

Uni Web Topics Presentation

Presentation on Cloud Native Development

Felix Pojtinger

2021-11-19

Introduction

Contributing

These study materials are heavily based on professor Heuzeroth's "Spezielle Themen für Web-Anwendungen" lecture at HdM Stuttgart.

Found an error or have a suggestion? Please open an issue on GitHub (github.com/poijntfx/uni-webtopics-notes):



Figure 1: QR code to source repository



Figure 2: AGPL-3.0 license badge

Uni Web Topics Presentation (c) 2021 Felix Pojtinger and contributors

SPDX-License-Identifier: AGPL-3.0

Overview

- What is DevOps?
- Which parts of the software lifecycle does it cover?
 - Development
 - Distribution (I will focus on this today)
 - Operation
- What is “cloud native”?
- Why are “traditional” distribution methods still relevant?

Development

Development

- DevOps: Also includes development!
- Modern development should not be bound to any client attributes
- It should not matter if the client is a RISC-V Linux machine, a locked-down Windows workstation or an Android phone
- Development should be possible from any platform, for any platform
- The only truly cross-platform application framework is the web
- PWAs make it possible for web apps to have all the features native apps have
- PWAs work offline by default
- Why not make our development environments PWAs?

Distribution

Basic Distribution Principles

- Binaries
 - Compiled forms of software
 - On Linux: ELF binaries, PE binaries on Windows and MACH-O binaries on macOS
 - Binaries can be statically or dynamically linked
 - Statically linked: Since the Linux ABIs are stable, one can depend on them not changing - this allows not linking against any specific C library and makes the resulting binary portable across distributions. It also allows including all external dependencies into the binary, effectively making it a “single-file” distribution method
 - Dynamically linked: Thanks to dlopen and package management, dynamic linking can also be used. Most of the time (especially on non-Linux OSes), at least the C library and external dependencies (i.e. SQLite) thus need to be available in LD_LIBRARY_PATH at runtime; if they are not, the application can’t continue. This makes the binaries non-portable across distributions: for example, if a binary is

Packaging Overview

- What is a package?
 - Includes the binary, assets, metadata and signature
 - Is self-describing
 - Mostly some form of archive (i.e. RPM, .tar.gz) in combination with a metadata file and signature
- What is a package manager?
 - Can install, remove and update packages
 - Mostly two components: Low-level tool to install and remove package files (dpkg on Debian, rpm on Fedora) and a high-level tool to search, download, install and resolve dependencies (apt on Debian, dnf on Fedora)
 - Can resolve and install runtime and build-time dependencies (i.e. dependency on C library, SQLite, SDL2, headers for cURL etc.)
 - Can check GPG signatures of

Distribution to RedHat Enterprise Linux

- RHEL is a very popular distribution and serves as the upstream of many other distros (CentOS, Rocky Linux etc.)
- Fedora Linux is its upstream
- Is based on the RPM package format and the DNF package manager
- Commercial
- Very long support cycles (at least ten years per major release)
- RPM package format: Demo
- DNF package manager and repositories: Demo

Distribution to Debian GNU/Linux

- Debian is another very popular distribution that also serves as the upstream of many other distros (Ubuntu, Linux Mint, Pop!_OS etc.)
- Is based on the DEB package format and the APT package manager
- Community-Driven, completely Free Software
- 5 years support per major release
- DEB package format: Demo
- APT package manager and repositories: Demo

Distribution to Linux (universal)

- Flatpak is a universal package format for Linux (“apps for Linux”)
- Sandboxed
- Standalone/runtime-based (does not depend on OS-provided libraries)
- Runs on all Linux distributions, even older major releases:
Allows the user to install modern software on stable systems like Debian
- Permission system: Camera, File Access, Terminals
- Portals: Allow interaction with host system (i.e. screen sharing, file access etc.)
- Includes a universal repository system
- Demo: Setting up Flatpak and installing “Video Downloader”
- No concept of source packages; a single YAML/JSON manifest (reverse FQDN) is the source package and serves as the build

In Comparison: Distribution to Android, Windows and macOS

- APKs in F-Droid repository
- MSI package with auto-updates
- DMG package with auto-updates

Distribution to Kubernetes/the Cloud

- Docker
- Kubernetes
- Helm
- Skaffold

- WASM-Binary
- WASI/wasm_exec equivalents

Operation

- Sentry
- OpenTelemetry
- Prometheus
- Grafana

- Bagop
- Hydrun
- GitHub Actions
- Semantic Release