

Deployment Infrastructure

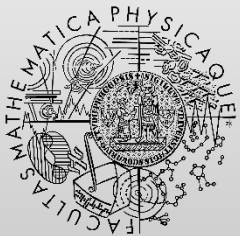
<http://d3s.mff.cuni.cz>

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Dependable
Systems



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Motivation

- Presenting your software in expected settings
 - To whom: labs tutor, lecturer (supervisor), reviewer (for bachelor thesis)
- Running your application somewhere in cloud
 - Where just the image has to be uploaded
- Shipping the software (package) for someone to try it without difficulties
 - Evaluation committees at various competitions

Docker

- Platform for deploying (sharing) and running applications in a controlled environment
- Runs on Windows, Linux, MacOS
- Key features
 - Isolating applications from the underlying host system and each other
- Web: <https://www.docker.com/>

Docker – resources

- Installing
 - <https://docs.docker.com/desktop/install/windows-install/>
 - <https://docs.docker.com/desktop/install/linux-install/>
- Basic usage
 - <https://docs.docker.com/guides/get-started/>
 - <https://docs.docker.com/guides/walkthroughs/what-is-a-container/>
 - <https://docs.docker.com/guides/walkthroughs/run-a-container/>
 - <https://docs.docker.com/build/building/packaging/>
- Documentation
 - <https://docs.docker.com/manuals/>
 - <https://docs.docker.com/get-started/overview/>

Docker – important concepts

- Image
 - Static description (template)
- Container
 - Runtime instance (process)

Docker – architecture

- Daemon dockerd
- Available clients
 - Command-line: docker
 - GUI: Docker Desktop

Docker – usage

- Requirements
 - WSL on Windows 10
- Main steps
 1. Prepare or get some image (template)
 2. Run the container (with application)
- Inspect the containers (files, ...)

Docker – custom images

- Image
 - Template for creating Docker containers
 - Based on another existing image
- Dockerfile
 - Specifies how to create the image
 - List of all necessary packages to be installed
 - Building steps (macros in a special notation)
- Relevant commands
 - `docker build -t <name_of_image> <directory with the Dockerfile>`
 - Example: `docker build -t mydb:pp .`
 - `docker run <image> [<command>]`

Docker – custom images

- Useful macros to be used in Dockerfile
 - FROM <base image>
 - ENV <variable>=<value>
 - WORKDIR <work dir inside the image>
 - COPY <work dir on host> <work dir in the image>
 - RUN <command that helps to build your app>
 - CMD [“<command to run your app within the container>”, “<arg 1>”, ..., “<arg N>”]
 - EXPOSE <network port number>

Docker – registry

- Purpose: repository (storage) for images
- Docker Hub
 - Global public registry (free)
 - <https://hub.docker.com/>
- Relevant commands
 - `docker pull`
 - `docker push`

Docker – advanced topics

- Docker Compose
 - Starting multiple containers together
 - Use case: one container for each application
 - Example: database + auth service + web frontend
 - Resources
 - <https://docs.docker.com/compose/>
 - <https://docs.docker.com/compose/compose-application-model/>
 - <https://docs.docker.com/compose/gettingstarted/>
- How it works
 - Virtualization at the OS level

Exercise

- Create the Docker image for your software
 - Essential part: Dockerfile
- This represents also the homework assignment for Docker
 - Start now (in the lab) and continue later
- Hint: use the available resources
 - See links to guides on the web

Other tools

- Package managers (Linux distributions)
 - APT (<https://www.debian.org/doc/manuals/debian-reference/ch02.en.html>), RPM, Portage
- Building from sources (Linux/Unix, Java)
 - GNU Autotools: `./configure; make; make install`
- Installers (Windows)
 - MSI files (Windows Installer, <https://learn.microsoft.com/en-us/windows/win32/msi/windows-installer-portal>)
 - WiX (<http://wixtoolset.org/>)
- Virtualization
 - Oracle VM VirtualBox (<https://www.virtualbox.org/>)

Infrastructure as code

- Goal: Configuration of systems and resources
- IaC: program code, machine-readable files
 - “Classic approach”: physical hardware, GUI tools
- Benefits: higher automation
 - Treat it like software (versioning, code review)
- Tool support: Terraform, Pulumi, Ansible