Yocto Project® : Building and deploying containers with meta-virtualization: now & in the future

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Agenda

- Goals
- (Brief) History of meta-virtualization
- Technology timeline
- Why use the Yocto project for containers ?
- Components of container build (and deployment)
- Past and current container build / deployment
- Future container build / deployment efforts

Presentation Goals

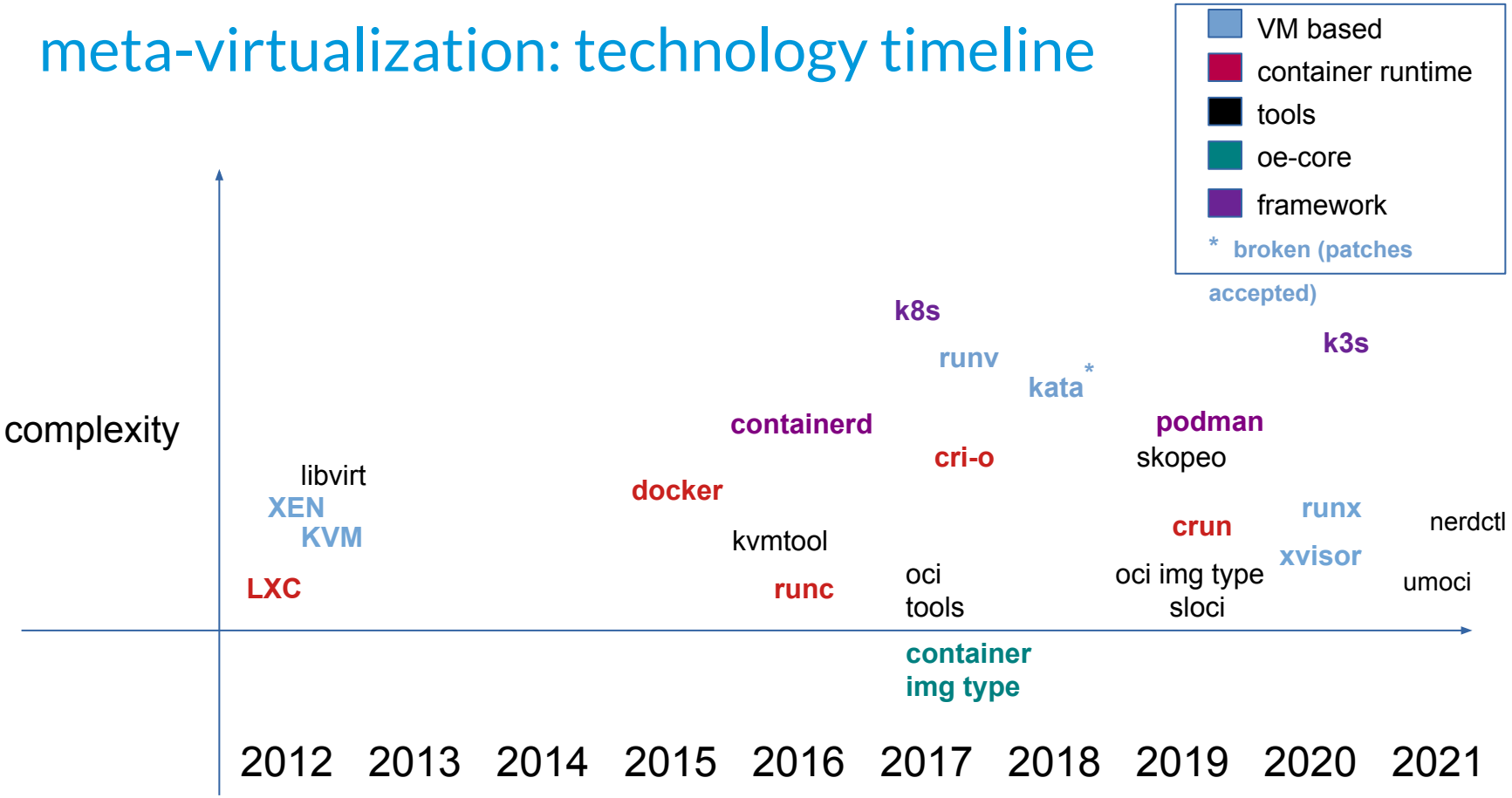
- Introduce the concepts driving container build and deploy
  - Not a how-to, not a survey
- Level set on the technology timeline
- Background / understanding of current capabilities
- What is where, and how (why) it works ..
- Insight into direction and upcoming features

Overview

meta-virtualization: a brief history

- Started June 2012
  - 1306+ commits made by 155+ contributors
- Point of integration for ‘virtualization’ technologies
  - VMs and containers
  - Core technology + support software
  - Many audiences: Bleeding edge and established tech
  - Tested (improving) and stable: needs CI
  - Baseline for creating OE derived virtualization solutions
  - Recipes migrate over time (into and out of meta-virtualization)

meta-virtualization: technology timeline



meta-virtualization: timeline summary

- Started with mainly VM solutions
  - now more container focused
- More solutions / choices than ever before
  - Very little has been removed / depreciated
- ‘Complexity’ has increased
  - Hence more complete solutions are possible
  - Need more system level configuration and flexibility
- Plumbing, tools and image creation assists
  - More are needed

Why the Yocto Project and containers

- Isn’t it all about the application ?
  - Why care about building from source ?
- Solves problems you don’t (yet) know you have
  - Evolving (think SBOM)
- Standards compliant and compatible
- Building block technologies
  - Choice: don’t pick winners and don’t lock in
  - Flexibility: Elements of the solution are spread through the ecosystem
- Configurability and tunability

Build & Deployment

What are container “build” and “deployment” ?

- For our purposes:
  - build:
    - compilation / construction from source of a container (or fetching of OE built artifacts)
  - deployment:
    - installing a container on a target (or image)

Container Build

- OE core has base support
- Techniques have evolved over time
  - Iterative / multiple builds and external assembly
  - Multiconfig
  - OCI Image type
- Leverage Yocto Project core values
  - Embrace, not replace or duplicate

Container Build: Challenges

- Clunky / Confusing
  - Regardless of which method you use
  - Not ‘end user’ friendly
- Path to binary container construction / reuse
  - Commonly cited guides don’t apply
- Streamlining work is in progress

Container Deployment

- Not standardized (and shouldn’t be)
  - Varies based on container runtime
- Some options:
  - Direct image install (for startup)
  - Registry / artifact repository push → pull
  - Management framework: k8s, k3s, etc
  - Custom ‘hacks’

Container Deployment: Challenges

- Not cross friendly
  - Daemons, root requirements, host requirements, licensing, reproducibility, etc
- Requirement creep
- Large set of runtimes and frameworks

Upcoming ...

Vision

- The Yocto Project as a 1st class platform for building CNCF technologies
  - Leveraging OE advantages and technologies, feeding into external solutions
    - baked directly into the outputs
- Simple inherit to generate containerized recipe output
- Direct deploy to images, or management framework
- Binary artifacts / reusable base containers

In progress / Upcoming (1/2)

- Streamlined build via bbclass
  - kernel-module-split style / dynamic packaging ?
- Direct image install
  - via -native tools
  - Autostart (depending on runtime)
- Multi-layer OCI container image build
  - Pluggable / flexible back end

In progress / Upcoming (2/2)

- Reference container host and app / system container images
- Target container (on host) rapid test
- Framework test / deployment streamlining
  - k8s, k3s, runX ..

Thanks for your time

What is the Yocto Project® ?

IT'S NOT AN EMBEDDED LINUX DISTRIBUTION,
IT CREATES A CUSTOM ONE FOR YOU.

The Yocto Project (YP) is an open source collaboration project that helps developers create custom Linux-based systems regardless of the hardware architecture.

The project provides a flexible set of tools and a space where embedded developers worldwide can share technologies, software stacks, configurations, and best practices that can be used to create tailored Linux images for embedded and IOT devices, or anywhere a customized Linux OS is needed.

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