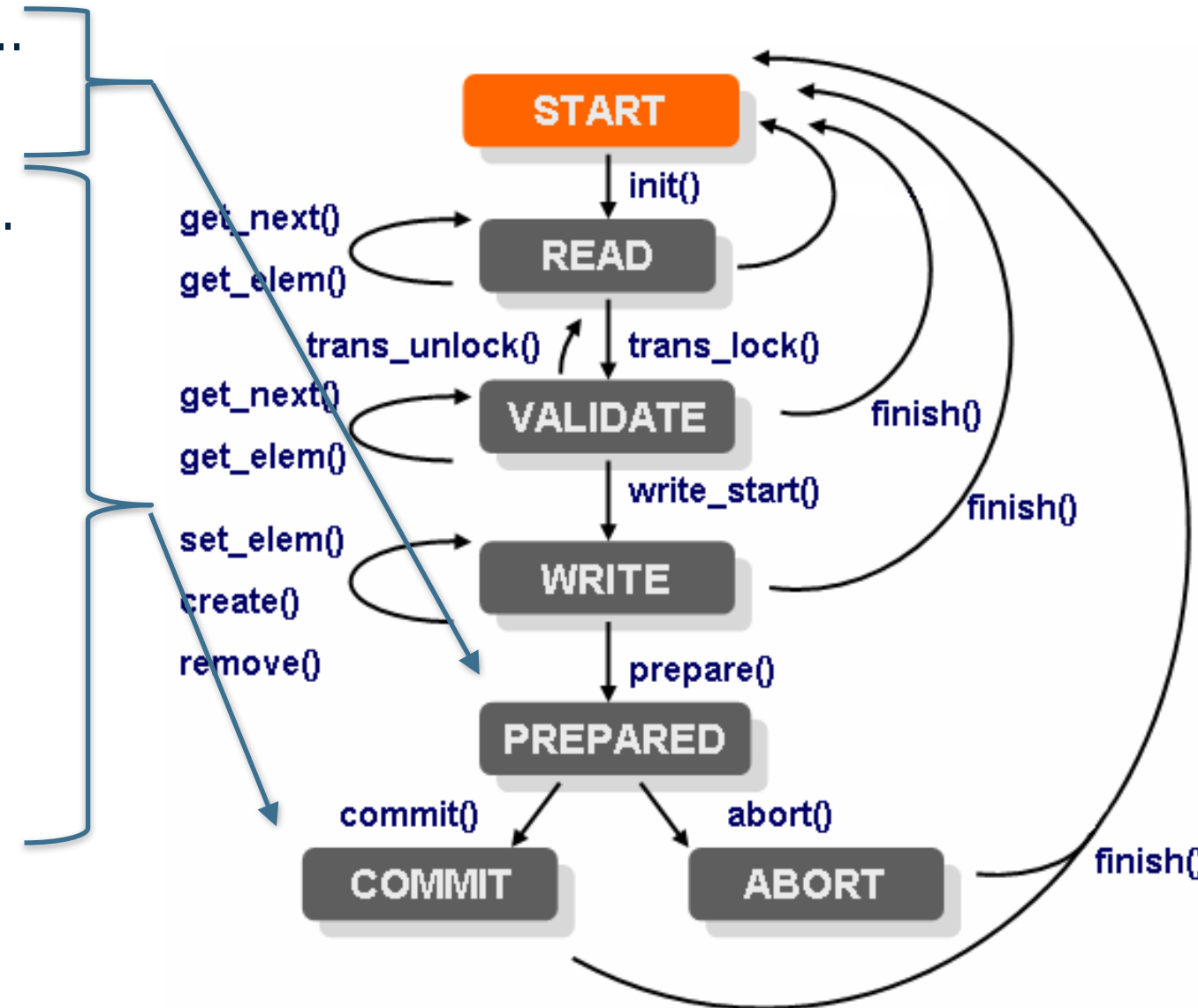
usid=13 thandle=113: entering **validate** phase for running...
usid=13 thandle=113: grabbing transaction lock...
usid=13 thandle=113: grabbing transaction lock ok
usid=13 thandle=113: creating rollback file...
usid=13 thandle=113: creating rollback file ok
usid=13 thandle=113: run transforms and transaction hooks...
usid=13 thandle=113: run transforms and transaction hooks done
usid=13 thandle=113: pre validate...
usid=13 thandle=113: pre validate ok
usid=13 thandle=113: run validation over the change set...
usid=13 thandle=113: validation over the change set done
usid=13 thandle=113: run dependency-triggered validation...
usid=13 thandle=113: dependency-triggered validation done
usid=13 thandle=113: leaving **validate** phase for running
usid=13 thandle=113: entering **write-start** phase for running...
usid=13 thandle=113: cdb: write-start
usid=13 thandle=113: leaving **write-start** phase for running



Picture from UG 8.5. User sessions and ConfD Transactions

intro/1-2-3-start-query-model /confdConfig/developerLogLevel=trace

usid=13 thandle=113: entering **prepare** phase for running...
usid=13 thandle=113: cdb: prepare
usid=13 thandle=113: leaving **prepare** phase for running
usid=13 thandle=113: entering **commit** phase for running...
usid=13 thandle=113: cdb: commit
usid=13 thandle=113: cdb: delivering commit subscription
notifications at prio 3
devel-cdb connect from ./dhcpd_conf
devel-cdb client ./dhcpd_conf has pid 96178/4
devel-cdb new session on running for ./dhcpd_conf
devel-cdb client ./dhcpd_conf closed
all commit subscription notifications acknowledged
usid=13 thandle=113: releasing transaction lock
usid=13 thandle=113: leaving **commit** phase for running
usid=13 thandle=113: applying transaction done



Picture from UG 8.5. User sessions and ConfD Transactions

intro/1-2-3-start-query-model hang

add to dhcpcd_conf.c:

```
printf("hanging\n");  
sleep(600);
```

before:

```
if (reslen > 0) {  
    if ((status = read_conf(&addr)) != CONFD_OK) {
```

```
$ ./dhcpcd_conf
```

```
^C #to kill the CDB subscriber
```

```
$ make all # recompile
```

```
$ ./dhcpcd_conf # restart the CDB subscriber
```

intro/1-2-3-start-query-model hang

```
$ confd_cli -u admin -g admin
admin@EMHOLMST-M-G2WZ> conf
Entering configuration mode private
admin@EMHOLMST-M-G2WZ% set dhcp subnets subnet 192.168.2.0 255.255.255.128
admin@EMHOLMST-M-G2WZ% show|compare
dhcp {
    subnets {
+       subnet 192.168.2.0 255.255.255.128 {
+       }
    }
}
admin@EMHOLMST-M-G2WZ% commit
<hanging>
```


devel.log

```
db=running usid=13 thandle=134: entering prepare phase for running...  
db=running usid=13 thandle=134: cdb: prepare  
db=running usid=13 thandle=134: leaving prepare phase for running  
db=running usid=13 thandle=134: entering commit phase for running...  
db=running usid=13 thandle=134: cdb: commit  
db=running usid=13 thandle=134: cdb: delivering commit subscription  
notifications at prio 3
```

```
$ confd --status | sed '/^cdb:/,/^$/!d'
```

cdb:

current transaction id: 1571-267342-355087

running:

filename: ./confd-cdb/A.cdb

disk size: 1.8 kB

ram size: 10.2 kB

read locks: 1

write lock: unset

operational:

...

waiting for sync-subscription from:

./dhcpd_conf (for event: prio=3 ids=7)

no pending subscription notifications

registered cdb clients:

client name: ./dhcpd_conf 96522/3

type: subscriber

subscriptions:

db=running id=7 priority=3 path=/dhcp

```
$ confd --status | sed '/^user sessions:/,/^$/!d'
```

user sessions:

sessionId=13 2019-10-16 15:59:31 admin@127.0.0.1 cli/console

no locks set

transaction tid=134 has the trans lock on running

transactions:

tid=134 db=running mode=read_write

tid=128 db=running mode=read

kill the CDB subscriber

```
$ ./dhcpd_conf  
^C
```

CDB leaves the **commit** phase, the transaction engine applies the transaction and the CLI becomes unblocked:

```
Commit complete.  
admin@EMHOLMST-M-G2WZ%
```

\$ confd —status

cdb:

current transaction id: 1571-267342-355087

running:

filename: ./confd-cdb/A.cdb

disk size: 1.9 kB

ram size: 10.3 kB

read locks: 0

write lock: unset

operational:

filename: ./confd-cdb/O.cdb

disk size: 4 bytes

ram size: 136 bytes

subscription lock: unset

no pending subscription notifications

no registered cdb clients

ConfD User Guide, Chapter 6. CDB - The ConfD XML Database

“Note that even though the notifications are delivered within the transaction it is not possible for a subscriber to reject the changes (since this would break the two-phase commit protocol used by the ConfD backplane towards all data-providers).”

Saving/loading configuration as XML

From confd_cli(1)

```
$ confd_cli -u admin -g admin  
> show configuration dhcp | display xml | save dhcp.xml  
> configure  
% load merge dhcp.xml
```

From confd_lib_maapi(3) with confd_load(1)

```
$ confd_load -Fp -p /dhcp >dhcp.xml  
$ confd_load -lm dhcp.xml
```

Saved XML can be used as initial data

```
$ confd —stop  
$ rm -f confd-cdb/*.cdb  
$ cp dhcp.xml confd-cdb/dhcp_init.xml  
$ confd -c confd.conf —addloadpath $CONFD_DIR/etc/confd
```

more info in the ConfD User Guide under **6.8. Loading initial data into CDB.**

Or used as a payload to a NETCONF <edit-config> operation

Remove the starting <config xmlns="http://tail-f.com/ns/config/1.0"> and ending </config> tags from dhcp.xml.

```
$ netconf-console —edit-config dhcp.xml
```

read back the data:

```
$ netconf-console —get-config -x /dhcp
```

more available commands:

```
$ netconf-console —help
```

confd_cmd(1) source code in \$CONFD_DIR/src/confd/tools

```
$ confd_cmd -c 'subwait_iter /dhcp 0 100'
SUBSCRIBED TO /dhcp
COMMIT
/dhcp /dhcp/subnets/subnet{192.168.33.0 255.255.255.0} created
/dhcp /dhcp/subnets/subnet{192.168.33.0 255.255.255.0}/net set ( -> 192.168.33.0)
/dhcp /dhcp/subnets/subnet{192.168.33.0 255.255.255.0}/mask set ( ->
255.255.255.0)
/dhcp /dhcp/subnets/subnet{192.168.33.0 255.255.255.0}/max-lease-time set ( ->
P0DT7200S)
DONE

more commands
$ confd_cmd -h commands
```

confd_load(1) source code in \$CONFD_DIR/src/confd/tools

```
$ confd_load -Fo -O -p /netconf-state/sessions
{
  "data": {
    "ietf-netconf-monitoring:netconf-state": {
      "sessions": {
        "session": [
          {
            "session-id": 19,
            "transport": "tailf-netconf-monitoring:cli-console",
            "username": "admin",
            "source-host": "127.0.0.1",
            "login-time": "2019-10-18T15:25:45-07:00",
            "tailf-netconf-monitoring:transaction": [
              {
                "id": 15,
```

A regression (fixed in ConfD-6.5.4, ConfD-6.6 and later)

- confd: If a container with a 'when' expression had a descendant 'choice' with a default 'case', and changes that both made the 'when' evaluate to "true" and selected a non-default 'case' in the 'choice' were done in a single commit, the 'case' selection was lost. This bug was introduced in ConfD-6.5 and has now been fixed.

(ENG-17566, RT:31400, PS-27454)

YANG module

```
interfaces-aug.yang:
augment "/if:interfaces/if:interface" {
  container mac-address {
    when "../if:type = 'ianaift:ethernetCsmacd'";
    choice mac-address {
      default auto;
      leaf auto {
        type empty;
      }
      leaf address {
        type yang:mac-address;
      }
    }
  }
}
```

Try to reproduce the bug

1. create a skeleton from the example

```
$ . ~/rel/confd-6.5/confdrc
```

```
$ cp -R $CONFD_DIR/examples.confd/intro/1-2-3-start-query-model ../repro1
```

2. add *.yang modules to the directory

```
$ cp *.yang ../repro1
```

3. and to the ../repro1/Makefile (replace the common-all target)

```
FXS = $(patsubst %.yang,%.fxs,$(wildcard *.yang))
```

```
common-all: $(FXS) commands-j.ccl commands-c.ccl $(CDB_DIR) ssh-keydir
```

Start ConfD and apply the config from the CLI

```
$ make clean all start
```

4. set the configuration from the cli

```
admin@EMHOLMST-M-G2WZ% set interfaces interface eth0 type ethernetCsmacd enabled mac-address  
address 00:11:22:33:44:55
```

```
admin@EMHOLMST-M-G2WZ% show|compare
```

```
interfaces {
```

```
+   interface eth0 {
```

```
+       type ethernetCsmacd;
```

```
+       enabled;
```

```
+       mac-address {
```

```
+           address 00:11:22:33:44:55;
```

```
+       }
```

```
+   }
```

```
}
```

```
admin@EMHOLMST-M-G2WZ% commit
```

Appears to work fine from the CLI

```
admin@EMHOLMST-M-G2WZ% show interfaces | display xml
<config xmlns="http://tail-f.com/ns/config/1.0">
  <interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces">
    <interface>
      <name>eth0</name>
      <type xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-
type">ianaift:ethernetCsmacd</type>
      <enabled>true</enabled>
      <mac-address xmlns="urn:interfaces-aug">
        <address>00:11:22:33:44:55</address>
      </mac-address>
    </interface>
  </interfaces>
</config>
```


Save and revert

5. save the configuration as XML

```
admin@EMHOLMST-M-G2WZ% show interfaces | display xml | save interfaces.xml
```

6. undo last transaction

```
admin@EMHOLMST-M-G2WZ% rollback  
admin@EMHOLMST-M-G2WZ% commit  
admin@EMHOLMST-M-G2WZ% show interfaces  
No entries found.
```

7. try from NETCONF instead

delete `<config xmlns="http://tail-f.com/ns/config/1.0">` and `</config>` tags from `interfaces.xml`.

```
$ netconf-console --edit-config interfaces.xml
```

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="1">
```

```
  <ok/>
```

```
</rpc-reply>
```

8. verify the result

```
$ netconf-console --get-config -x /interfaces
<?xml version="1.0" encoding="UTF-8"?>
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="1">
  <data>
    <interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces">
      <interface>
        <name>eth0</name>
        <type xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-
type">ianaift:ethernetCsmacd</type>
        <enabled>true</enabled>
      </interface>
    </interfaces>
  </data>
</rpc-reply>
```



tail=f