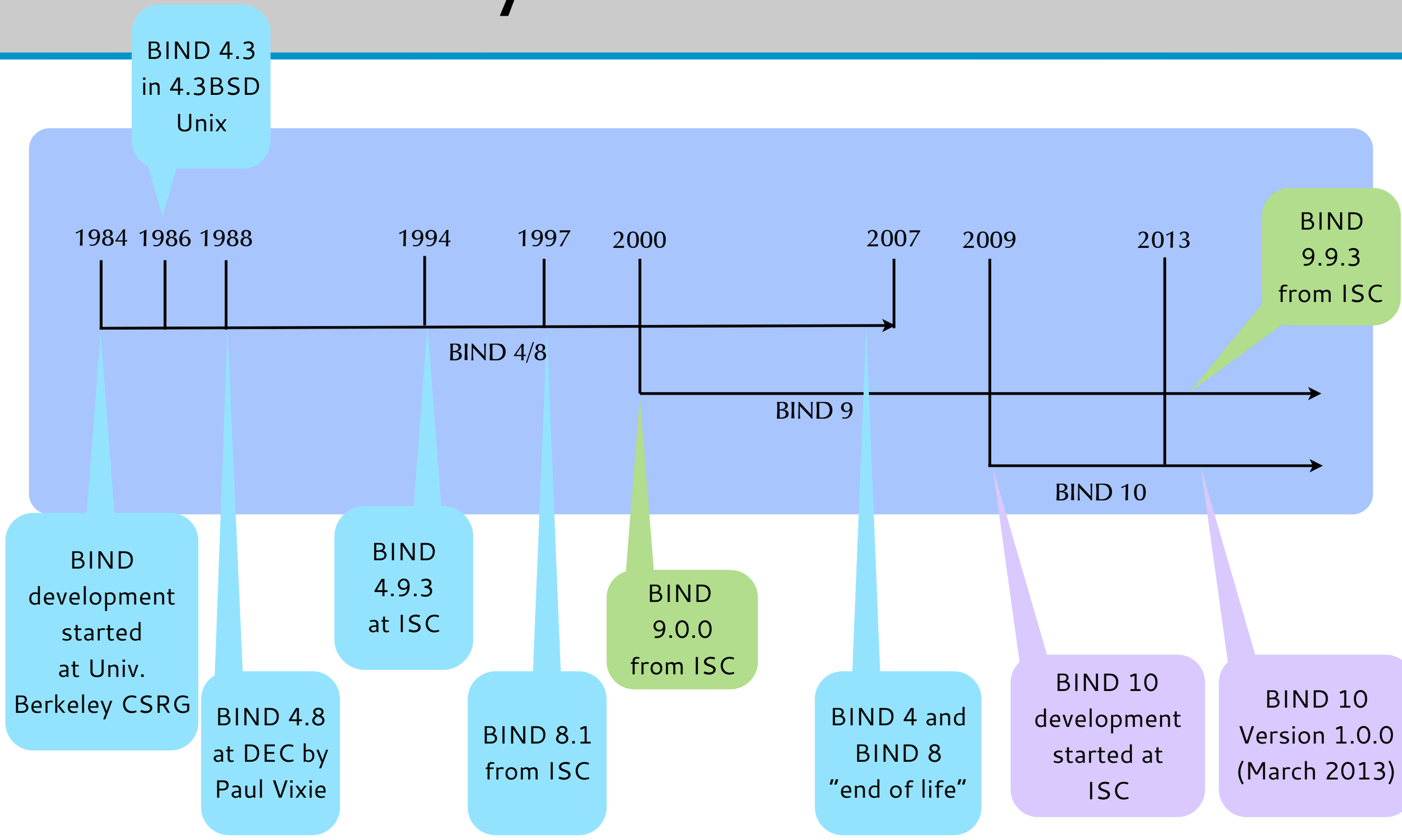

MEN&MICE

# BIND 10


# The BIND 10 story

# History of BIND DNS



# Why a new BIND

- BIND 9 was designed in 1998-1999
  - first release 9.0.0 in September 2000
- the world has changed since then
  - multicore CPU, lots of memory
  - new requirements ...





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# requirements for a modern BIND DNS Server

- Hardware scalability
- 10's to 100's of CPU cores
- multi-machine cluster





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# requirements for a modern BIND DNS Server

- Robustness through modularization
  - minimized the impact of software errors
  - only requested modules are loaded
  - reduced "fate-sharing"
    - a software error will only bring down one module, not the whole BIND 10 system





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# requirements for a modern BIND DNS Server

- Extensibility through modularization
  - BIND is the "IETF reference implementation" for DNS (and DHCP)
- BIND 10 implements new functions as modules
  - not every operator needs to load and use these functions
- operators can create their own extension modules





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# requirements for a modern BIND DNS Server

- Customization "out-of-the-box"
  - recursive-caching DNS
  - authoritative DNS
  - DHCPv4
  - DHCPv6





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# requirements for a modern BIND DNS Server

- Dynamic reconfiguration
  - configuration changes through command-line-interface (CLI) or API
  - configuration changes are applies immediately (no "reload")
  - configuration "roll-back"





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# requirements for a modern BIND DNS Server

- SQL backend
- integration into provisioning systems through SQL Database backends
- configuration and data (DNS and DHCP)





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# BIND 10 development

- BIND 10 1.0.0 was released in February 2013
- Development will continue to add more functionality





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# BIND 10 sponsors

# What about BIND 9?

- ISC will continue to develop and maintain BIND 9 in parallel to BIND 10
  - BIND 9 EOL (end-of-live) will be announced years ahead once BIND 10 has most (or all) BIND 9 features
  - BIND 9.9 will be the new ESV (extended support version)
  - BIND 9.10 will be released in 2013





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# BIND 10 architecture

# Architecture

- BIND 4/8/9 had a monolithic architecture
  - (almost) all functions where inside the "named" process
- BIND 10 has a multi-process architecture
  - multiple specialized processes run and communicate over a message bus





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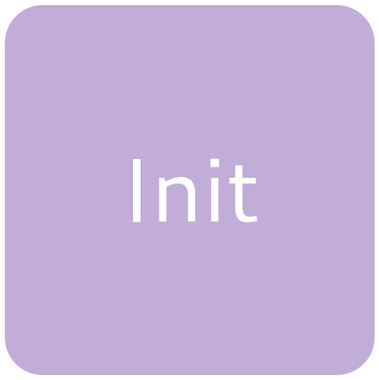
# BIND 10 architecture

# BIND 10 architecture

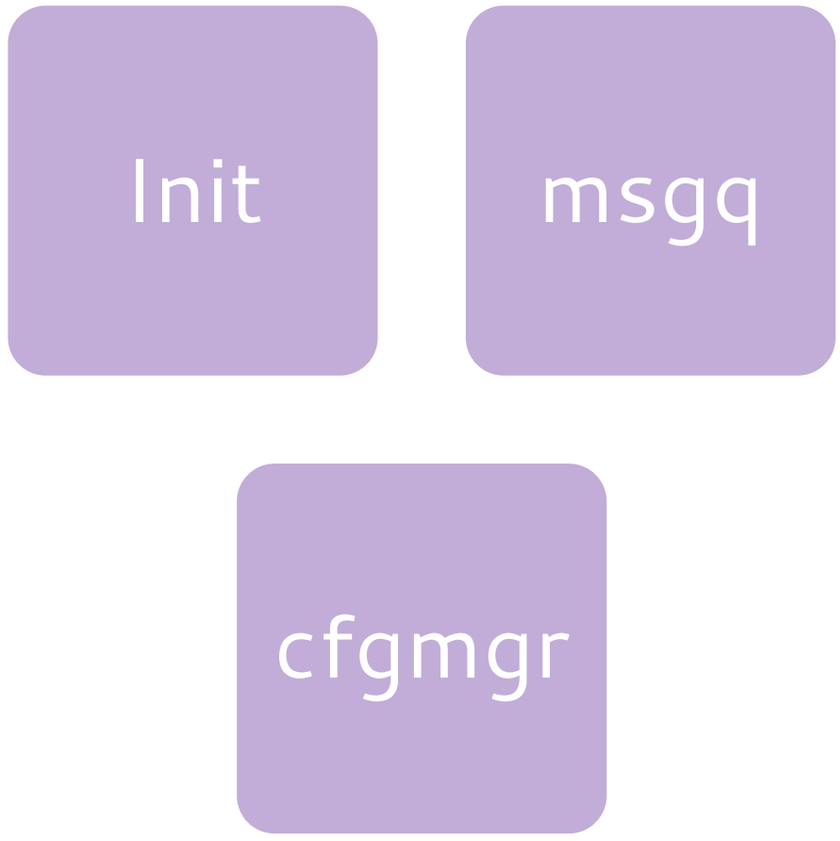


# BIND 10 architecture

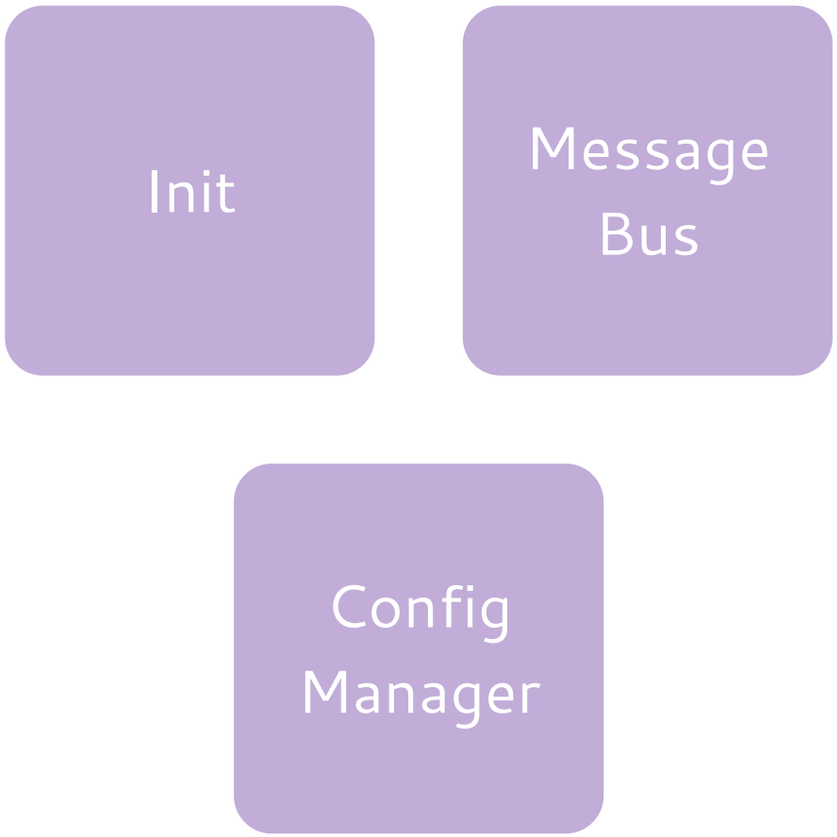
Init

msgq

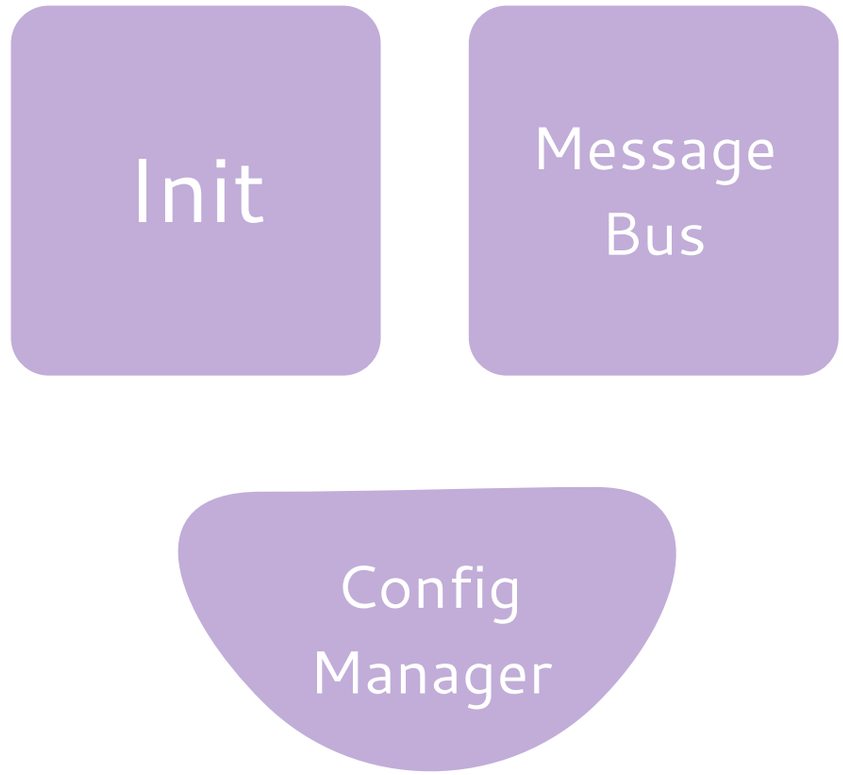
# BIND 10 architecture



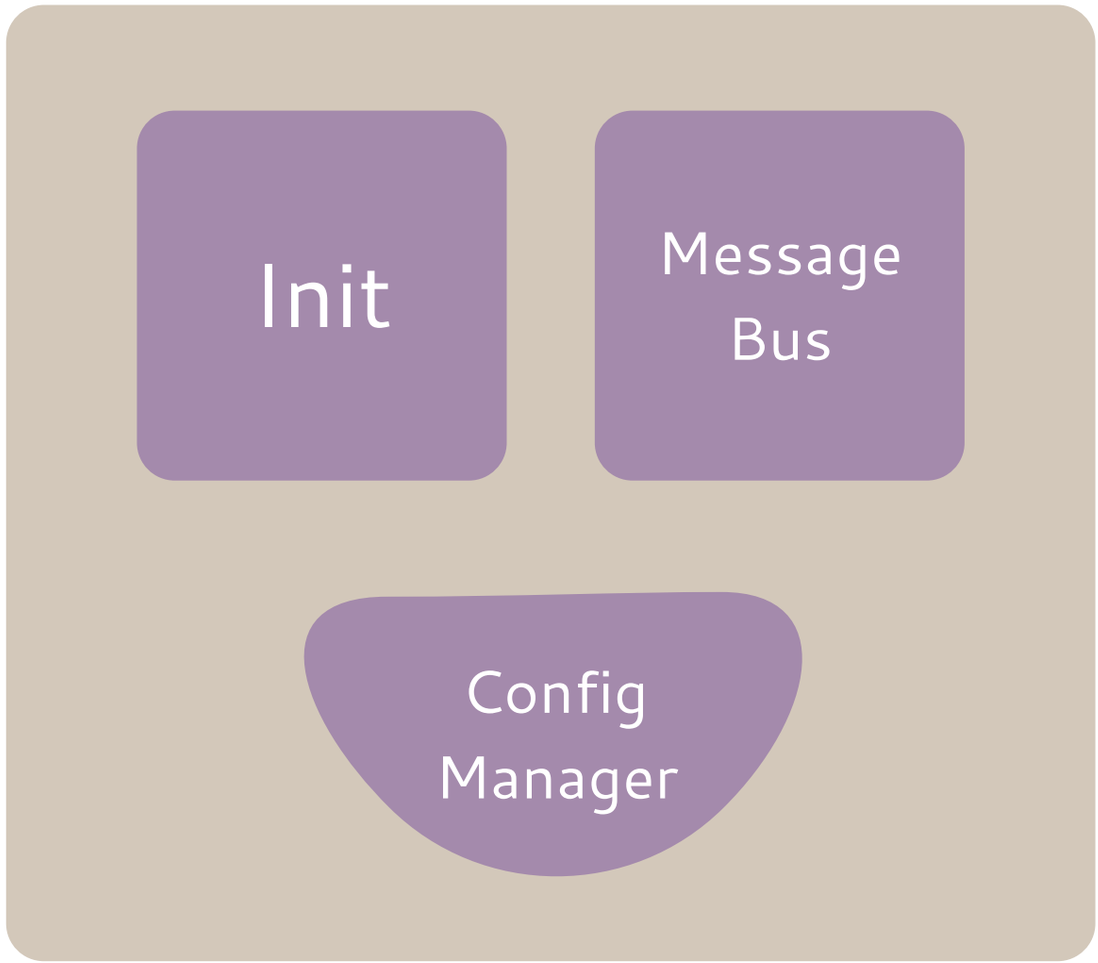
# BIND 10 architecture



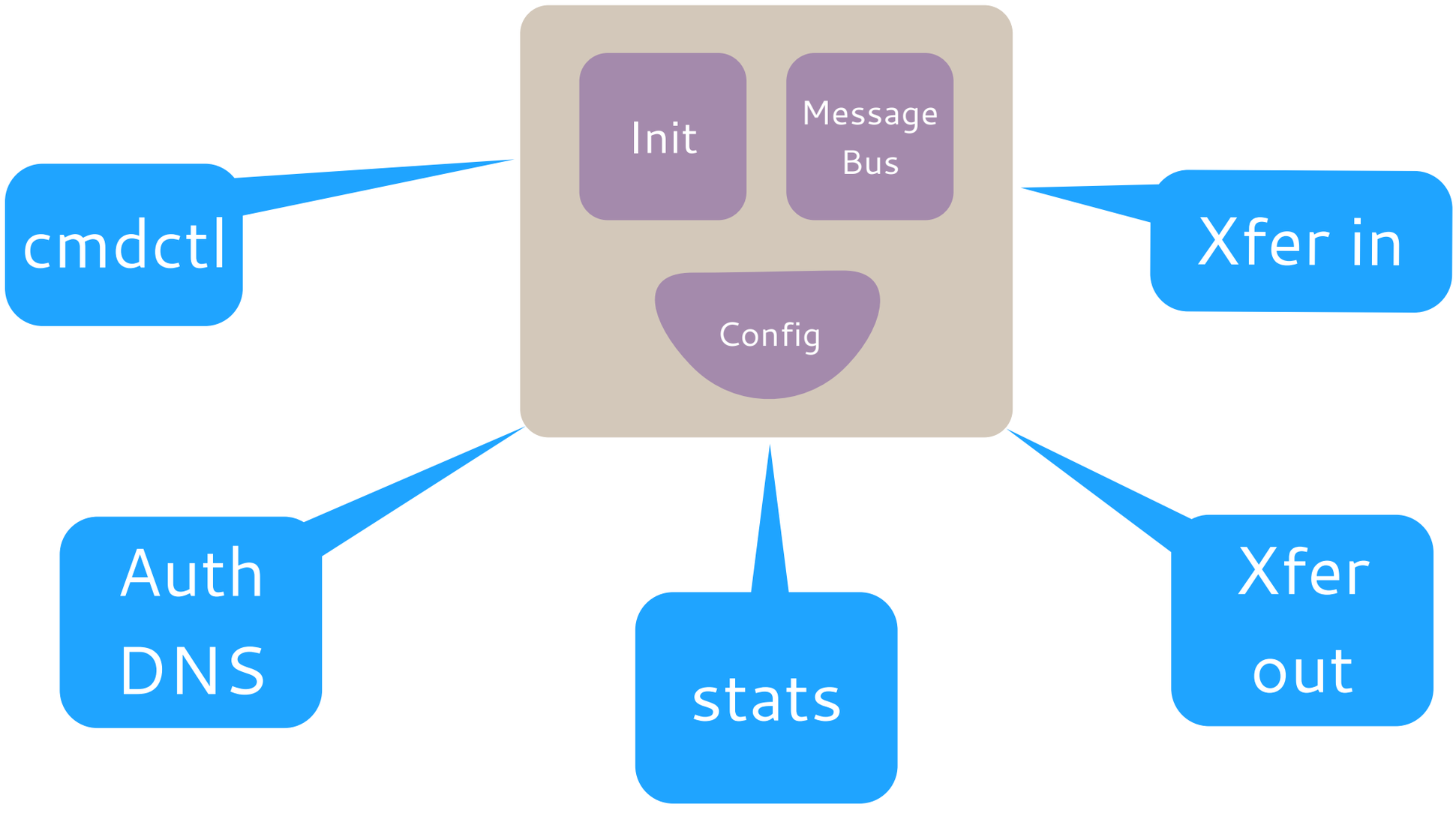
# BIND 10 architecture



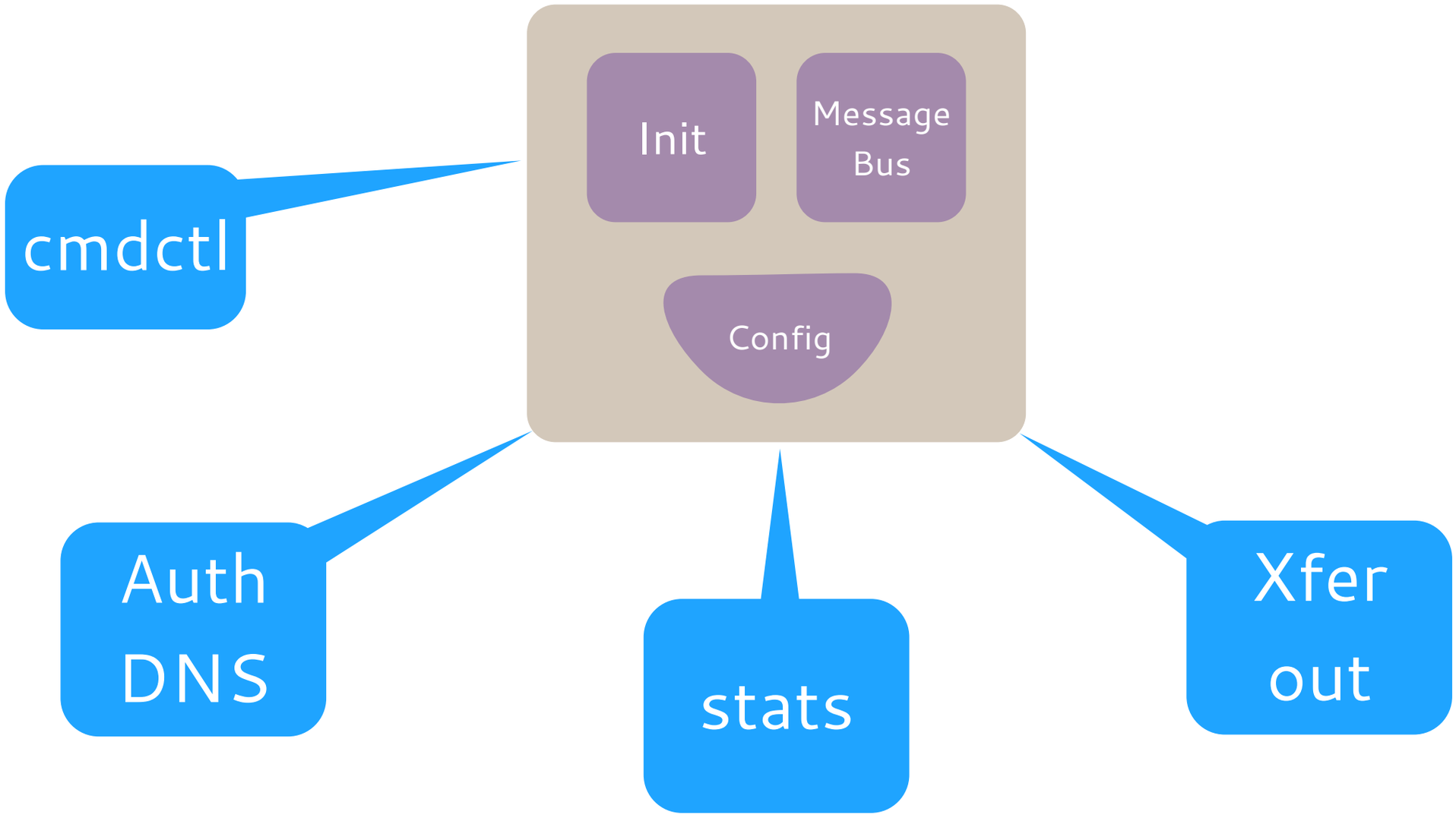
# BIND 10 architecture



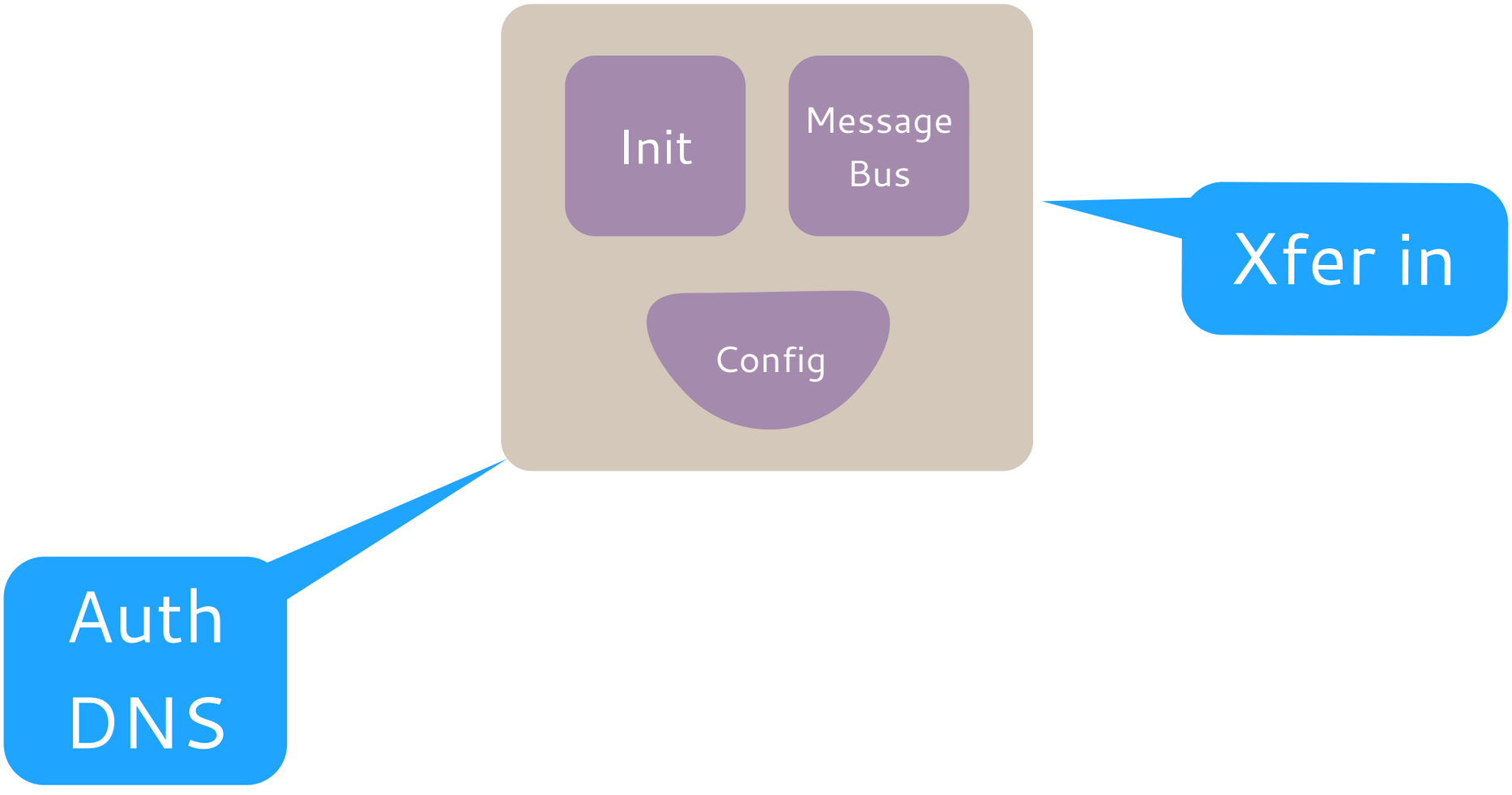
# Example: Authoritative DNS



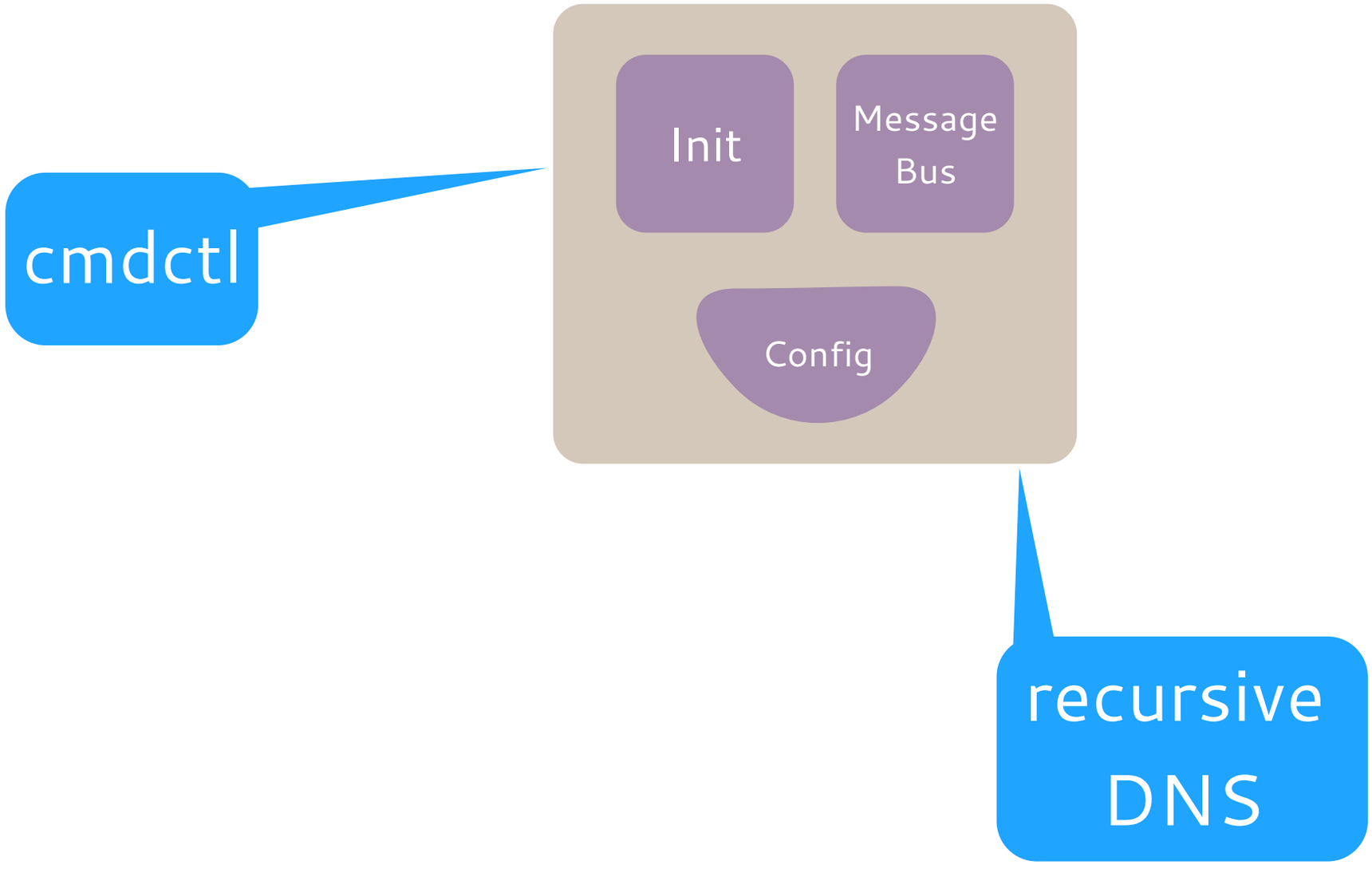
# Example: Authoritative DNS (Master)



# Example: Secondary DNS (Slave)



# Example: caching DNS



# BIND 10 – implementation

- C++
  - core libraries
  - high performance parts
- Python 3.x
  - for everything else
  - bindings to core C++ libraries



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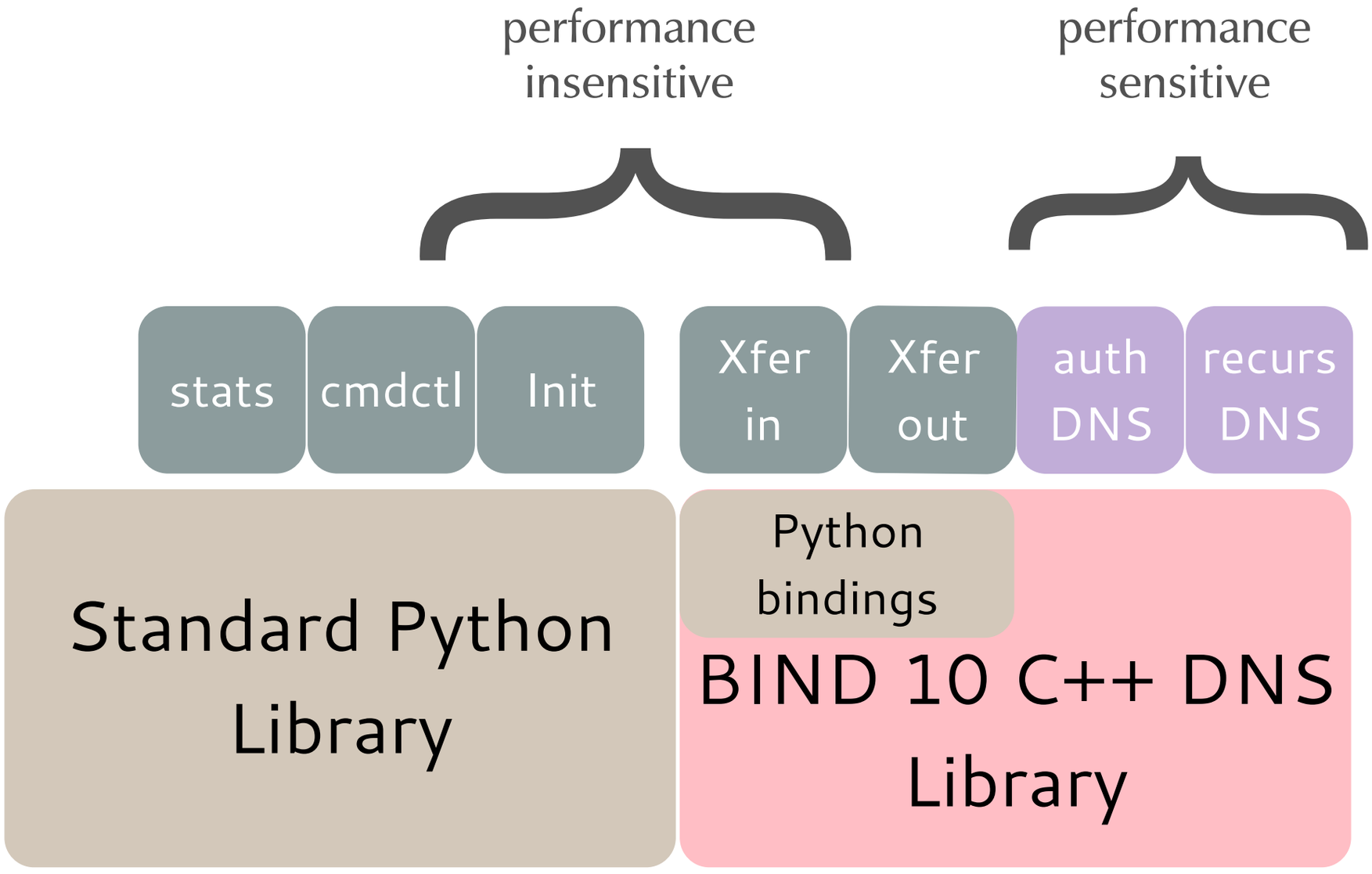
# BIND 10 implementation




# Installing BIND 10

# Installing from packages

- BIND 10 is currently not available in the standard Unix/Linux package repositories

- precompiled BIND 10 packages are available at

  `http://support.menandmice.com/download/bind10`

  - including required dependency packages





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# BIND 10 installation

- The BIND 10 documents the installation steps for popular operating systems at

  http://bind10.isc.org/wiki/InstallStartPage

- The Sourcecode:

  ftp://ftp.isc.org/isc/bind10/





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# Dependencies

- Python3
  - BIND 10 makes heavy use of the scripting language Python
  - some BIND 10 modules are implemented using Python
- BIND 10 requires Python Version 3.1 (or later)
  - many Unix/Linux systems come with Python 2.x pre-installed, but Python3 is available in the package repositories
  - Python2 and Python3 can be installed in parallel





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# Dependencies

- Python3
  - Python3 will replace Python2 as the default Python version in many Unix/Linux systems in the next years
- Homepage: `http://www.python.org/`





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# Dependencies

- BOTAN
  - BOTAN is a library for cryptographic functions similar to OpenSSL
  - many popular DNS products (incl. BIND 9) rely on OpenSSL for their cryptographic functions
  - to prevent monoculture, ISC has decided to base BIND 10 on an alternative crypto-library





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# Dependencies

- BOTAN
  - BOTAN is available in some Unix/Linux repositories
  - BIND 10 requires BOTAN version 1.8 (or later)
  - Homepage: `http://botan.randombit.net/`





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# Dependencies

- log4cplus
  - a logging framework for C++
  - this dependency is sometimes not available from the package repository and must be installed from source
  - BIND 10 requires version 1.0.3 (or later)
  - Homepage: `http://log4cplus.sourceforge.net/`





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# Dependencies

- SQLite
  - SQLite is a lightweight file-based SQL database
  - BIND 10 requires version 3.3.9 (or later) when configured as an authoritative DNS server
  - Homepage: `http://www.sqlite.org/`





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# Building BIND 10

- Building BIND 10 requires a C++ compiler
- standard development headers
- make
- pkg-config





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# Building BIND 10

- BIND 10 builds have been tested with
  - GCC g++
  - Clang++
  - Sun C++





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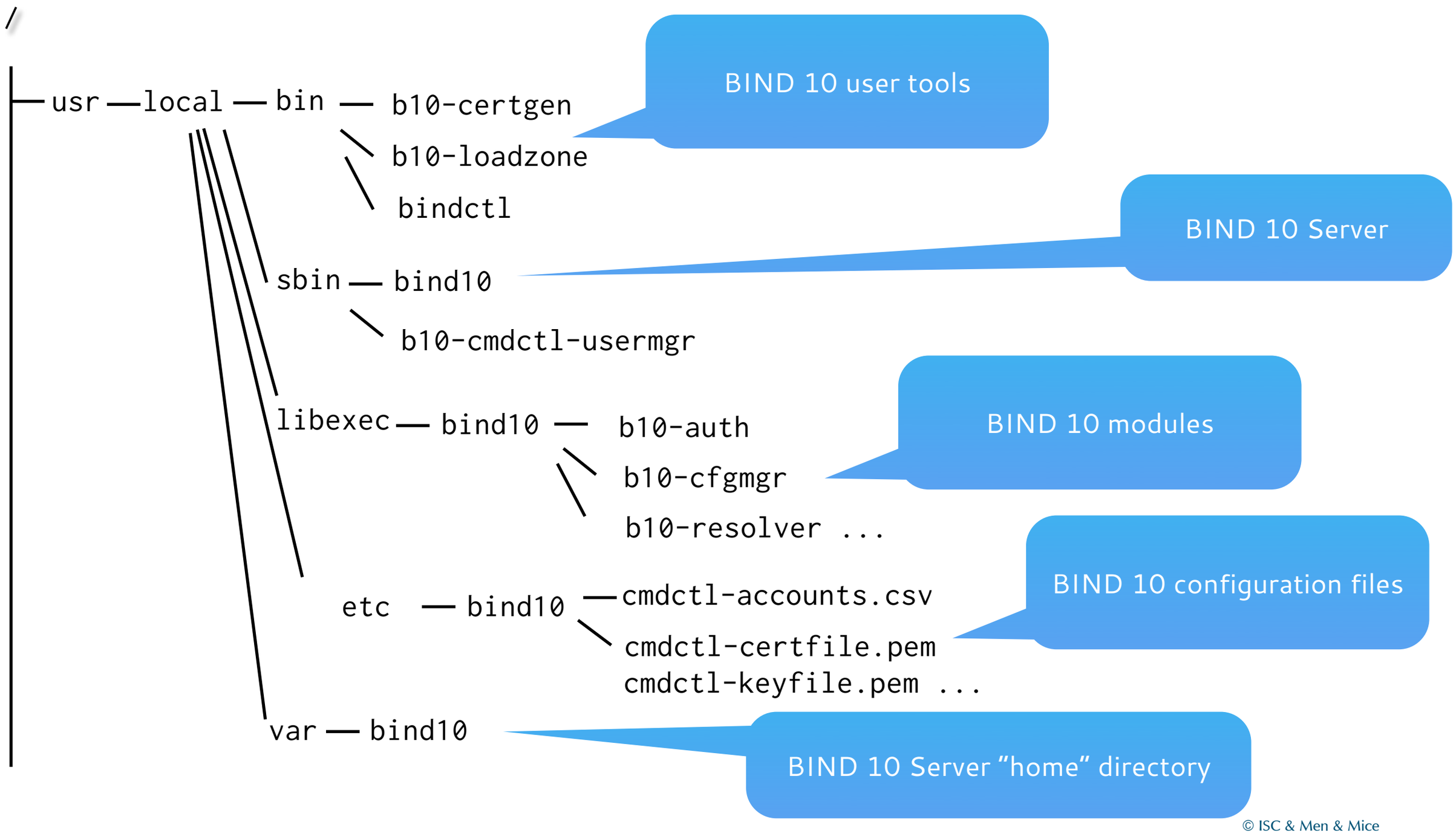
# BIND 10 file locations



# BIND 10 user tools

- BIND 10 currently (Version 1.0.0) does **not** come with tools for dynamic updates or sending queries

- it is recommended to have the BIND 9 tools (dig, host, nsupdate, ...) installed alongside BIND 10

- Unix/Linux package repositories have extra packages for the BIND 9 tools





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# BIND 10 start

- the "bind10" command can launch all BIND 10 subprocesses
- based on the current configuration
- the "bind10" process will run in foreground by default





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bind10 startup messages

# bind10 command

```
[root@bind10]# bind10
2013-02-11 20:24:23.326 INFO  [b10-cfgmgr.cfgmgr/18966] CFGMGR_CONFIG_FILE Configuration manager starting with configuration file: /
usr/local/var/bind10/b10-config.db
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_STARTING starting BIND10: bind10 20110223 (BIND 10 1.0.0-beta)
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_CONFIGURATOR_START bind10 component configurator is starting up
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_COMPONENT_START component Socket creator is starting
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_SOCKCREATOR_INIT initializing socket creator parser
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_COMPONENT_START component msgq is starting
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_STARTING_PROCESS starting process b10-msgq
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_COMPONENT_START component cfgmgr is starting
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_STARTING_PROCESS starting process b10-cfgmgr
2013-02-11 20:24:24.153 INFO  [b10-init.init/18963] BIND10_STARTING_CC starting configuration/command session
2013-02-11 20:24:24.166 INFO  [b10-init.init/18963] BIND10_READING_BOSS_CONFIGURATION reading boss configuration
2013-02-11 20:24:24.166 INFO  [b10-init.init/18963] BIND10_CONFIGURATOR_RECONFIGURE reconfiguring running components
2013-02-11 20:24:24.167 INFO  [b10-init.init/18963] BIND10_COMPONENT_START component b10-cmdctl is starting
2013-02-11 20:24:24.167 INFO  [b10-init.init/18963] BIND10_STARTING_PROCESS starting process b10-cmdctl
2013-02-11 20:24:24.193 INFO  [b10-init.init/18963] BIND10_COMPONENT_START component b10-stats is starting
2013-02-11 20:24:24.195 INFO  [b10-init.init/18963] BIND10_STARTING_PROCESS starting process b10-stats
2013-02-11 20:24:24.251 INFO  [b10-init.init/18963] BIND10_STARTUP_COMPLETE BIND 10 started
2013-02-11 20:24:24.509 INFO  [b10-stats.stats/18968] STATS_STARTING starting
```

# bind10 command

```
[root@bind10] ps -ef
[ ... ]
root     18963 18954  0 20:24 pts/1    00:00:00 /usr/local/bin/python3 /usr/local/sbin/bind10
root     18964 18963  0 20:24 pts/1    00:00:00 b10-sockcreator
root     18965 18963  0 20:24 pts/1    00:00:00 /usr/local/bin/python3 /usr/local/libexec/bind10/b10-msgq
root     18966 18963  0 20:24 pts/1    00:00:00 /usr/local/bin/python3 /usr/local/libexec/bind10/b10-cfgmgr
root     18967 18963  0 20:24 pts/1    00:00:00 /usr/local/bin/python3 /usr/local/libexec/bind10/b10-cmdctl
root     18968 18963  0 20:24 pts/1    00:00:00 /usr/local/bin/python3 /usr/local/libexec/bind10/b10-stats
```





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# Initial configuration

- Adding a new user
  - the tool "b10-cmdctl-usermanager" can be used on the server to add a new user account to the BIND 10 server

```
[root@bind10]# b10-cmdctl-usermgr -f /usr/local/etc/bind10/cmdctl-accounts.csv
Desired Login Name:bind10admin
Choose a password:
Re-enter password:
create new account successfully!

continue to create new account by input 'y' or 'Y':
[root@bind10]#
```





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# DHCP

# DHCP in BIND 10

- unlike BIND 9, which was a DNS server only, BIND 10 also comes with DHCP functionality
  - DHCPv4 for IPv4
  - DHCPv6 for IPv6
- this enables synergy effects
  - direct synchronization between DNS and DHCP
  - use of the same "core" infrastructure (logging, configuration)
  - same configuration tools





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# DHCP in BIND 10

- DHCPv4 and DHCPv6 are independent protocols

- BIND 10 provides separate modules for DHCPv4 and DHCPv6

- the configuration of both components is very similar





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# DHCP in BIND 10

- the DHCP modules store the lease information inside a SQL database

- currently MySQL is supported (more database systems will be supported in future version)

- BIND 10 must be compiled with MySQL support





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# preparing MySQL for BIND 10

- the database for the DHCP components of BIND 10 must be created before BIND 10 DHCP is started
- BIND 10 comes with a script that creates the database tables





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# create DHCP database

```
# mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 5
Server version: 5.1.67 Source distribution

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reserved.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input
statement.

mysql> CREATE DATABASE bind10dhcp;
Query OK, 1 row affected (0.00 sec)
```

this is the MySQL password

creates a new database;

# create the database tables

```
mysql> use bind10dhcp;
Database changed

mysql> SOURCE /usr/local/share/bind10/dhcpdb_create.mysql;
Query OK, 0 rows affected (0.04 sec)
Query OK, 0 rows affected (0.02 sec)
Records: 0  Duplicates: 0  Warnings: 0
Query OK, 0 rows affected (0.03 sec)
Records: 0  Duplicates: 0  Warnings: 0
Query OK, 0 rows affected (0.01 sec)
Query OK, 0 rows affected (0.02 sec)
Records: 0  Duplicates: 0  Warnings: 0
Query OK, 0 rows affected (0.01 sec)
Query OK, 0 rows affected (0.00 sec)
Query OK, 1 row affected (0.00 sec)
Query OK, 1 row affected (0.00 sec)
Query OK, 1 row affected (0.00 sec)
Query OK, 0 rows affected (0.00 sec)
Query OK, 0 rows affected (0.00 sec)
Query OK, 0 rows affected (0.00 sec)
Query OK, 1 row affected (0.00 sec)
Query OK, 0 rows affected (0.01 sec)

mysql> GRANT ALL ON bind10dhcp.* TO bind10@'localhost' IDENTIFIED BY 'bind10password';
Query OK, 0 rows affected (0.00 sec)

mysql> quit;
Bye
```

select the new database

create the tables from the BIND 10 DHCP initialization script

create a user for the BIND 10 dhcp database





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# DHCPv4

- the BIND 10 DHCPv4 server implements DHCP as defined in RFC 2131 and RFC 2132

- BIND 10 DHCPv4 does not support the older BOOTP protocol





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# BIND 10 DHCPv4 limitations

- leases cannot be selected based on client-identifier (Hardware MAC addresses)
  - also known as "reservations" or "static DHCP"
- the DHCP4 component will only respond to DHCP queries coming over UDP from a relay agent. It will not respond to a client on a local attached subnet





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# BIND 10 DHCPv4 limitations

- Upon start, the server will open sockets on all interfaces that are not loopback, are up and running and have IPv4 address

- Interface detection is currently working on Linux only

- The DHCPv4 server does not verify via ICMP (ping) that the assigned address is unused





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# BIND 10 DHCPv4 limitations

- Address rebinding (REBIND) and duplication report (DECLINE) are not supported yet
- DNS Update is not yet supported





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# Extending BIND 10

# customizing BIND 10

- there is no "one-size-fits-all" DNS or DHCP server
  - different environments have different needs
    - performance
    - scalability
    - redundancy
    - reporting
    - ease-of-use
    - provisioning systems ...





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# customizing BIND 10

- BIND 10 architecture design makes it the best DNS and DHCP server to customize
  - large parts are implemented in Python, which is a very accessible programming language
  - the interfaces and protocols between the BIND 10 components are open (and will be documented)
  - it is possible to write custom components (like datasources, web-interfaces, scripting support ...)





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# BIND 10 scripting

- the BIND 10 user interface (bindctl) can be scripted
- from the shell or from within the command line
  - use use of numeric list indices make scripting harder than it should be, that will be solved in future version





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# Example: shutting down BIND 10

```
# cat /usr/local/bin/b10-shutdown

#!/bin/sh
echo "Init shutdown" | bindctl

# b10-shutdown

Exit from bindctl

#
```

# bindctl execute

- bindclt command "execute" can be used to launch scripts of bindctl commands

- Syntax:

  > execute <build-in-script> [show]

  or

  > execute file </path/to/script> [show]

print the commands without executing them





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# Example: bindctl execute

```
> execute init_authoritative_server show

!echo adding Authoritative server component
config add /Init/components b10-auth
config set /Init/components/b10-auth/kind needed
config set /Init/components/b10-auth/special auth
!echo adding Xfrin component
config add /Init/components b10-xfrin
config set /Init/components/b10-xfrin/address Xfrin
config set /Init/components/b10-xfrin/kind dispensable
!echo adding Xfrout component
config add /Init/components b10-xfrout
config set /Init/components/b10-xfrout/address Xfrout
config set /Init/components/b10-xfrout/kind dispensable
!echo adding Zone Manager component
config add /Init/components b10-zonemgr
config set /Init/components/b10-zonemgr/address Zonemgr
config set /Init/components/b10-zonemgr/kind dispensable
!echo Components added. Please enter "config commit" to
!echo finalize initial setup and run the components.
```

# Example: bindctl execute

```
> execute file /var/bind10/scripts/remove_authoritative_server show


!echo Removing the authoritative DNS Server
config remove /Init/components b10-auth
!echo Removing the incoming zone transfer module
config remove /Init/components b10-xfrin
!echo Removing the outgoing zone transfer module
config remove /Init/components b10-xfrout
!echo Removing the zone manager
config remove /Init/components b10-zonemgr
!echo Components removed. Please execute "config commit"
!echo to stop the server modules.


>
```

# Example: bindctl execute

```
> execute file /var/bind10/scripts/remove_authoritative_server


Removing the authoritative DNS Server
Removing the incoming zone transfer module
Removing the outgoing zone transfer module
Removing the zone manager


Components removed. Please execute "config commit"
to stop the server modules.


> config commit
```

# Python 3

- Free Python 3 resources
  - Dive into Python 3 (Book)
    http://getpython3.com/diveintopython3/
  - Python 3 tutorial
    http://docs.python.org/3.3/tutorial/
  - Python Screencasts
    http://www.youtube.com/playlist?list=PLEA1FEF17E1E5C0DA
  - Python 3 Patterns & Idioms (Book)
    https://bitbucket.org/BruceEckel/python-3-patterns-idioms/
  - How to Think Like a Computer Scientist – Python 3 edt. (Book)
    http://openbookproject.net/thinkcs/python/english3e/
  - Learn Python The Hard Way
    http://learncodethehardway.org/





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# The end

# Stay in contact

- the BIND 10 website: http://bind10.isc.org
- BIND 10 Users Mailing list:
  `https://lists.isc.org/mailman/listinfo/bind10-users`
- the BIND 10 Jabber Chat room:
  xmpp:bind10@conference.jabber.isc.org
- BIND 10 Training:
  `http://menandmice.com/training`



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# Thank you!