Uni Web Topics Presentation

Presentation on Cloud Native Development

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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/pojntfx/uni-webtopics-notes):

Figure 1: QR code to source repository

Figure 2: AGPL-3.0 license badge

Overview

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 overview
- Flatpak's build system and differences to traditional packages
- Flatpak repository

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

Distribution to Kubernetes/the Cloud

- Docker
- Kubernetes
- Helm
- Skaffold

Distribution to WebAssembly

- WASM-Binary
- WASI/wasm_exec equivalents

Operation

Operation

- Sentry
- OpenTelemetry
- Prometheus
- Grafana

Pipelines

- Bagop
- Hydrun
- GitHub Actions
- Semantic Release