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Domino on Kubernetes

DACHNUG, June 2023

Daniel Nashed -- https://blog.nashcom.de

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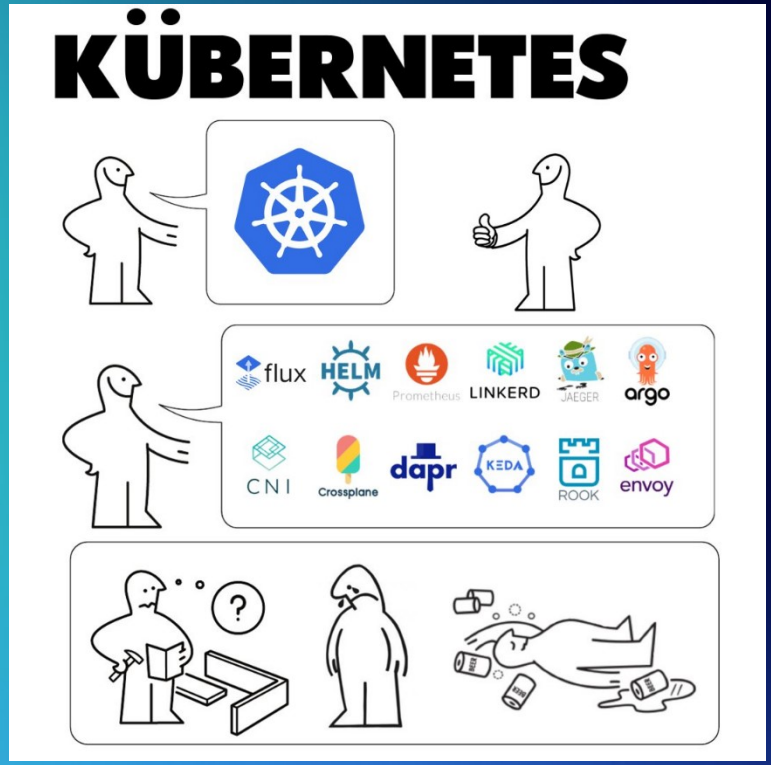
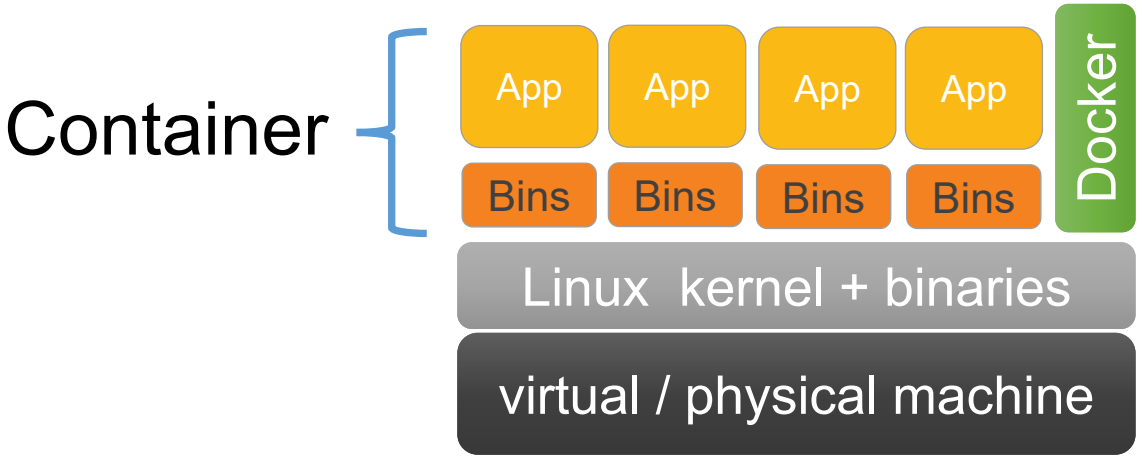
Running Domino in Containers on

Docker & Kubernetes



Reasons to use Container Technology

- **Automation testing**
- **Continuous development & deployment**
  - e.g **consistent deployment** of applications in **test**, **QE** and **production** environments
- Cost reduction by **standardization & automation**
- Cost reduction by **lowering the overhead** to deploy and run a Container vs. VM
  - Application runs an easy to deploy **container** instead of a separate **virtual machine**
- **Automated updates** with less down time (for individual servers)
- **Containers can improve security**
  - If **built** and **deployed** in the right way!



Containers in Automation Testing

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- **Continuous development** requires continuous automation testing

- HCL Domino development team uses automation testing for every git submit
  - All automation tests have to pass as one requirement before code can be committed!

- More complex integration tests are running every daily build

- New technology requires test suites integrating with other systems (OIDC, Let's Encrypt, ..)
  - Leveraging containers new automation tests
  - New HCL Domino 12.0.2 container image is used for all container based automation testing

Domino Container Image Test Automation

- The Domino container image project provides an automation testing suite
- Part of the **Open Source GitHub project**
  - Extendable by customers and partners
  - The same test you find in GitHub repository is running in a **Jenkins pipeline** every night on the daily build
  - Leverages **OneTouch setup,** results are written in a standardized **JSON** format


```
{
  "testResults": {
    "harness": "DominoCommunityImage",
    "suite": "Regression",
    "testClient": "testing.notes.lab",
    "testServer": "testing.notes.lab",
    "platform": "CentOS Stream 8",
    "testBuild": "12.0.1FP1",
    "containerPlatform": "Docker",
    "containerPlatformVersion": "20.10.21",
    "kernelVersion": "4.18.0-408.el8.x86_64",
    "kernelBuildTime": "#1 SMP Mon Jul 18 17:42:52 UTC 2022",
    "glibcVersion": "glibc-2.28-214.el8.x86_64",
    "libstdcVersion": "libstdc++-8.5.0-15.el8.x86_64",
    "testcase": [
      {
        "name": "domino.jvm.available",
        "description": "Domino JVM available",
        "executionResult": "SUCCESS",
        "errorText": ""
      },
```


```
[ SUCCESS ]  domino.jvm.available
[ SUCCESS ]  domino.server.running
[ SUCCESS ]  domino.http.running
[ SUCCESS ]  domino.certificate.available
[ SUCCESS ]  domino.server.onetouch.microca-cert
[ SUCCESS ]  domino.server.onetouch.createdb
[ SUCCESS ]  domino.idvault.create
[ SUCCESS ]  domino.backup.create
[ SUCCESS ]  startscript.archivelog
[ SUCCESS ]  container.health
[ SUCCESS ]  startscript.server.restart
[ SUCCESS ]  domino.translog.create
[ SUCCESS ]  domino.smtp_pop3.mail

--------------------------------------------------------------------------------

Success :  13
Error   :   0
Total   :  13
```

Domino Container Images

HCL Domino

- **HCL Image**
  - **Download** HCL Domino 12.0.2 Container from **Flexnet** or **pull from HCL registry**
  - Documentation is updated, including examples
    - https://help.hcltechsw.com/domino/12.0.2/admin/inst_dock_deploying_new.html
- **HCL Community image**
  - Built by customers & partners
    - Download **Linux WebKit installer** and just run "**./build.sh domino**"
    - Support for the build process and the additional image functionality is **GitHub community based**
- Support for **standard Domino & start script functionality** in both containers by HCL
  - Additional functionality is supported by the community project via GitHub
  - **Kernel** of host + **glibc** & **libstdc++** version of the container must match system requirements!

Domino Container Community Image

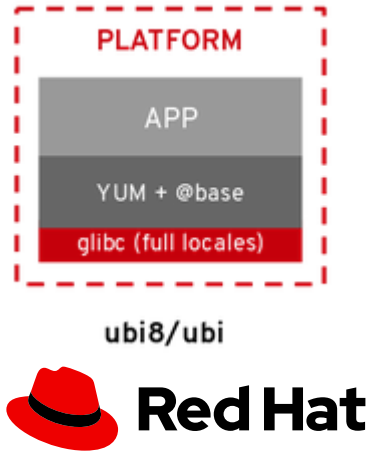
- Domino Docker “image” available since Domino 9.0.1
  - Originally initiated at IBM as a GitHub Open Source project by Thomas Hampel
  - Moved to HCL https://github.com/HCL-TECH-SOFTWARE/domino-container

- Not a ready to use image to download
  - But you get a nice box of “**LEGO® bricks**” with a lot of flexibility
  - **Easy to use build script** leveraging HCL Domino Linux server web-kits
  - Provides download links for HCL **web-kits** from FlexNet and download hash checking
- Additional functionality & flexibility
  - Add-on installers for **Nomad Server**, **Verse**, **C-API** build environment, **Borg Backup**, ...
- Supported by community project on **GitHub**

New Domino 12.0.2 Container Image

HCL Domino

- Based on Community image with all it's included image functionality
- **Stable snapshot of the community project**
  - Updates are planned for each release / fixpack
- Supports the functionality of the community image without the additional components
- Special build of the community image
  - **RedHat Universal Base Image (UBI) 8.6**
  - Only required Linux packages are installed (e.g. no OpenSSL and other helper tools)
- New **HCL Traveler 12.0.2** & **Domino Leap 1.1** image are based on new image



HCL GitHub Project Setup

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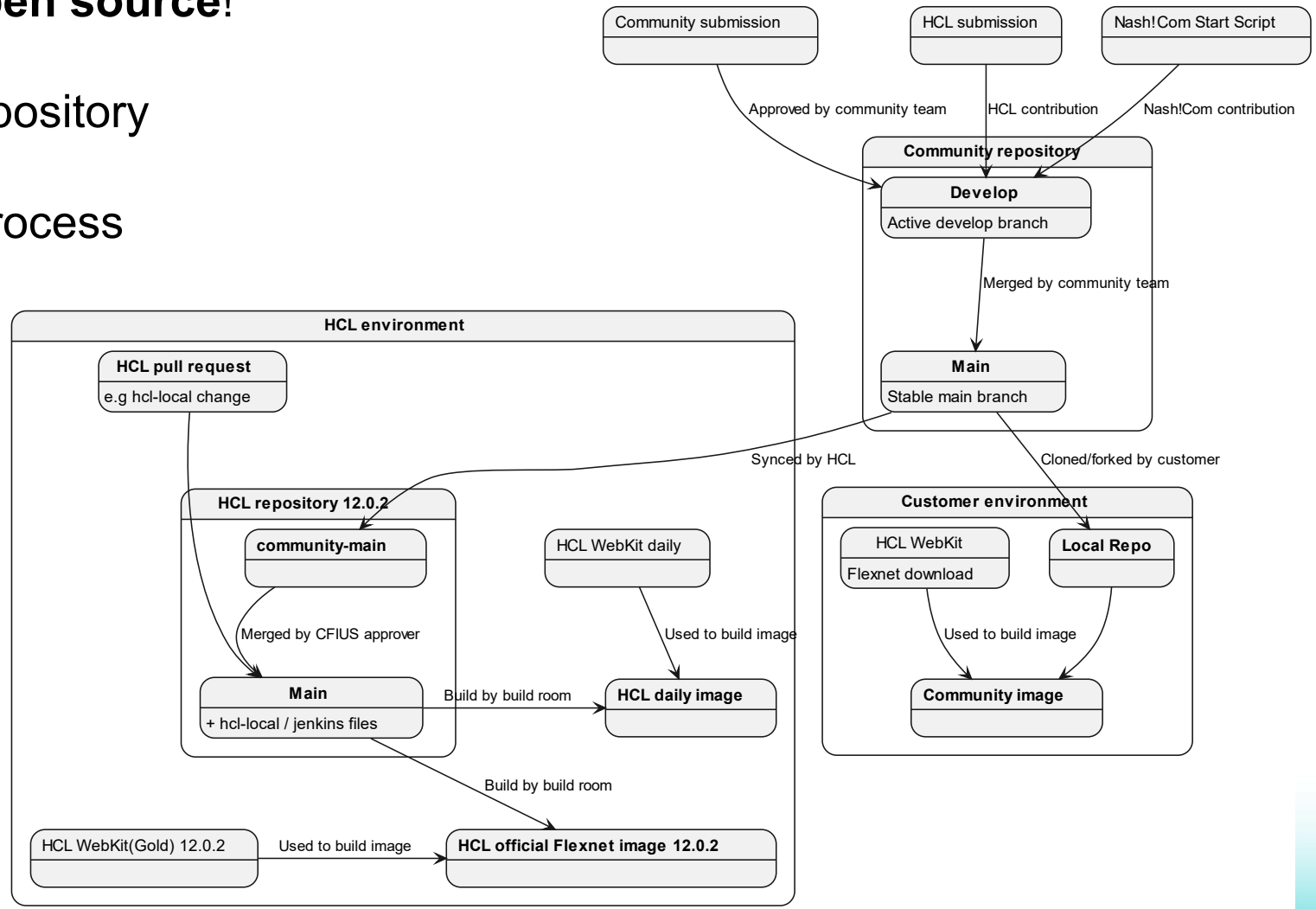
- Project continues to be developed **open source**!
- HCL has an own internal “synced” repository
- Internal development and approval process
- Build tools in `/hcl-local` directory
  - Jenkins scripts for build room
  - Security scan configuration
  - …



Changes to previous Image

HCL Domino

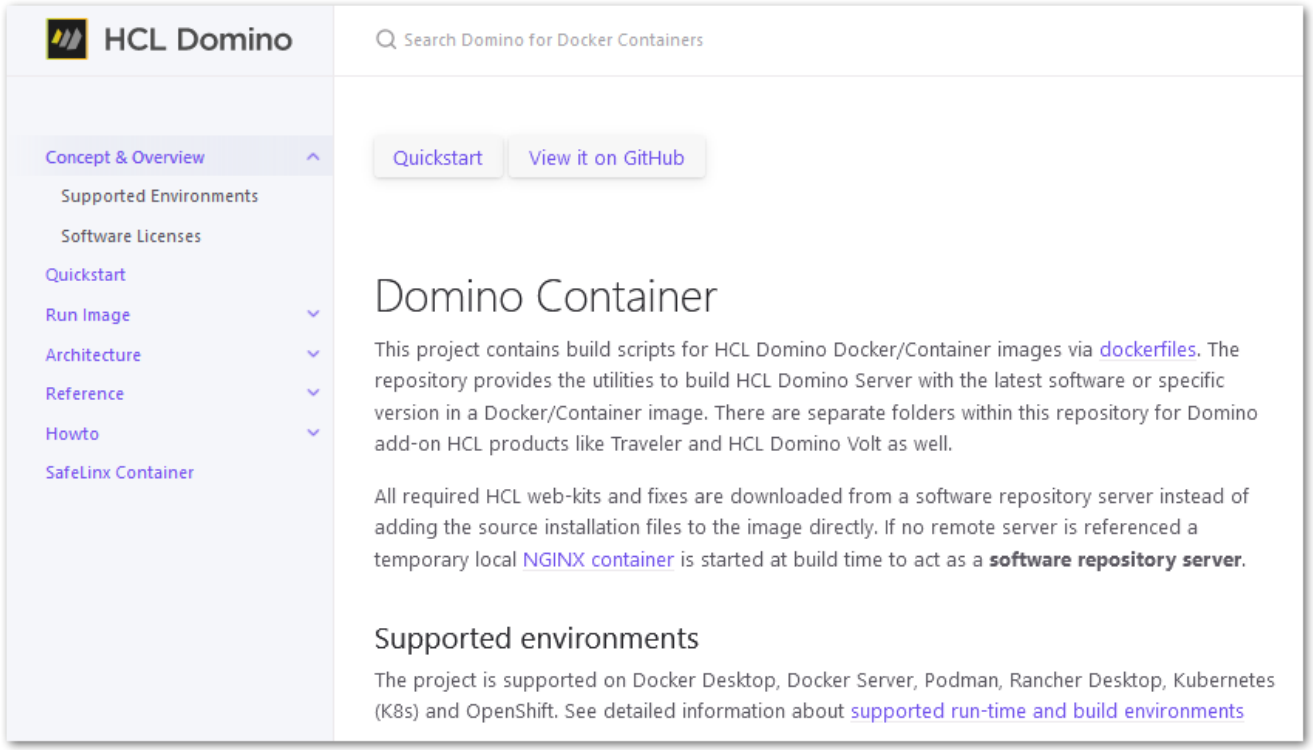
- Most of the basic functionality stays the same!
- No more temporary containers for **setup**, **maintenance** and **update**
- Admins just initiate a new container to setup or update with a new image
- **Migration from the previous image to the new image is just running a new container!**

- Domino Server process output is written to **`/local/notesdata/notes.log`**
  - The **`notes.log`** will be compressed automatically on restart
  - The previous container image wrote all the output to **`stdout`**

Domino Community Project & Documentation

- Project & Documentation
- Useful additional documentation
  - Architecture
  - How-To information
  - References
  - Examples

GitHub



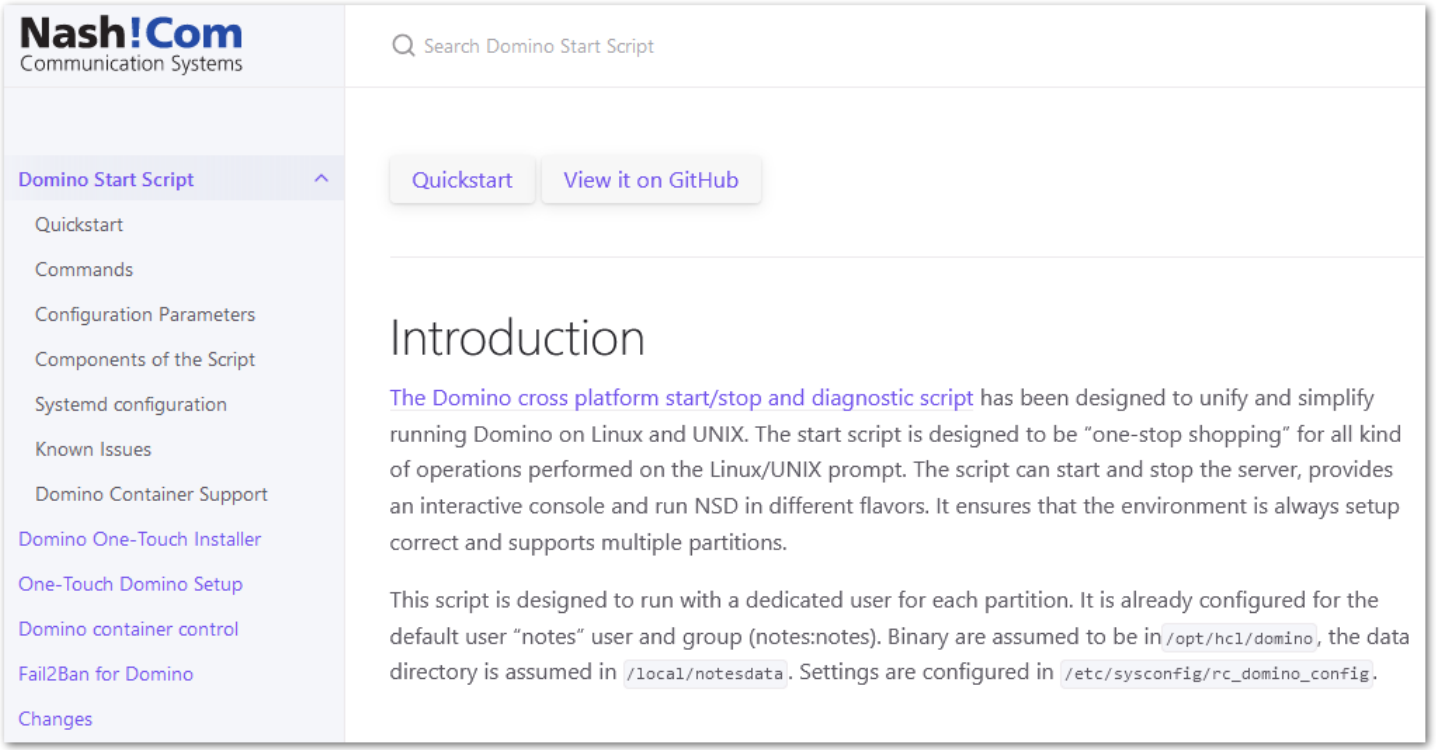
https://github.com/HCL-TECH-SOFTWARE/domino-container

https://opensource.hcltechsw.com/domino-container/

Domino Start Script Project & Documentation

- Project & Documentation
- Full start script documentation
  - Including all commands
- OneTouch Setup information
- Domino Container Control (**dominoctl**)

GitHub



https://github.com/nashcom/domino-startscript

https://nashcom.github.io/domino-startscript/

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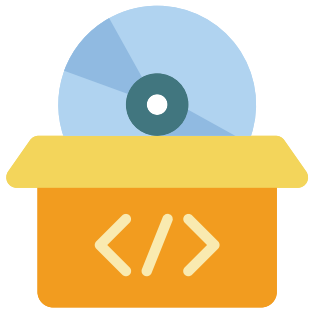
Docker vs Kubernetes

Docker vs. Kubernetes

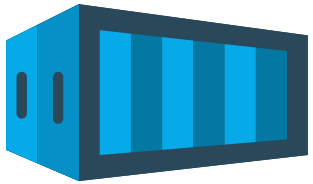
- Easier local storage
- Easier networking
- Lower security requirements
- Easy operations
- *“Developer friendly”*

- Storage classes, PVCs, …
- Ingress, NodePorts, LoadBalancers
- ServiceAccounts, RBAC, …
- Helm, upgrades, monitoring, …
- *“Machine friendly”*

The basic flow
(for both Docker and Kubernetes)



You start with an image. It is like a *template*.



From the image you create a container. It is like an *instance*.

You use parameters to create multiple containers from one image.

A K8s pod usually has one of more containers. Pods are a wrapper around containers to manage them

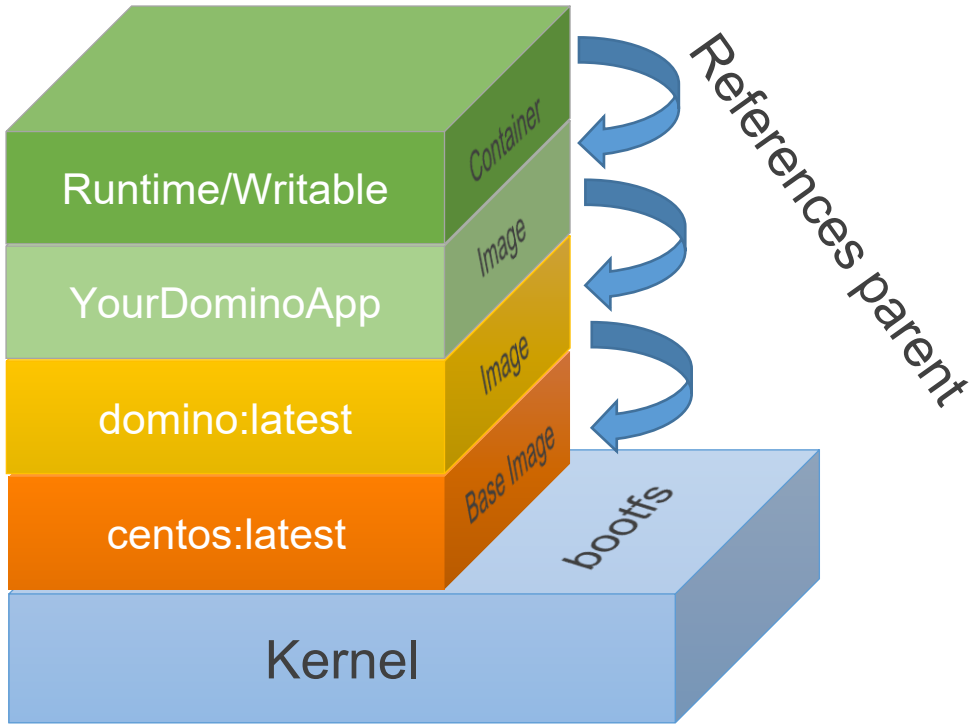
Container Concept – Example : Domino

Container is

- a layered file system where each layer references the layer below
- a runtime instance of an image.
- not containing your persistent (Domino) data

Images

- Are used to create containers
- Layers build on top of each other
  only the differences are stored in each layer.



Binaries and data split

Necessary for running inside a container.

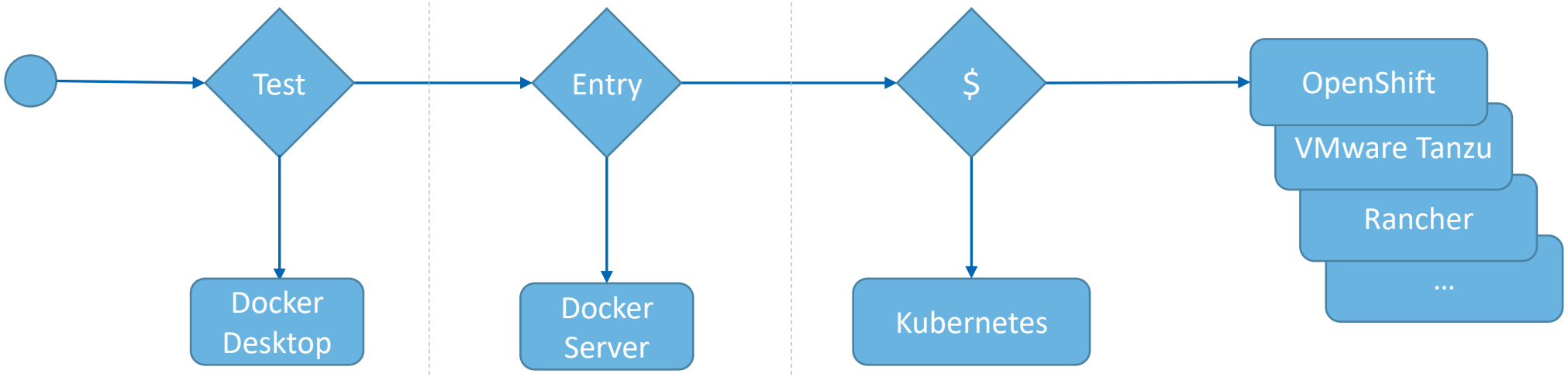
/opt/hcl/domino

Domino binaries
Traveler, Verse,
Leap, Nomad, …

/local/notesdata

*.nsf, *.ntf, *.id,
notes.ini,
translog, daos, …

Where to start - Decision Flow



Level 1
Test & Development

Level 2
Prod. Hosting

Level 3
Scale

Container Terminology for Domino Admins

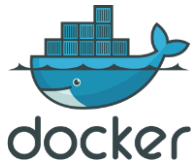


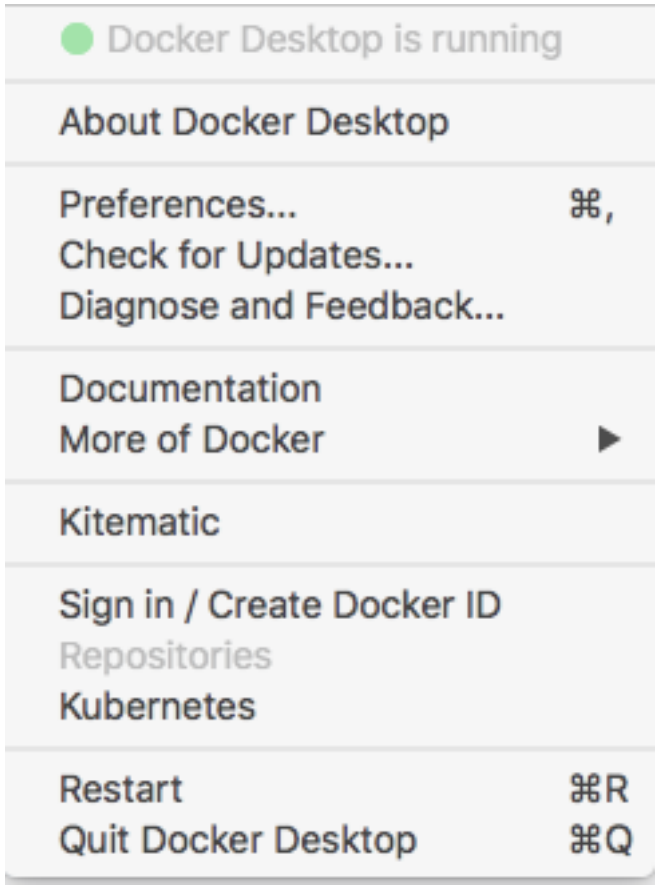
Image	=	Template
Container	=	Application
Volume	=	Domino Data Directory
CLI	=	Domino console
Registry	=	OpenNTF.org

Level 1 - Docker in MacOSX

- Uses Mac integrated virtualization
- Also runs a Linux VM with Container run-time
- Desktop Application
- Kubernetes single node-cluster
- Docker Compose

- Start here: https://docs.docker.com/docker-for-mac/

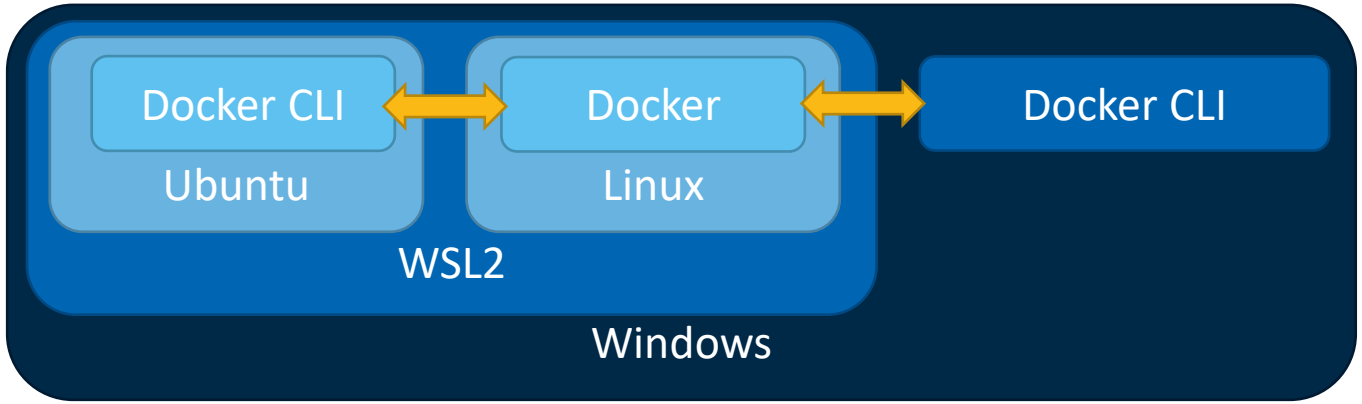
Docker.app

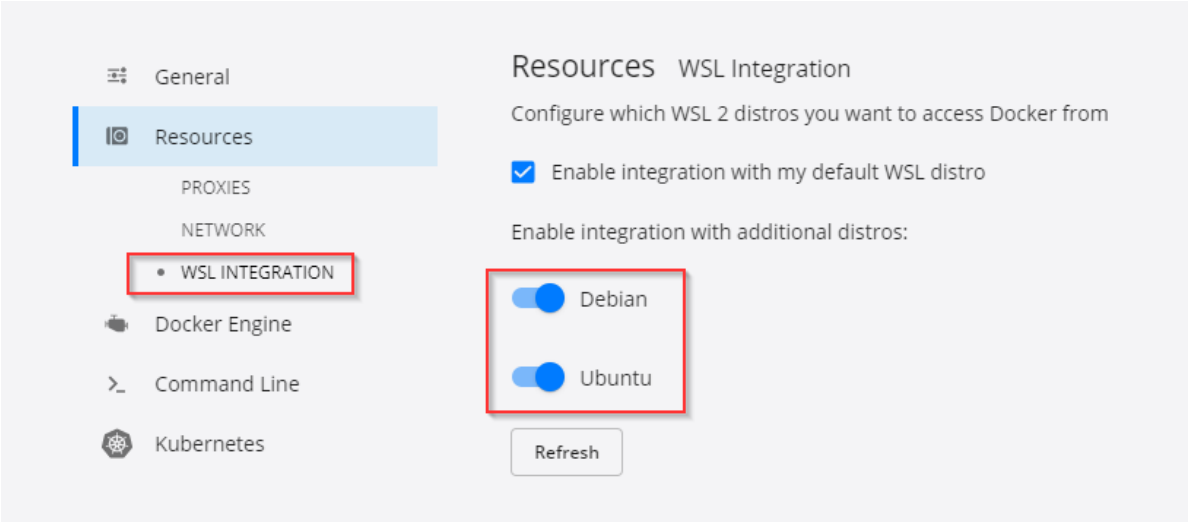


Level 1 – Docker on Windows with WSL 2

- Uses native WSL2 Linux containers for Container run-time
- Full integration in guest Linux like Ubuntu running in separate WSL container each
- Built and run-time environment
- Kubernetes single node-cluster
- Docker Compose
- Not free any more for corporate users
  - Free for small companies and open source projects
- Still the best to use desktop solution

- Start here: https://docs.docker.com/docker-for-windows/wsl/

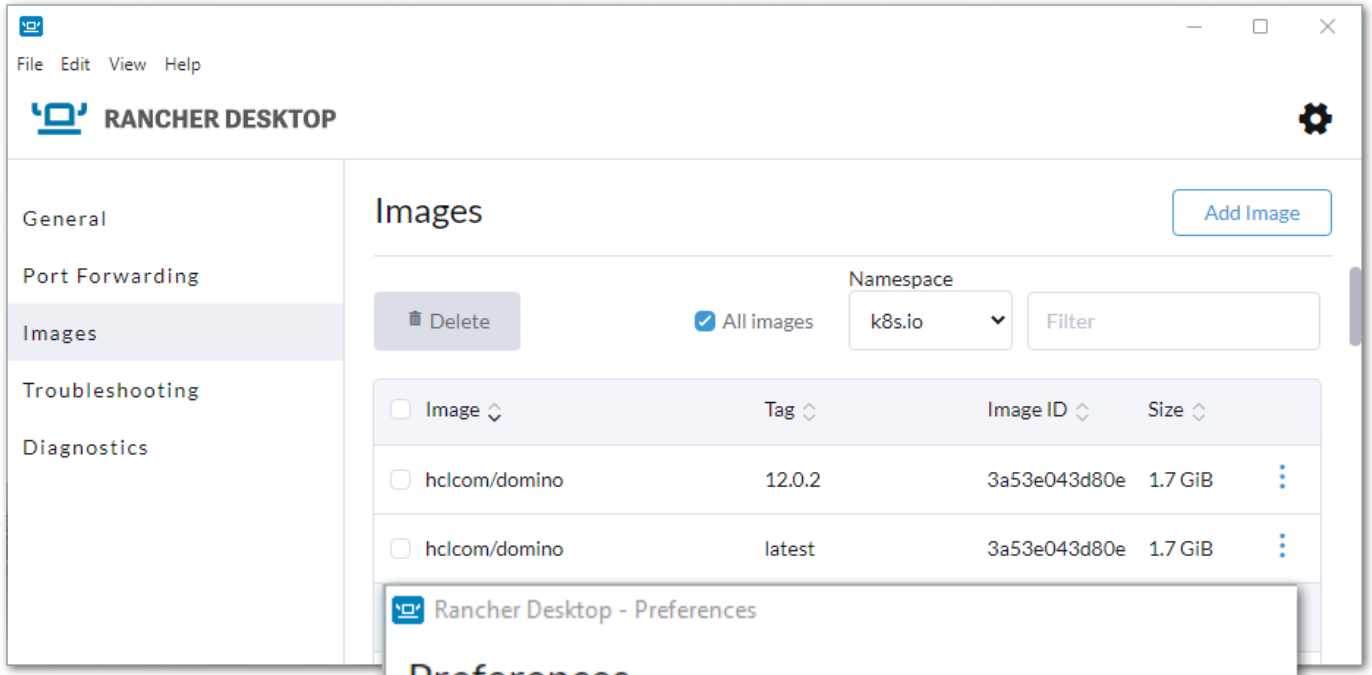


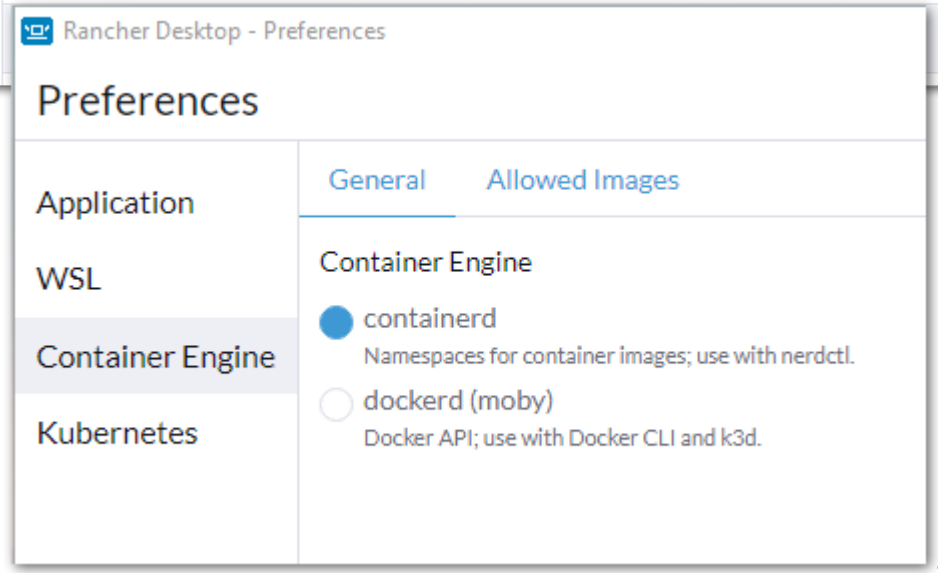


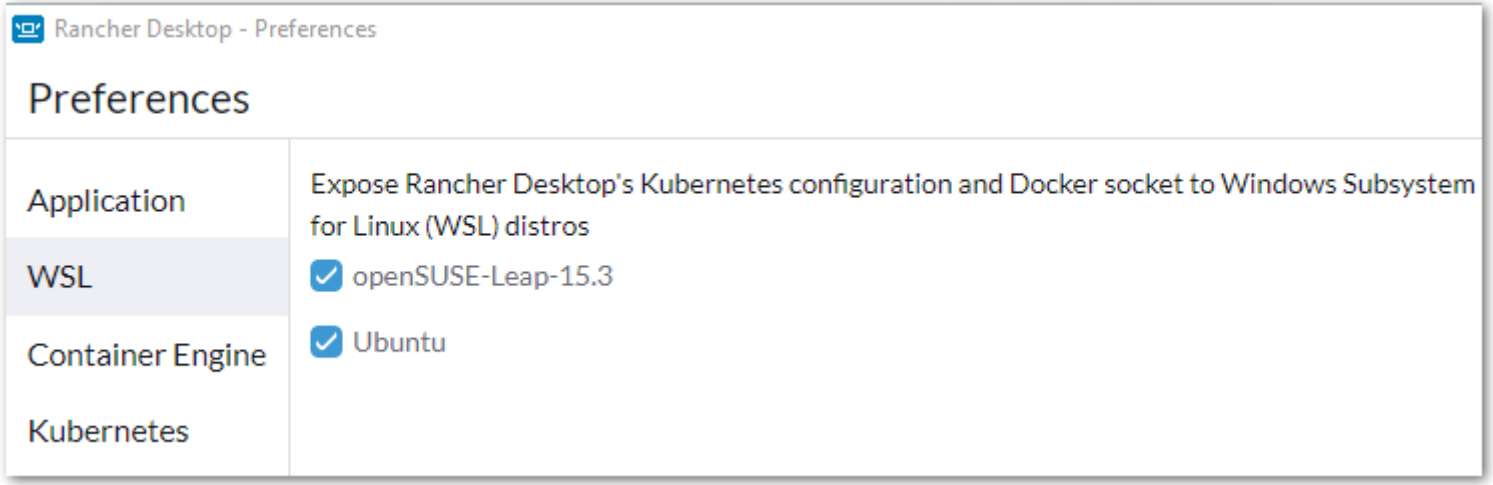
Level 1 – Rancher Desktop

RANCHER DESKTOP

- Free
- Platforms supported
  - Windows WSL
  - Linux
  - Mac Intel + Apple Silicon
- Supports Docker with **docker** cmd
- Or Containerd with **nerdctl** cmd
- Full WSL integration on Windows
- A build and run-time environment

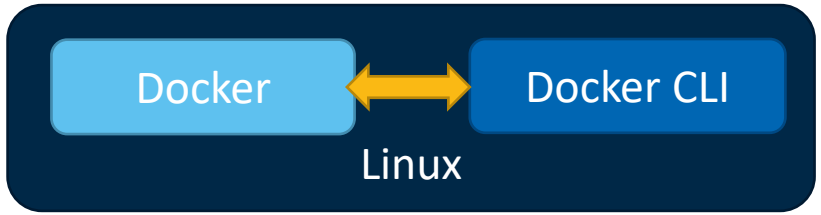




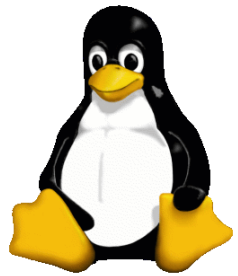


Level 1 – Docker on Linux

- CentOS/RedHat, Debian, Fedora, Ubuntu
  (separate install instructions per platform)
- Docker service controlling containerd + Docker Client
- Runs native on Linux
- Okay for smaller production deployments
- You can optionally install Docker Compose
- No Kubernetes included
- Build and run-time environment

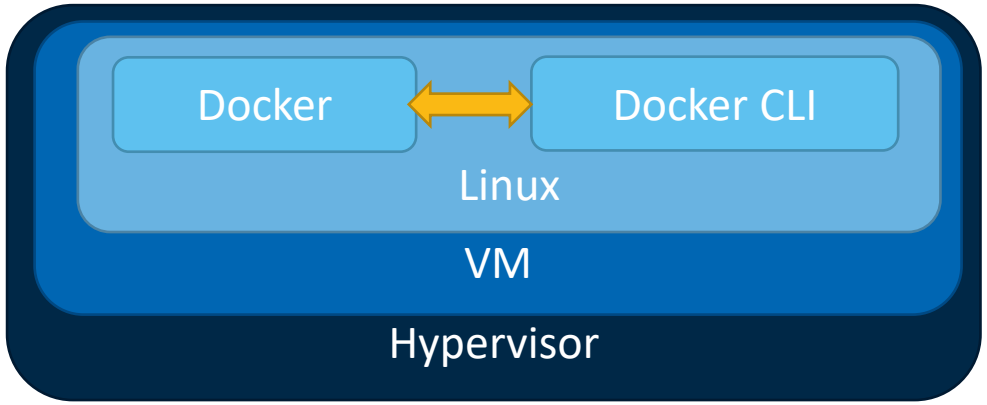


- Start here: https://docs.docker.com/engine/install/



Level 1 conclusion : Win? MacOS? Linux? It's always Linux in one way or the other

Level 2 – Docker Server



- Intended for small deployments and POC type environments
- Easiest to install and configure
- Build and run-time environment
- Does not support automatic scaling
- Fully supported for production

- System Recommendation
  - min. 2 CPU Cores,
  - 8 GB RAM,
  - 50 GB storage
- Linux Operating System
  e.g. CentOS Stream 8+ or RedHat 8+
- Docker CE 20+

Level 3 – Kubernetes (k8s)

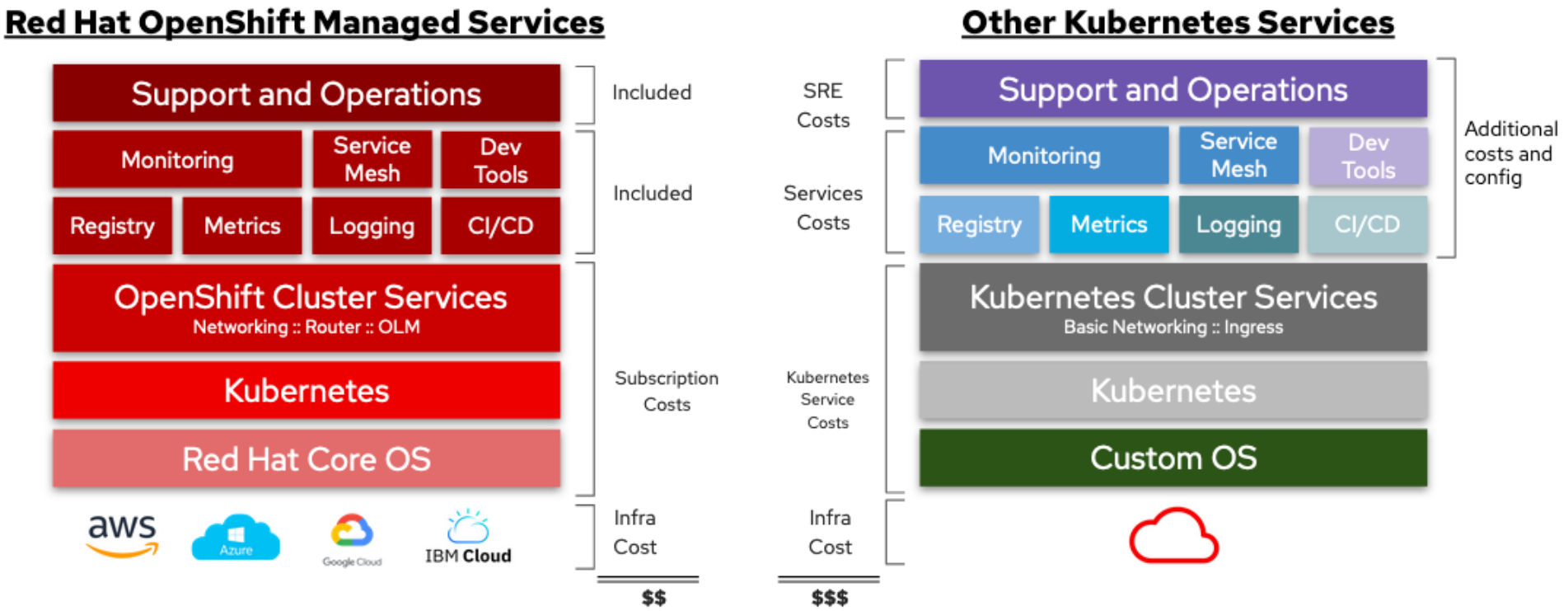
- https://kubernetes.io/
- Aka “vanilla” kubernetes
- Built for enterprise deployments at scale
- Contains management and orchestration
- Open source & free of charge
- Runs on virtualized machine or on HW

- Various “flavors” and branded versions of Kubernetes exist
  - e.g. https://k3s.io/ a lightweight distribution for IoT

Level 3 – OpenShift

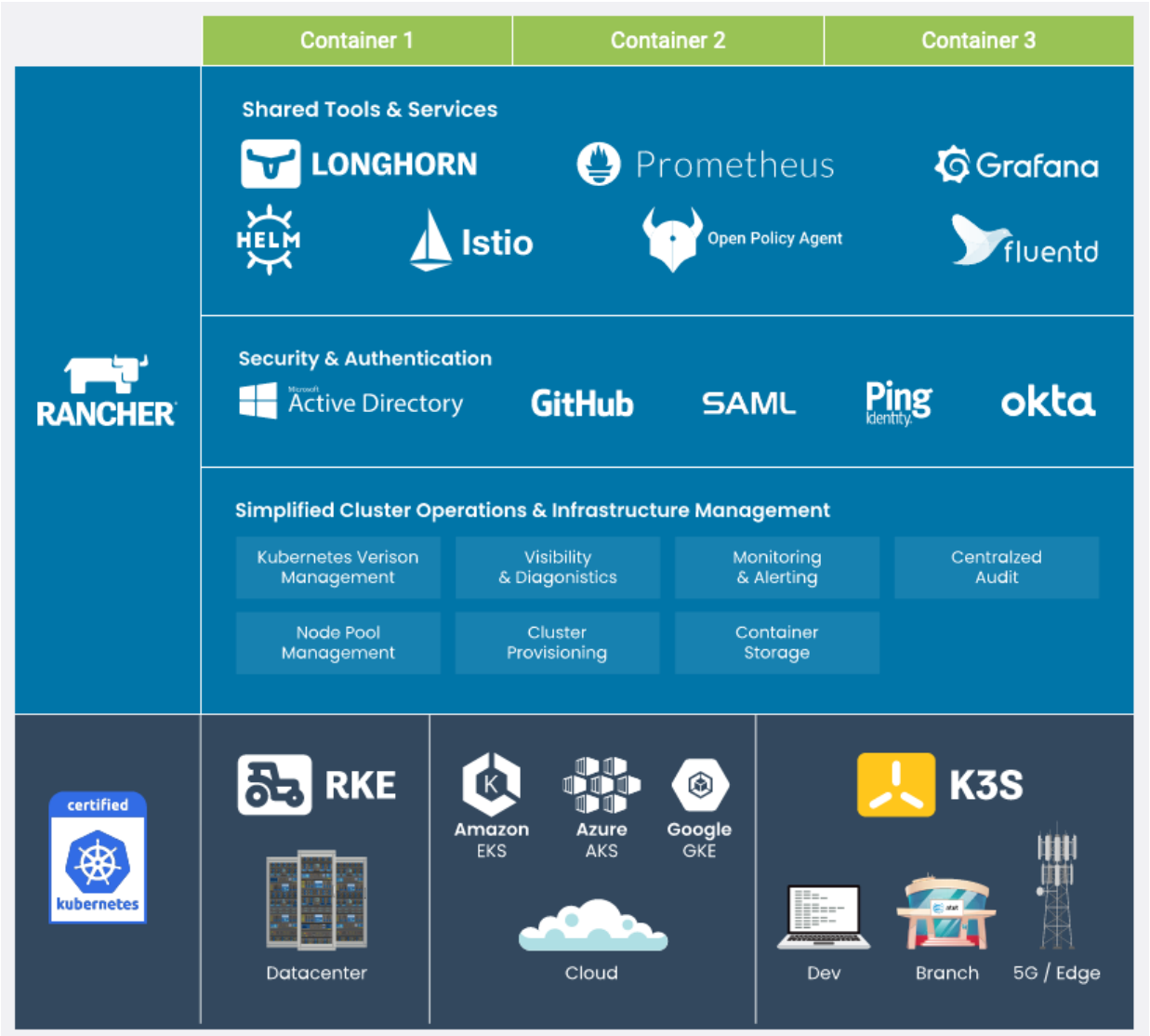
https://www.openshift.com/

- It's a flavor of Kubernetes
- Built for enterprise deployments at scale
- Contains management and orchestration
- Strong focus on security



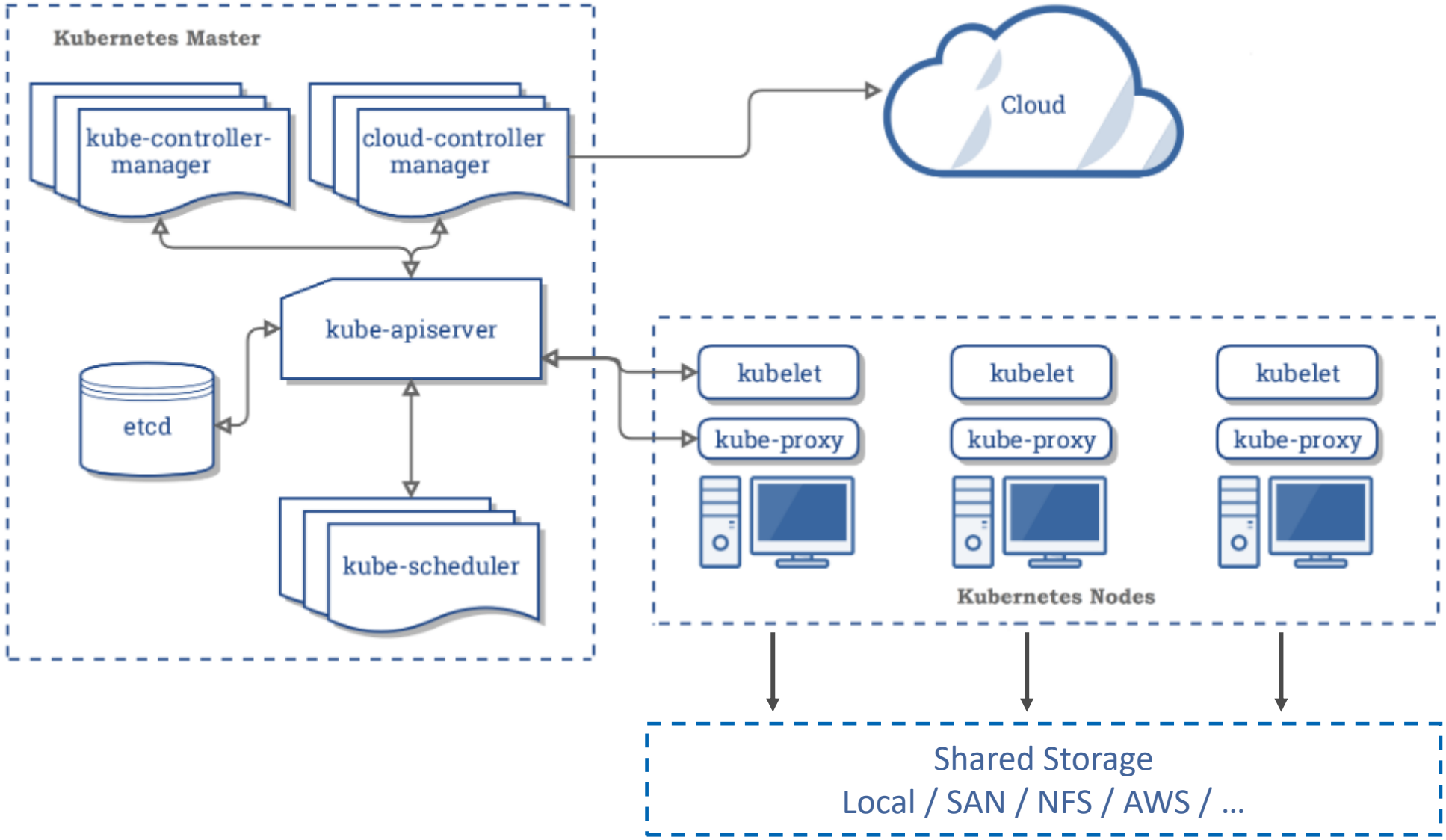
Level 3 – Rancher

- https://rancher.com
- It’s a flavor of Kubernetes
- Built for enterprise deployments at scale
- Contains management and orchestration
- Runs on virtualized machine or bare metal



RKE 2

Kubernetes Architecture: Don’t worry if this looks complicated!



Container Terminology for Domino Admins

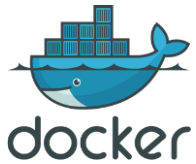
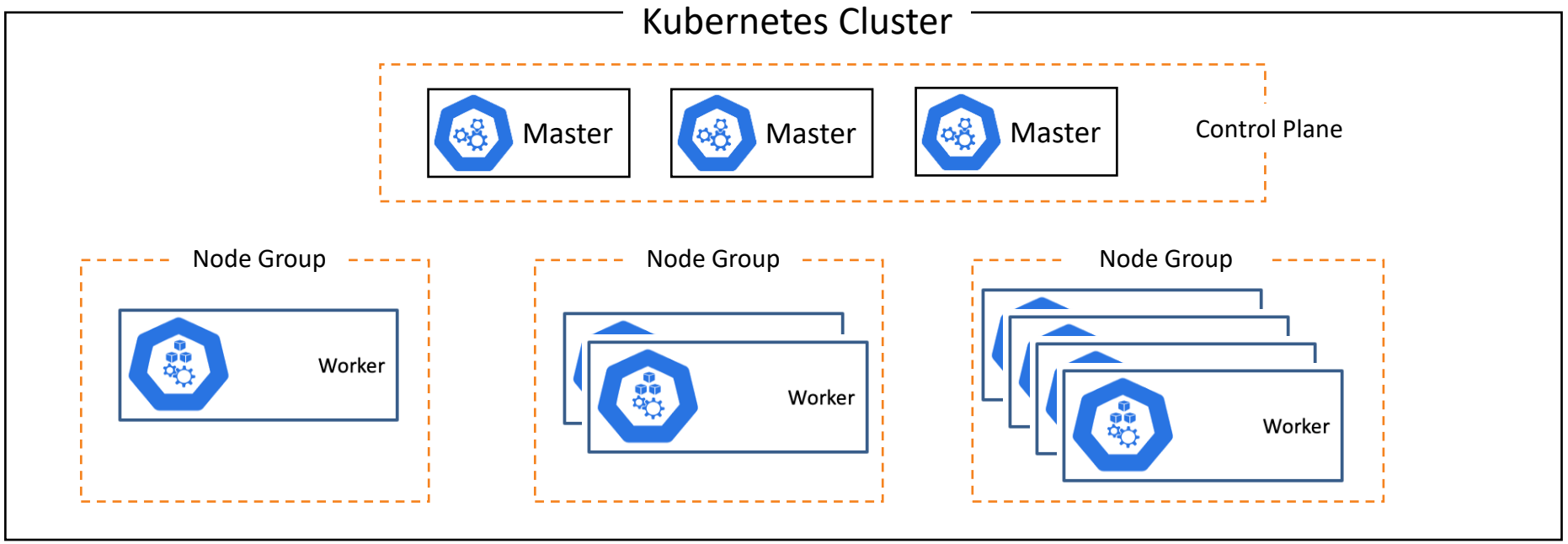


Image	=	Template
Container	=	Application
Volume	=	Domino Data Directory
CLI	=	Domino console
Registry	=	OpenNTF.org

Node	=	Domino Server		
Pod	=	Application	+	DDM
kubelet	=	Admin4.nsf		
etcd	=	Names.nsf Cldbdir.nsf		
Controller	=	DDM Probe		
Kube-proxy	=	Passthru		
Service	=	Domino Cluster		
YAML file	=	Your perfect Documentation		

Kubernetes

- Kubernetes = Containers Orchestration
  - High Availability
  - Failover
  - Auto scale
  - Workload Management



Basic Kubernetes Concepts

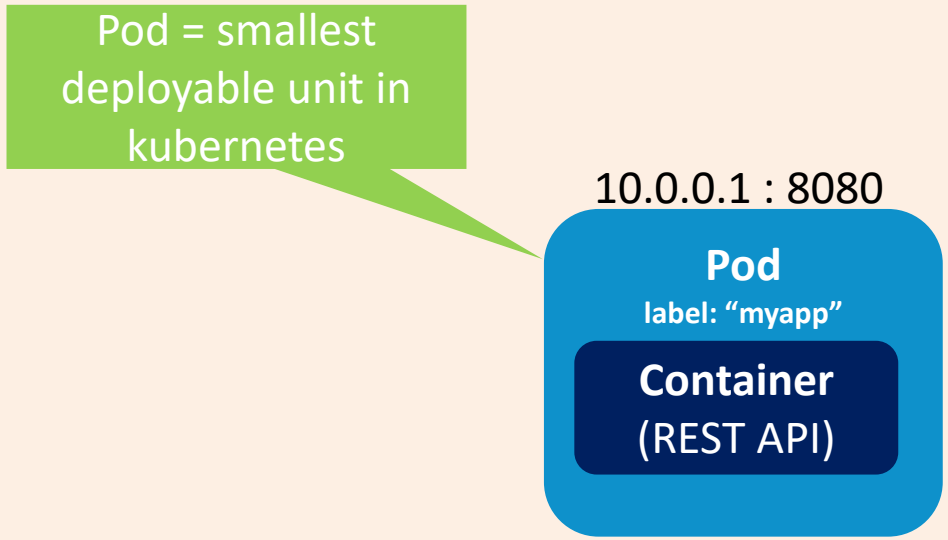
- **Pod**
  - Smallest scheduled component containing one or more containers exposing **ports**
- **Service**
  - Maps to one or more **Pods** providing and application service
  - Load balances requests among pods mapped for this Service
  - Can be externally exposed on a **NodePort** / **Cluster IP**
  - Or consumed via an **Ingress**
- **Ingress**
  - Provides external access via HTTP(S)

Kubernetes Cluster

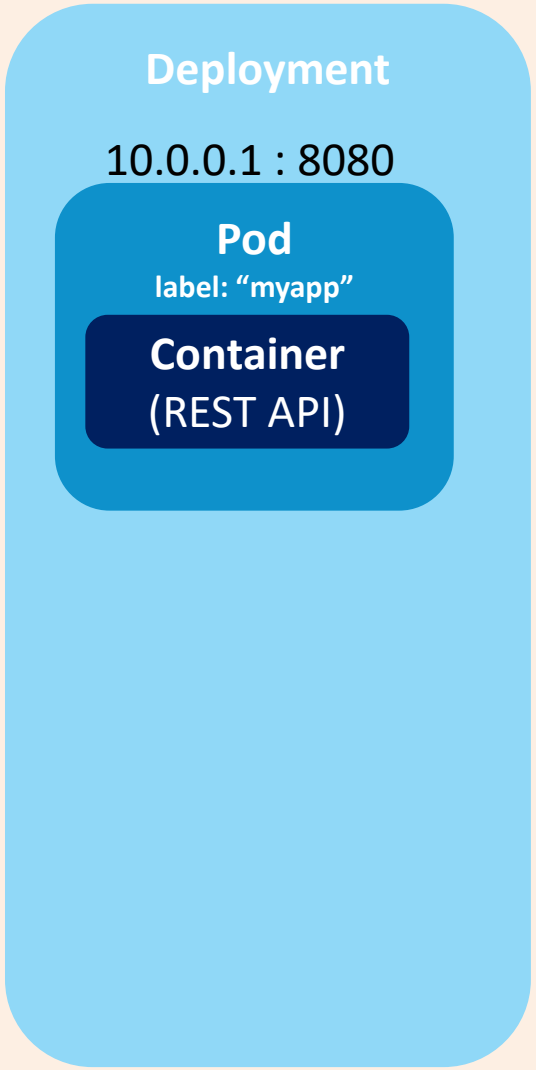
Kubernetes Cluster

Container
(REST API)

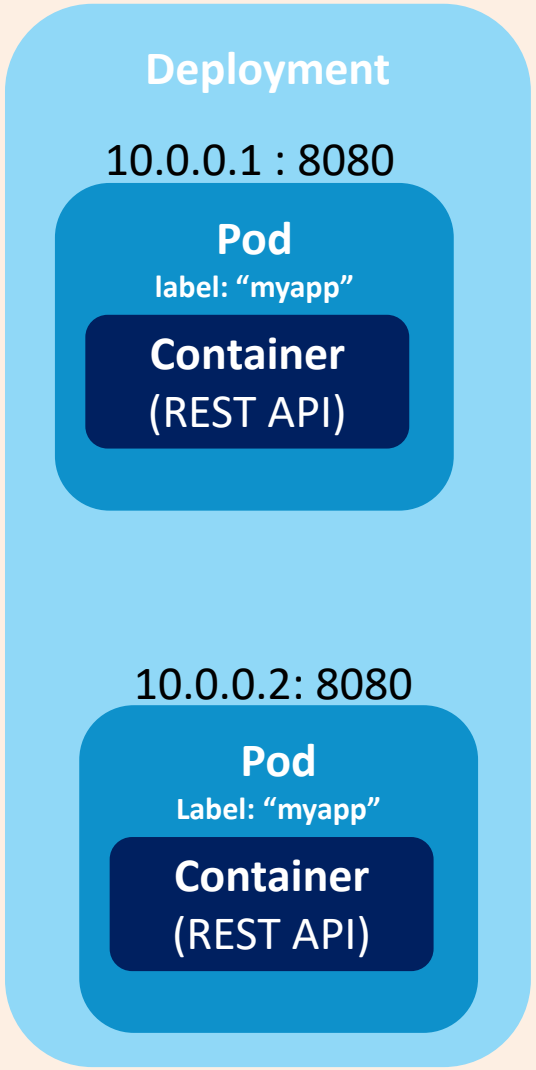
Kubernetes Cluster



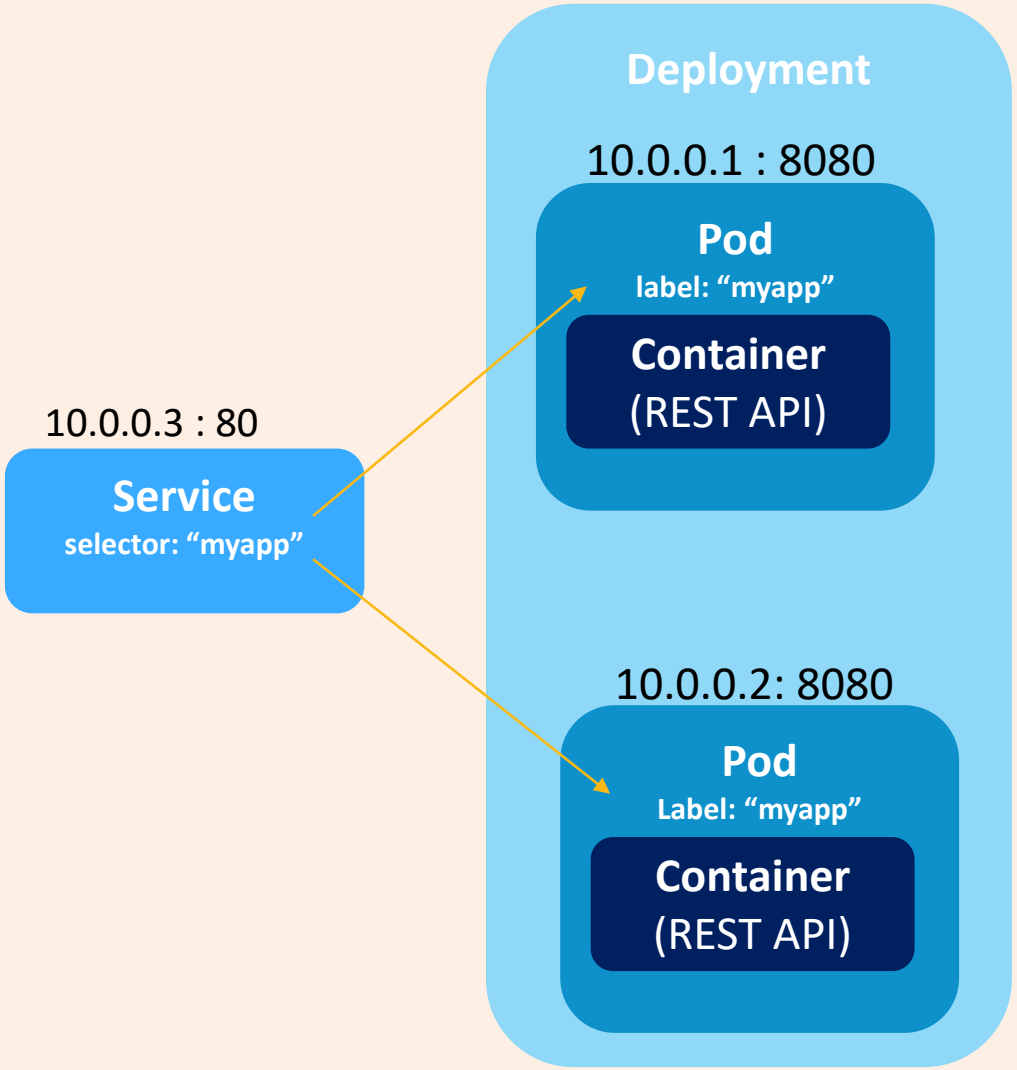
Kubernetes Cluster

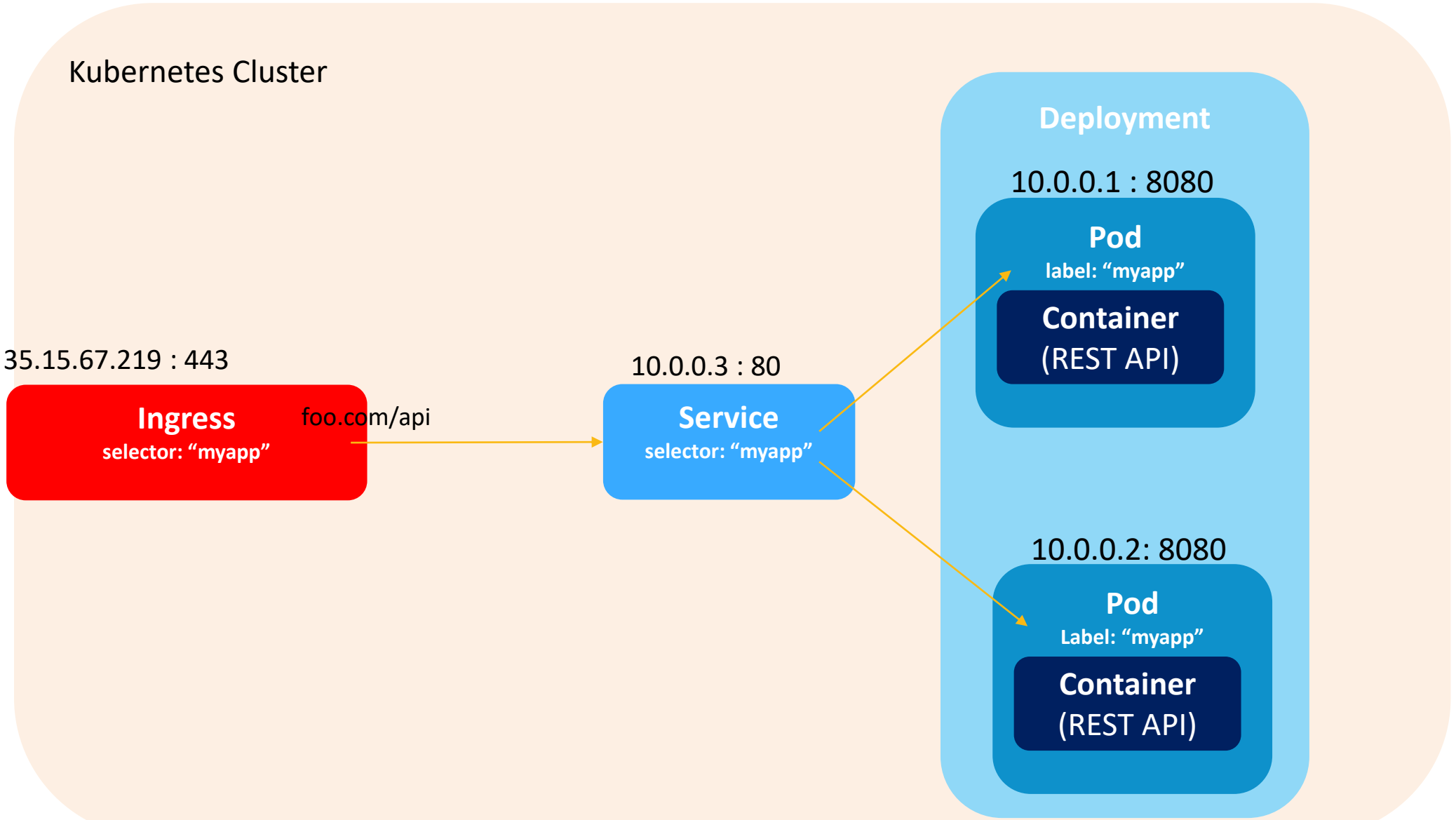


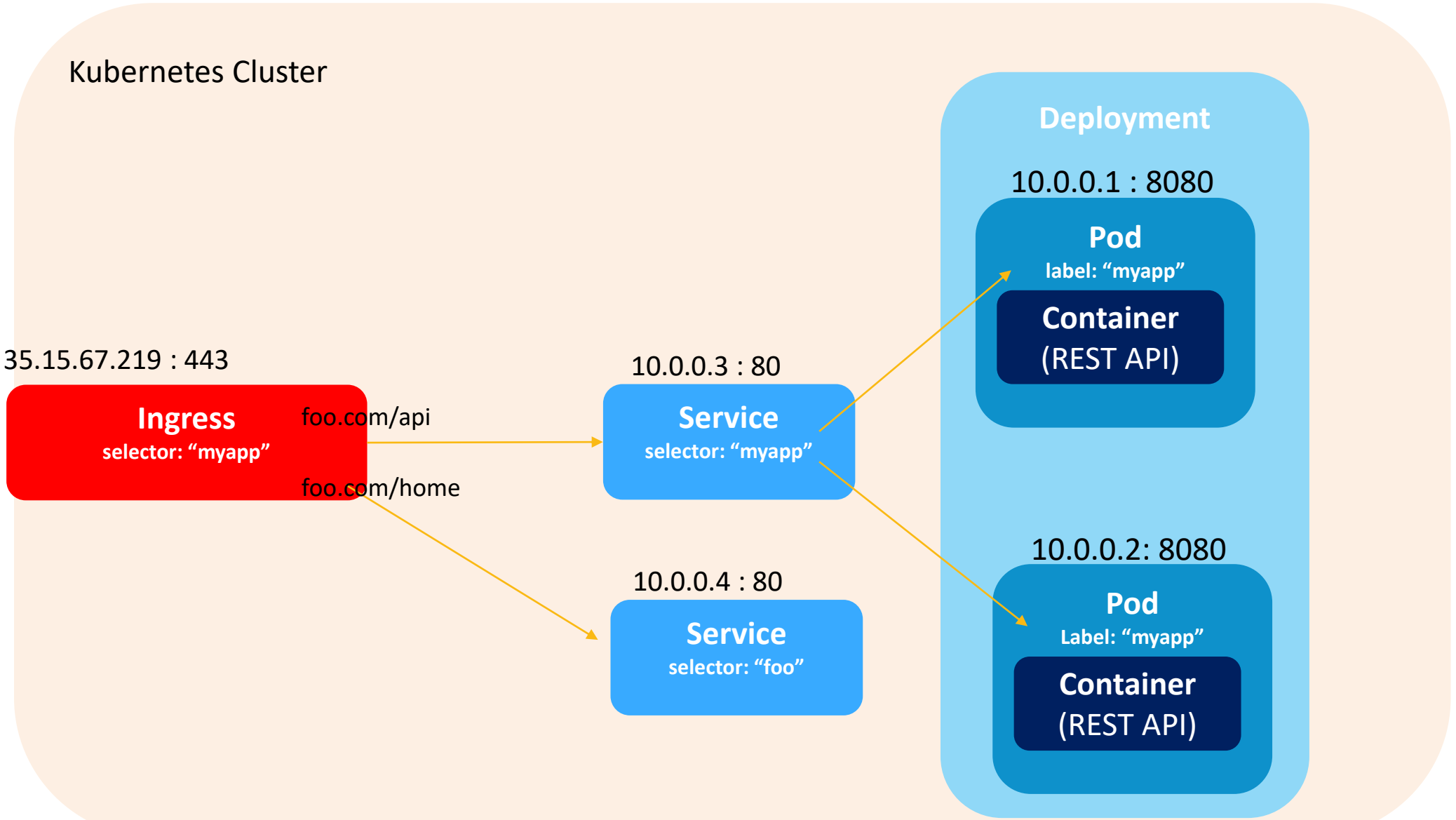
Kubernetes Cluster



Kubernetes Cluster




Kubernetes Cluster
Deployment
10.0.0.1 : 8080
Pod
label: “myapp”
Container
(REST API)
35.15.67.219 : 443
Ingress
selector: “myapp”
foo.com/api
10.0.0.3 : 80
Service
selector: “myapp”
10.0.0.2: 8080
Pod
Label: “myapp”
Container
(REST API)


Kubernetes Cluster
Deployment
10.0.0.1 : 8080
Pod
label: “myapp”
Container
(REST API)
35.15.67.219 : 443
Ingress
selector: “myapp”
foo.com/api
foo.com/home
10.0.0.3 : 80
Service
selector: “myapp”
10.0.0.4 : 80
Service
selector: “foo”
10.0.0.2: 8080
Pod
Label: “myapp”
Container
(REST API)

Basic Kubernetes Concepts

- **Deployment / ReplicaSet / DeamonSet**
  - Defines Pods to be created for applications, which are stateless and can scale
- **StatefulSet**
  - Defines Pods for a stateful application, which usually needs one or more volumes
- **Persistent Volume Claim** (PVC)
  - Provides storage for stateful applications mapped to **Containers**
- **ConfigMap**
  - Configuration mounted into a container (similar to a volume)
- **Secret**
  - Information like TLS credentials, passwords etc, mounted into a container (similar to a ConfiMap..)

Kubernetes Storage

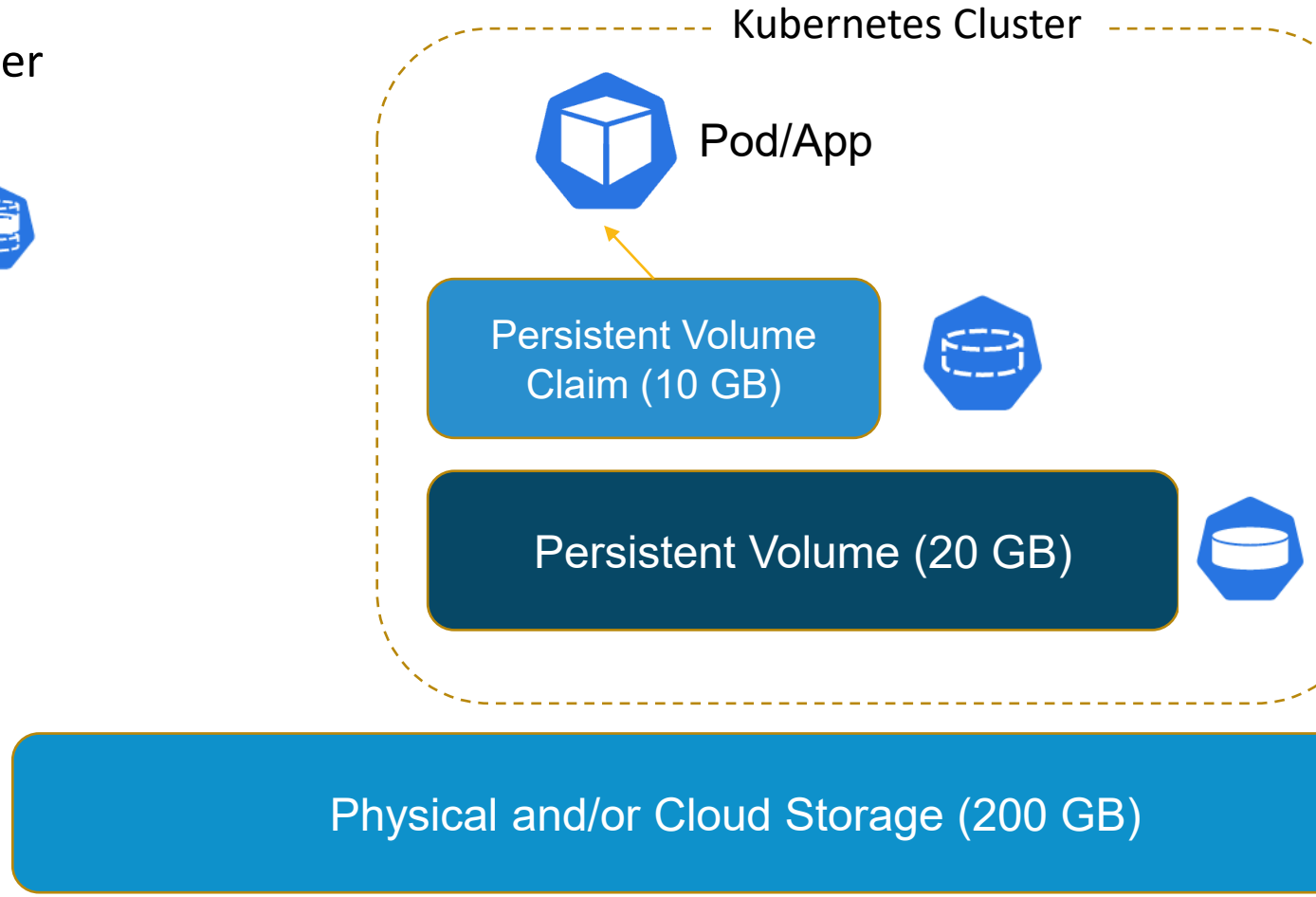
Persistent Volume
Allocated to the entire Kubernetes Cluster

Persistent Volume Claim

Storage needed (claimed) by a Pod

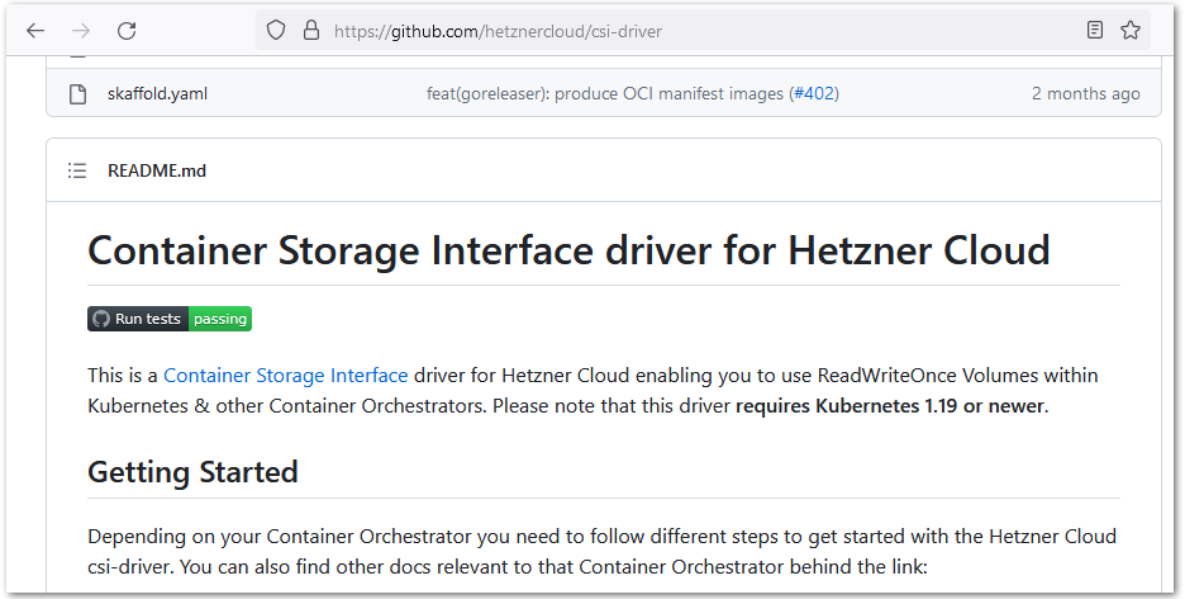
StorageClass

Automates the process to create PV dynamically as Pods asks for PVC



Container Storage Interface driver (CSI)

- **“CSI” is the standard for implementing storage drivers**
  - Drivers can implement additional services like
    - Volume expansions
    - Snapshots
- Cloud providers have their own CSI driver for their storage
  - Example: Hetzner Cloud Server
    - https://github.com/hetznercloud/csi-driver
- Rancher Longhorn enterprise storage uses iSCSI to provide storage in a cluster
  - Supports volume expansion, replication, snapshots



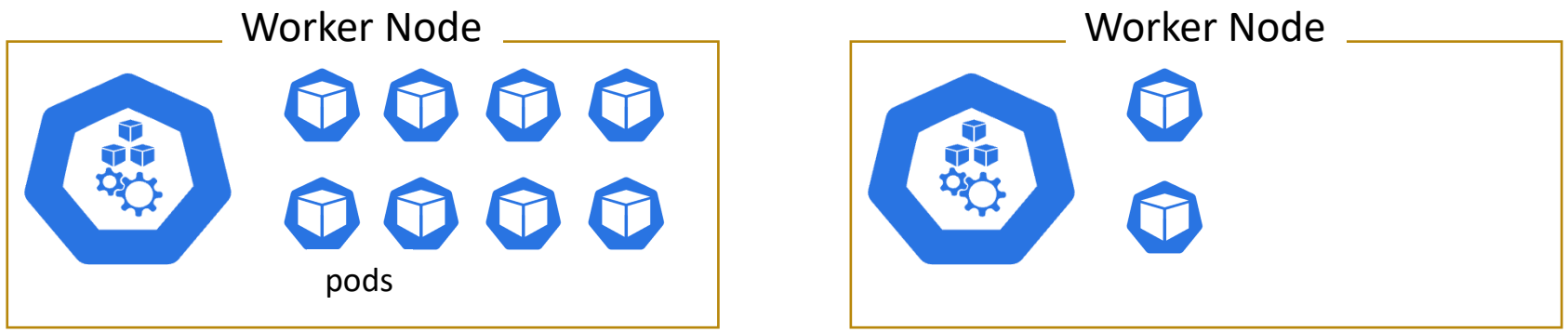
Container Terminology for Domino Admins

Image	=	Template
Container	=	Application
Volume	=	Domino Data Directory
CLI	=	Domino console
Registry	=	OpenNTF.org
Namespace	=	Domain

Node	=	Domino Server		
Pod	=	Application	+	DDM
kubelet	=	Admin4.nsf		
etcd	=	Names.nsf Cldbdir.nsf		
Controller	=	DDM Probe		
Kube-proxy	=	Passthru		
Service	=	Domino Cluster		
YAML file	=	Your perfect Documentation		

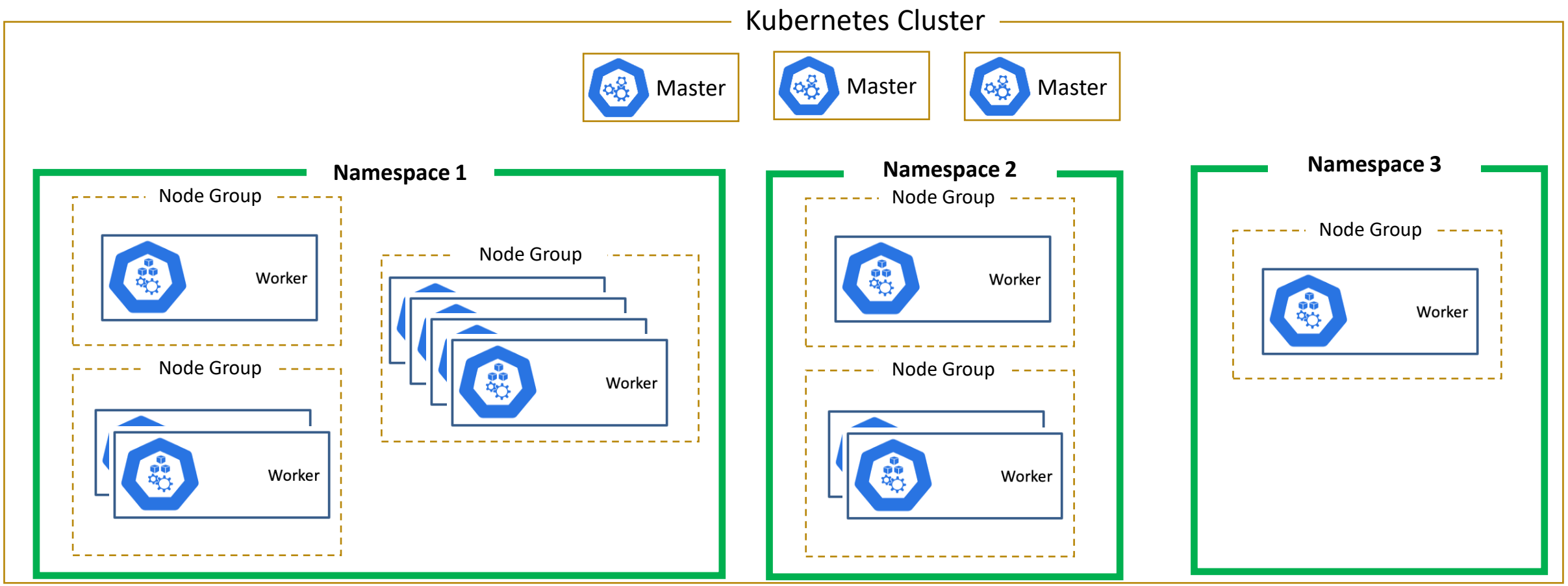
Kubernetes Nodes and Pods

- You can use a single cluster for many workloads or applications (Namespaces)
- One application can run on one or multiple nodes
- Containers run inside pods
- When Applications need to scale, more Pods are added.
- When Nodes run out of compute power, new Nodes are added.



Kubernetes and Namespaces

- Allows to organize different workloads (or Applications) in the same cluster



Which provider?

Managed Kubernetes or self-hosted?

Managed

- Easier to start.
- The provider manages the cluster.
- Provider offers related services (Load Balancers, Storage, …)

Self-hosted

- Test environment – easy.
  Production environment – complex.
- You manage the cluster.
- You manage networking and storage.

Image registry

A catalog of private/public images

IMPORTANT: HCL Domino is not free software. If you build a container image for a Domino server, you cannot publish it on an open image registry.

You must use a private image registry protected from public access.

You also have to provide access credentials to the registry (as a part of custom config settings).

Registries offered by cloud providers

AWS Elastic Container Registry

Google Artifact Registry

Azure Container Registry

Registries you can deploy yourself

Private Registry

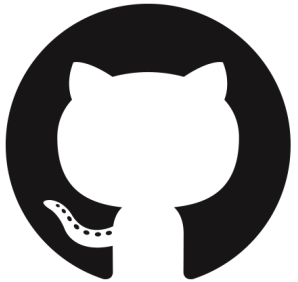
HARBOR

Red Hat Quay

HCLSoftware

Tools & Technologies You should know

Git & GitHub



- **GIT**
  - De-facto standard in software development today
  - Originally invented by Linus Torvalds to coordinate Linux kernel development
  - Command line & GUI tools
- **GitHub**
  - Many open source projects are mainly available and developed on GitHub
  - HCL Software provides many open source projects under the main umbrella
    - https://github.com/HCL-TECH-SOFTWARE
    - CertMgr, Domino 12 Backup and Domino container image provide repositories

Git

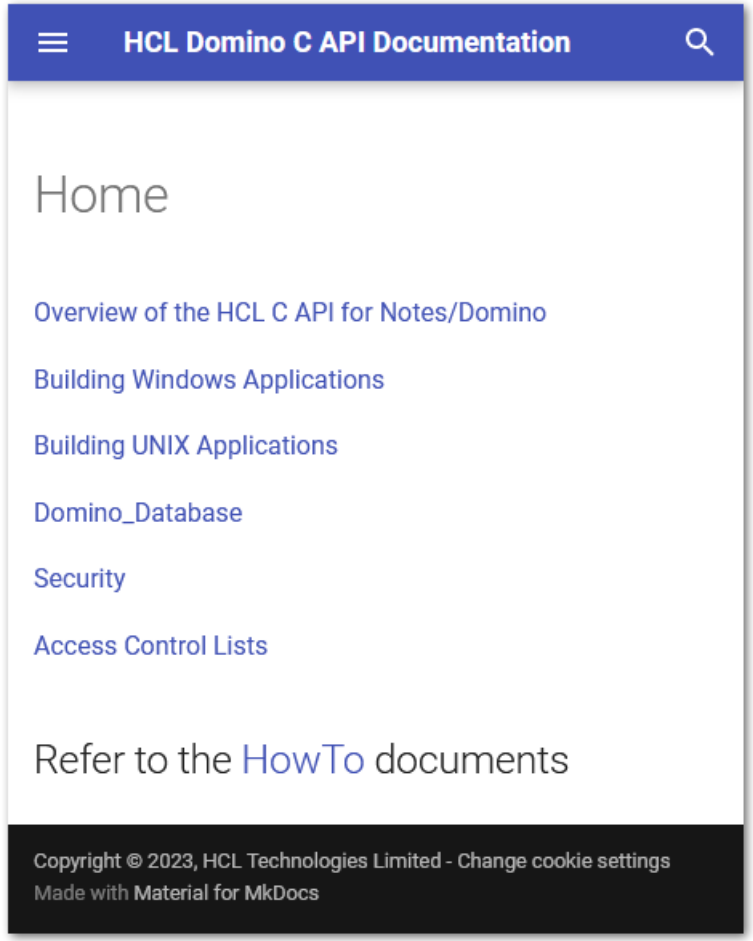
- A tool you should know today!
- Many software developers and companies use Git to manage their source code
- For our workshop you will need some simple git commands

- "**git clone**" – to clone a project
- "**git checkout develop**" – to switch to the develop branch of the project
- "**git pull**" – to update your local repo

- TIP: Git client on Windows provides **Linux tools**
  - For example **ldd.exe** is very convenient for analyzing Windows dependencies
  - There is even **vi** - Very useful if you log into a machine via SSH

Git uses Mark Down standard (.md)

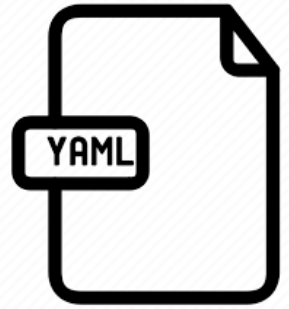
- Very simple and reduced syntax to write easy to use documents
  - https://en.wikipedia.org/wiki/Markdown
  - https://www.markdownguide.org/
- HCL Documentation project C-API Docs
  - https://github.com/HCL-TECH-SOFTWARE/domino-c-api-docs
- GitHub Pages & MKDocs
  - https://opensource.hcltechsw.com/domino-c-api-docs/



{JSON} – A standard you should know

- https://www.json.org
- Most configuration files today are in JSON
- It replaces XML in many cases.
- If you never looked into JSON you have start now!
- The most popular parser on Linux and Windows:
- **JQ** – https://stedolan.github.io/jq/
- Very powerful and included in the Linux distributions

YAML – Another standard you should know



- https://yaml.org/
- YAML / YML is often used in the container world to describe a configuration
  - For example used in docker-compose and K8s configuration
- Very reduced & simplified format
- What their homepage says:
  - "YAML: YAML Ain't Markup Language"
  - "What It Is: YAML is a human friendly data serialization standard for all programming languages."
- Tool for Linux: https://mikefarah.gitbook.io/yq/

XML –> JSON → YAML

XML	JSON	YAML

<Servers>
<Server>
<name>Server1</name>
<owner>John</owner>
<created>123456</created>
<status>active</status>
</Server>
</Servers>
	{
	Servers: [
	{
	name: Server1,
	owner: John,
	created: 123456,
	status: active
	}
	]
	}
		Servers:
		- name: Server1
		owner: John
		created: 123456
		status: active

- Source: https://developer.ibm.com/technologies/containers/tutorials/yaml-basics-and-usage-in-kubernetes/
- Great video with all you need to start: https://www.youtube.com/watch?v=1uFVr15xDGg&t=116s

CURL – A tool you should know

- De-facto standard for HTTP/HTTPS and other internet protocol operations
- **A - Command line tool** shipped with Windows and Linux
- **B. LibCurl** is an open source SDK used by applications (usually dynamically linked → “DLL”)
  - Domino and CertMgr leverages **LibCurl** internally as well
  - Free PDF book: https://everything.curl.dev/
  - Founder and lead developer Daniel Stenberg / https://daniel.haxx.se/
  - Commercial support available for developers by WolfSSL
- We will use the command line version on Linux and Windows to download files
  - Example: **curl –L https://download.com/nshcertool -o /usr/bin/nshcertool**
- Tip: Download current curl version to replace old version included in Windows
  - https://curl.se/windows/

DNUG LAB

- Initiated for #DACHNUG49
  - https://dnug.de/dnug-lab/
- Stable, permanent lab environment covering the latest Domino, Traveler, Nomad, ST, .. features
- Can be used by all members for
  - Checking out new functionality
  - Collaborate on projects
- Reference implementation for Domino on different platforms
  - Windows, Linux, Docker, Podman
  - **New:** Kubernetes environment
    - RKE2 + Rancher + Longhorn storage

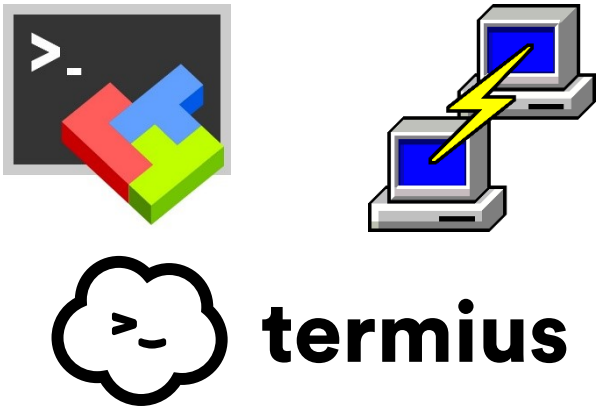
RKE 2

RANCHER BY SUSE

LONGHORN

Secure Shell SSH

- **Standard and most secure connection to servers**
  - User/Password
  - **SSH key (recommended --> Disable password authentication!!)**
  - TOTP
  - Or a combination of all three?
- Global configuration + authorized keys per user
- Used for
  - Terminal sessions
  - Secure copy (scp, sftp)
  - Execution of remote commands
  - Tunnel connections



- Recommended tools
  - MobaXterm
  - Putty
  - Terminus

- OpenSSH server for Windows → https://github.com/PowerShell/Win32-OpenSSH/releases

HCLSoftware

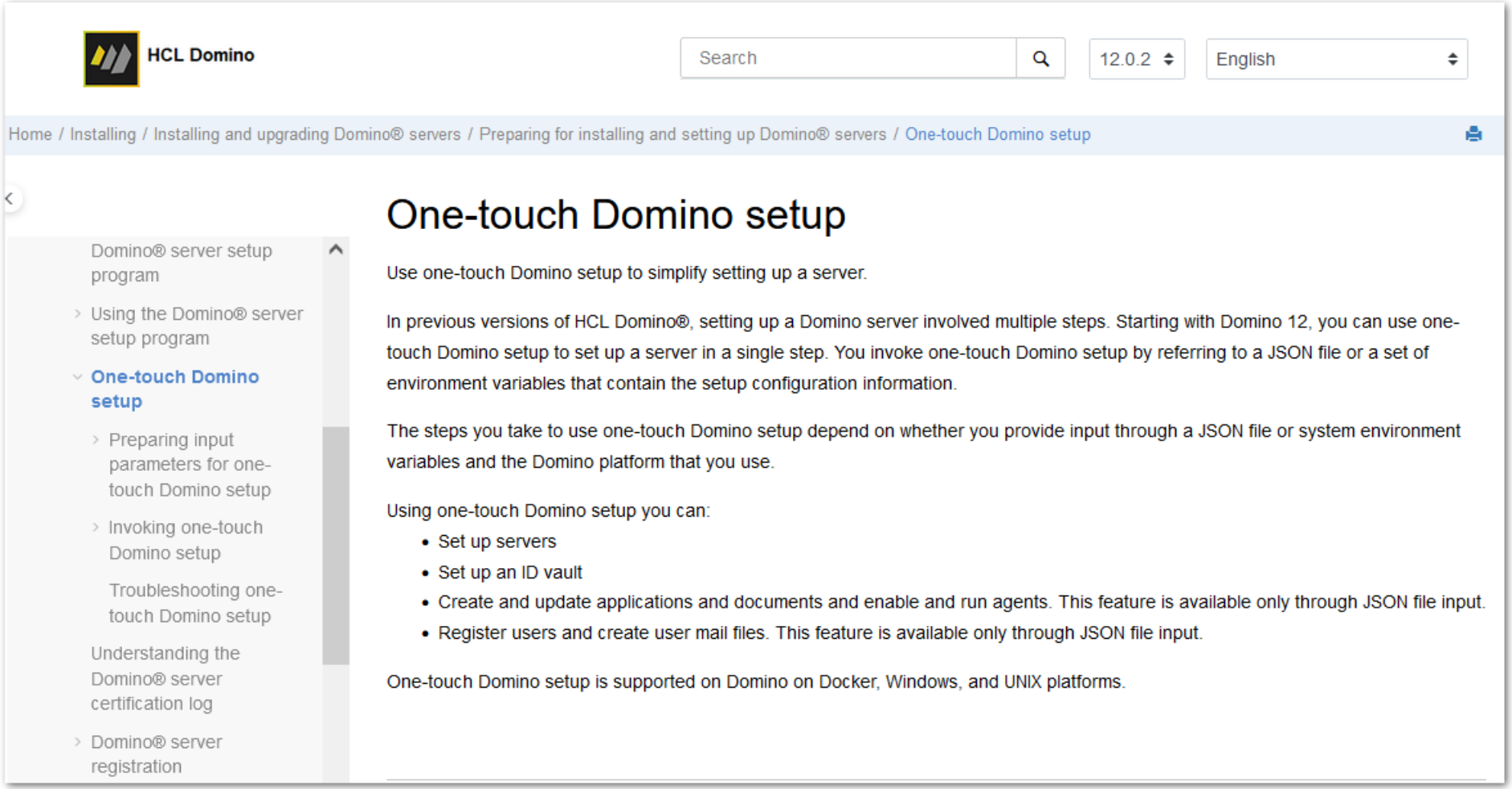
Domino 12
One Touch Setup

"Auto Config"

Domino 12 One-Touch

HCL Domino

- HCL Documentation
  - https://help.hcltechsw.com/domino/12.0.2/admin/inst_onetouch.html



Domino 12 One-Touch (OTS)

HCL Domino

- Two different configuration options
- **Simple ENVIRONMENT variable setup**
  - Very simple to use
- **JSON based setup**
  - More complex, but very powerful and flexible
  - Including Application configuration (update documents, create databases, documents, etc.)
  - Schema validation for JSON format
- OTS automation is fully integrated into the HCL Community Domino and HCL Domino image
  - Provides automated ways to download JSON file
  - Replaces **{{ ENVIRONMENT_.. }}** placeholders

HCLSoftware

Domino 12
on Docker & Podman

podman

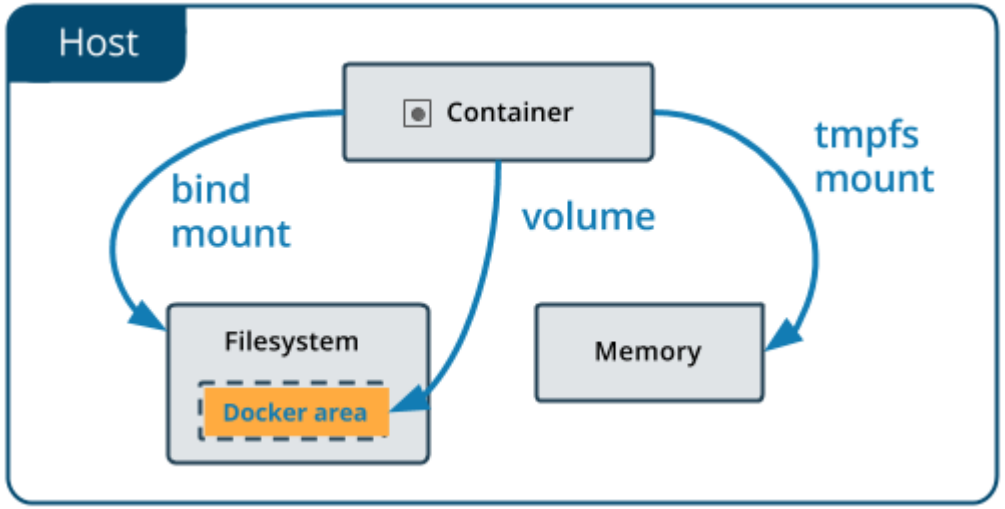
Podman vs Docker

podman

- Podman is another **run-time** and **build** platform shipping with Redhat and SUSE distributions
- Installation is a single command:
  - "`yum install -y podman`" (Redhat/CentOS – and clones)
  - "`zypper install -y podman`" (SUSE)
- In contrast to Docker, Podman does not use a **daemon**
  - it is not running as **systemd** service and all containers are started directly by **podman**
- 1:1 replacement for Docker functionality
  - With some minor differences in detail
- **podman-compose** is **not** a 1:1 replacement for **docker-compose**
  - But you can use docker-compose also with podman
    - See https://www.redhat.com/sysadmin/podman-docker-compose for details

Run your first Domino Server in a Container

```
• docker run -it -d --name domino12 \
  --hostname=marvel.domino-lab.net \
  -p 80:80 -p 443:443 -p 1352:1352 \
  -v vol-notesdata:/local/notesdata \
  --cap-add=SYS_PTRACE  \
  --env-file env_domino \

  domino-container:V1202_09152022prod
```



`-it -d`	Run in interactive mode but detached
`--name`	Defines name of container
`--hostname`	Defines host name inside the container
`-p host-port:container-port`	Publishes and maps a port outside the container
`-v volume-name:/local/notesdata`	Maps a volume to the container
`--cap-add-SYSPTRACE`	Allows GNU debugger to attach to processes (NSD)
`--env-file`	Specifies environment variable file

Interact with your Domino Server

HCL Domino

- Daily administration should be performed via Admin client
- Admins can also start a **shell** into the running container if really needed

- **`docker exec -it domino12 /bin/bash`**
  - Return via “exit”
  - Use “**`-u 0`**” option for root access

- **“`docker logs domino12`”**
  to see the logs from startup & configuration operations

Domino Start Script Commands

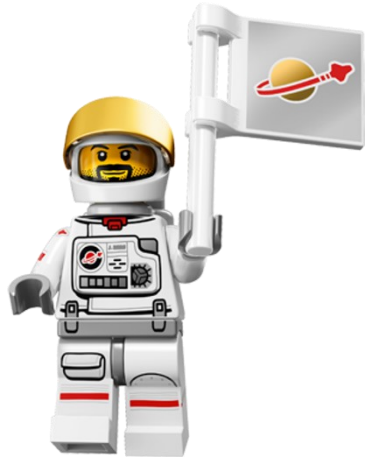
- Invoked inside the container via “**domino**” command

```
show server

Lotus Domino (r) Server (Release 5.0.3 (Intl) for UNIX) 06/11/2022 08:27:32 PM

Server name:            lego-builder/FactoryTour
Server directory:       /local/notesdata
Partition:              .local.notesdata
Elapsed time:           11 days 04:21:24
Transactions/minute:    Last minute: 0; Last hour: 0; Peak: 0
Peak # of sessions:     2 at 04/11/2022 03:53:41 AM
Transactions:           0
Availability Index:     100 (state: AVAILABLE)
Message Tracking:       Not Enabled
Shared mail:            Not Enabled
Number of Mailboxes:    1
Pending mail:  0        Dead mail:  0
Waiting Tasks:          0
Transactional Logging:  Enabled
> close
Live Console closed.
```

domino console	Runs Domino live console
domino help	Lists commands with short description
domino start/stop	Starts/Stops Domino server inside the container
domino archivelog	Archives notes.log file and compresses it
domino nsd	Runs a manual NSD
domino res	Shows Domino processes, memory and MQs

dominoctl – Domino Container Control Script

- Optional admin script designed to run the Domino Community + new HCL image
  - Simplifies Domino container administration
  - Supports **docker** & **podman** (+ **nerdctl** on Rancher Desktop)



- Run "**`dominoctl`**" from a prompt
  - **dominoctl** provides command-line help
  - Provides start/stop, update, config & troubleshooting commands
- **Installation**
  - Clone or download the GitHub project https://github.com/nashcom/domino-startscript
    - Example: **`git clone https://github.com/nashcom/domino-startscript.git`**
  - Run install script
    - **`./domino-startscript/install_dominoctl`**

GitHub

Domino Container Run-Time Support

- The new image is tested on
  - **Domino Docker 20.10+**
  - **Podman 3.3.0+**



- Working but not actively tested
  - **Kubernetes** (K8s), **Redhat OpenShift**
  - **Docker Desktop** on Windows/Mac, **Rancher Desktop**
  - Customers cannot expect HCL Support to help with container run-time platform issues
    - **Container itself is supported** similar to Linux distributions meeting the basic system requirements

Import Docker Image

- Import image to your Docker host via “docker” command remains the same
- **docker load --input Domino_12.0.2_Container_Image.tgz**

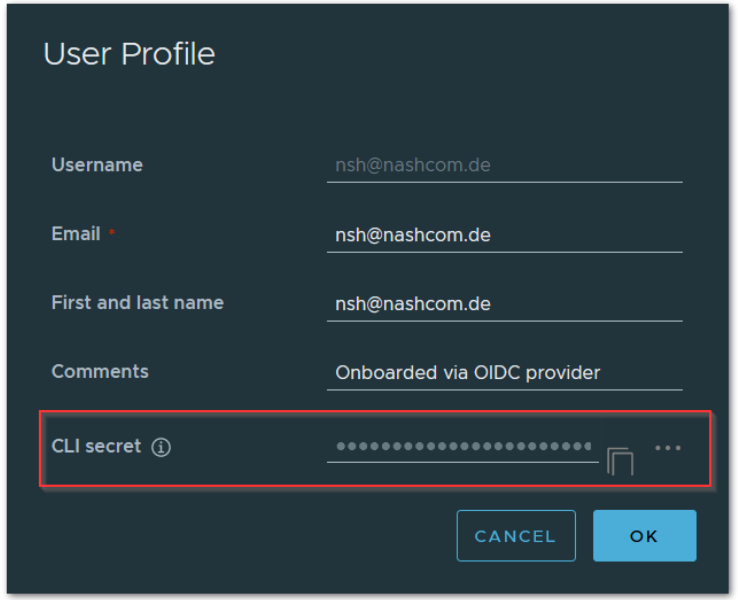
```
aae852b00c54: Loading layer [==========================>] 44.54kB/44.54kB
6da388c94871: Loading layer [==========================>] 239.1kB/239.1kB
92487d3c7076: Loading layer [==========================>]  56.1MB/56.1MB
dbe8a9ec8c94: Loading layer [==========================>] 1.077GB/1.077GB
Loaded image: domino-container:V1202_09152022prod
```

- Verify the Docker image is on your Docker server

```
docker images
REPOSITORY          TAG                    IMAGE ID       CREATED          SIZE
domino-container    V1202_09152022prod     c3919b6d975c   3 weeks ago      1.34GB
```

Pull Image from HCL Harbor Registry

- Domino isn't available on the Docker public Registry
  - But every customer on maintenance should have access to the HCL Harbor registry
- 1. Login with your Flexnet account to the Harbor registry
  - Also uses Okta SSO
- → https://hclcr.io/
- 2. Get an authentication token
- 3. Login with your e-mail address + token
  - **`docker login hclcr.io`**
- 4. Pull image
  - **`docker pull hclcr.io/domino/domino-container:V1202_11032022prod`**



Domino 12 “One Touch Setup”

- Domino 12 introduced “One Touch Setup”
  - Provides **automated setup** + **server configuration**
  - Cross platform, integrated into core -- Not only available for containers!
    - Very useful in the container world
- Two modes
  - a.) **Environment variables** – Designed to be used with containers
    - Basic functionality
  - b.) **JSON File** → Allows to configure many additional settings!
    - Create databases, documents, configure ID-Vault, TLS Credentials ..

Domino V12 “One Touch Setup”

- For basic configuration use environment variables
  - More advanced functionality is available passing a JSON file (e.g. via volume mount)
  - Environment on Docker host referenced in docker run statement via `--env-file env_domino`

- env_domino

```
SetupAutoConfigure=1
SERVERSETUP_SERVER_TYPE=first
SERVERSETUP_ADMIN_FIRSTNAME=John
SERVERSETUP_ADMIN_LASTNAME=Doe
SERVERSETUP_ADMIN_PASSWORD=domino4ever
SERVERSETUP_ADMIN_IDFILEPATH=admin.id
SERVERSETUP_ORG_CERTIFIERPASSWORD=domino4ever
SERVERSETUP_SERVER_DOMAINNAME=DominoDemo
SERVERSETUP_ORG_ORGNAME=Domino-Demo
SERVERSETUP_SERVER_NAME=domino-demo-v12
SERVERSETUP_NETWORK_HOSTNAME=domino.acme.com
```

Log Files and config files inside the Container

- **/tmp/domino-container/install_domino.log**
  - Domino installation log (from the build process → just for information)
- **/tmp/domino-container/data_update.log**
  - Log for extracting the data directory from **/domino-container/install_data_domino.taz**
- **/domino-container/domino_ver.txt → /local/notesdata/domino_ver.txt**
  - Version of the Domino image used for triggering updates
- **/local/notesdata/notes.log**
  - Domino server log output file
- **/etc/sysconfig/rc_domino_config**
  - Start Script configuration

Stop a Domino Server cleanly!

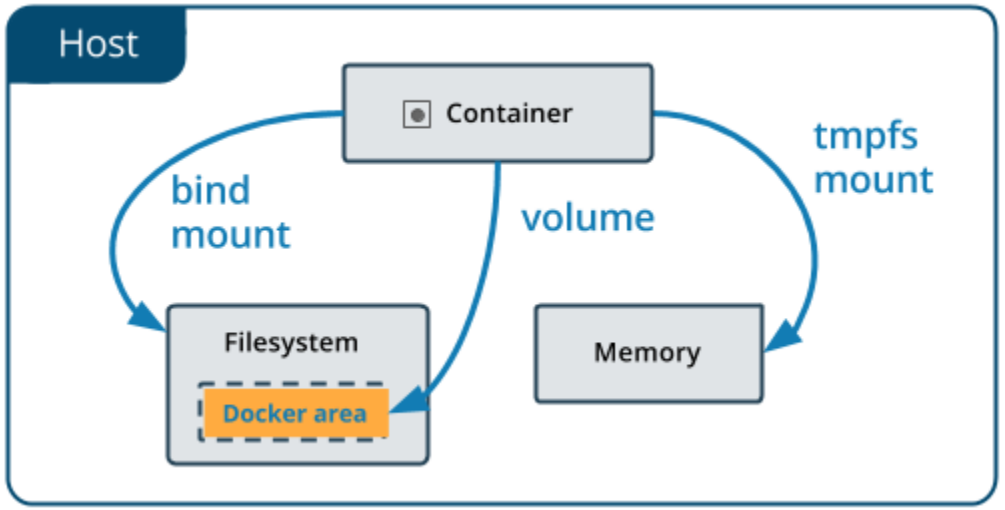
- Docker by default sends a **SIGTERM** signal to the main process of the container
  - If the main process does not stop within **10 seconds**, a **SIGKILL** signal is send to the container!
  - This would not allow Domino to shutdown cleanly
  - Always specify **`set --stop-timeout=90`** on the run statement
- Specify a higher wait time if needed for specific situations in the shutdown command
  - **`docker stop --time=120 domino12`**

Working with Docker

`docker images`	Lists locally available images
`docker run`	Runs a new container based on an image
`docker start/stop`	Starts/stops an existing container
`docker ps [-a]`	Shows all running process – All processes using **–a**
`docker inspect`	Shows detailed information for a container or image
`docker exec`	Executes a command or shell inside the container
`docker system prune`	Removes all stopped containers, unused networks, dangling images (images not tagged)

Docker Volumes

- By default all data is stored in the container
- For applications with local storage requirements, this does not work well
- Docker supports “volumes” which are mapped into the container
  - The data from the local directory will be copied to the volume at first run when the volume is empty
  - The default implementation is a local disk
    - You can either create a volume manually, mount existing directories or let Docker create it
- https://docs.docker.com/storage/volumes/



Docker Volumes

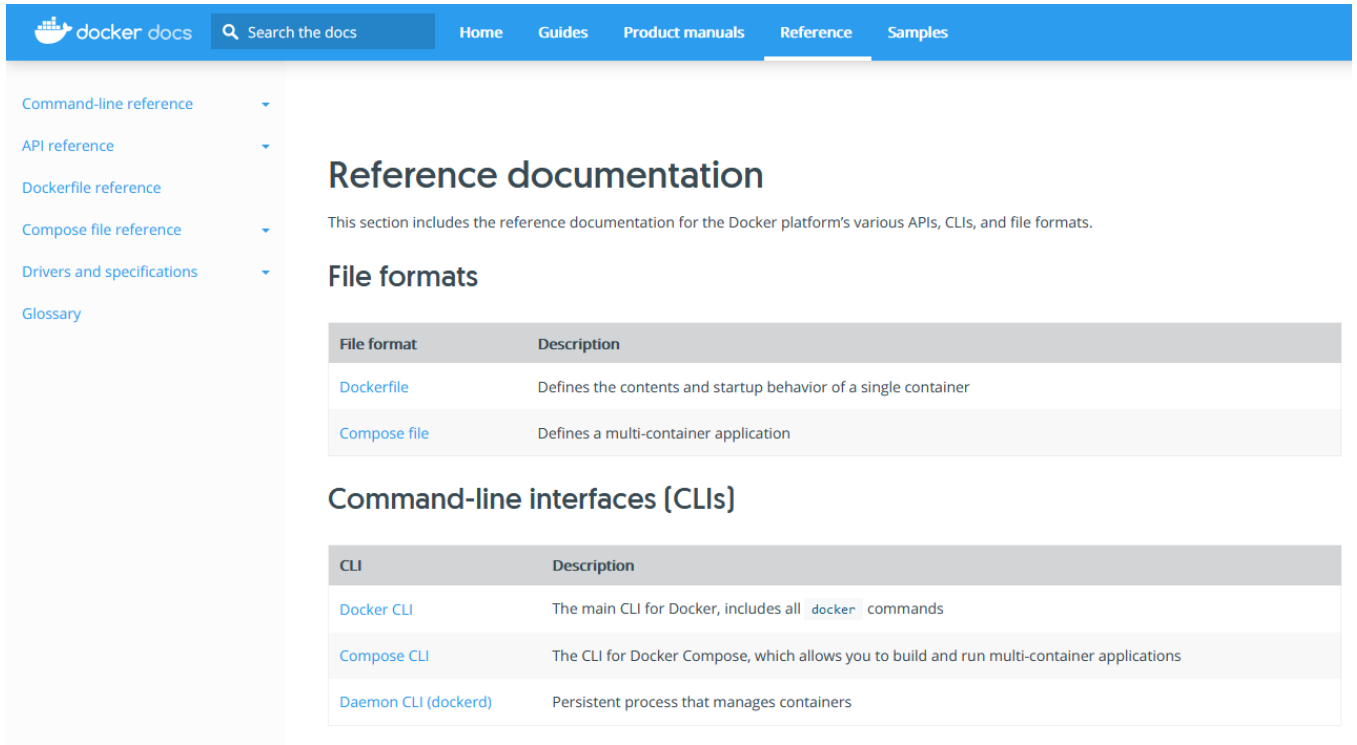
- You can specify an existing volume in your run statement
  - docker run --rm -it **-v /local/data1:/local/data** centos:latest bash
- Or let Docker create a local volume
  - docker run --rm -it **-v test-data1:/local/data** centos:latest bash
  - Default location: /var/lib/docker/volumes
- Or for example use a NFS mount on a NAS
  - docker volume create **--driver local --opt type=nfs --opt o=addr=192.168.96.41,rw --opt device=:/data/docker_vol --name nfsvol**
  - docker run --rm -it **-v nfsvol:/local** centos:latest bash

Docker Volume Commands

`docker volume ls`	Lists all volumes
`docker volume inspect my-vol`	Shows details about one volume
`docker volume create my-vol`	Creates a new volume
`Docker volume rm my-vol`	Removes a volume!
`Docker system df`	Shows used and free space
`Docker volume prune`	**Use with care**: Removed all volumes not referenced by any container

Docker Documentation

- Great documentation
  - If you google you are hitting the official website most of the time
- Reference for all commands
- Official website
  - https://docs.docker.com
- Includes installation instructions for all platforms



Docker Compose

- Uses a **YAML** file to define one or multiple containers
  - Multiple containers can join the same **network** also defined by the configuration
  - Sametime meetings is using docker-compose to bring up multiple containers as one **service**

- Many other projects use **docker-compose.yml** files to describe their services
- In the end it's still managing the same containers we already know in a different way
- Examples in the community image Git repository
- The docker-compose syntax is different than the standard to define pods in in Kubernetes
  - But the principles are similar
  - Podman has “**podman play**” bridging to the K8s world

Docker Compose Commands

`docker-compose up`	Starts containers described in **docker-compose.yml**
`docker-compose down`	Stops the same containers and removes them
`docker-compose up -d`	Starts containers and detaches from console
`docker-compose logs`	Shows logs
`docker-compose ps`	Shows running containers
`docker-compose stop`	Stops containers without removing them
`docker-compose rm`	Removes containers

Docker Compose Example

```
version: '3.6'
services:

  domino:
    image: hclcom/domino:latest
    container_name: domino-acme-01
    hostname: domino-acme-01.acme.com
    stop_grace_period: 60s

    environment:
      LANG: en_US.UTF-8

    cap_add:
      - SYS_PTRACE

    ports:
      - 1353:1352
      - 80:80
      - 443:443

    volumes:
      - domino_vol:/local

volumes:
  domino_vol:
    name: domino_acme_01_local
    external: false
```

- Shows all the information you already know
- Can bring up multiple containers together defining a service
  - Like the Sametime Meeting server
- Defines resources like volumes and networks separately
  - In this example you see a Domino data volume mounted at **/local**
- Can use variable names specified in an **.env** file

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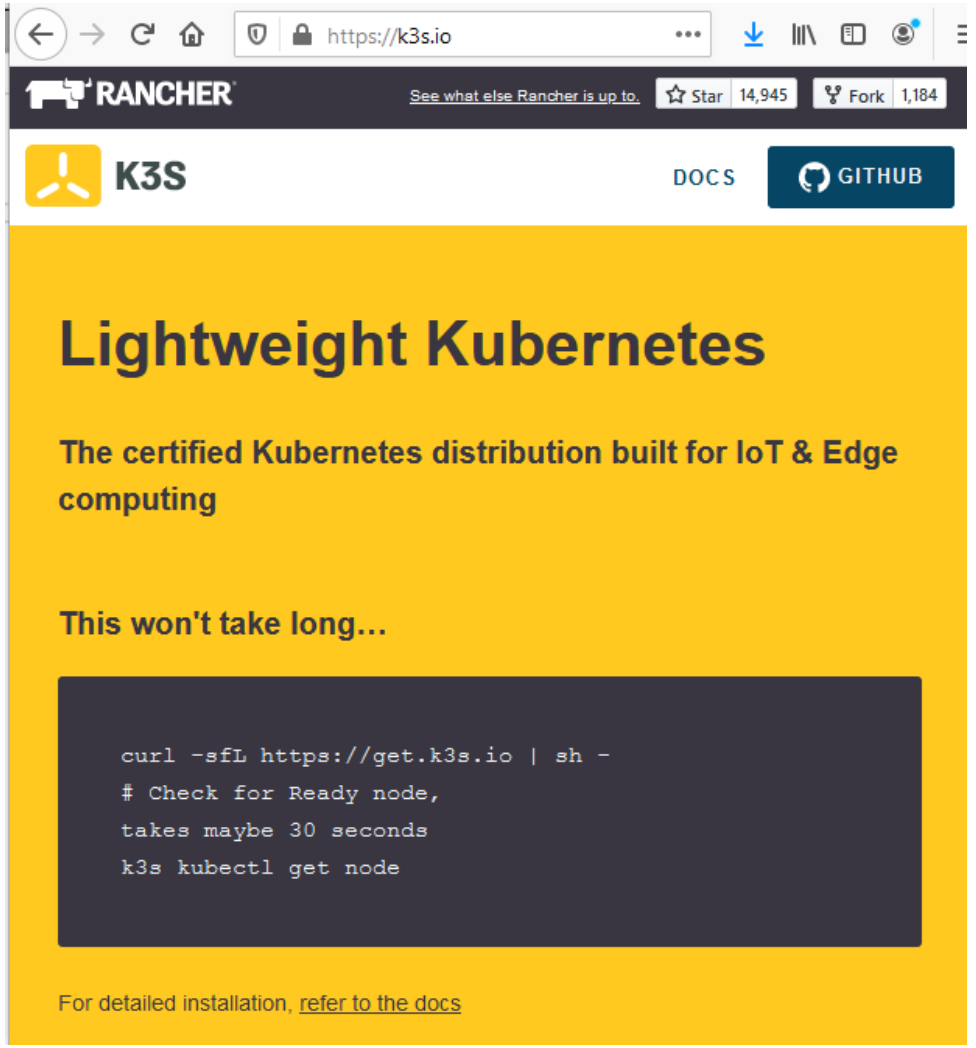
Domino 12 on Kubernetes

Rancher K3s – Kubernetes in 1 Minute!

- Kubernetes & other distributions setup
- Can take a while and needs some resources!
- **K3s** works with **2 GB RAM** and **1 CPU** core
  - Very small production grade K8s!
- https://k3s.io/
- A single command installs the K3s
  - `curl -sfL https://get.k3s.io | sh -`
- Check installation
  - `kubectl get node`



“Hello world” Kubernetes

- Create your first pod: **`kubectl apply -f nginx.yml`**
- Needs a pod definition in YAML

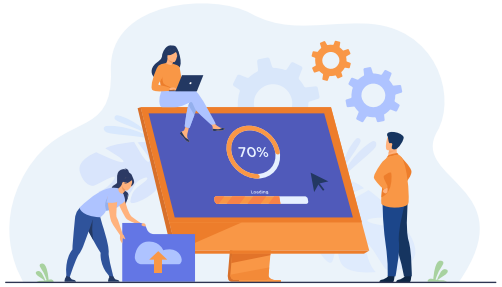
```
apiVersion: v1
kind: Pod

metadata
  name: hello-nginx
  labels:
    app: demo
spec:
  containers:
  - name: nginx
    image: nginx:latest
```

Working with kubectl

- Kubectl is the management command-line tool for K8s
  - Similar to **docker-compose.yml** files are used to describe pods, services, storage, network, etc

`kubectl get node`	Shows infos about a K8s node
`kubectl apply -f domino.yml`	Apply a YML config with definitions for resources
`kubectl get all`	Overview of all resources defined
`kubectl describe pod/domino`	Show detailed information about a pod
`kubectl exec -it pod/domino -- bash`	Runs a bash into a pod
`kubectl logs pod/domino`	Shows logs for the pod
`kubectl delete -f domino.yml`	Delete resource defined in YML file

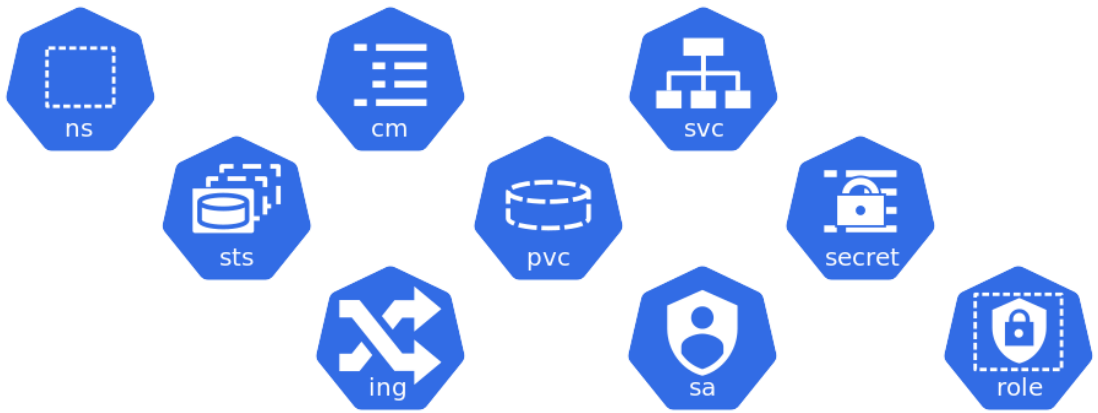


Deployment script

All components that each Domino requires

Helm Chart

Contains manifests that describe Kubernetes components needed to run an application.

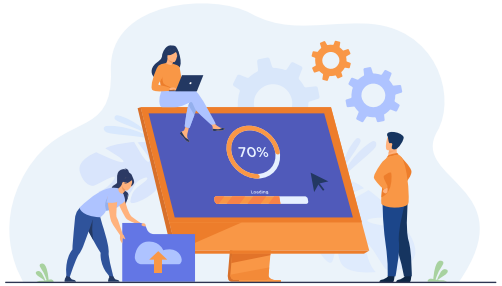


Values

A YAML file that contains values that can be parameterized.

You can use the default values or overwrite them with your custom values.

```
domino:
  server:
    name: Alpha
    domainName: Space
  network:
    hostName: alpha.space.com
  org:
    orgName: Space
    certifierPassword: password
  admin:
    firstName: Domino
    lastName: Administrator
    password: password
```



Deployment script

Domino Helm chart

Domino Helm Chart

An unofficial Helm chart for deploying Domino servers on Kubernetes cluster.

main · 1 branch · 0 tags · Go to file · Add file · Code

pkunc Publish new Helm chart for Domin... ✓ add8afa 7 hours ago 32 commits

charts	Add serviceAccount support	3 weeks ago
docs	Publish new Helm chart for Domino and Do...	7 hours ago
examples	Add Example config files documentation	2 weeks ago
scripts	Polish scripts	yesterday
.gitignore	Add Example config files documentation	2 weeks ago
LICENSE	Initial commit	3 months ago
README.md	Create Deploy cert-manager script	2 months ago

README.md

Helm Chart for HCL Domino

A Helm chart for HCL Domino server. Unofficial.

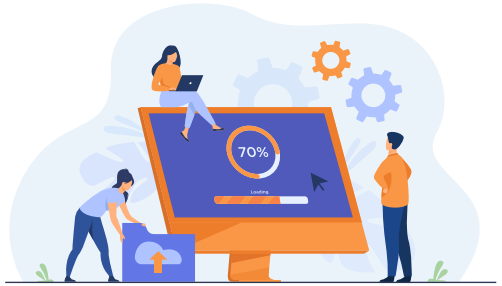
Helm charts
- domino
- domino-shared

Values description

Config examples

Helper scripts
- Kubernetes install
- cert-manager
- Ingress NGINX
- DNS records

https://github.com/pkunc/domino-charts



Deployment script

Domino Helm chart

Example: Deploying the first Domino server on Kubernetes.

```
helm install domino-shared pkunc/domino-shared \
       --namespace domino -f examples/domino-shared.yaml

helm install alpha pkunc/domino \
       --namespace domino -f examples/alpha-eks.yaml
```

Download

What do I need to download?

I want to build and customize

Download Domino on Linux installation package from FlexNet / new Downlaod portal

Use the package to build a Domino image using a Domino Community script.
Use parameters to build the image that fits your needs (version, add-ons)

OR

I just want to download

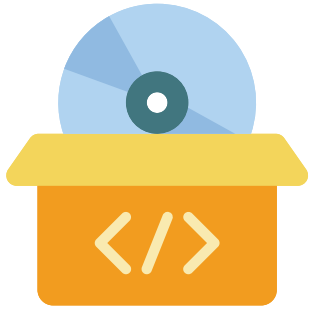
Download the already-built Domino image from FlexNet / new HCL download portal

or

…pull the image from the HCL container registry `hclcr.io`

Upgrade

Upgrading the Domino server to a new version.



Build a new Domino image with a new tag and upload it to the registry.

Change the Domino version (image tag) in a Helm chart values file.

Apply Helm chart to upgrade the deployment.

The old pod is deleted. A new Domino pod with the new version is created.

The same applies when you want to modify add-ons (add Verse, Nomad, Leap, …)

Certificates

Who manages server TLS certificates?

A Load Balancer

You have to manage TLS certificates on Domino.

B Ingress

The Ingress Controller manages TLS certificates for you. You can automate it with *cert-manager*.

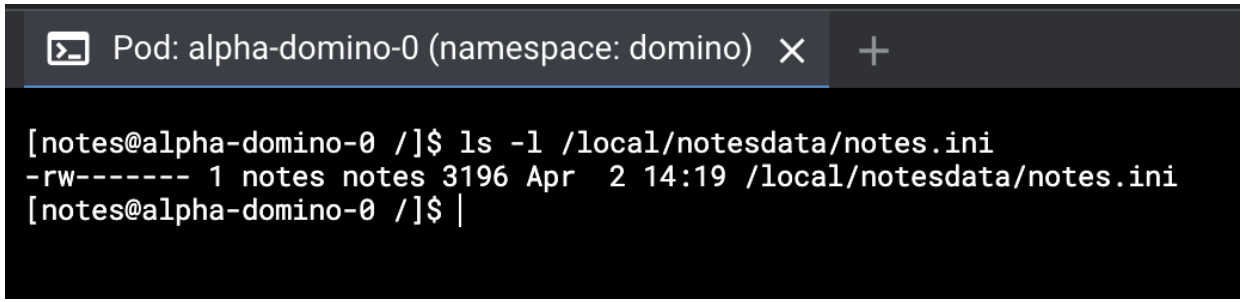
HCLSoftware

hcltechsw.com

OS-level access

Access the operating system when the Domino runs

Many Kubernetes management and observation tools offer pod shell access.




```
kubectl exec -it alpha-domino-0 -n domino -- bash
$ domino stop
$ /opt/hcl/domino/bin/compact names.nsf
$ domino start
$ exit
```

You can also use the command line.

Upload files

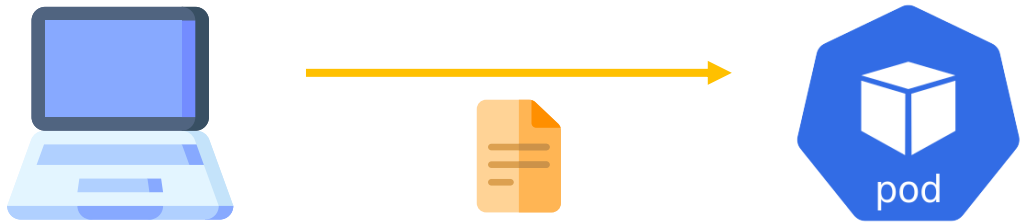
Upload files from your desktop to a pod

Sometimes you need to upload the file(s) from your workstation to a pod.
Example: Upload existing *.nsf files.

Use the command line.

```
kubectl cp server-alpha.id domino/alpha-domino-0:/local/notesdata/server.id
```

local file — namespace — pod — remote file



For multiple files transfer, you can use my script. It compresses a local folder, uploads it to a pod, and uncompresses
the content in `/local`.

```
./upload-data.sh
```

Download files

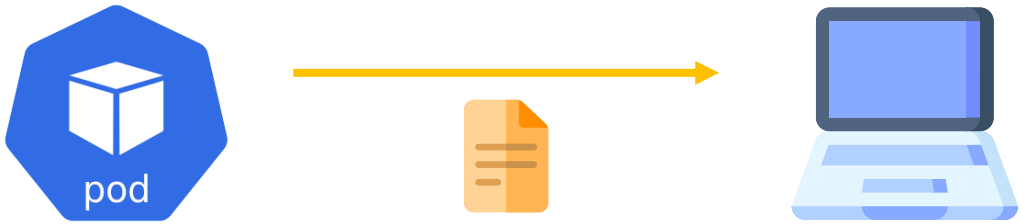
Download files from a pod to your desktop

Sometimes you need to download the file(s) from a pod to your workstation.
Example: Download cert, server, or admin Notes IDs.

Use the command line.

```
kubectl cp domino/alpha-domino-0:/local/notesdata/server.id server-alpha.id
```

namespace — pod — remote file — local file



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CertMgr & CertStore

Domain wide trusted root,
private key & certificate management

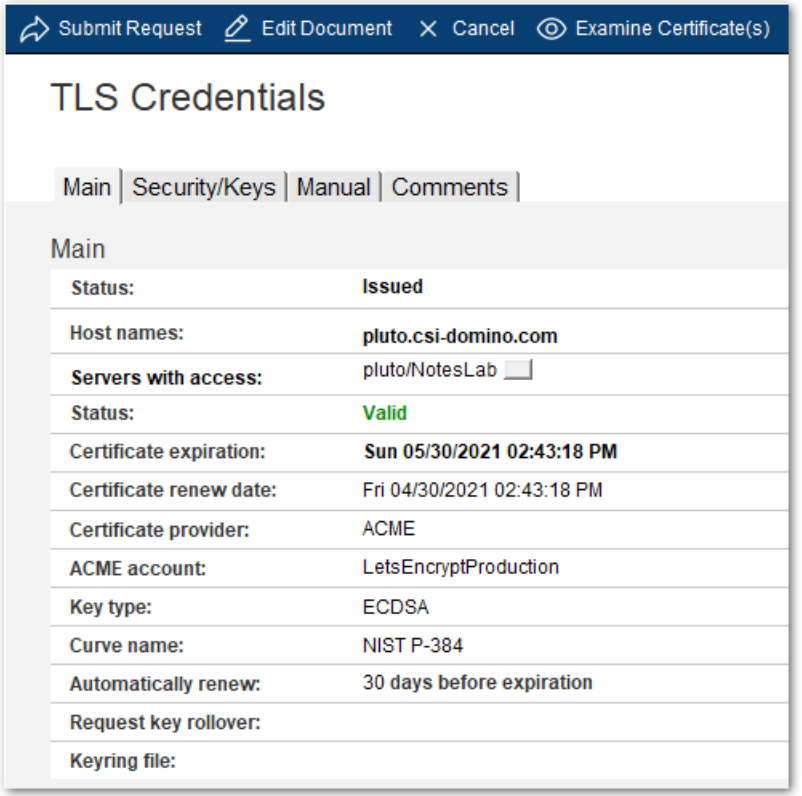
certstore.nsf – TLS Credentials

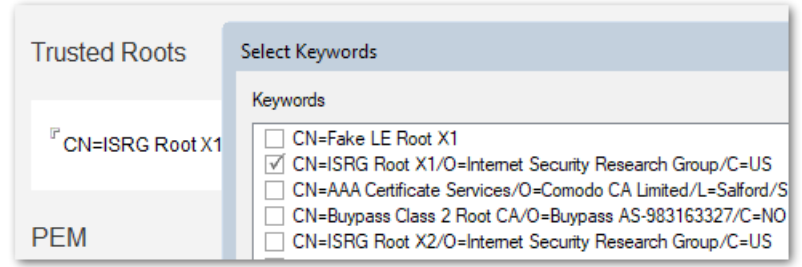
- **TLS Credential** = **private key** + **leaf certificate** + **chain** (intermediates) + **trusted root**

- Replaces "***.kyr** files"
  - Stored in **PEM** format (text with base64 encoded data)

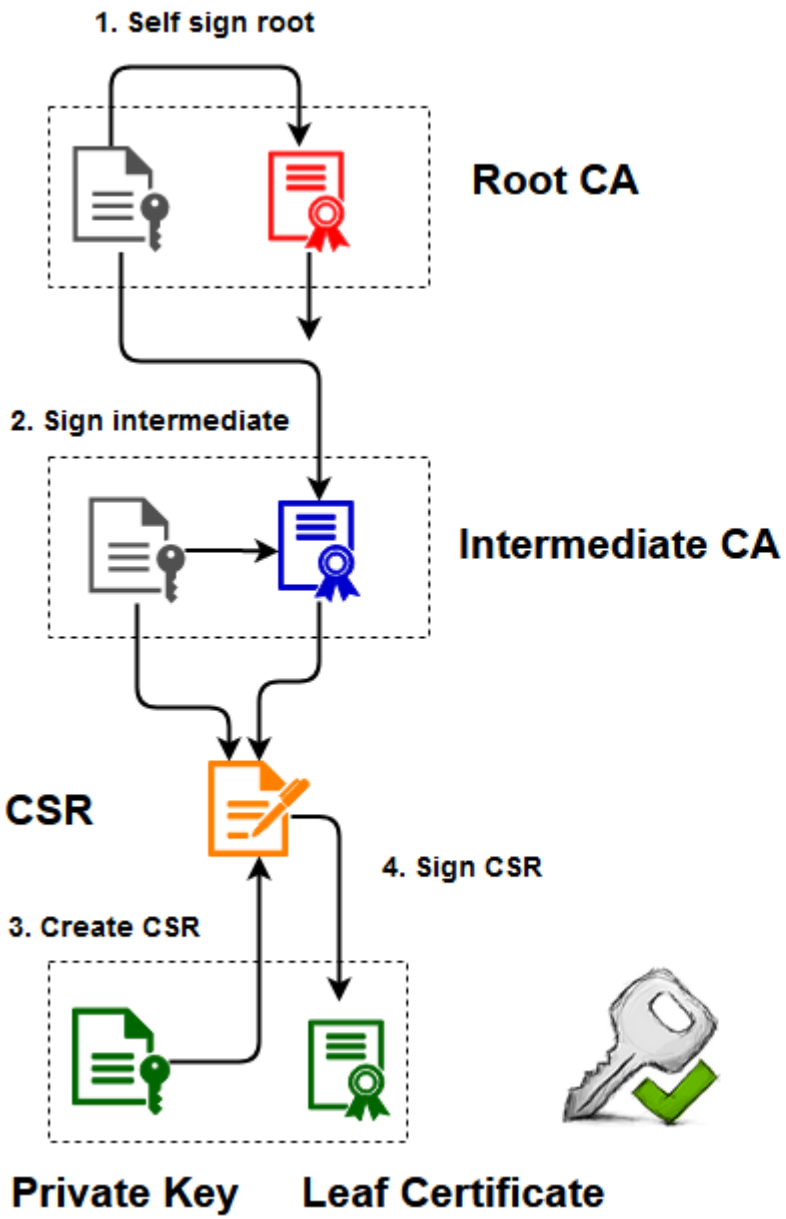
- Can be created via
  - **ACME V2** protocol (Let's Encrypt & others)
  - Manual flows including import
  - Domino MicroCA (exportable in 12.0.2)

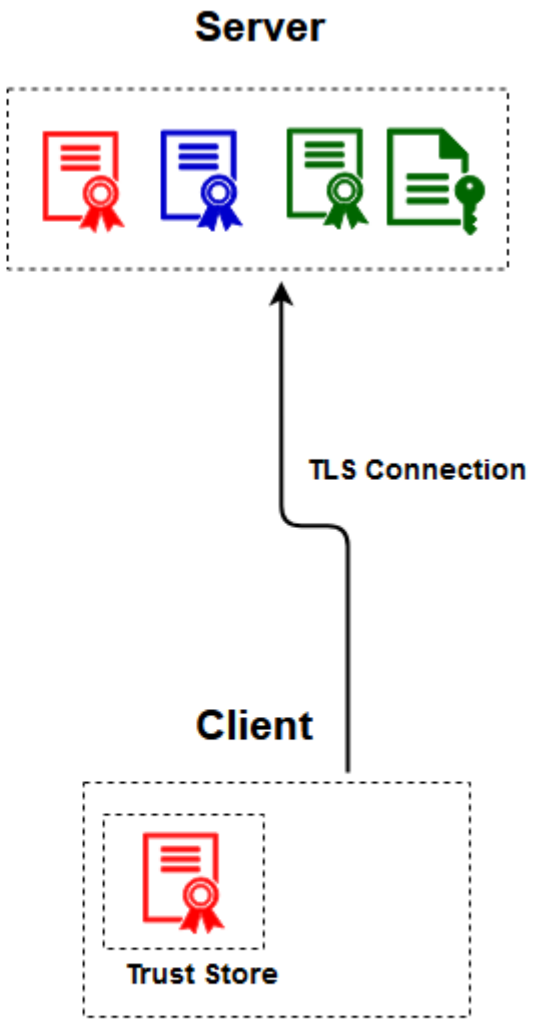
- Specify trusted roots used for client certificate verification
  - Used to be hidden in **kyr-file** and was difficult to manage





Keys, Certs, Chain & Root ..

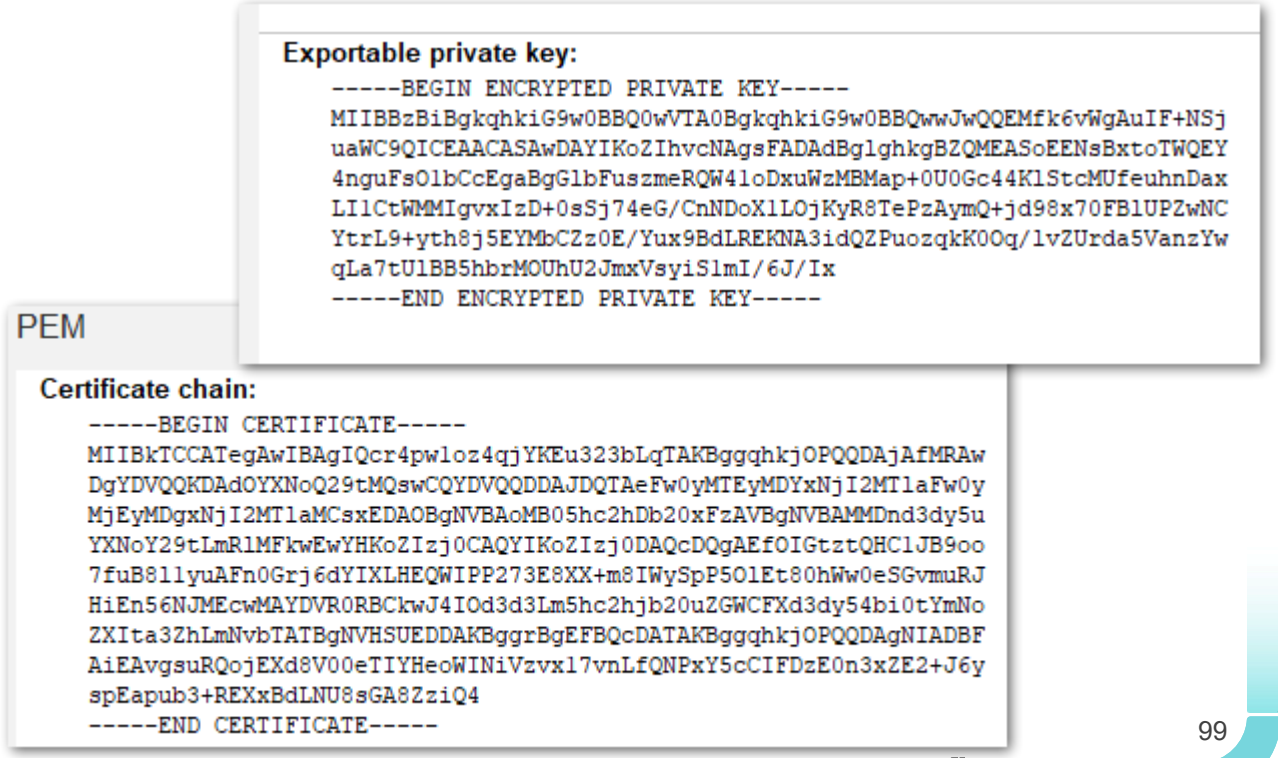




- CA is a self signed certificate installed as a trust into a **local trust store**
- CA and intermediate/sub CAs have a private key signed by the next higher CA
- The last intermediate "**issuing CA**" signs the CSR resulting in a **leaf certificate**
- A **CSR** is signed by the private key with the information about what to certify (e.g. SAN, org)
- To verify a certificate the local root from the trust store + the full chain is used

PEM Format

- Widely used de-facto standard to represent key and certificate information
  - https://en.wikipedia.org/wiki/Privacy-Enhanced_Mail
- Text based format which can be merged and edited with any editor
  - **Base64** encoded form of the **binary DER format** + markers for begin and end of the data
- Supports unencrypted and encrypted keys
  - Encryption uses a “password/passphrase”
  - Data is still shown as text (base64 encoded)
- Many applications use separate PEM files for key and certificate chain
- A big benefit:
  - Update certs without re-encrypting the key



Domino 12 One-Touch Setup Certificate Support

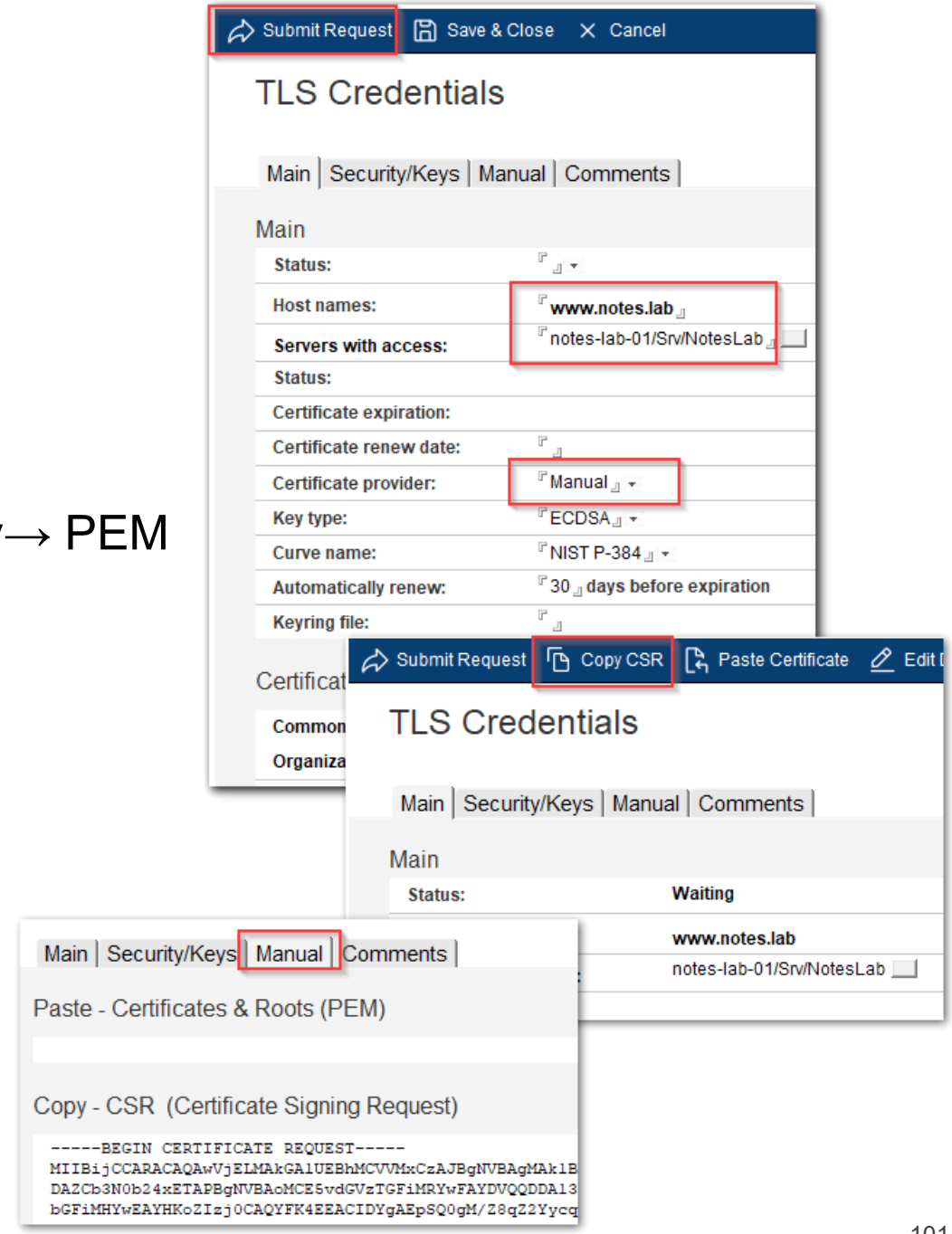
- Simple settings assuming defaults
  - More settings available in ENV and JSON config
- **Micro CA**
  - SERVERSETUP_SECURITY_TLSSETUP_METHOD=**dominoMicroCA**
- **Import PEM**
  - SERVERSETUP_SECURITY_TLSSETUP_METHOD=**import**
  - SERVERSETUP_SECURITY_TLSSETUP_IMPORTFILEPATH=**my.pem**

```
"security": {
 "ACL": {
   "prohibitAnonymousAccess": true,
   "addLocalDomainAdmins": true
 },
 "TLSSetup": {
   "method": "import",
   "retainImportFile": true,
   "importFilePath": "wildcard_nashcom_org.pem",
   "exportPassword": "Super42Secret007Password4Key
 }
}
```

```
 "security": {
 "ACL": {
   "prohibitAnonymousAccess": true,
   "addLocalDomainAdmins": true
 },
 "TLSSetup": {
   "method": "dominoMicroCA",
   "CADisplayName": "Demo CA",
   "CAOrgName": "NotesLab",
   "CAKeyType": "ECDSA",
   "CAExpirationDays": 1096,
   "orgName": "NotesLab",
   "TLSKeyType": "RSA2048",
   "certExpirationDays": 120
 }
}
```

Manual Certificate Operations

- **1. CertMgr** processes submitted requests and creates
  - Private key (RSA or ECDSA)
    - Saved locally encrypted for assigned servers
- CSR (**C**ertificate **S**igning **R**equest) signed by private key→ PEM
- **2.** Admin copies CSR to CA
- **3.** Admin imports certificate & chain (PEM) back
- Paste full chain in any order and submits the form again
- Duplicate certs are ignored
- Missing intermediate certs and root are automatically added from “Trusted Roots” in **certstore.nsf**

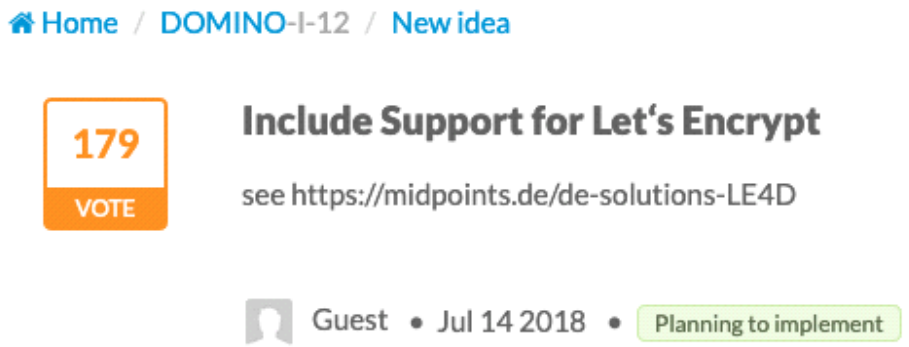


Nash!Com Lab CA for testing

- Manual CA operations require a CA for testing
- Nash!Com CA runs on a Linux server listening on a TCP/IP port
  - Based on OpenSSL C code
- Mail-in database with pre-delivery agent sends HTTPS request to CA
- Send your **CSR** to lab-ca@nashcom.de with subject: **cert**
- You receive a **certificate** and **chain** in reply!
  - Root certificate is not included in reply – like for most other CAs
    - Import your cert first and see the missing root
    - In the second step let's import the root

Automated Certificate Management

- Support for Let's Encrypt
  - ACME protocol V2 (**RFC 8555**)
  - **A**utomatic **C**ertificate **M**anagement **E**nvironment
- Free of charge SSL/TLS certificates
- Fully integrated into **certstore.nsf** & **CertMgr**
- Easy to deploy
- Automatic certificate update (request) and deployment (reload on server)



ACME HTTP-01 Challenges

- How it works
  1. ACME server sends a challenge to ACME client
  2. ACME server will ask via in-bound HTTP port 80 for the “secret” at a well-known URL
- DSAPI Filter “certmgrdsapi” needs to be enabled in server doc / internet site !!
  - Tip: **load certmgr -c** adds the DSAPI filter to server doc – Internet sites need to specify manually
- If server is configured to only allow authenticated connection configure public URL
  - Notes.ini: HTTPPUBLICURLS=/**.well-known/acme-challenge/***:/redir.nsf/*:/MFASetup*
- Again: **Inbound HTTP port 80 required**!
- If the server is not reachable by the ACME server (e.g. Let's Encrypt), the challenge fails !!!
  - Tip: Inbound connection can be a proxy connection

ACME Provider Let‘s Encrypt – included in template

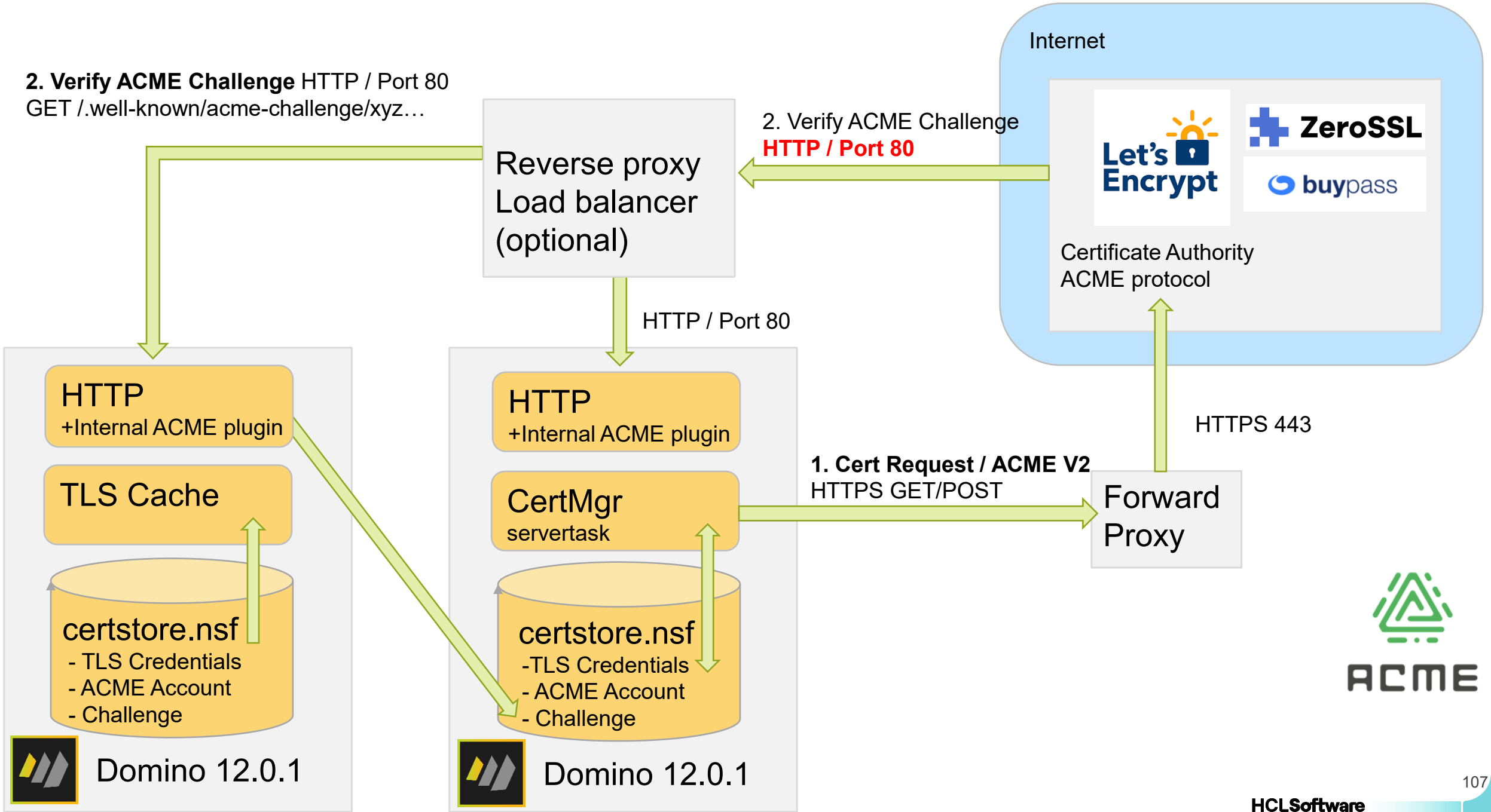
- Let's Encrypt Staging
  - https://letsencrypt.org/docs/staging-environment
  - Should always be used for first steps testing connectivity
  - Provides the same functionality like Let's Encrypt production
  - Much higher limits for certificates and errors

- Let's Encrypt production
  - https://letsencrypt.org

Additional tested ACME Providers

- **ACME** is a standard supported by more providers
- New ACME provider can be added using their published directory URL

- **ZeroSSL**
  - https://zerossl.com
  - Requires registration + external account binding (EAB)
- **BuyPass**
  - https://buypass.com
- **SSL.Com** (requires V12.0.1)
  - https://www.ssl.com
  - Requires registration + external account binding (EAB)


2. Verify ACME Challenge HTTP / Port 80
GET /.well-known/acme-challenge/xyz…
Reverse proxy
Load balancer
(optional)
2. Verify ACME Challenge
HTTP / Port 80
Internet
Let's Encrypt
ZeroSSL
buypass
Certificate Authority
ACME protocol
HTTP / Port 80
HTTP
+Internal ACME plugin
TLS Cache
certstore.nsf
- TLS Credentials
- ACME Account
- Challenge
Domino 12.0.1
HTTP
+Internal ACME plugin
CertMgr
servertask
certstore.nsf
-TLS Credentials
- ACME Account
- Challenge
Domino 12.0.1
1. Cert Request / ACME V2
HTTPS GET/POST
Forward
Proxy
HTTPS 443
ACME

ACME HTTP-01 Challenges

- How it works
  1. ACME server sends a challenge to ACME client
  2. ACME server will ask via in-bound HTTP port 80 for the “secret” at a well-known URL
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- Again: **Inbound HTTP port 80 required**!
- If the server is not reachable by the ACME server (e.g. Let's Encrypt), the challenge fails !!!
  - Tip: Inbound connection can be a proxy connection

ACME HTTP-01 Challenge & Troubleshooting

- Port 80 inbound needs to be open unauthenticated for ACME Challenge
  - GET **/.well-known/acme-challenge/**xyz…
  - First request needs to be port 80!
  - ACME challenge request can be redirected
  - All HTTP servers can respond to all ACME challenges

- **No tickets for ACME HTTP-01 challenge issues should be escalated without checking all steps in troubleshooting guide!**

  - https://github.com/HCL-TECH-SOFTWARE/domino-cert-manager/blob/main/docs/troubleshooting_acme_challenges.md
  - Very detailed guide with links for additional troubleshooting self services
  - Living document in HCL GitHub repository