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Test Automation Design for Embedded Systems

DAY 2 : Using Docker for a Test Automation Environment

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THE SPEAKER

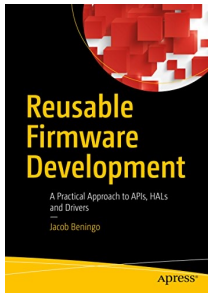
Jacob Beningo

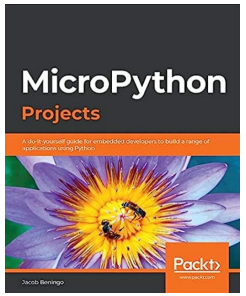
Jacob@beningo.com

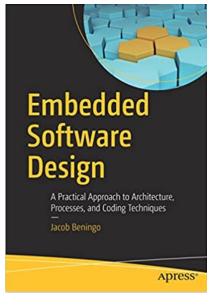
Beningo Embedded Group – CEO / Founder

Focus: Embedded Software Consulting and Training

Help teams deliver higher-quality embedded software faster. We specialize in creating and promoting embedded software excellence in businesses around the world.







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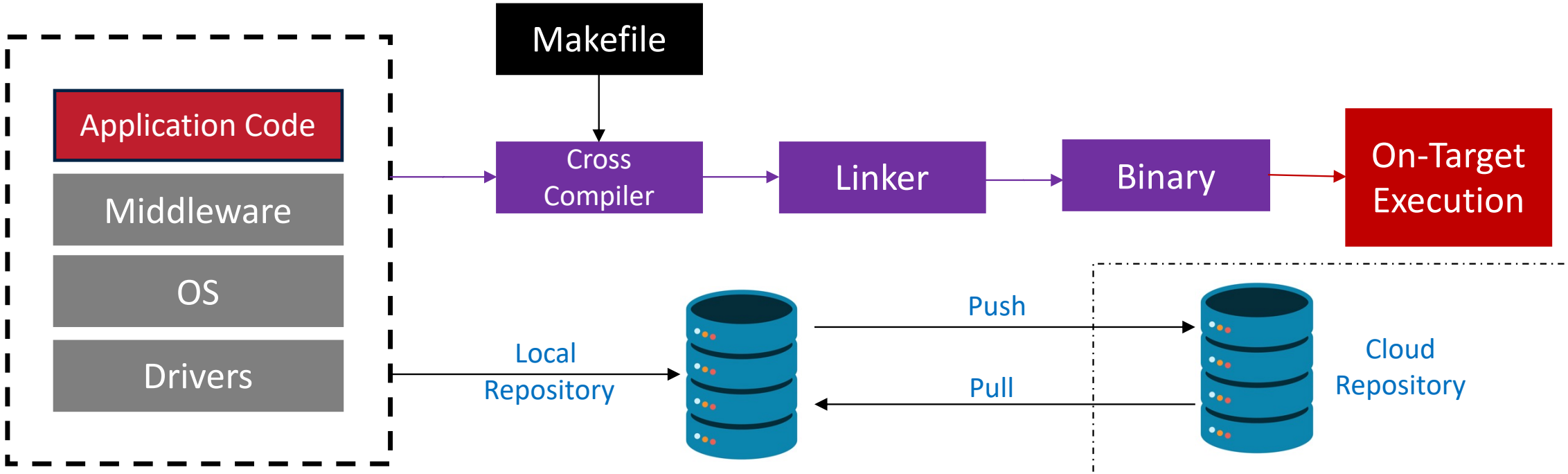
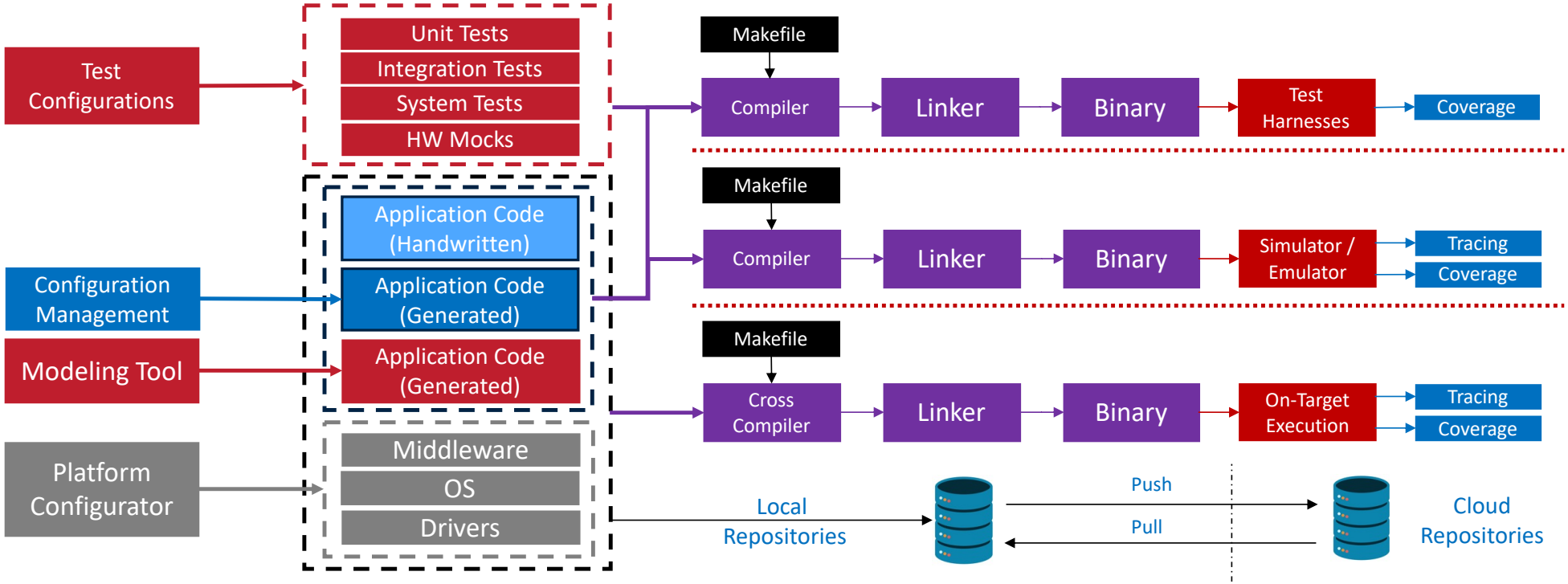
01

Embedded Build Systems

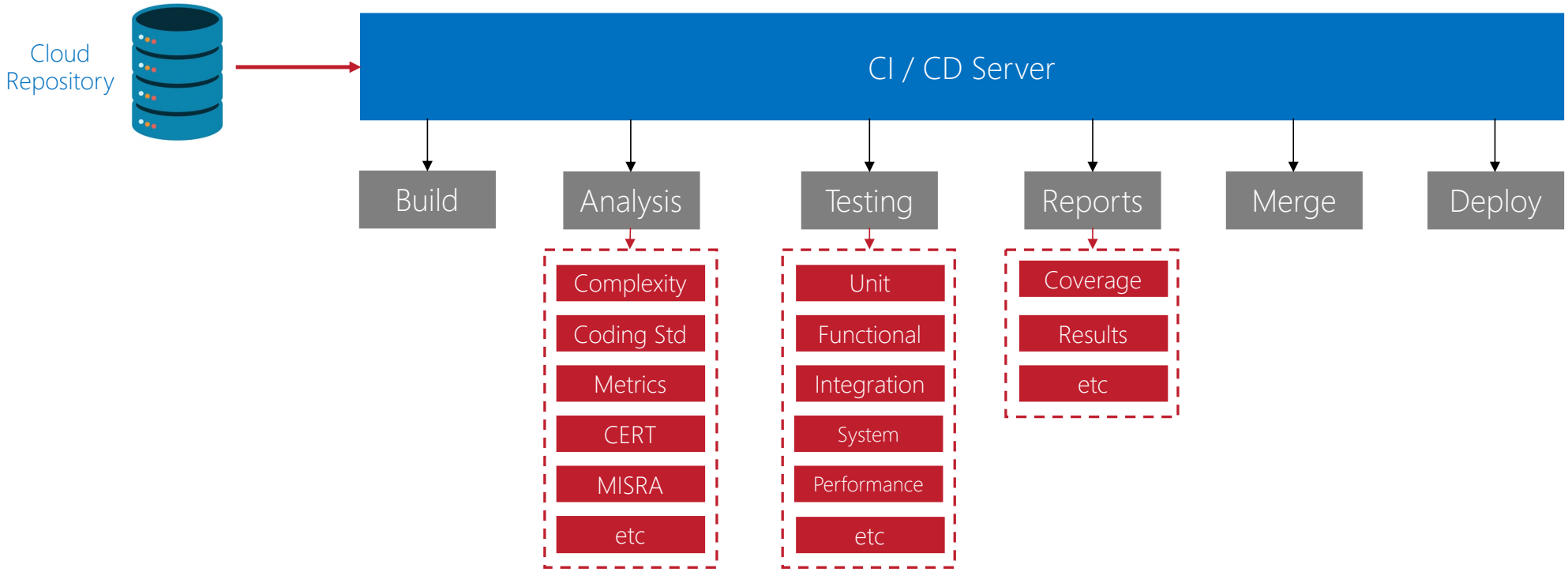
Traditional Build Systems



Modern Build Systems



Continuous Integration / Continuous Deployment (CI/CD)



Audience POLL Question

How would you classify your build system today?
- Traditional
- Modern
- In between
- Other

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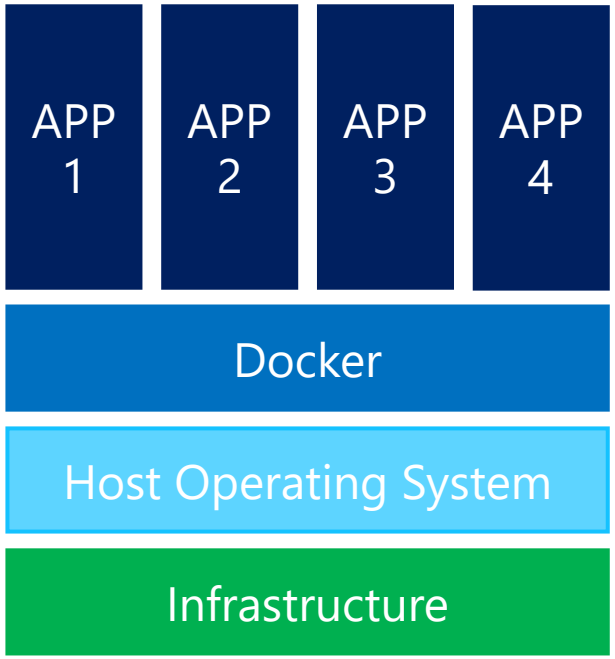
02

Docker

Docker Containers

A **container** is a standard unit of software that packages up code and all its dependencies, so the application runs quickly and reliably from one computing environment to another.

A **Docker container** image is a lightweight, standalone, executable package of software that includes everything needed to run an application: code, runtime, system tools, system libraries and settings.



Benefits of Containers

1. **Consistent Environment**: Containers provide a consistent development environment across all stages of the embedded software lifecycle, from development to testing to deployment. This reduces the "it works on my machine" problem.
2. **Isolation**: Containers isolate the build environment from the host system, ensuring that dependencies and configurations do not clash with the developer's environment or with other projects.
3. **Dependency Control**: By using containers, you can precisely control and version the dependencies and tools required for your build, ensuring that every build uses the exact same set of tools and libraries
4. **Portability**: Since containers package an application with all of its dependencies, the containerized build system can easily be moved between different machines, different CI/CD systems, or even different cloud providers without needing any changes.
5. **CI/CD Integration**: Containers integrate well with continuous integration and continuous deployment (CI/CD) pipelines, allowing you to create reproducible builds and automate the testing and deployment of embedded software.

Docker Architecture

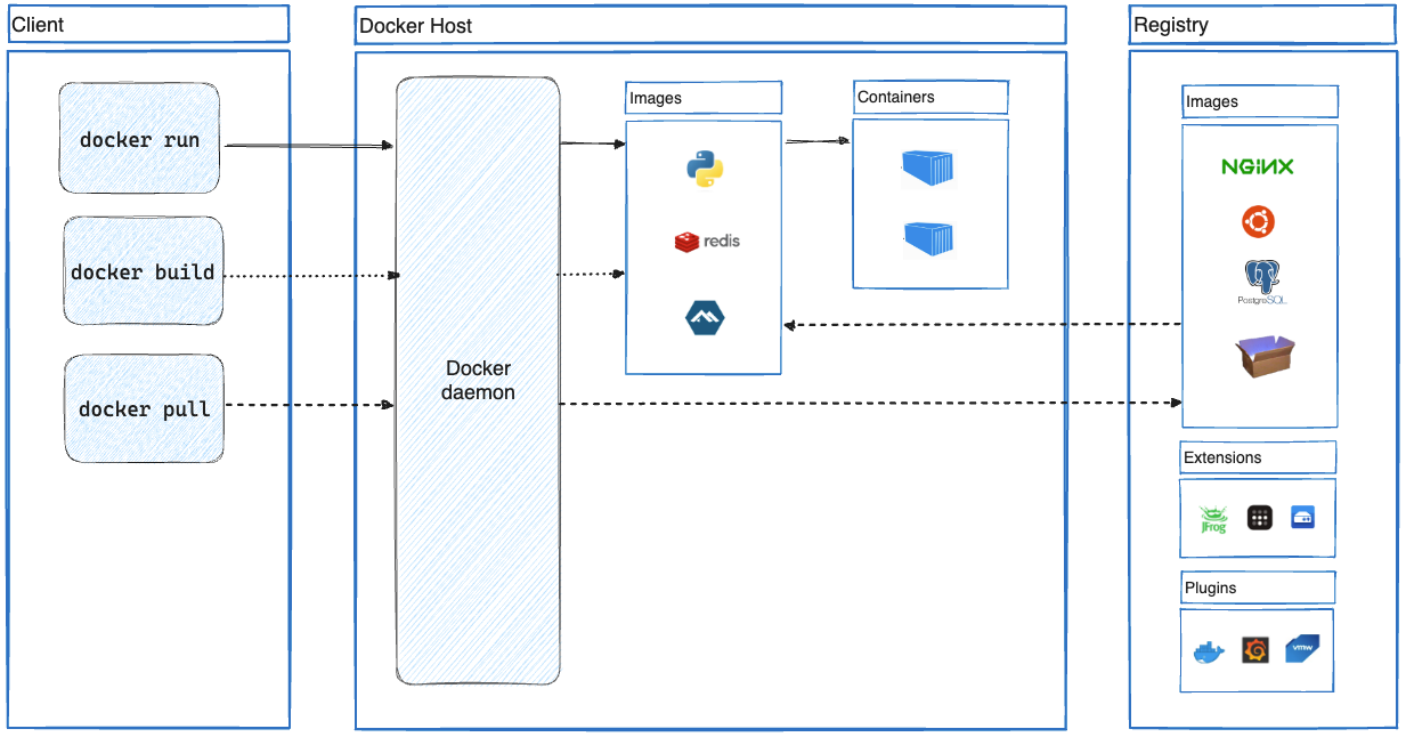
Client – Docker API and command interface.

Daemon – listens for API requests and manages Docker objects.

Images – ready-to-use templates with instructions for creating a container.

Container – A runnable instance of an image.

Registry – stores Docker images.



Audience POLL Question

Do you use Docker?
- No, I don't like it
- No, my company doesn't allow me to
- Yes, because I'm forced to
- Yes, because it makes my job easier

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03

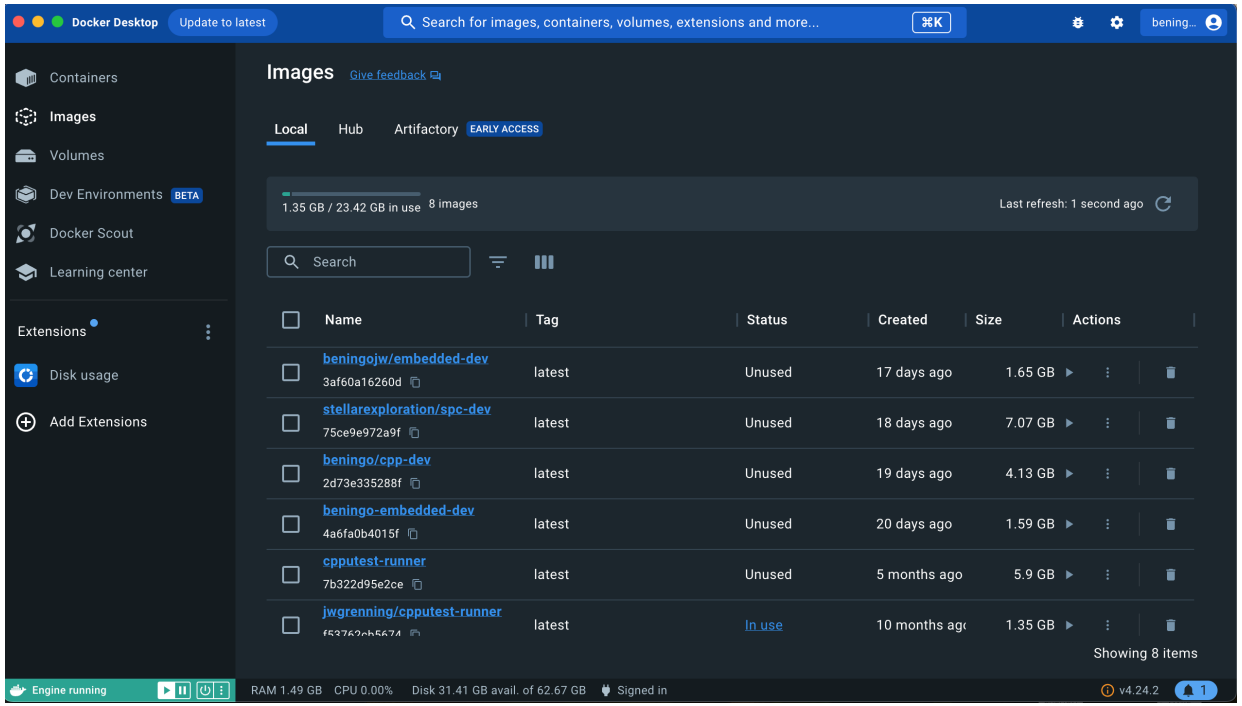
Containerizing Your Test Environment

Docker Desktop

Docker Desktop is a MacOS, Windows, or Linux application that enables building and sharing of containerized applications. It includes:

- Docker Daemon
- Docker Client
- Docker Compose
- Docker Content Trust
- Kubernetes
- Credential Helper

Interesting for Embedded folks!



Building a Container

Dockerfile – a text document that contains all the commands a user could call on the command line to assemble an image in Docker.

docker-compose.yml - file to configure your application's services, networks, and volumes. Then, with a single command, you create and start all the services defined in your configuration.

```
docker build -t beningojw/embedded-dev .
```

Dockerfile > ...

You, 3 weeks ago | 1 author (You)

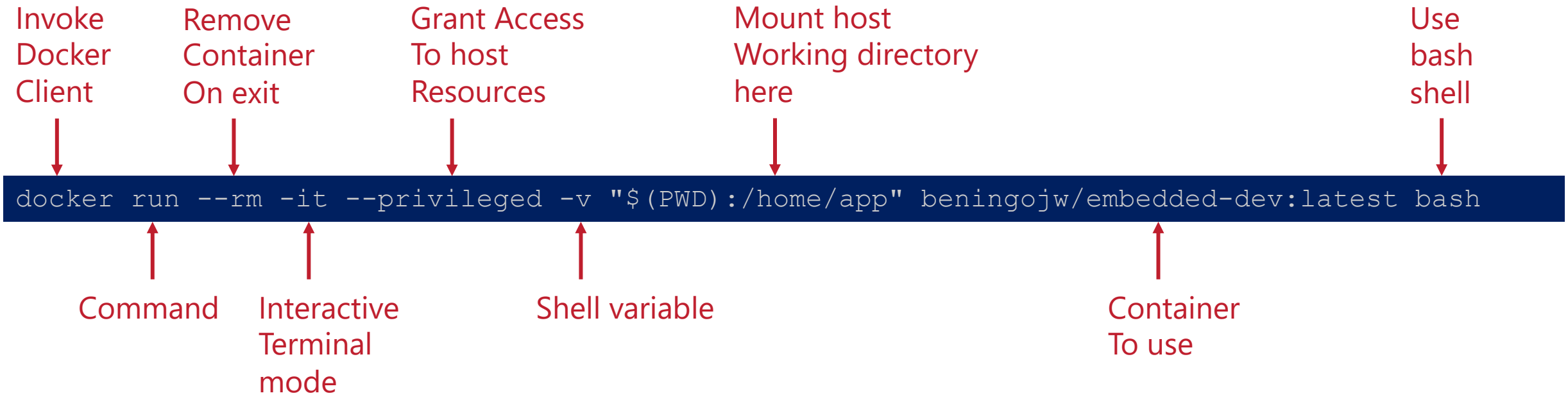
```
# Use the latest version of Ubuntu as the base image
FROM ubuntu:latest

# Set the maintainer label
LABEL maintainer="jacob@beningo.com"

# Set environment variables to non-interactive (this will prevent some prompts)
ENV DEBIAN_FRONTEND=non-interactive

# Update package lists, install basic tools, toolchains, stlink-tools, and clean up
RUN apt-get update -y && \
    apt-get install -y --no-install-recommends \
    autoconf \
    automake \
    curl \
    build-essential \
    git \
    libtool \
    make \
    pkg-config \
    ca-certificates \
    software-properties-common \
    clang-format \
    clang-tidy \
    stlink-tools \
    cmake \
    ninja-build && \
    apt-get clean && \
    rm -rf /var/lib/apt/lists/*
```

Running a Container



Audience POLL Question

What is the most important automation tool you'd want in a container?

a) Cpputest for unit testing
b) Python for system level testing
c) Build system for testing code builds
d) Code analysis tools
e) other

Next Steps

04

Test Automation Build System

Build System Example

- Docker container build system
- Makefile-based
- Cmake with Ninja Example
- Compilation scripts
- Integrated tools like cpputest

https://mailchi.mp/beningo/beningo-devops

Additional Resources

Please consider the resources below:

- Jacob's Blogs
- Jacob's CEC courses
- Embedded Software Academy

- Embedded Bytes Newsletter
  - http://bit.ly/1BAHYXm

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Next Steps

- ✓ Introduction to Test Automation Design
- ✓ Using Docker for a Test Automation Environment
- Unit-Testing Using Test-Driven Development Part 1
- Unit-Testing Using Test-Driven Development Part 2
- Automating System-Level Testing

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