Cloud Native

Eric Brewer
VP, Infrastructure

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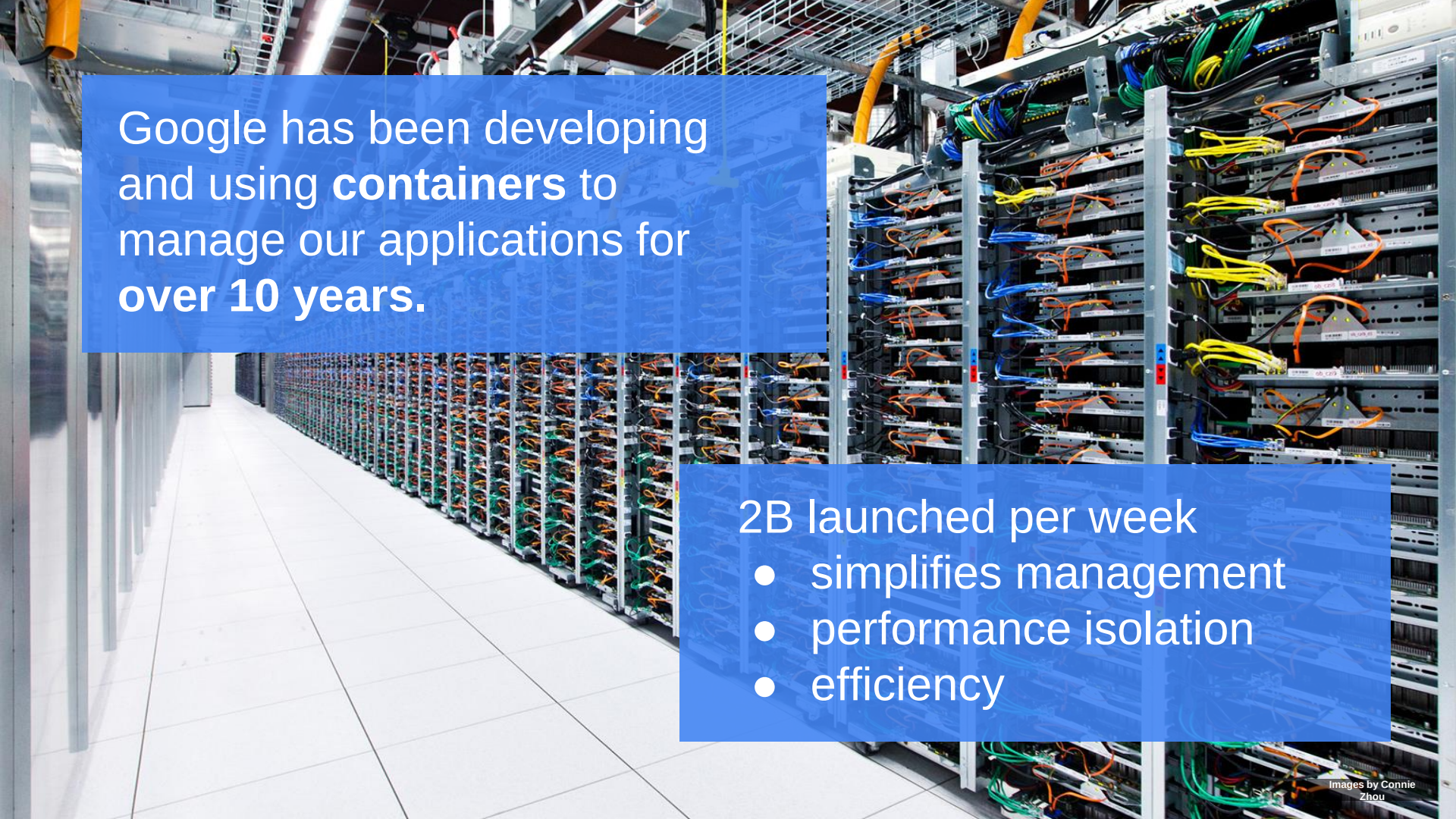
XLDB

“Cloud Native” Applications

Middle of a great transition

- unlimited “ethereal” resources in the Cloud
- an environment of *services* not machines
- thinking in APIs and co-designed services
- high availability offered and expected



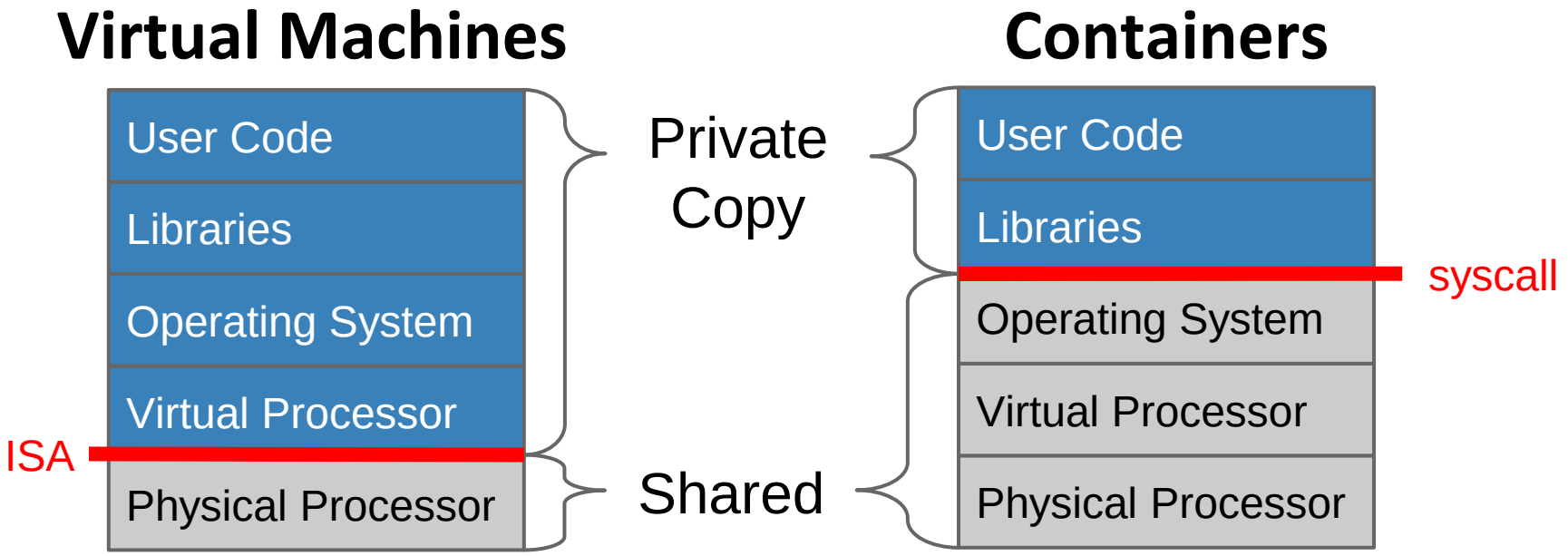
Google has been developing and using **containers** to manage our applications for **over 10 years.**

2B launched per week

- simplifies management
- performance isolation
- efficiency

Images by Connie Zhou

VMs vs. Containers



Containers: less overhead, enable more “magic”

Merging Two Kinds of Containers

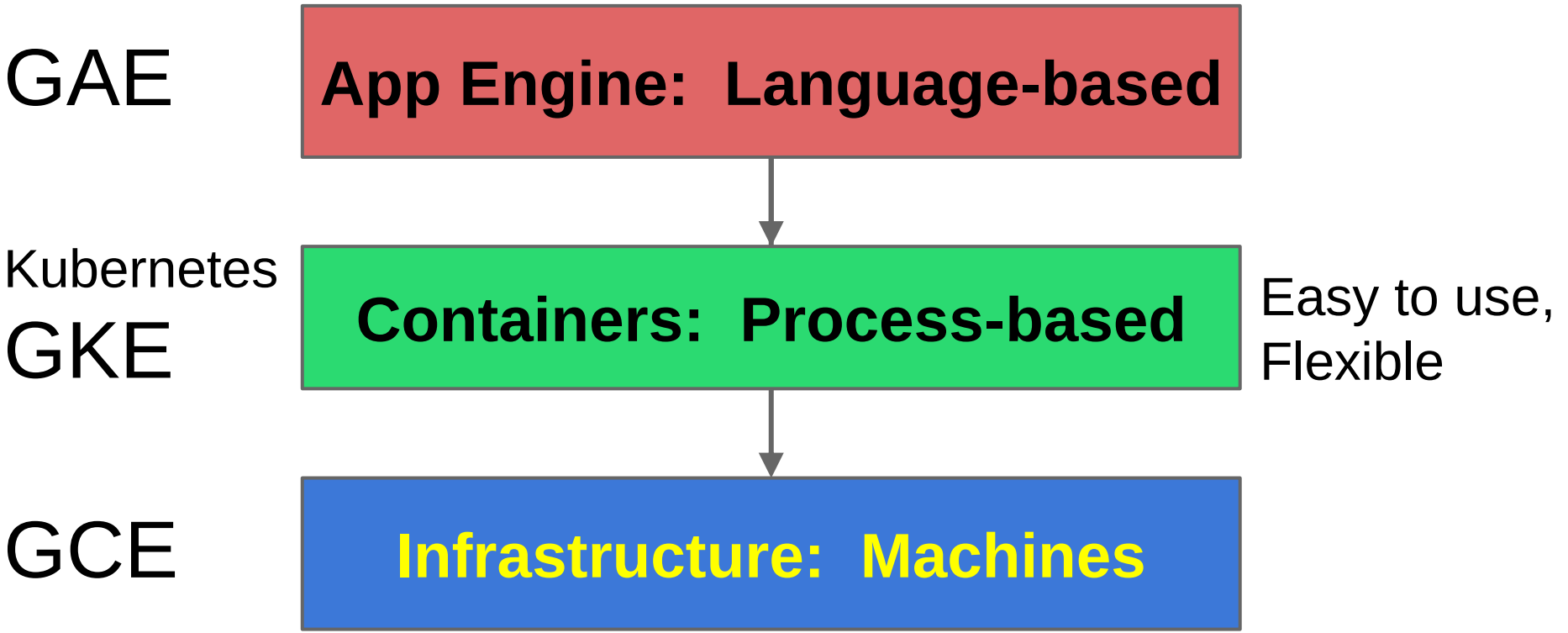
Docker

- It's about ***packaging***
- Control:
  - packages
  - versions
  - (some config)
- Layered file system
- => Prod matches testing

Linux Containers

- It's about ***isolation***
  … *performance isolation*
- not *security* isolation
  … use VMs for that
- Manage CPUs, memory, bandwidth, …
- Nested groups

Google Platform Layering



Kubernetes: Higher level of Abstraction

Think About

- Composition of services
- Load-balancing
- Names of services
- State management
- Monitoring and Logging
- Upgrading

Don't Worry About

- OS details
- Packages — no conflicts
- Machine sizes (much)
- Mixing languages
- Port conflicts

Evolution is the Real Value

Apps Structured as Independent Microservices

- Encapsulated state with APIs (like “objects”)
- Mixture of languages
- Mixture of *teams*

Services are *Abstract*

- A “Service” is just a long-lived abstract name
- Varied implementations over time (versions)
- Kubernetes routes to the right implementation

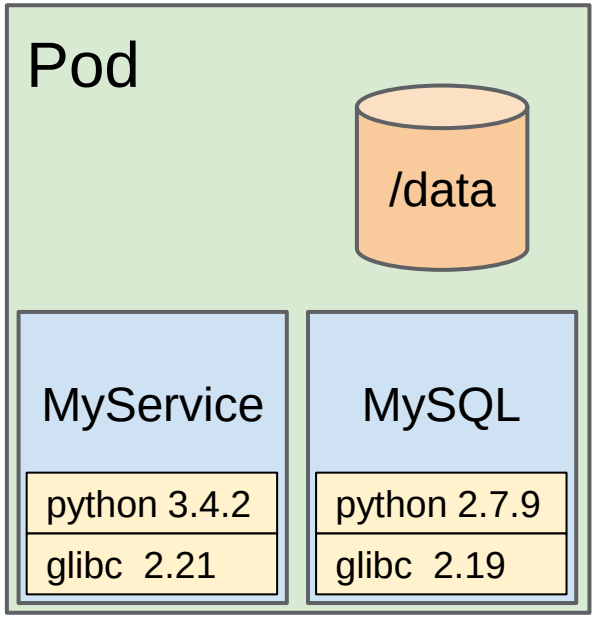
Managing Dependencies

Containers:

- Handle *package* dependencies
- Different versions, same machine
- No “DLL hell”

Pods:

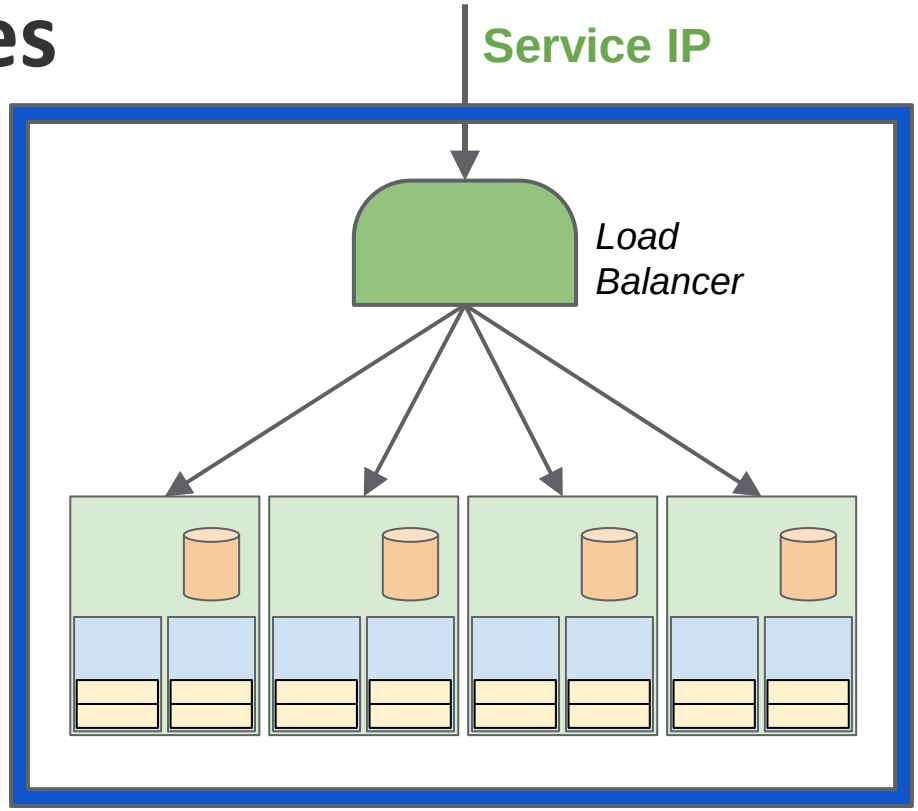
- *Co-locate* containers
- Shared volumes
- IP address, independent port space
- Unit of deployment, migration



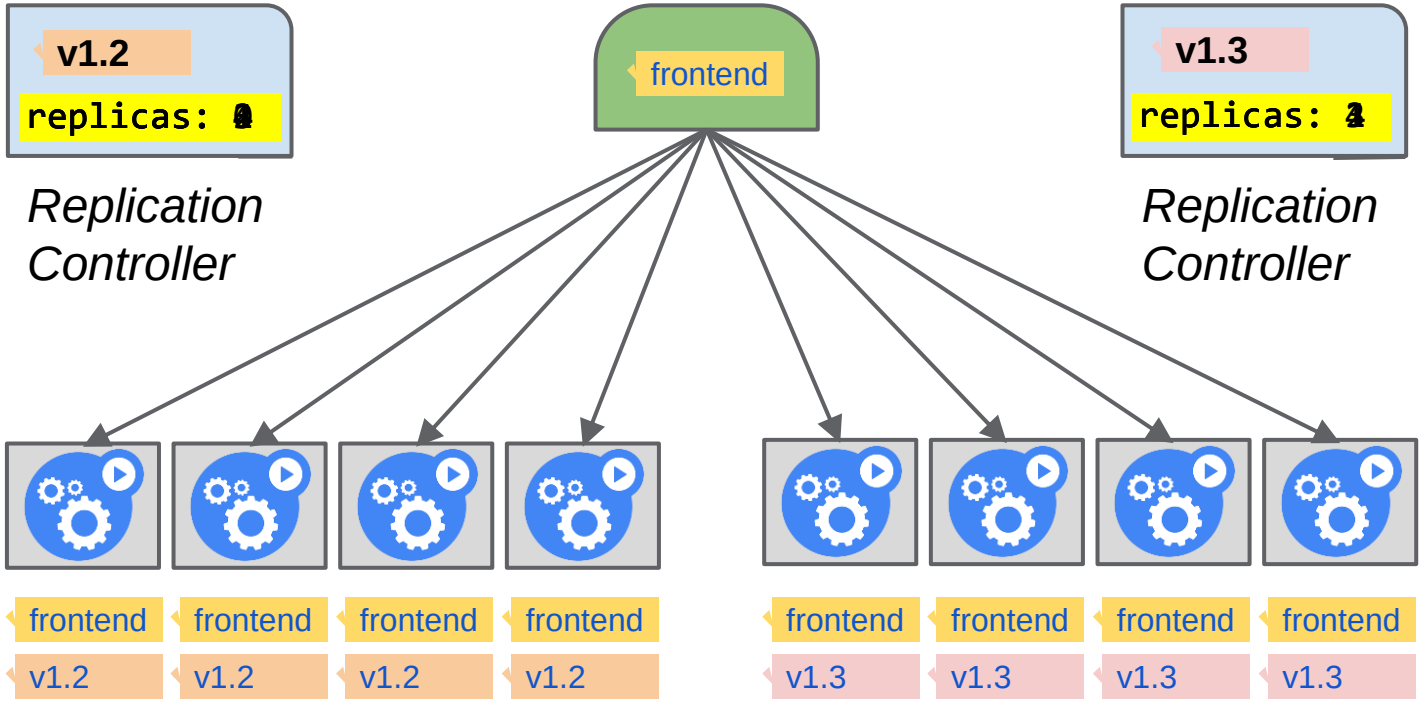
Dependencies: Services

Service:

- Replicated pods
  - Source pod is a template
- Auto-restart member pods
- Abstract name (DNS)
- IP address for the service
  - in addition to the members
- Load balancing among replicas



Example: Rolling Upgrade with Labels



Summary

A new path for Cloud Native applications:

- Collection of independent (micro) services
- Each service evolves on its own
  - Scale as needed
  - Update as needed
  - Mix versions as needed
- Pods are a building block
  - Template for service members
  - Group containers and volumes
  - Dedicated IP and thus port space
- Containers simplify deployment

BACKUP

How?

Implemented by a number of (unrelated) Linux APIs:

- **cgroups:** Restrict resources a process can consume
  - CPU, memory, disk IO, ...
- **namespaces:** Change a process's view of the system
  - Network interfaces, PIDs, users, mounts, ...
- **capabilities:** Limits what a user can do
  - mount, kill, chown, ...
- **chroots:** Determines what parts of the filesystem a user can see