Building NETCONF-enabled Network Management Systems with libnetconf

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NETCONF Protocol

NETCONF is the IETF proposed standard protocol for network configuration.

Characteristics:

- XML-encoded RPC mechanism
- SSH/TLS as a transport protocol
- extensible via Capabilities
- optional asynchronous message delivery (Event Notifications)

LIBNETCONF

libnetconf is an open source C library implementing the NETCONF protocol for the GNU/Linux.

Supported Features:

- NETCONF **1.0** and **1.1** (RFC 6241)
- **SSH transport** (RFC 6242)
- distinct and writable **running**, **startup** and **candidate** data stores (RFC 6241)
- **Event Notifications** (RFC 5277)
- **Access Control** (RFC 6536)
- **With-defaults** capability (RFC 6243)
- status information (RFC 6022)

Covered Areas:

- NETCONF session management
- handling NETCONF messages
- creating and handling NETCONF Event Notifications
- data store manipulation

Lessons Learned

Easy to use rule – do all the necessary steps with as a few functions as possible. These functions have to **do the right thing by default**.

Requested Features

- event-driven **non-blocking** API for sending and receiving messages
- **multi-threading** support
- utilization of multiple **SSH channels**
- integration with an **existing storage**
- optimization for a **non-PC** (e.g., uClibc) **environment** (routers, switches, …)
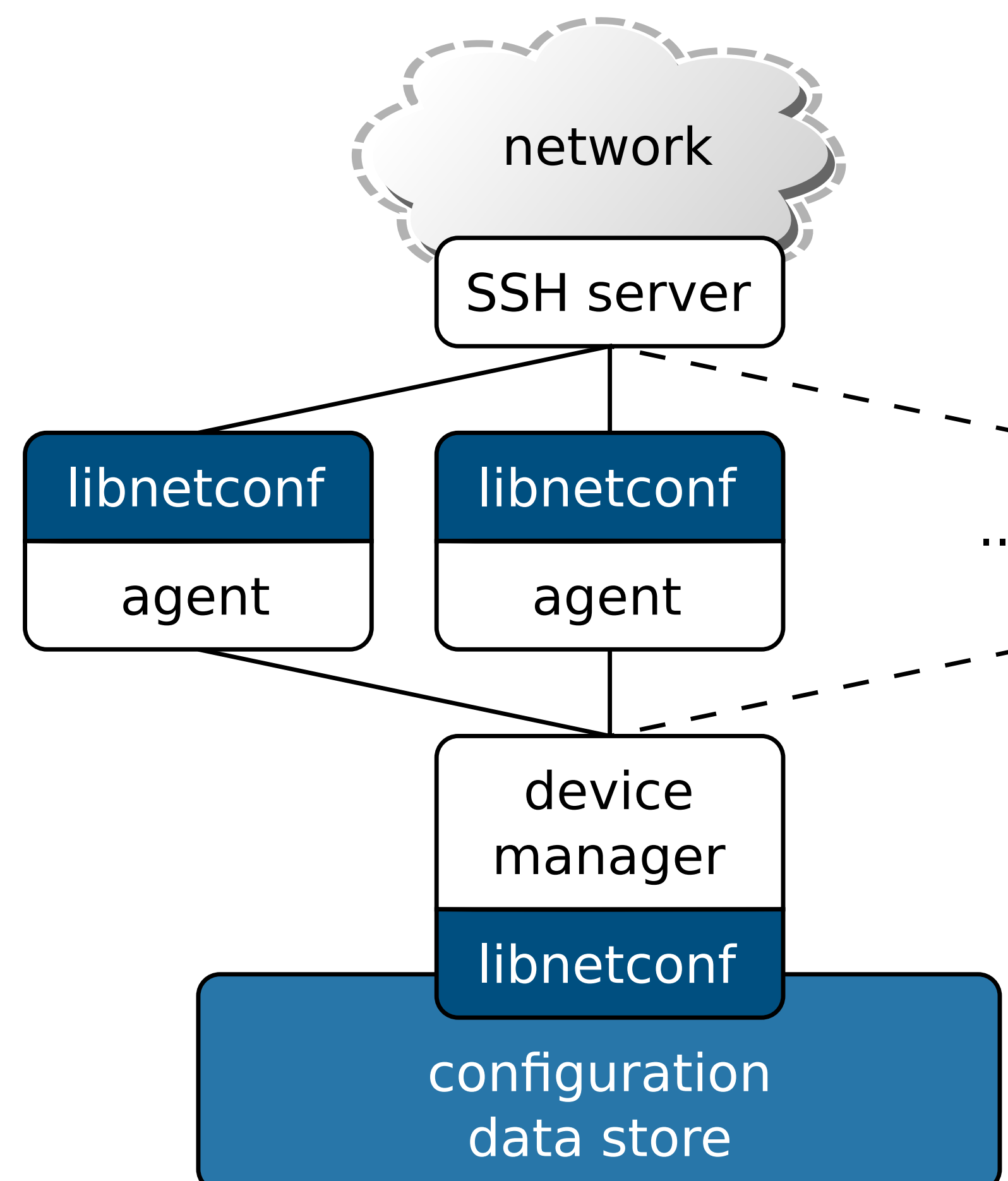
TransAPI

A template code generator based on a device configuration data model.
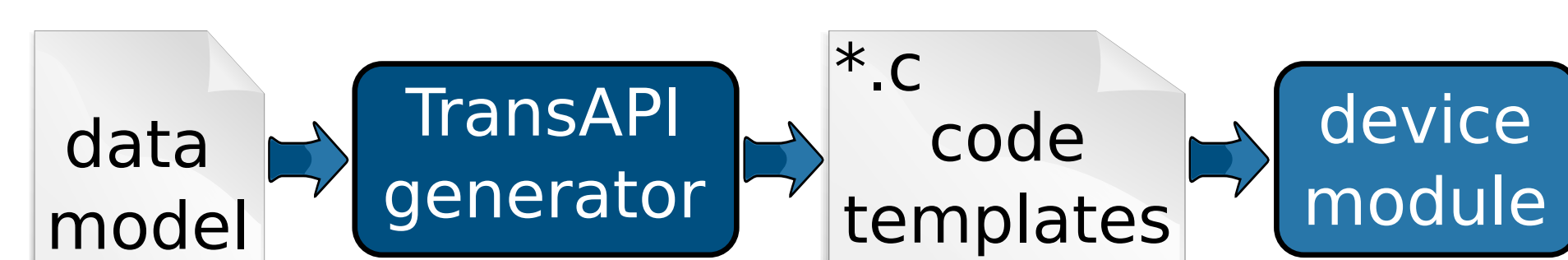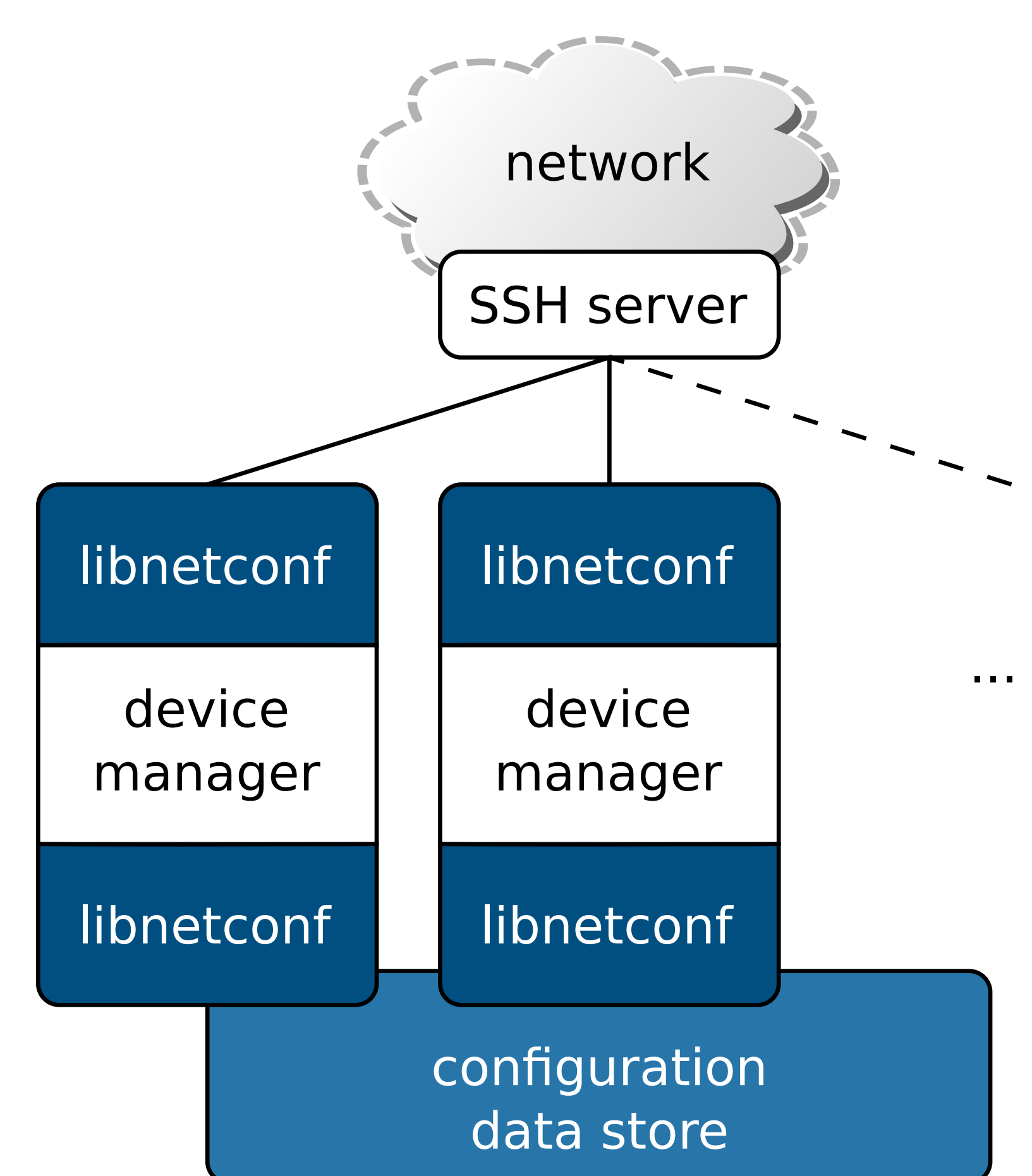

NETCONF Server

libnetconf has to reflect different approaches of building a NETCONF server:
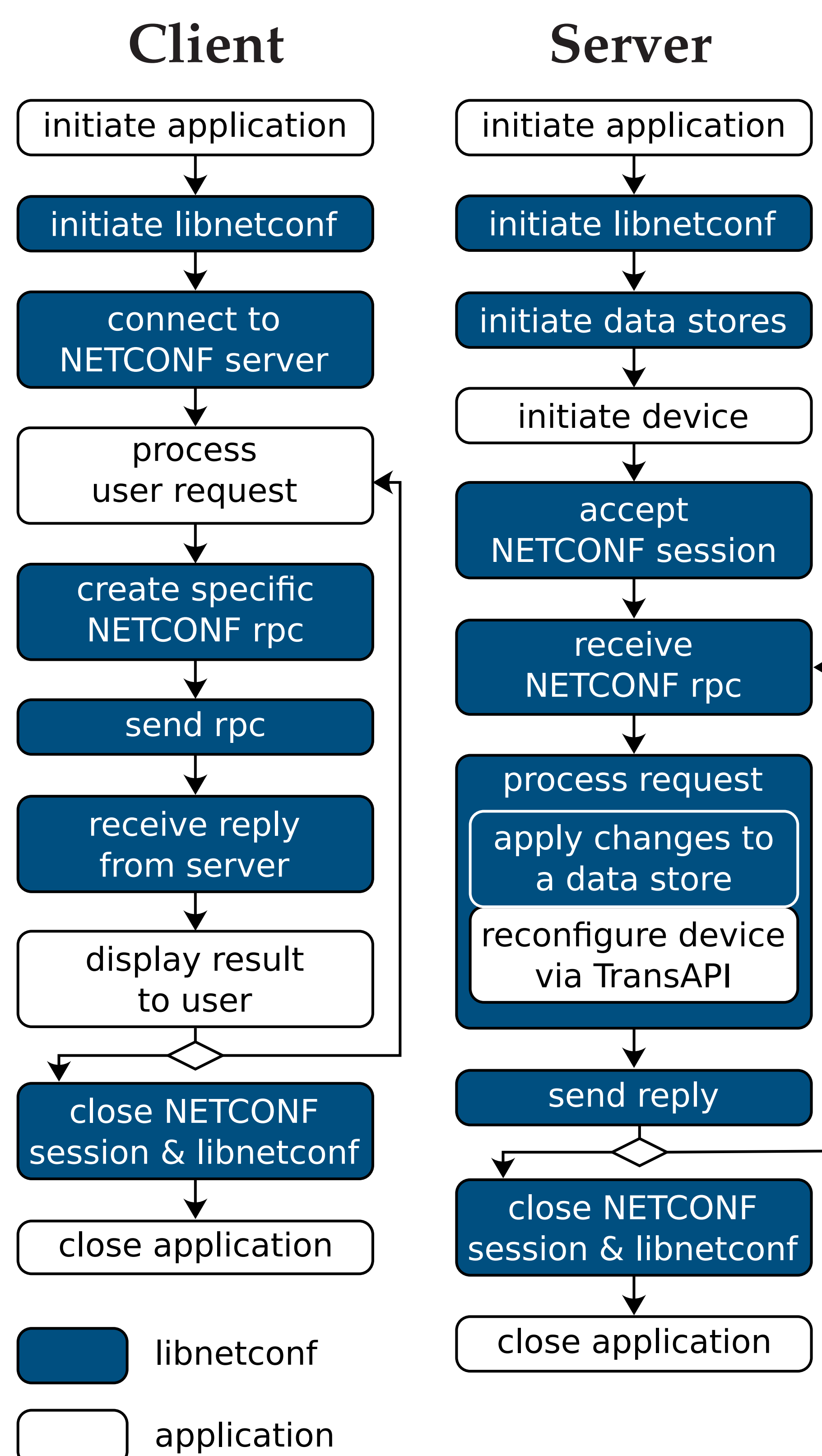
Multi-level Architecture

- *device manager* as a system daemon
- *agents* invoked as an SSH Subsystem

Single-level Architecture

- no persistent system daemon
- instance of a *device manager* for each session

libnetconf Examples

Client

Server

- libnetconf
- application

The example server is written within three hundreds lines of code without a deep knowledge of the NETCONF protocol. It provides an example of integrating *libnetconf* with an event-driven library. As an example, it controls a virtual toaster allowing user to make a toast with choosing how well it is done or what kind of bread is used to make a toast.

The example client provides a simple command-line interface to demonstrate using of *libnetconf* on a client side. To keep it simple and readable, in contrast to *libnetconf*, the example client does not allow usage of multiple SSH channels and it is limited to connect only to a single server at the same time.

In November 2012, *libnetconf*-based applications were successfully tested at the IETF NETCONF Interoperability Event during the IETF 85 meeting.

Acknowledgements

Source Code

The libnetconf source code, API documentation and example applications can be found at:

https://libnetconf.googlecode.com