

# Jitsi on OpenBSD

Puffy presents video conferencing

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**Abstract**—This paper will cover all bits and bolts to fully understand the components at play, their intercommunications and how this knowledge can be used to create a Jitsi-on-OpenBSD setup that features a restricted (compartmentalized) setup using dedicated machines or -as shown- VMM based VMs, where each VM runs only one of the components.

It'll be documented what's necessary to create a sensible `pf.conf` on the host, on each VM and how to add system and application specific startup parameters and configuration of each component.

This paper refers to OpenBSD 7.3 - there is a bonus stage now, too.

**Index Terms**—Jitsi, OpenBSD, VMM

## I. INTRODUCTION

Jitsi and OpenBSD are both not covered much as a documented setup. Installation documents for Jitsi are almost always about Linux OS (and there mostly Debian) and do not cover some internals. The reference documentation on the other hand can be very overwhelming.

There is some FreeBSD “all in one” port (package) with no explanation and it cannot be used to install only core components on different nodes.

This documentation is to show a distributed install on OpenBSD nodes using newly developed native packages and need-to-function (minimum) firewall settings (`'pf.conf'`).

The described configurations will enable a fully integrated video conferencing to be available at `'https://jts.fips.de'` - adapt the shown settings accordingly for your domain.

## II. RIDDLES

Both major players show obstacles that have to be overcome to gain a functioning installation.

### A. Jitsi

A “full blown” Jitsi installation can consist of over over a dozen components and the necessary networking/firewalling configuration can be exhaustive. Any possible discovery magic is not there but the documentation and examples could lead to suspect that.

Some configuration snippets are undocumented and tend to make the understanding poorer not better. Worst example

are necessary DNS settings, startup variable names and `'nginx.conf'`.

The typical answer to be found when asking questions is to use the official ‘all-in-one’ Debian VM or now ‘docker’.

### B. OpenBSD

This also leads to the question if it's possible to run a (core) Jitsi installation on OpenBSD only or if there's (technical) need be for Linux.

Also it's a bit difficult to find example-based documentation on VMM, e.g. for using VMM to provide the VMs and act as the core router, too (`'vm.conf'`). The networking needed has to be adapted in `'pf.conf'`.

Can we scale the installation horizontally and how to use Java based applications with `'rcctl'`?

## III. COMPONENTS

### A. OpenBSD

In this example setup I make heavy use of ‘VMM’ eco system on OpenBSD which consists of:

- `vmm(4)` - virtual machine monitor  
kernel driver isolating/providing the required resources for the VMs (`'hypervisor'`)
- `vmd(8)`  
userland daemon to interact with `'vmm'`
- `vmctl(8)`  
administrative tool to create, start/stop, .. VMs
- `vm.conf(5)`  
persist VMs resource configuration

### B. Jitsi

A core (basic video conferencing) setup comprised by:

- `nginx(8)` web  
serving web assets and reverse proxy BOSH or websockets
- `prosody(8)` xmpp  
conference chat + internal components communication (esp. PubSub for health/discovery)
- `jicofo` - Jitsi COncference FOCus  
room+session handling in conferences (whos talking to whom and where)

jvb - Jitsi videobridge  
mediastream (WebRTC) handlings between participants (SFU)  
jibri - Jitsi BRroadcasting Infrastructure (optional)  
recording + streaming conferences

#### IV. ARCHITECTURE

To host the Jitsi components in a VM each, this uses the following architecture (see Figure 1).

#### V. COMMUNICATIONS

Communication between the components and the logical ‘publication’ + ‘subscription’ in Jitsi is as follows (needed in ‘pf.conf’ later on) (see Figure 2+3).

#### VI. INSTALLATION

The installation is structured in the following steps:

- create VM images
- construct /etc/vm.conf
- add hosts / DNS
- ‘nginx’: install, config, certs
- ‘prosody’: pkg install, config, certs, users
- ‘jicofo’: pkg install, config
- ‘jvb’: pkg install, config

##### A. VM setup

To create an VM image being used in the following setup:

```
rcctl enable vmd
rcctl start vmd
mkdir /home/vmm; cd /home/vmm
vmctl create -s 5G web.qcow2
ftp https://cdn.openbsd.org/pub/OpenBSD\
/7.1/amd64/install171.iso
vmctl start -m 2G -L -i 1 -r install171.iso \
-d /home/vmm/web.qcow2 web
vmctl console web
```

```
## run the (I)nstaller, default options.
## only one 'a' slice on (w)hole disk
## halt -p (so new sshd_keys per VM)
```

```
vmctl stop web
for vm in xmpp jicofo jvb ; do
cp web.qcow2 ${vm}.qcow2; done
echo 'net.inet.ip.forwarding=1' >> \
/etc/sysctl.conf
```

The VM definitions in ‘/etc/vm.conf’ are as follows. The “instance” keyword tells ‘vmctl’ to use “web”’s configuration as a template and only adapt changes like “disk” or “memory” to it.

```
vm "web" {
  enable
  memory 2G
  disk "/home/vmm/web.qcow2" format qcow2
  local interface { up }
}
```

```
vm "web" instance "xmpp" {
  disk "/home/vmm/xmpp.qcow2" format qcow2
}
vm "web" instance "jicofo" {
  memory 4G
  disk "/home/vmm/jicofo.qcow2" format qcow2
}
vm "web" instance "jvb" {
  memory 4G
  disk "/home/vmm/jvb.qcow2" format qcow2
}
```

##### B. DNS + /etc/hosts

DNS is only ONE A-RR for “jts.fips.de”; but local ‘/etc/hosts’ for jicofo (or split DNS).

The following ‘/etc/hosts’ needs to be on each VM and on the VMM host. Use these names in ‘/etc/myname’, too.

```
100.64.1.3    web
100.64.2.3    xmpp jts.fips.de
100.64.3.3    jicofo
100.64.4.3    jvb
```

#### VII. FIREWALLING

On each VM the following ‘pf.conf’ is for good (admin) measure:

```
block return log
pass out quick on egress proto { tcp udp }
to any port { 123 53 80 443 }
pass in quick on egress proto tcp
from $admin to port 22
```

##### A. VMM

Assumption is that all traffic comes via the VMM external IP-address (on egress) here:

```
pass in on egress proto tcp to any
port { 80 443 } rdr-to web
pass in on egress proto udp to any
port { 10000 } rdr-to jvb
pass in proto tcp from { jvb jicofo }
to xmpp port 5222 # native
pass in proto tcp from web to xmpp
port 5280 # http/BOSH
pass in on egress proto tcp to any
port 5280 rdr-to xmpp # debug
# DNS
vms={ web xmpp jicofo jvb }
pass in proto { udp tcp } from $vms
to any port domain rdr-to $resolver
```

##### B. web/nginx

The webserver needs the basic ports and for the proxy connection to BOSH an outgoing to 5280/tcp.

```
pass in quick on egress proto tcp
to self port { 80 443 }
pass out quick on egress proto tcp
to xmpp port 5280
```

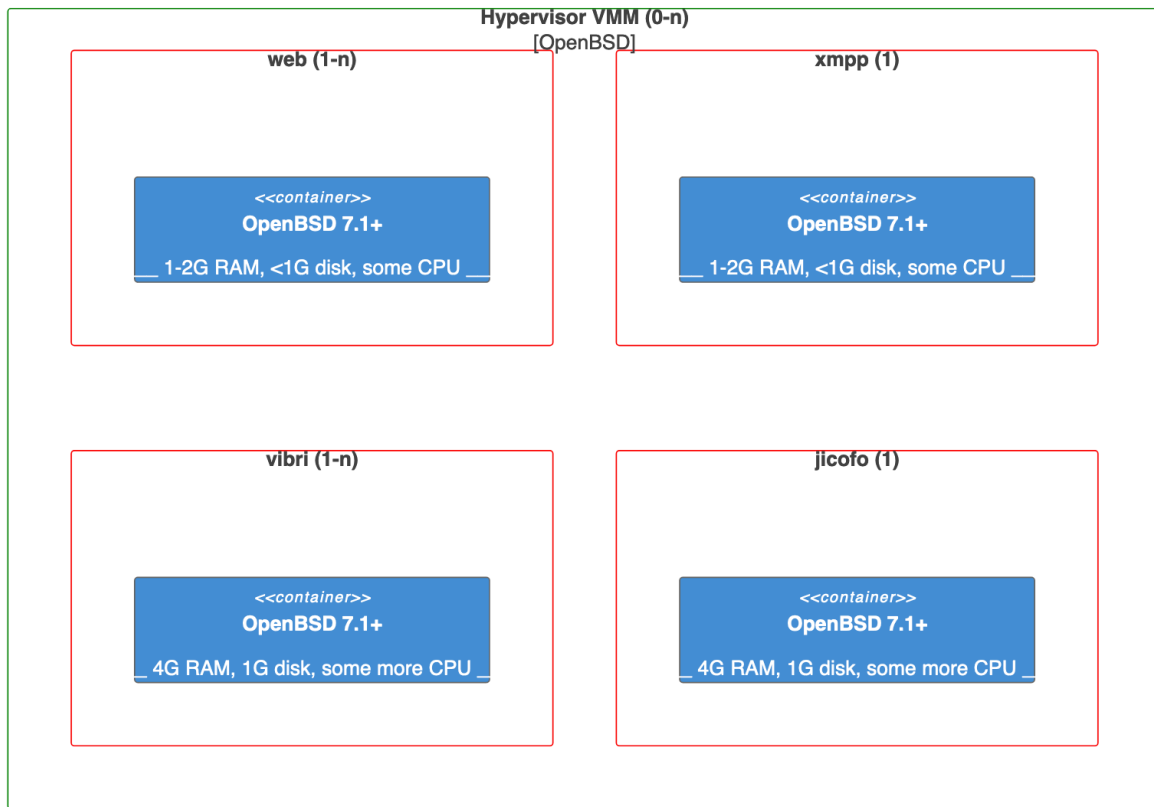


Fig. 1. OpenBSD VMM architecture

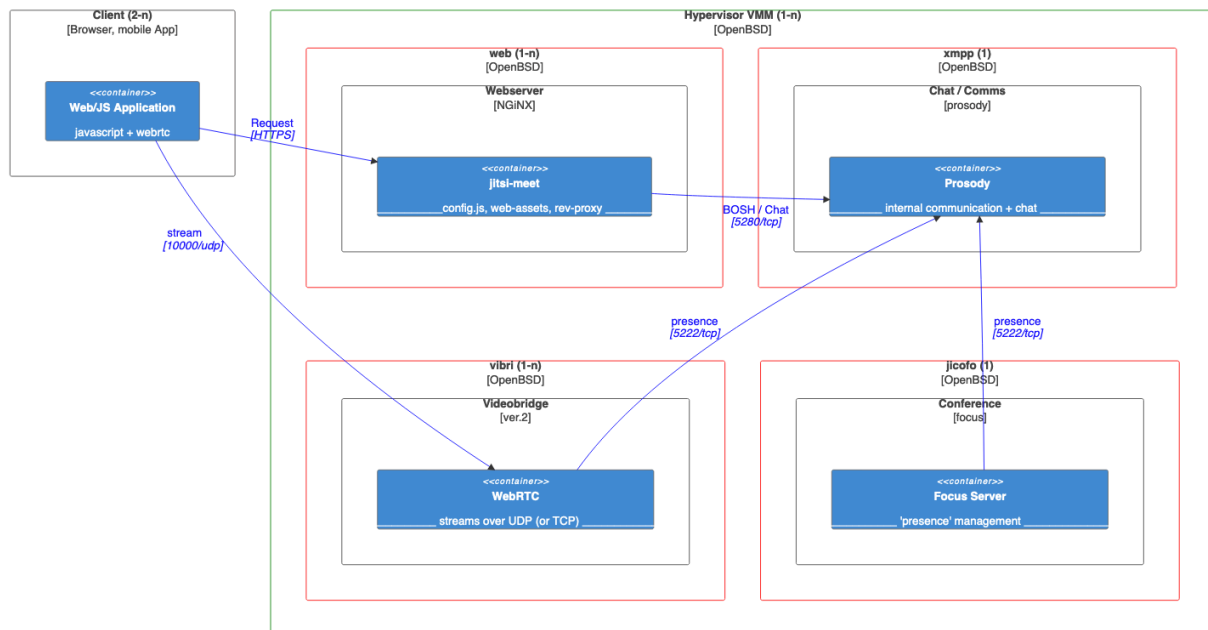


Fig. 2. OpenBSD VMM architecture

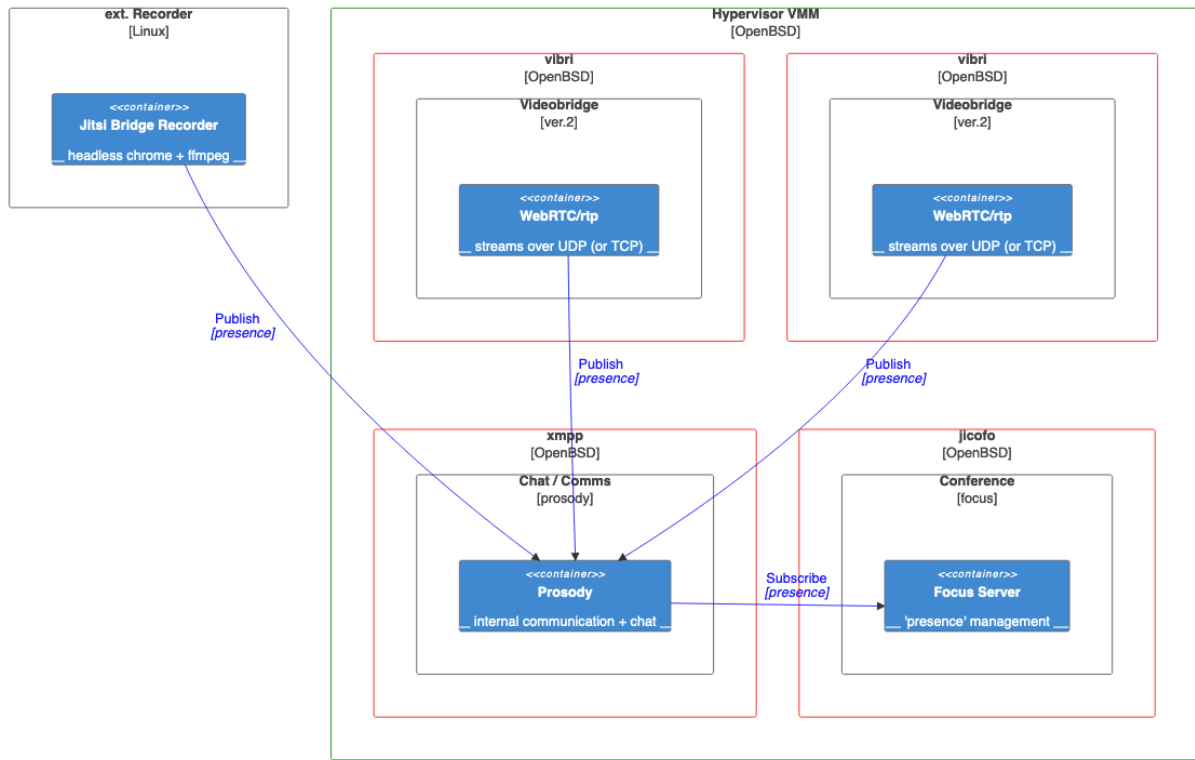


Fig. 3. OpenBSD VMM architecture

### C. prosody

The XMPP "native" only used from jicofo and jvb. The BOSH like as above and if need be the dedicated auth via 5347/tcp (not covered here).

```
pass in proto tcp from { jicofo jvb }
  to self port { 5222 }
pass in proto tcp from web
  to self port 5280
pass in proto tcp from { $admin }
  to self port { 5280 5347 } # debug
```

### D. jicofo

Jicofo talks to prosody as above. The webclient connects to jicofo via 10000/udp. There is an administrative connection possible to 8080/tcp to establish e.g. monitoring with prometheus. To scale out the 10000/udp can be changed and would make use of a port range e.g. "10000:10050" vertically or explicit "rdr-to"s in VMM for horizontally.

```
pass out quick on egress proto
  tcp to xmpp port { 5222 5280 }
pass in quick on egress proto
  udp to self port 10000
pass in quick on egress proto
  tcp from $monitor to self port 8080
```

### E. videobridge

The videobridge only needs to reach out to prosody. The monitoring exporter on 8888/tcp seems to be broken (no

values) as of this writing.

```
pass out quick on egress proto
  tcp to xmpp port 5222
pass in quick on egress proto
  tcp from $monitor to self port 8888
```

## VIII. PROSODY

To install prosody two simple steps are enough.

```
pkg_add unzip--
pkg_add jitsi-prosody-plugins
```

The 'jitsi-prosody-plugins' does contain two needed plugins and some more for use cases not mentioned in this document. Need be is 'mod\_client\_proxy' and 'mod\_roster\_command'.

The modules do not need further configuration in 'prosody.cfg.lua'. 'client\_proxy' gets loaded from the "Component" configuration. The 'roster\_command' is for CLI use only.

The configuration key bits in '/etc/prosody/prosody.cfg.lua' are:

```
http_interfaces = { "*", "://" }
VirtualHost "jts.fips.de"
  authentication = "anonymous";

modules_enabled = { "bosh";
  "pubsub"; }
c2s_require_encryption = false

VirtualHost "auth.jts.fips.de"
```

```
admins = { "focus@auth.jts.fips.de",
  "jvb@auth.jts.fips.de" }

ssl = { key =
  "/var/prosody/auth.jts.fips.de.key";
  certificate =
  "/var/prosody/auth.jts.fips.de.crt"; }

authentication = "internal_hashed"

Component "conference.jts.fips.de" "muc"
Component "jvb.jts.fips.de"
  component_secret = "CHANGE_jvb"
Component "focus.jts.fips.de" "client_proxy"
  target_address =
  "focus@auth.jts.fips.de"
Component "internal.auth.jts.fips.de" "muc"
  muc_room_locking = false
  muc_room_default_public_jids = true
```

The additional 'FQDN' are prosody internal only and do NOT need any DNS configuration (works like an HTTP 'Host' header).

It's possible that 'jvb' follows the example of 'focus' to change authentication from shared secret to a user ('target\_address').

An example for the above configuration will be installed in '/usr/local/share/examples/prosody/' if the 'meta/jitsi' package is being installed.

#### A. Users

The connection for 'jvb' uses a shared secret as shown in the previous configuration. The further users in use here:

```
rcctl enable prosody
rcctl start prosody
prosodyctl register focus \
  auth.jts.fips.de CHANGE_FOCUS
prosodyctl mod_roster_command \
  subscribe focus.jts.fips.de \
  focus@auth.jts.fips.de
```

#### B. TLS

Besides WebRTC demanding the use of 'https' between browser and server side, we shall encrypt all internal traffic, too. For the prosody connections:

```
prosodyctl cert generate \
  auth.jts.fips.de
# fill in the shown `openssl req` dialog

cd /var/prosody
yes | /usr/local/jdk-11/bin/keytool
  -import -alias prosody -file \
  auth.jts.fips.de.crt -keystore \
  jicofo-key.store -storepass jitsicool

cp jicofo-key.store jvb-key.store
# copy to VM jicofo and jvb accordingly
```

'keytool' comes with the JDK package and this task can also be done on jicofo or jvb VM - or copy over the resulting store-files to the jicofo/jvb VM respectively.

Do NOT change JDK's 'lib/security/cacerts' - any later upgrade of JDK would overwrite the changed keystore and result in a loss of comms.

### IX. NGINX

To install nginx and the jitsi web elements (javascript, images, ..) only two packages are needed:

```
pkg_add nginx
pkg_add jitsi-meet
```

A TLS setup is mandatory for browser/jvb or it will refuse to let you use the camera and microphone. Using Let's Encrypt with 'acme-client(1)' for the TLS setup is easily possible and included in './testing-config/nginx.conf' (see "Availability" section).

#### A. web

The configuration for nginx is pretty straight forward:

```
server_name jts.fips.de;
root /var/www/jitsi-meet;

ssi on;
ssi_types application/x-javascript
  application/javascript;

location ~ ^/(libs|css|static|images|
  fonts|lang|sounds|
  connection_optimization)/(.*)$ {
  add_header
    'Access-Control-Allow-Origin' '*';
  alias /var/www/jitsi-meet/$1/$2; }

location /external_api.js { alias
  /var/www/jitsi-meet/libs/external_api.min.js; }

location = /http-bind { # BOSH
  proxy_pass http://xmpp:5280/http-bind;
  proxy_set_header X-Forwarded-For
    $remote_addr;
  proxy_set_header Host $http_host; }
```

```
location ~ ^/([a-zA-Z0-9=\?]+)$ {
  rewrite ^/(.*)$ / break; }
```

If using Let's Encrypt, put the 'well-known' location first after 'ssi' configuration block.

A configuration snippet to be used in '/etc/nginx/conf.d' can be found in '/usr/local/share/doc/pkg-readmes' if the 'meta/jitsi' package is being installed

#### B. jitsi-web

The configuration for the webclient goes to '/var/www/jitsi-meet/config.js':

```
var config = {
  hosts: {
```

```

    domain: 'jts.fips.de',
    muc: 'conference.jts.fips.de'
  },
  bosh: '///jts.fips.de/http-bind',
  useTurnUdp: false,
  ^^IenableWelcomePage: true,
  prejoinConfig: {
    enabled: true,
    hideExtraJoinButtons:
      [ 'no-audio', 'by-phone' ] },
  p2p: {
    stunServers: [
      { urls:
        'stun:meet-jit-si-turnrelay.jitsi.net:443'
      } ] ]
}

```

The use of TURN servers depend on NAT environment(s), most often it is needed (esp. p2p).

A ‘config.js.sample’ and ‘interfaces\_config.js.sample’ is being installed by the package.

## X. JICOFO

The installation is one package and the configuration is split into two files plus adaption of the infra/systems configuration.

### A. JVM / startup

```
pkg_add jicofo
```

```

/etc/jicofo/jicofo.in.sh:
JICOFO_CONF=/etc/jicofo/jicofo.conf
JICOFO_LOG_CONFIG=\
  /usr/local/share/\
  jicofo/lib/logging.properties
JICOFO_TRUSTSTORE=\
  /etc/ssl/jicofo-key.store
JICOFO_TRUSTSTORE_PASSWORD=jitsicool
JICOFO_MAXMEM=3G
JICOFO_DHKEYSIZE=2048
JAVA_SYS_PROPS=""

```

jicofo-key.store is generated from prosody certificate, see prosody in section ‘VIII/B’. One can enable an XMPP-packet-debug-log in logging.properties if need be.

### B. Parameters

The main configuration for jicofo is ‘/etc/jicofo/jicofo.conf’:

```

jicofo { bridge {
  brewery-jid =
    "JvbBrewery@internal.auth.jts.fips.de"
  xmpp-connection-name = Client }
  sctp { enabled = false }
  xmpp {
    client {
      port = 5222
      domain = "auth.jts.fips.de"
      username = "focus"
      password = "CHANGE_FOCUS"
    }
  }
}

```

```

    use-tls = true
  }
  // trusted service domains.
  // Logged in -> advance to bridges
  trusted-domains =
    [ "auth.jts.fips.de" ]
}

```

For proper startup and reachability it’s needed to add “jicofo\_flags=-host=jts.fips.de” to ‘/etc/rc.conf.local’. This needs to be present in ‘/etc/hosts’ or in (split) DNS and the resolved IP address must point to the VM’s local address! Since this is used as a matching string for “virtual host” one cannot use an IP address here!

For proper logging add this to syslog configuration and then jicofo can be started

```

/etc/syslog.conf:
!jicofo
*.*/var/log/jicofo
EOF
rcctl enable jicofo
rcctl start jicofo

```

## XI. VIDEOBRIDGE

The installation is one package and the configuration is split into two files plus adaption of the infra/systems configuration.

Installing ‘jitsi-srtp’ is optional, but the speedup in encryption of WebRTC is substantial. There’s no additional configuration needed, if present JVB will load the native library just by standard means (‘ld.so(1)’).

### A. JVM / startup

```

pkg_add jitsi-videobridge
pkg_add jitsi-srtp

```

```

/etc/jicofo/jvb.in.sh:
JVB_CONF=/etc/jvb/jvb.conf
JVB_LOG_CONFIG=\
  /usr/local/share/jvb/lib/logging.properties
JVB_TRUSTSTORE=/etc/ssl/jvb-key.store
JVB_TRUSTSTORE_PASSWORD=jitsicool
JVB_MAXMEM=3G
JVB_DHKEYSIZE=2048
JVB_GC_TYPE=G1GC
JAVA_SYS_PROPS=""

```

```

/etc/jvb/sip-communicator.properties:
JVB_SC_HOME_LOCATION='/etc'
JVB_SC_HOME_NAME='jvb'

```

jvb-key.store is generated from prosody certificate as for jicofo. Can be same file as /etc/jicofo/jicofo-key.store if both are on one VM.

### B. Parameters

The main configuration file is ‘/etc/jvb/jvb.conf’ as referenced above.

```
videobridge { apis {
  xmpp-client {
    configs {
      ourprosody {
        hostname = "xmpp"
        domain =
          "auth.jitsi.fips.de" // realm
        username = "jvb"
        password = "CHANGE_jvb"
        muc_jids =
          "JvbBrewery@internal.auth.jitsi.fips.de"
        muc_nickname = "jvb-foo"
        disable_certificate_verification =
          true
      } } } }
  sctp { enabled = false } // n/a on OpenBSD
  ice { tcp {
    enabled = false
    port = 443
  } udp {
    port = 10000
  }
}
```

The ‘JvbBrewery’ part is a fixed string and cannot be replaced!

A third party library needs its own configuration file in ‘/etc/jvb/sip-communicator.properties’ as referenced in ‘jvb.in.sh’. The following must be written in three lines and are just split up due to format reasons.

```
org.ice4j.ice.harvest.\
  NAT_HARVESTER_LOCAL_ADDRESS=100.64.4.3
org.ice4j.ice.harvest.\
  NAT_HARVESTER_PUBLIC_ADDRESS=87.253.170.146
org.ice4j.ice.harvest.\
  DISABLE_AWS_HARVESTER=true
```

The LOCAL is the VMs internal address, the PUBLIC must be the one “presented” to the outside world (e.g. nat-to on egress).

JVB does not need any ‘rc.conf’ settings, but add this for logging and startup:

```
cat <<EOF >> /etc/syslog.conf
!jvb
*. *      /var/log/jvb
EOF
rcctl enable jvb
rcctl start jvb
```

## XII. PITFALLS / HINTS

There are some typical pitfalls that should be avoided eventually.

### A. OpenBSD

- ‘rc.conf’: using IP address instead of hostname/FQDN
- startup ordering: nginx, prosody, jicofo, jvb – or wait times increase (pubsub)

### B. Jitsi

Jitsi can have some more subtle ones and some are just advisable.

- xmpp: host vs. virtualhost vs. domain
- DNS: one and only one (or mess up xmpp fallback)
- not disabling sctp (jvb AND jicofo)
- (hidden) version bumps (“no longer component!”)
- jicofo has an XMPP-packetlogger (see ‘logging.properties’)
- patience, be really patient (at initial start)
- always check the ‘,’ in config.js (JSON after all..)

## XIII. STATUS

It works! Some of the packages have landed in 7.2 already:

- ‘net/jitsi/meet’
- ‘net/jitsi/jicofo’
- ‘net/jitsi/videobridge’

Beginning with 7.3 there are also:

- ‘net/jitsi/srtp’
- ‘net/jitsi/prosody-plugins’
- ‘meta/jitsi’

A backport of these three is not difficult (see my talk at EuroBSDCon 2022 for hints) - but 7.3 is already/soon out there!

## XIV. OUTLOOK

The jitsi component ‘jibri’ for recording and/or streaming conferences can only run on Linux for now. Main work would be needed to realize that in an Alpine or NixOS VM or going the long way to get “chromedriver” running on OpenBSD.

Another component might be ‘jigasi’ for SIP/POTS, but unsure about demand and feasibility.

## XV. ACKNOWLEDGMENTS

I want to make a shoutout to ‘Jitsi’ and ‘OpenBSD’ of course. A sincere “THANK YOU” to Aisha Tammy spending lots of effort on making the packages and get them upstream.

My employer to be thanked as well allowing so many hours working on this project.

## XVI. AVAILABILITY

This paper, presentation slides and other directly related resources can be found on github: <https://github.com/double-p/presentations/AsiaBSDCon/2023/>

## REFERENCES

- [1] OpenBSD project <https://www.openbsd.org/>
- [2] Jitsi <https://github.com/jitsi/>
- [3] sysfive.com GmbH <https://www.sysfive.com/>

## XVII. LOGFILES

Some typical logfiles pointing to "known" errors:

*# wrong/missing keystore [in prosody logfile]:*

Sep 16 14:35:58 c2s60a86b47480 info

Client connected

Sep 16 14:35:58 c2s60a86b47480 info

Client disconnected: sslv3 alert certificate unknown

*# wrong password [in prosody logfile]:*

Sep 16 14:36:20 c2s60blaced0c0 info

Stream encrypted (TLSv1.3 with TLS\_AES\_256\_GCM\_SHA384)

Sep 16 14:36:21 c2s60blaced0c0 info

Client disconnected: connection closed

*# all good [in prosody logfile]:*

Sep 16 14:37:00 c2s60a5b549900 info

Stream encrypted (TLSv1.3 with TLS\_AES\_256\_GCM\_SHA384)

Sep 16 14:37:01 c2s60a5b549900 info

Authenticated as focus@auth.jts.fips.de

*# on cannot use a jvb before this log [in jicofo logging]:*

Jicofo 2022-09-16 14:45:24.260 INFO: [35]

[type=bridge brewery=jvbbrewery]

BaseBrewery.addInstance#341: Added brewery

instance: jvbbrewery@internal.auth.jts.fips.de/jvb

*# JVB loading SRTP lib (only active connections)*

INFO: [71] JitsiOpenSslProvider.<clinit>#52:

jitsisrtp successfully loaded **for** OpenSSL 1.1