REBUILD

Simplifying Embedded and IoT Development Using Linux Containers

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We feel developers' pain

Build environments frustration

Versions

Packages

Compilers

Conflicts

Toolchains

Updates

Build environments frustration

It works on my machine!!!

Solution

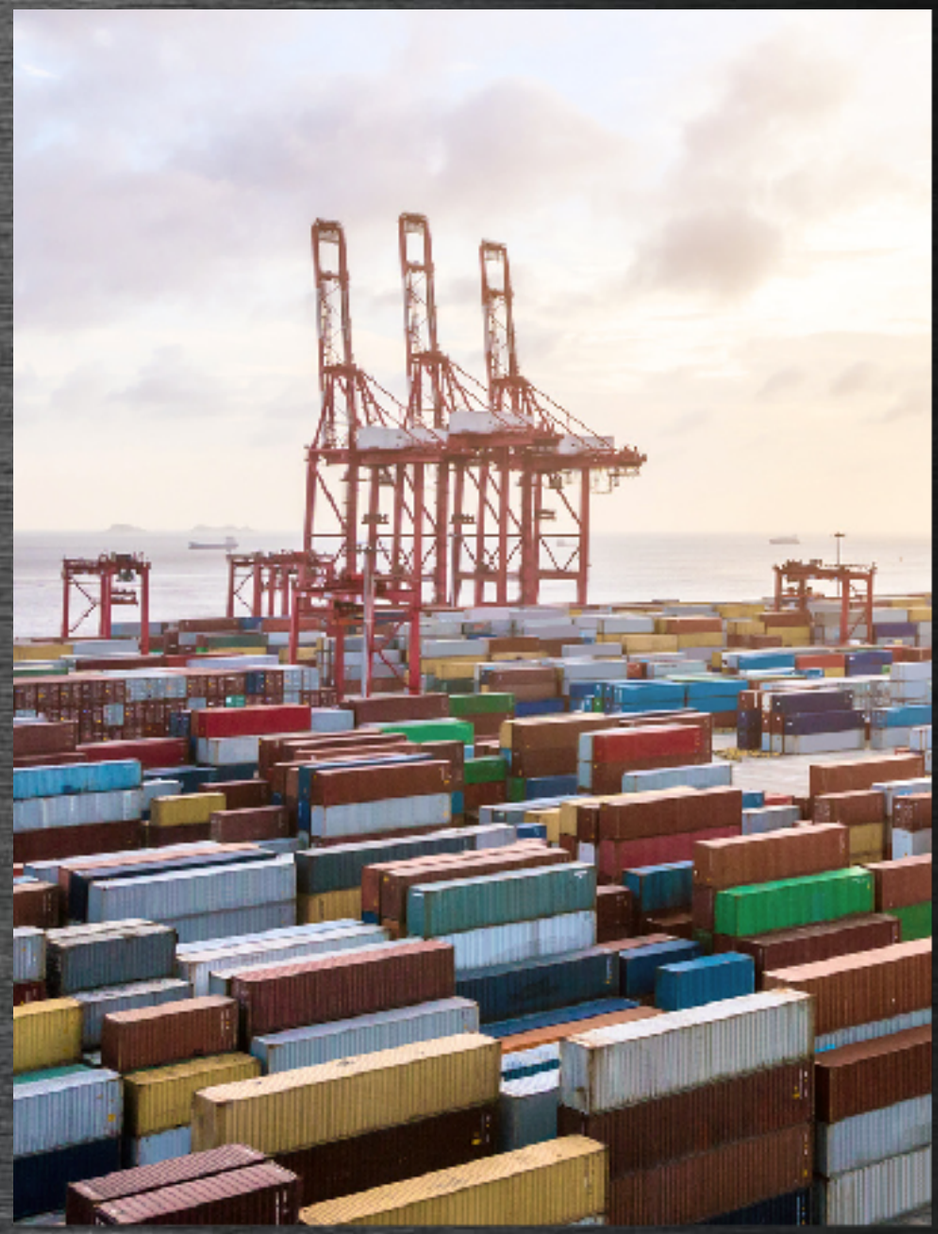
REBUILD

- Leverages containers technology
- Seamless usage of multiple environments
- Environments are easily created and shared
- No more “works on my machine”

DEMO

Underlying magic

- Leverages Linux containers
- Enables correct file permission and ownership
- Works on any modern OS



What are containers?

Linux Containers - is an operating-system-level virtualization method for running multiple isolated Linux systems (containers) on a control host using a single Linux kernel.

What is container’s image?

A lightweight, stand-alone, executable package that includes everything needed to run a piece of software, including the code, a runtime, libraries, environment variables and config files.

https://github.com/rbld/rebuild

Architecture

Rebuild CLI

Docker Engine

Environments registry

Docker private registry

Rebuild native registry

DockerHub

Rebuild CLI

yanvugenfirer — -bash — 95×30

```
Last login: Sun Apr 23 12:14:20 on ttys000
Yans-MacBook-Pro-2:~ yanvugenfirer$ rbld help
Usage:
  rbld help                 Show this help screen
  rbld help COMMAND         Show help for COMMAND
  rbld COMMAND [PARAMS]     Run COMMAND with PARAMS

rebuild: Zero-dependency, reproducible build environments

Commands:

  checkout
  commit
  create
  deploy
  list
  load
  modify
  publish
  rm
  run
  save
  search
  status
  version

Yans-MacBook-Pro-2:~ yanvugenfirer$
```

CLI concepts

- Seamless usage for developer
- No knowledge of Docker, Docker files or other container technologies is needed

CLI concepts: Manage local environments

- Manage environments on local machine
  - List - lists local environments
  - Remove (rm) - deletes local environment
  - Save\load - saves or loads to\from container image

CLI concepts: Environment names and versioning

- name:tag
  - Name - environment ID
  - Tag - should be used for tracking the version of the environment

CLI concepts: Deploy

- Deploy environment from remote registry to local machine
- Search repository for environments
- Need to be done once
- Environment can be instantly used after deployment

CLI concepts: Run

- Run the environment
  - Environment doesn't change in the process of running
  - Can be used in interactive mode or to run just one command
  - Changes to local files are preserved with correct permissions and ownership

CLI concepts: Create

- Create new environment
- From base image from DockerHub
- From archive of a file system

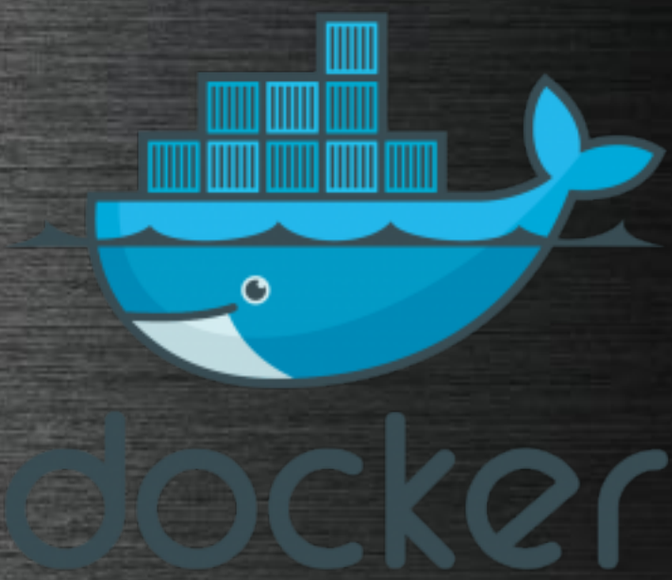
CLI concepts: Modify, status and commit

- Change existing environment
  - Modify - instructs rebuild to track changes in existing environment
  - Status - shows environments' status
  - Commit - saves the changes and create new tag for the environment

CLI concepts: Publish

- Share your work
- “Pushes” the environment to repository

Registry: DockerHub



- Images saved to public cloud
- Images can be shared with everybody
- Images from official repositories can be used as base images for new environments

Registry: Docker private registry

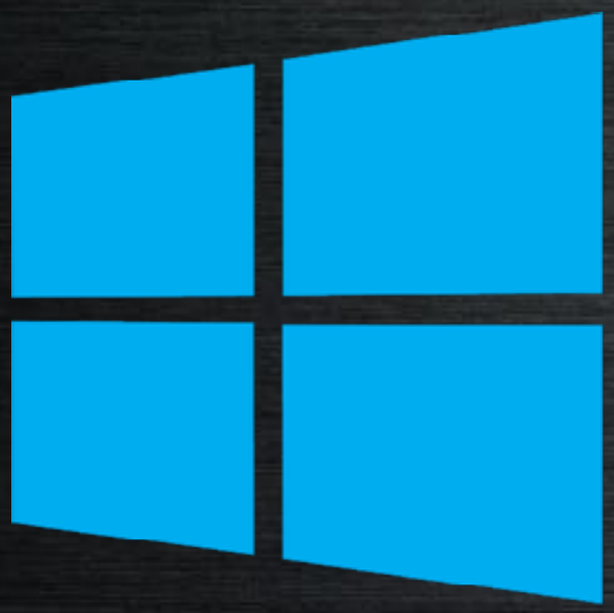
- Docker enterprise or community addition of private registry
- Internal to your organisation
- Might need additional configurations

PRIVATE DOCKER CONTAINER IMAGES

Registry: Rebuild Native registry

- Easy to deploy and use in production
- Lightweight
- Internal for your organisation
- No configuration is needed

Supported OSes



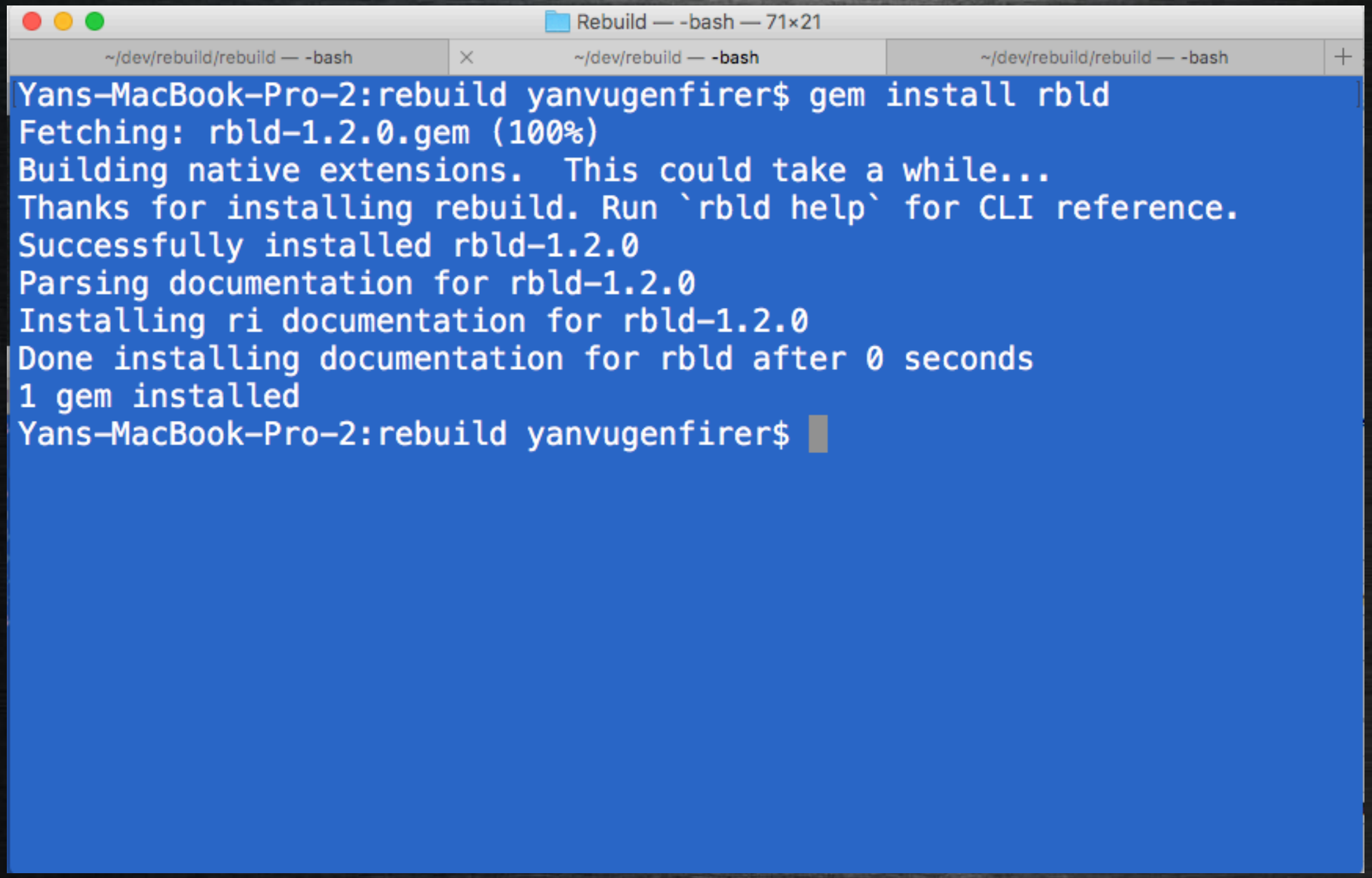
OS X

Installation

Installation - dependencies

- Docker engine
- Ruby 2.0+

Installation



Quick start

- Run: rbld help
- Already configured to deploy environments from Rebuild DockerHub repositories
- Can create environments based on DockerHub

Get Help

Rebuild — -bash — 77×25

~/dev/rebuild/rebuild — -bash | ~/dev/rebuild — -bash | ~/dev/rebuild/rebuild — -bash

```
Yans-MacBook-Pro-2:rebuild yanvugenfirer$ rbld help
Usage:
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  run
  save
  search
  status
  version

Yans-MacBook-Pro-2:rebuild yanvugenfirer$
```

Configuration: DockerHub

- $HOME/.rbld/rebuild.conf

```
#DockerHub
REMOTE_NAME=origin
REMOTE_TYPE_origin="dockerhub"
REMOTE_origin="<NAMESPACE>/<REPOSITORY>"
```

Configuration: Rebuild registry

- $HOME/.rbld/rebuild.conf

```
#Rebuild registry
REMOTE_NAME=origin
REMOTE_TYPE_origin="rebuild"
REMOTE_origin="<ABSOLUTE PATH TO
REGISTRY ROOT DIRECTORY>"
```

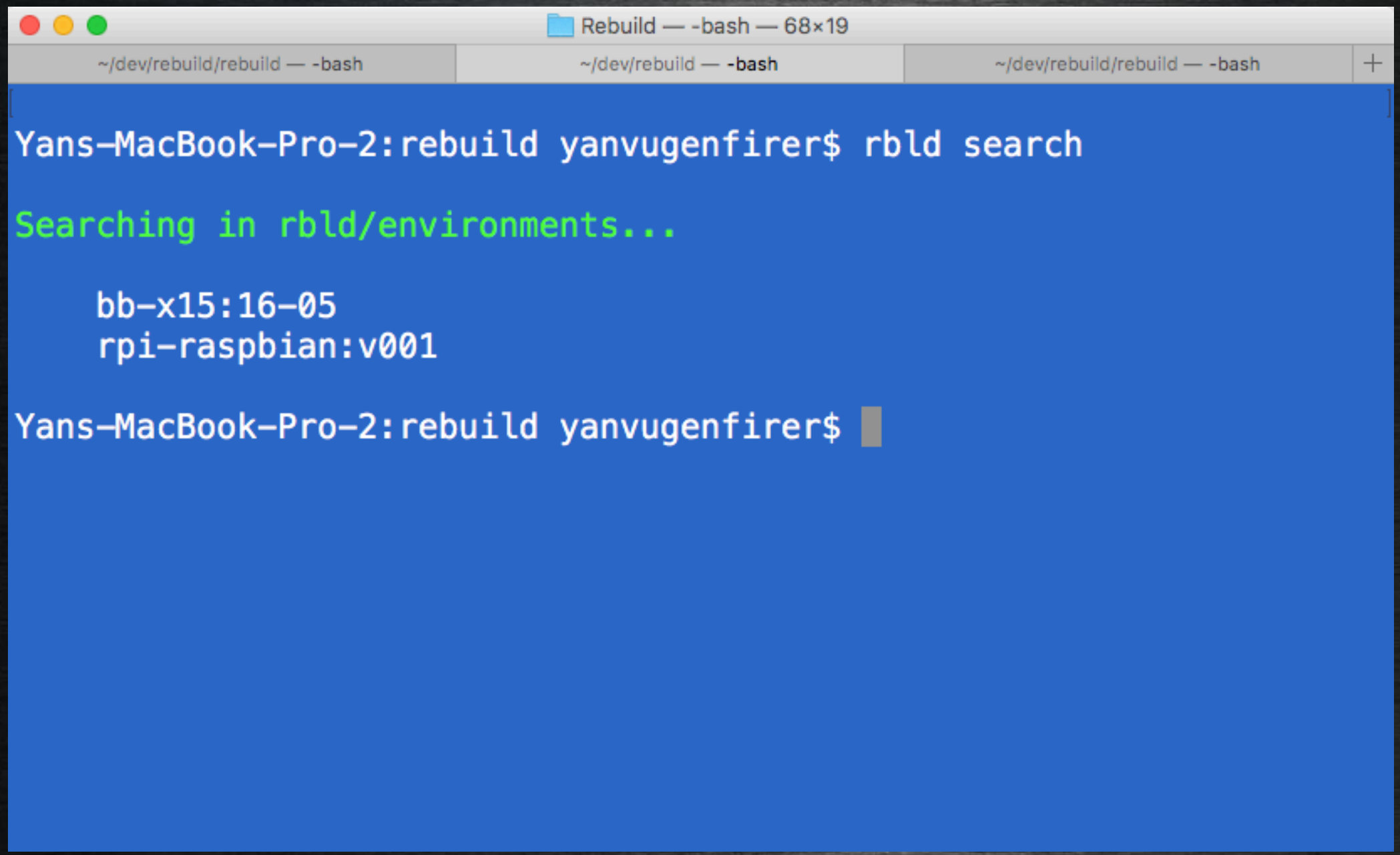
Configuration: Docker Registry

- $HOME/.rbld/rebuild.conf

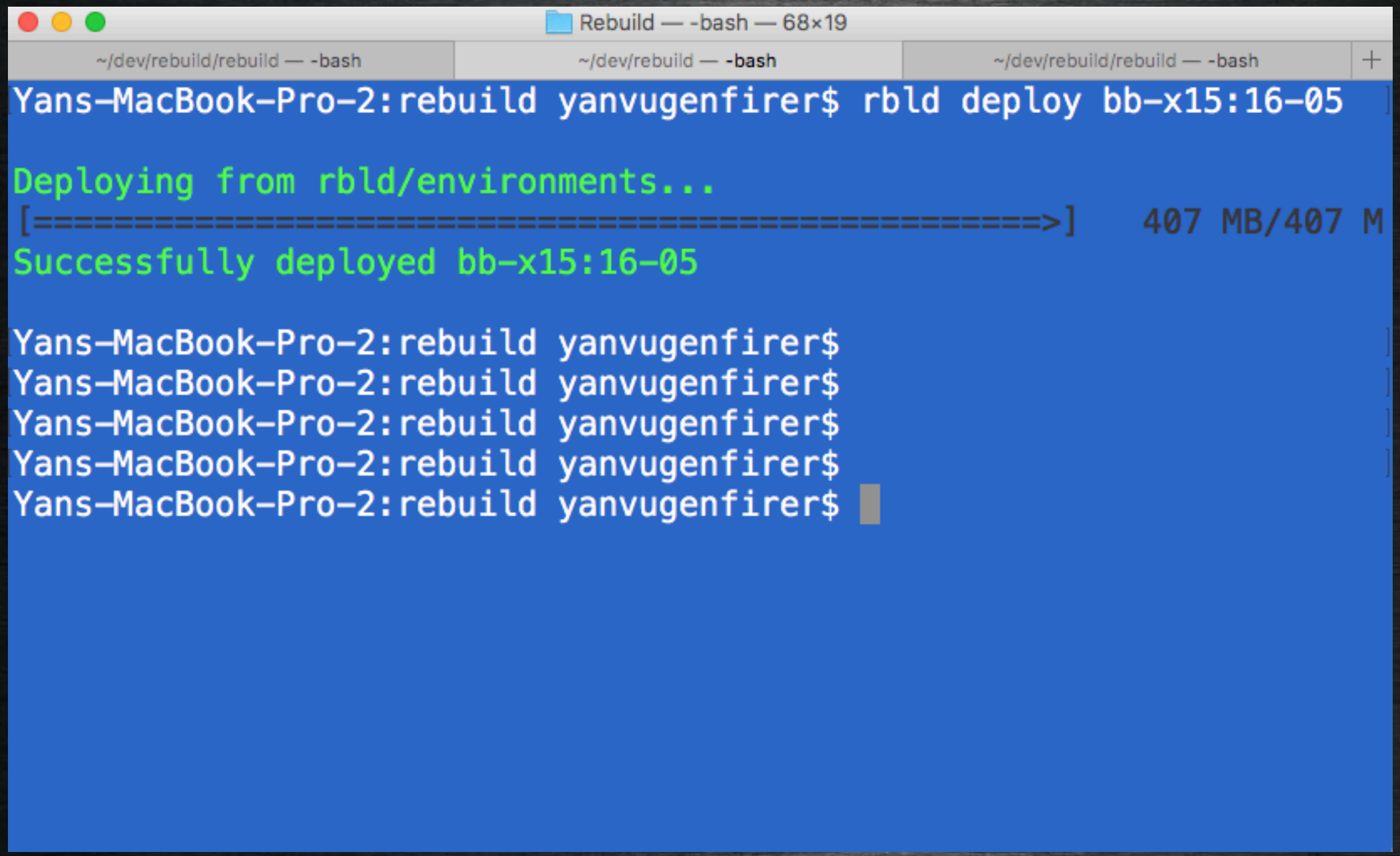
```
#Docker registry
REMOTE_NAME=origin
REMOTE_TYPE_origin="docker"
REMOTE_origin="<REGISTRY IP>:<PORT>"
```

Environment deployment

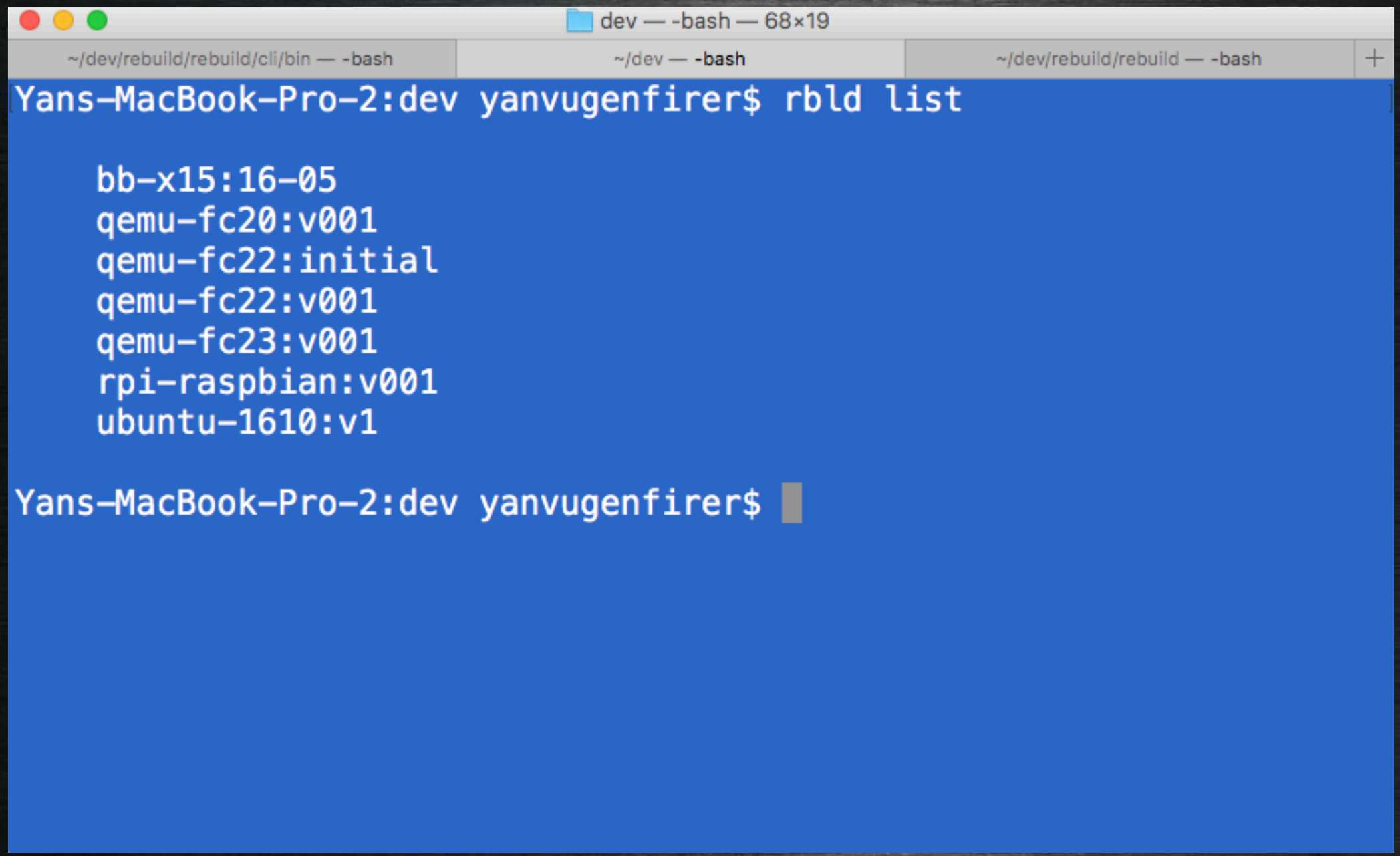
Environment deployment - search in registry



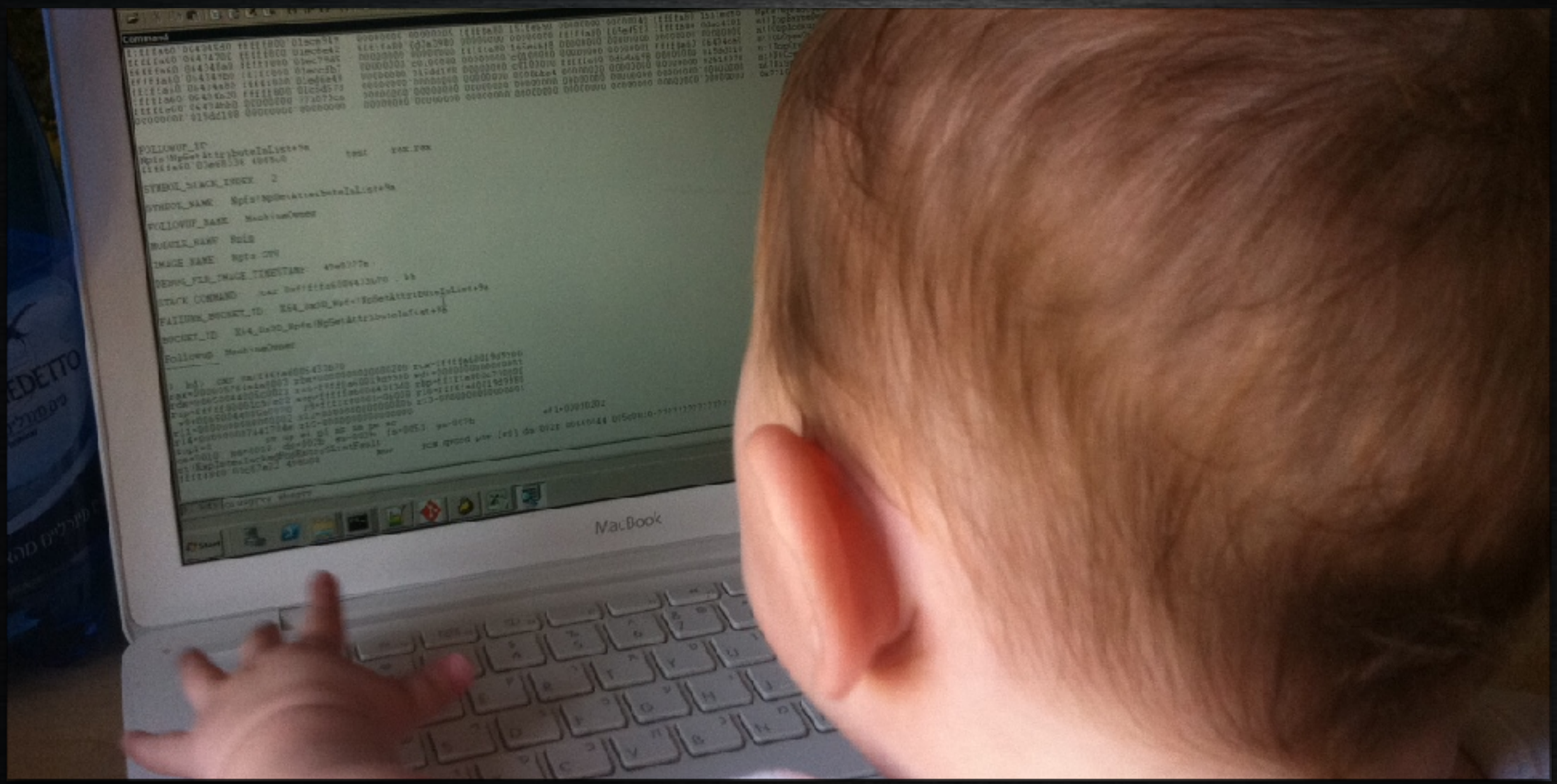
Environment deployment



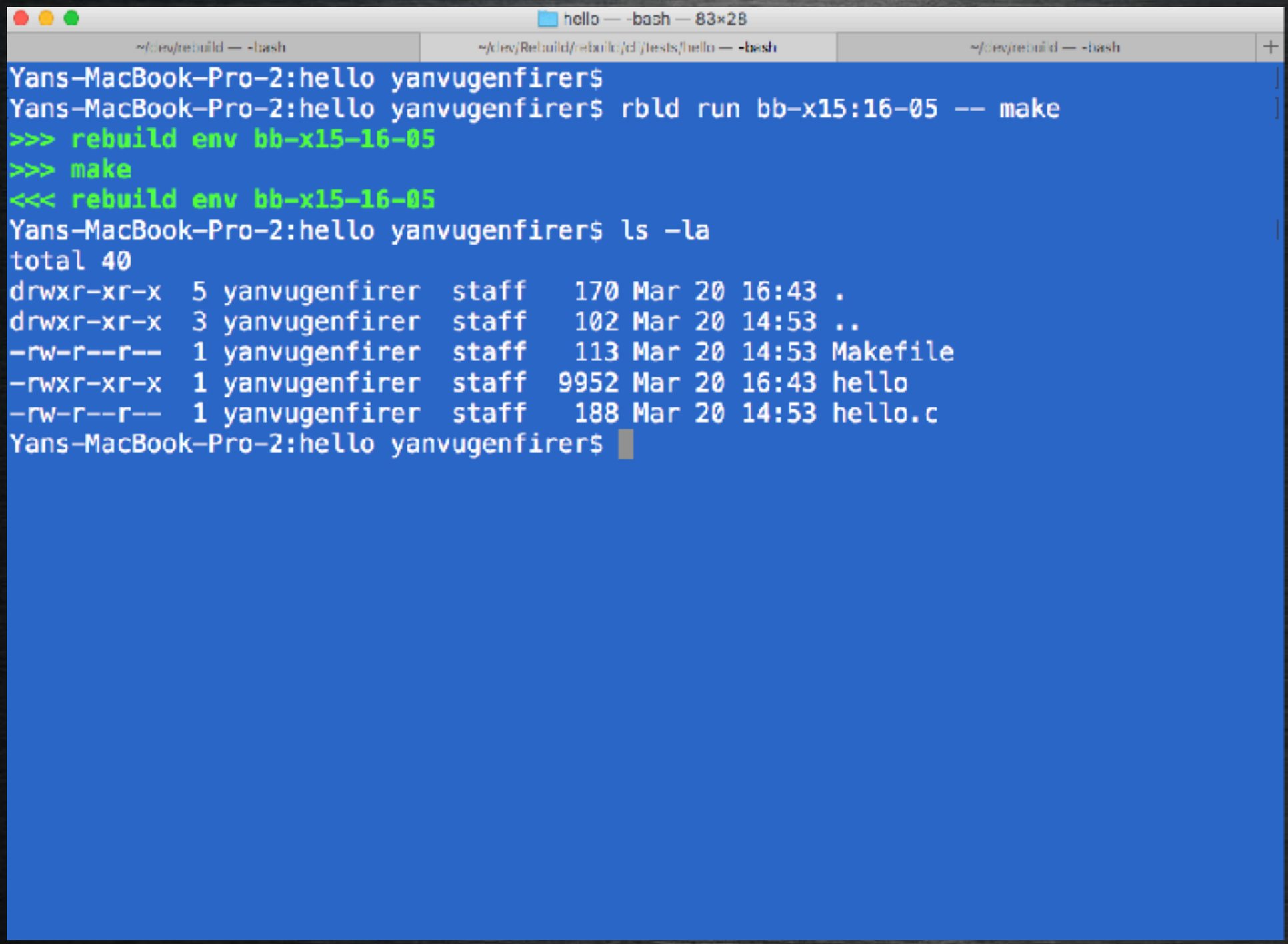
Environment deployment



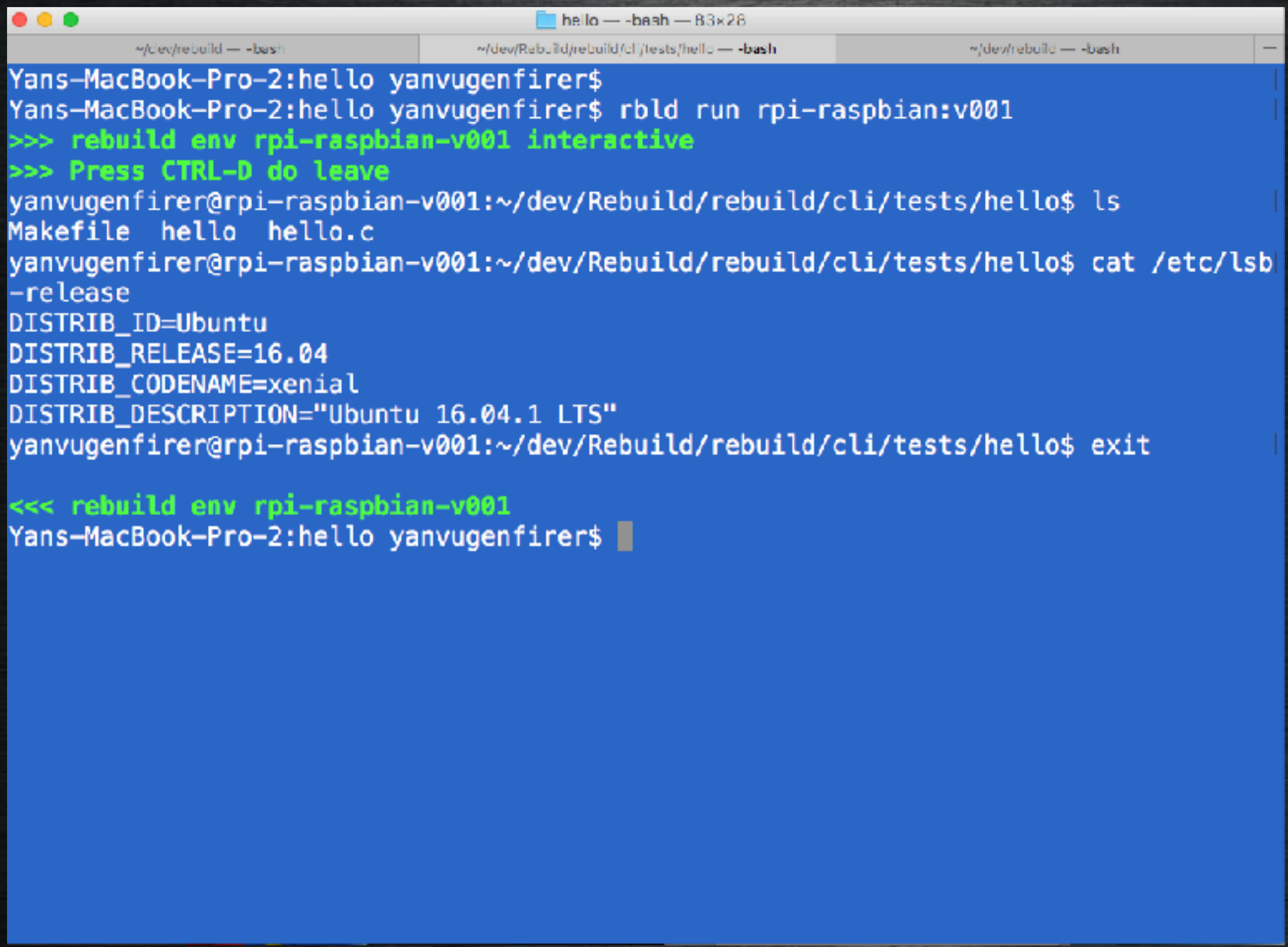
Usage



Usage - single command



Usage - interactive



Environment creation

Environment creation

```
[test@rebuild-fedora23-1 ~]$ rbld create --base ubuntu:
15.10 ubuntu1510
Downloading the base image...
Trying to pull repository docker.io/library/ubuntu ...
15.10: Pulling from library/ubuntu

...

Successfully created ubuntu1510:initial
```

Environment creation

```
[test@rebuild-fedora23-1 ~]$ rbld create --basefile
alpine34.tar.gz alpine34

Building environment...

...

Successfully created alpine34:initial
```

Environment modification

Modify

```
[test@rebuild-fedora23-1 ~]$ rbld modify ubuntu1510 -- \
                                    "sudo apt-get update &&
\
                                   sudo apt-get install -y
gcc"

Initializing environment [.....]
>>> rebuild env ubuntu1510:initial-M
>>> sudo apt-get update && sudo apt-get install -y gcc
Hit http://archive.ubuntu.com wily InRelease

...

Processing triggers for libc-bin (2.21-0ubuntu4.3) ...
<<< rebuild env ubuntu1510:initial-M
```

Modify - interactive mode

```
[test@rebuild-fedora23-1 ~]$ rbld modify
ubuntu1510:initial

Initializing environment [.....]
>>> rebuild env ubuntu1510:initial-M interactive
>>> Press CTRL-D do leave
test@ubuntu1510:initial-M:~$
```

Get status

```
[test@rebuild-fedora23-1 ~]$ rbld status

        modified: ubuntu1510:initial
```

Commit changes to environment

```
[test@rebuild-fedora23-1 ~]$ rbld commit --tag v001
```

Revert changes

```
[test@rebuild-fedora23-1 ~]$ rbld checkout ubuntu1510:initial
```

Environment-wide variables

```
[test@rebuild-fedora23-1 ~]$ rbld modify ubuntu1510:initial

Initializing environment [.....]
>>> rebuild env ubuntu1510:initial-M interactive
>>> Press CTRL-D do leave
test@ubuntu1510:initial-M:~$ sudo vi /rebuild/rebuild.rc
test@ubuntu1510:initial-M:~$ cat /rebuild/rebuild.rc
# This is the rebuild environment definition file.
# Define required environment variables here.
#
# NOTE: Make sure to prefix definitions with
# 'export' directive, i.e.
#export MY_PATH=/path/to/some/location
export CC=clang

test@ubuntu1510:initial-M:~$ exit
<<< rebuild env ubuntu1510:initial-M
```

Putting all together

```
git clone git://github.com/raspberrypi/tools.git rpi-tools

rbld create --base ubuntu:16.04 rpi-raspbian

rbld modify rpi-raspbian:initial
>> sudo apt-get update
>> sudo apt-get install -y make
>> TOOLCHAIN=gcc-linaro-arm-linux-gnueabihf-raspbian-x64
>> sudo cp -r rpi-tools/arm-bcm2708/$TOOLCHAIN /
>> echo export CC=/$TOOLCHAIN/bin/arm-linux-gnueabihf- |
sudo tee -a /rebuild/rebuild.rc
>> exit

rbld commit rpi-raspbian --tag v001
```

Sharing environments - publishing to registry

```
[test@rebuild-fedora23-1 ~]$ rbld publish qemu-fc22:v001
Checking for collisions...

Publishing at 10.0.110.110:5000...

...

Successfully published qemu-fc22:v001
```

Sharing environments - saving and loading from file

```
[test@rebuild-fedora23-1 ~]$ rbld save qemu-fc20:v001
Successfully saved environment qemu-fc20:v001 to qemu-
fc20-v001.rbld


[test@rebuild-fedora23-1 ~]$ rbld load qemu-fc20-v001.rbld

Successfully loaded environment from qemu-fc20-v001.rbld
```

Debugging

- Rebuild CLI
  - RBLD_LOG_LEVEL - info, warn, error and fatal
  - RBLD_LOG_FILE - save logs to file
- Environment bootstrap tracing
  - RBLD_BOOTSTRAP_TRACE - set to 1 to enable environment startup tracing for rbld run and rbld modify.

https://github.com/rbld/rebuild

Summary

- Seamless usage
- Isolated environments
- Easy to share the environments between team members

Future plans

- Enterprise Dashboard with role management
- Multiple registries support
- Support for additional image registries
- USB redirection for non-Linux hosts


Q&A

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https://github.com/rbld/rebuild