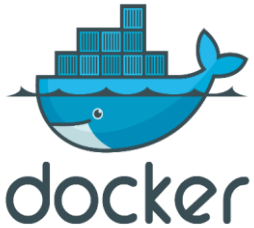
Frank Geisler



SQL Server on Docker

Frank Geisler

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Microsoft P-TSP

Chapter Leader PASS Chapter Ruhrgebiet

Director Marketing & Communications PASS Deutschland e.V.

Author

Speaker

FRIEND OF redgate 2016

MVP Microsoft Most Valuable Professional

@FrankGeisler

Agenda

- The Big Container Theory
- Windows and Containers
- Building a SQL Server Container
- Building a customized Container Image
- Export Images
- Publishing customized Images on Docker Hub
- A really nice GUI for Docker
- Scenarios where you can use Docker
- References

The Big Container Theory

Definition Container

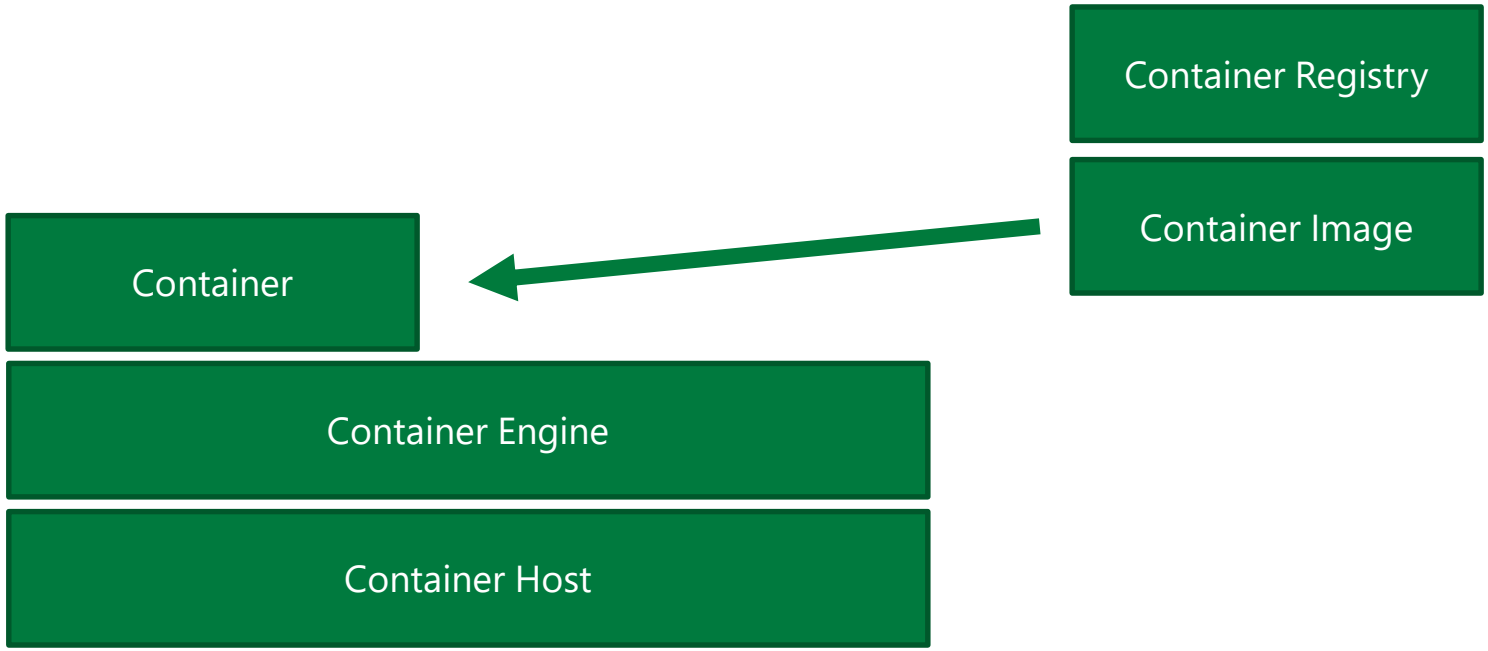
Containers wrap a piece of software in a complete filesystem that contains everything needed to run: code, runtime, system tools, system libraries – anything that can be installed on a server. This guarantees that the software will always run the same, regardless of its environment.

https://www.docker.com/what-docker

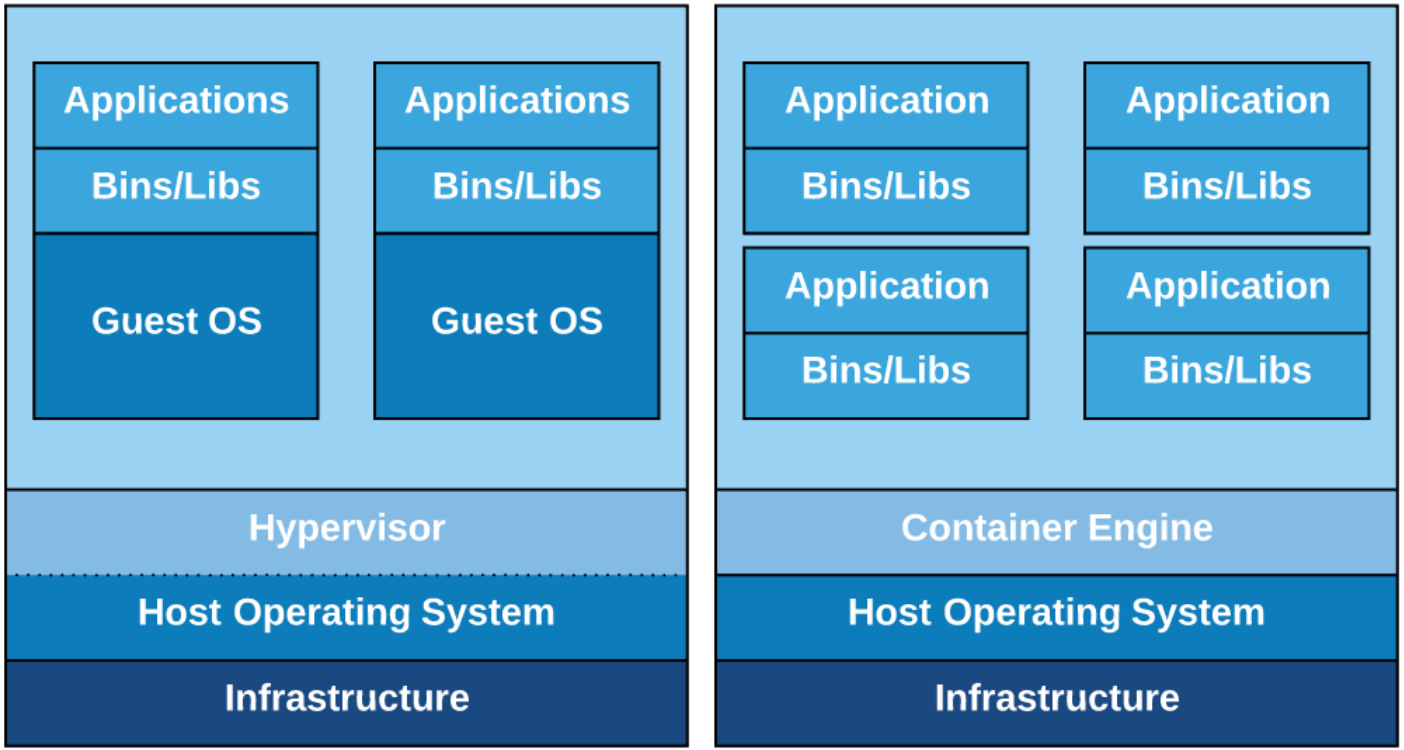
Basic Elements of Docker

- Container Image
- Container
- Container Host
- Container Engine
- Container Registry

How do the Elements relate?



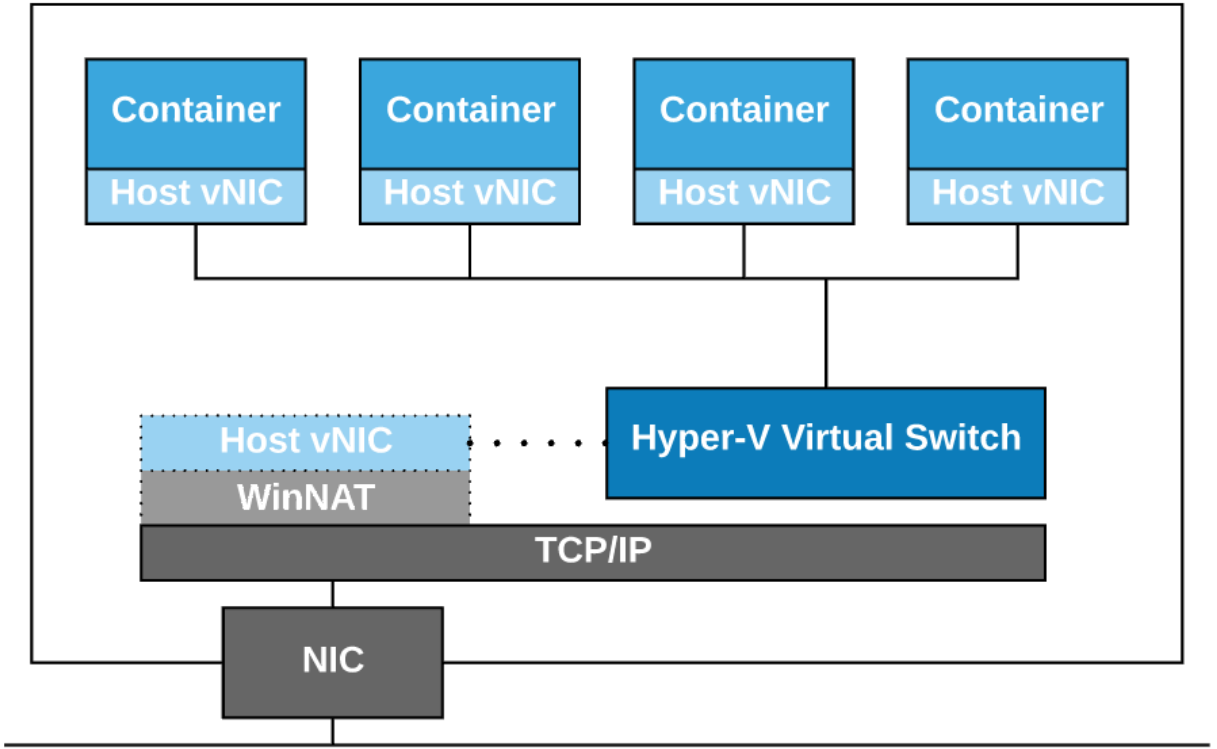
Virtual Machines vs. Containers



Containers are no VMs !

- They are just processes
- They are restricted which Ressources they can use
- They are stopped when the process is quit

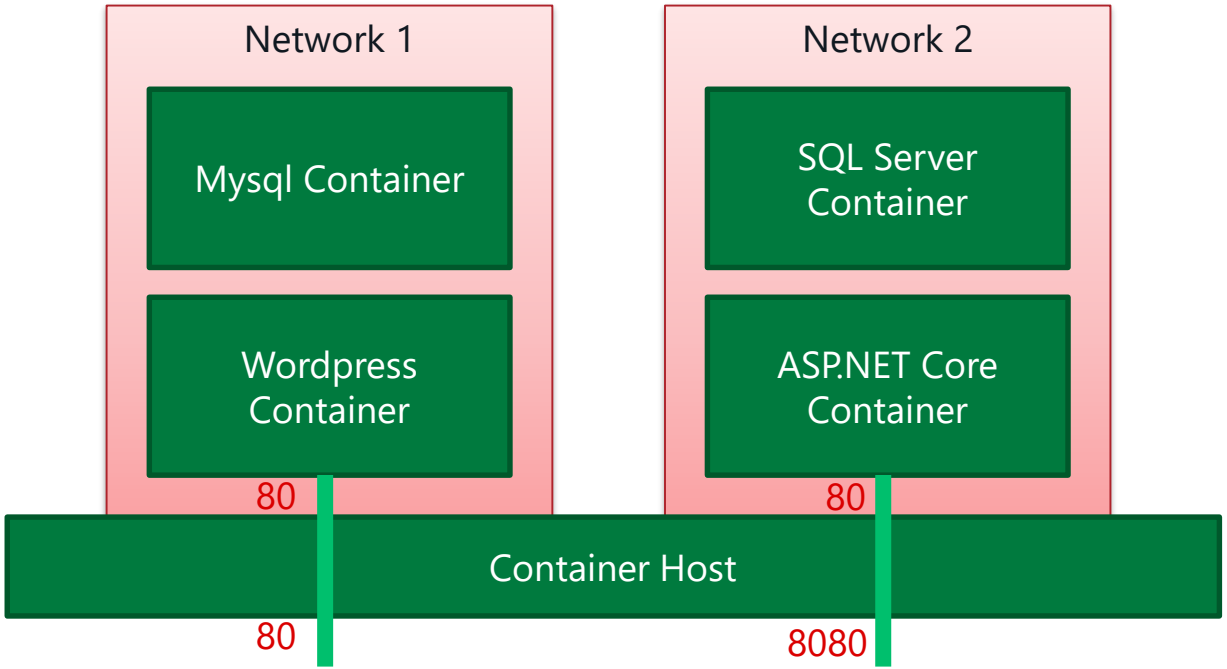
Container Network



Container Network

- Each Container is connected to a virtual private default network that is called „bridge“
- Each virtual Network is bound through a NAT Firewall to the host IP.
- Container in the same virtual network are allowed to communicate (without –p)
- Best practice: Create an own network for each Application

Best practices



What is in an image

- App Binaries and Dependencies
- Metadata on how the Image File and the Image have to be executed
- Official Definition: „An image is an ordered collection of root filesystem changes and the corresponding execution parameters for use within a container runtime.“
- No complete OS, no kernel, no kernel modules (like drivers)
- Can be very small or very big

Windows and Containers

Docker and Microsoft

Announced cooperation in 2014

Windows Server 2016 and Windows 10 Anniversary Edition support Containers

Docker and Microsoft partner to bring container applications across platforms

October 15, 2014 | Microsoft News Center

Editor's note – Oct. 16, 2014 *–The press release below was updated to clarify that the orchestration of containers on Azure is planned to be integrated in a future Docker release.*

SAN FRANCISCO and REDMOND, Wash. — Oct. 15, 2014 — Microsoft Corp. and Docker Inc., the company behind the fast-growing Docker open platform for distributed applications, on Wednesday announced a strategic partnership to provide Docker with support for new container technologies that will be delivered in a future release of Windows Server. Developers and organizations that want to create container applications using Docker will be able to use either Windows Server or Linux with the same growing Docker ecosystem of users, applications and tools.

Today's business climate requires higher levels of innovation than before, and distributed applications that support open portability are at the forefront of this demand. Docker is

http://news.microsoft.com/2014/10/15/DockerPR/

Types of Containers

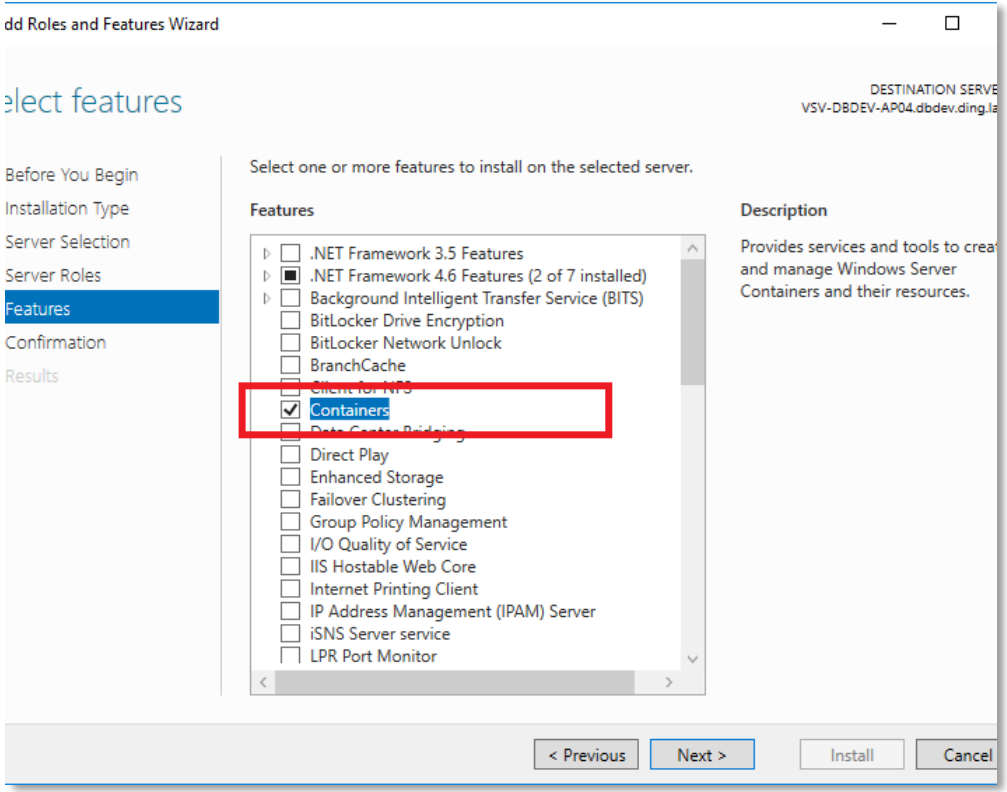
Windows Server Containers

- Isolation on Namespace, Ressources and Prozess Isolierung
- Share the host kernel with host and other containers

Hyper-V Containers

- Extend Isolation compared to Windows Server Containers
- Are executed within a special virtual machine
- Don’t share the Kerne with the host
- Are determined on runtime with **--isolation=hyperv**
- You can also execute a linux host (linux vm)

Activate Container Feature



Install Docker Engine with PowerShell

```
Install-PackageProvider -Name NuGet -MinimumVersion
2.8.5.201 -Force

Install-Module -Name DockerMsftProvider -Force

Install-Package -Name docker -ProviderName
DockerMsftProvider -Force

Restart-Computer -Force
```

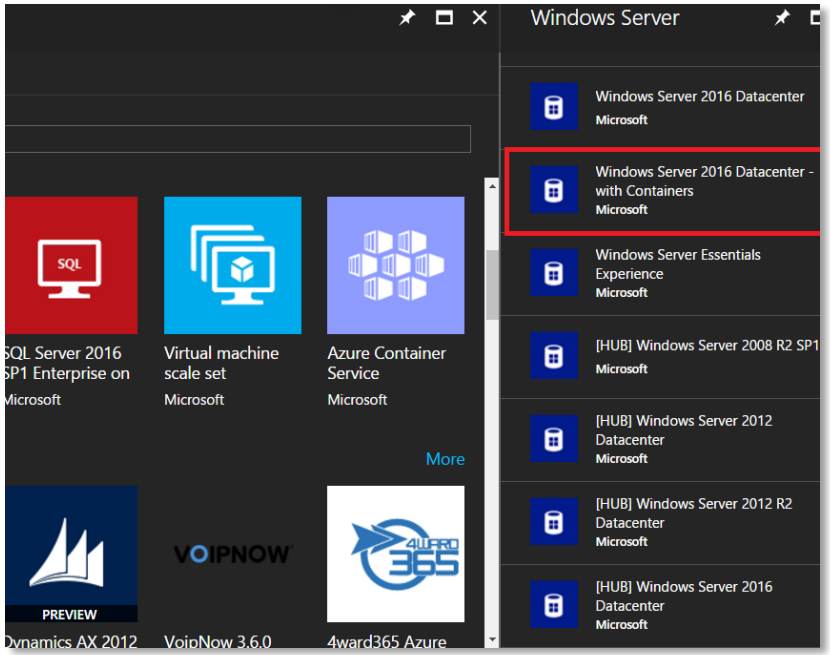
Windows 10 - Docker Store

Download .msi

https://store.docker.com/

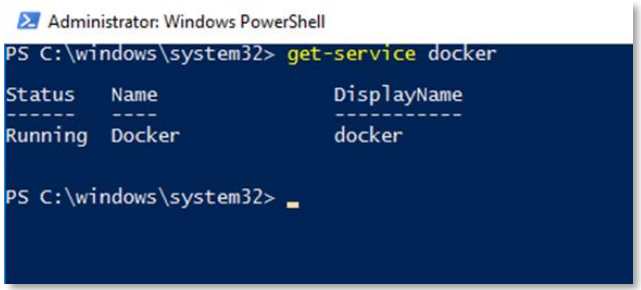
Azure

- There are plenty possibilities…
- E.g.: There is an image where container role is already activated and the docker engine is installed

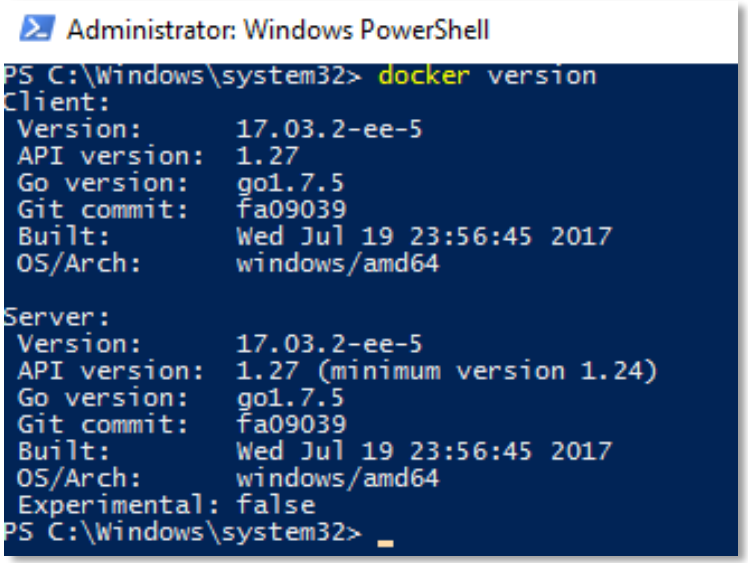


Check if Docker is running

Get-Service docker



docker version



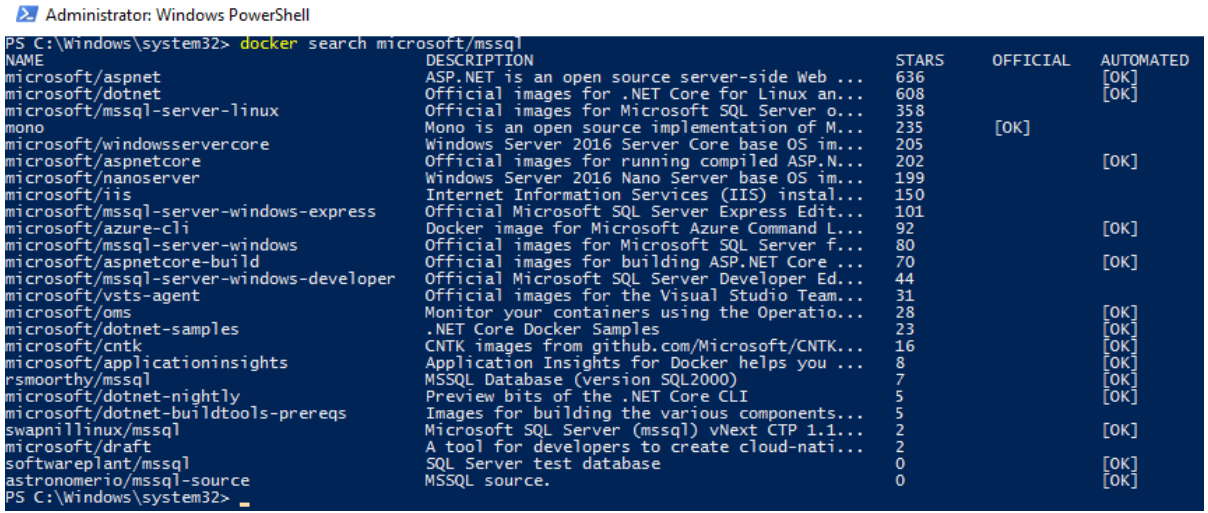
Docker with older Versions of Windows / SQL Server

- www.windocks.com
- A port of the open source project of Docker Inc.
- Software supports the creation of Containers with older Versions of SQL Server (2008+) and older Versions of Windows Server (2012+)
- Free Community Edition available
  www.windocks.com/leads/add?src=downloadcommunity

Building a SQL Server Container

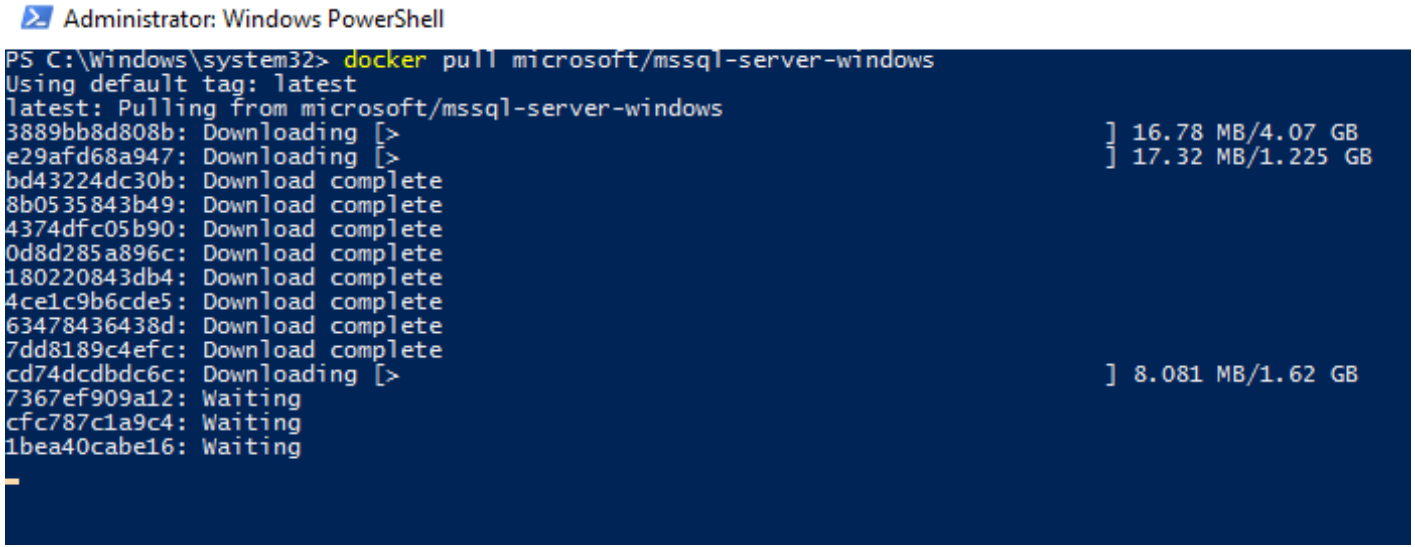
Browser the docker repository

docker search microsoft/mssql



Download an image

docker pull microsoft/mssql-server-linux

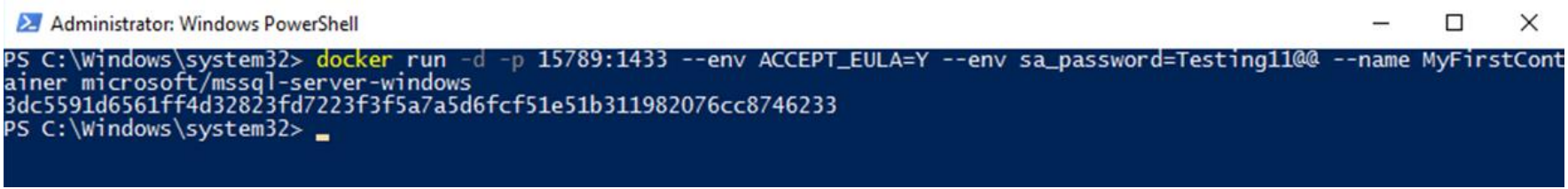


Check the image

docker images

Create a Container from the Image

docker container run –d –p 1433:1433 --env ACCEPT_EULA=Y --env SA_PASSWORD=!test123 --name sqlcontainer microsoft/mssql-server-linux

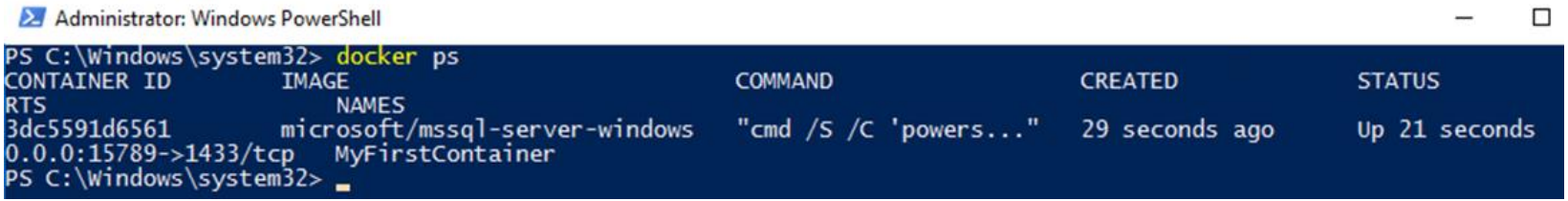


What happens on docker run in the background?

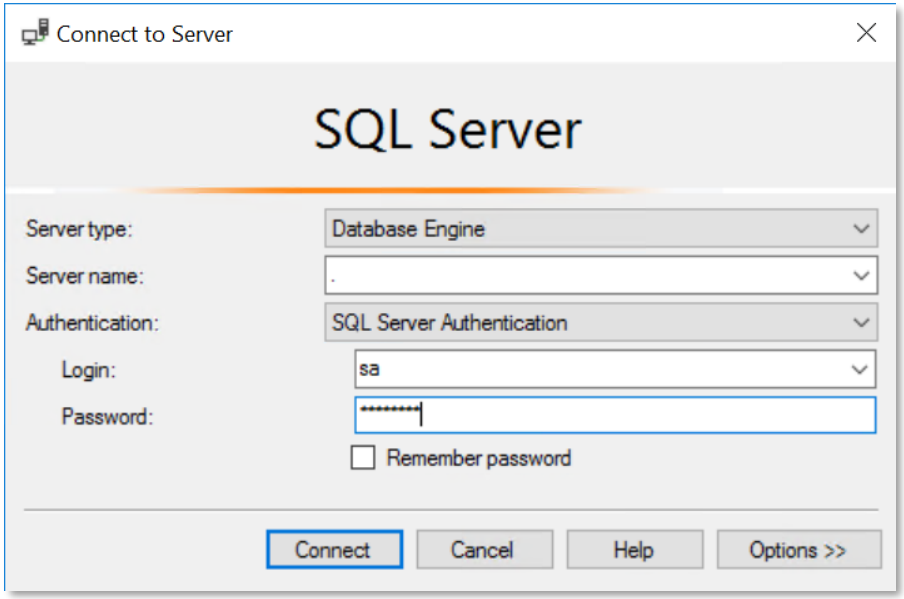
1. Docker determines if the image is locally in the cache (in given Version)
2. Could the image not be found it will be searched in the image repository (Standard: Docker Hub)
3. Downloads the newest version (in our demo case because no Version is specified)
4. Creates a new container based on the image and prepares it for start.
5. Assigns a virtual IP-Address to the container in the private Docker Network.
6. Binds Port 1433 internally on Port 1433 externally
7. Starts the container and executes the CMD Commands in Docker File

Check if container is running

docker ps [-a]

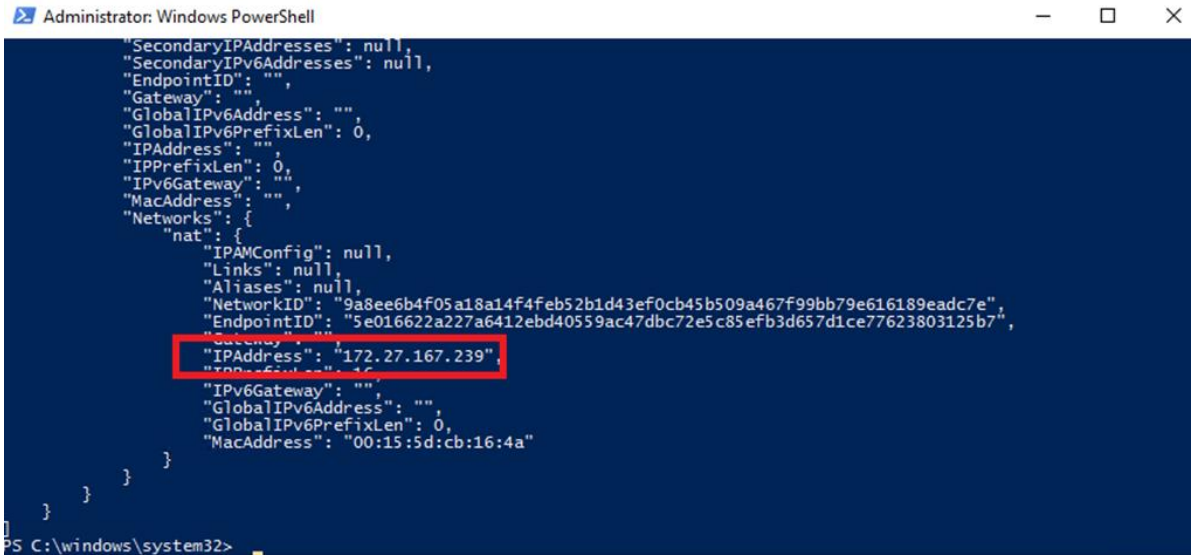


Connect to SQL Server



Check Container

docker inspect sqlcontainer



Connect to the container

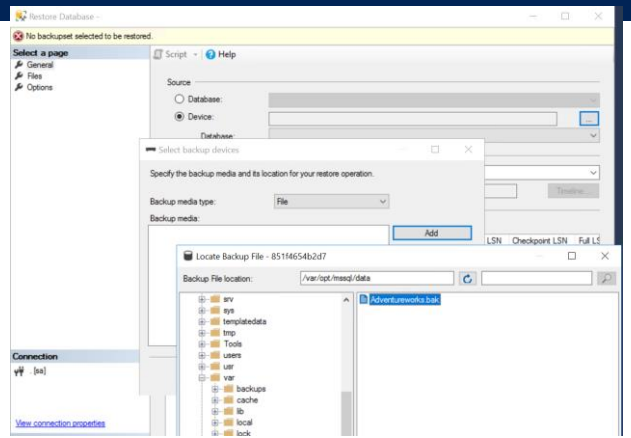
docker exec –it sqlcontainer bash

```
PS C:\Users\testadmin> docker exec -it sqlcontainer bash
root@851f4654b2d7:/# ls
bin   core  etc   install.sh  lib64  mnt  proc  run   srv  tmp  var
boot  dev   home  lib         media  opt  root  sbin  sys  usr
root@851f4654b2d7:/# cd /var/opt/mssql/data
root@851f4654b2d7:/var/opt/mssql/data# ls
master.mdf  mastlog.ldf  model.mdf  modellog.ldf  msdbdata.mdf  msdblog.ldf  tempdb.mdf  templog.ldf
root@851f4654b2d7:/var/opt/mssql/data#
```

Copy files into the container

docker cp c:\temp\Adventureworks.bak sqlcontainer:/var/opt/mssql/data/Adventureworks.bak

```
PS C:\Users\testadmin> docker cp c:\temp\Adventureworks.bak sqlcontainer:/var/opt/mssql/data/Adventureworks.bak
PS C:\Users\testadmin> _
```

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Advantages

- Easy and quick installation
- New Containers can be deployed in seconds
- Small footprint compared to Virtual Machines
- Customize Images
- Access to Docker Repository (hundreds of images are available)
- Portable – Images can be stored on Docker Hub
- Independent from the cloud vendor

Disadvantages for SQL Server

- At the moment only the relational engine is supported
- Only official support on Windows Server 2016 / Windows 10 Anniversary Edition.
- There are only official SQL Server Images for 2016 and 2017
- SQL Images can be really big (~13GB)
- No Overcommitting of ressources

Buliding a cutomized Image

Dockerfile

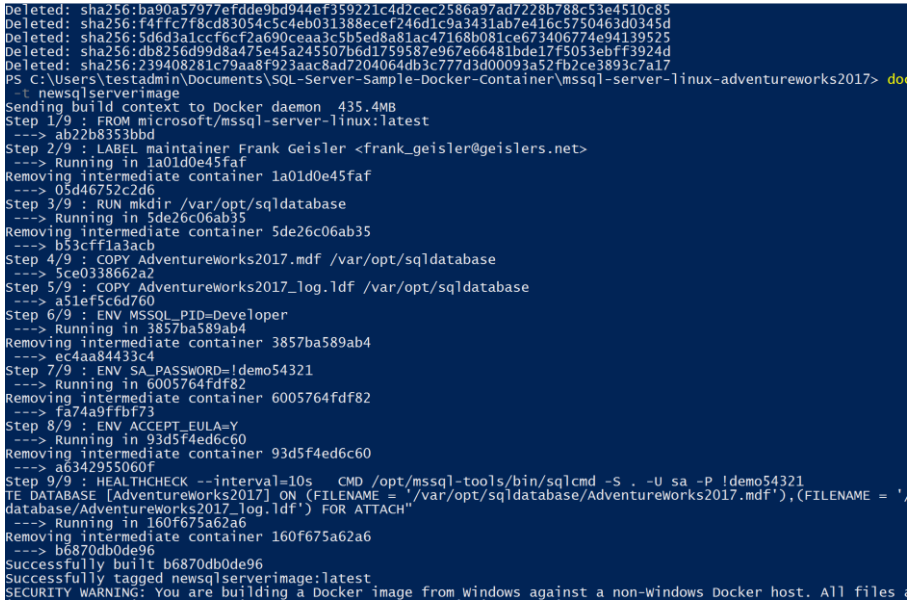
A file on the docker host that contains all commands that create a customized Image.

Dockerfile Code

```
FROM microsoft/mssql-server-linux:latest
LABEL maintainer Frank Geisler <frank_geisler@geislers.net>

# Create a directory where we can copy the Database files.
RUN mkdir /var/opt/sqldatabase

COPY AdventureWorks2017.mdf /var/opt/sqldatabase
COPY AdventureWorks2017_log.ldf /var/opt/sqldatabase

ENV MSSQL_PID=Developer
ENV SA_PASSWORD=!demo54321
ENV ACCEPT_EULA=Y

HEALTHCHECK --interval=10s \
    CMD /opt/mssql-tools/bin/sqlcmd -S . -U sa -P !demo54321 \
        -Q "CREATE DATABASE [AdventureWorks2017] ON (FILENAME =
'/var/opt/sqldatabase/AdventureWorks2017.mdf'),(FILENAME =
'/var/opt/sqldatabase/AdventureWorks2017_log.ldf') FOR ATTACH"
```

Build an Image

docker build –t newsqlserverimage .



Check the new image

docker images

```
PS C:\Users\testadmin\Documents\SQL-Server-Sample-Docker-Container\mssql-server-linux-adventureworks2017> doc
REPOSITORY                    TAG                 IMAGE ID            CREATED             SIZE
newsqlserverimage             latest              b6870db0de96        11 seconds ago      1.77GB
microsoft/mssql-server-linux  latest              ab22b8353bbd        10 days ago         1.42GB
PS C:\Users\testadmin\Documents\SQL-Server-Sample-Docker-Container\mssql-server-linux-adventureworks2017>
```

Create a new container from the image

docker run –d –p 1433:1433 --name newsqlservercontainer newsqlserverimage

```
PS C:\Users\testadmin\Documents\SQL-Server-Sample-Docker-Container\mssql-server-linux-adventureworks2017> docker conta
er run -d -p 1433:1433 --name neuersqlcontainer newsqlserverimage
89b7b3d96ce33f107f2689ab977d9f46e94dbbba0ee74f72bd4d769f95abfcfa
```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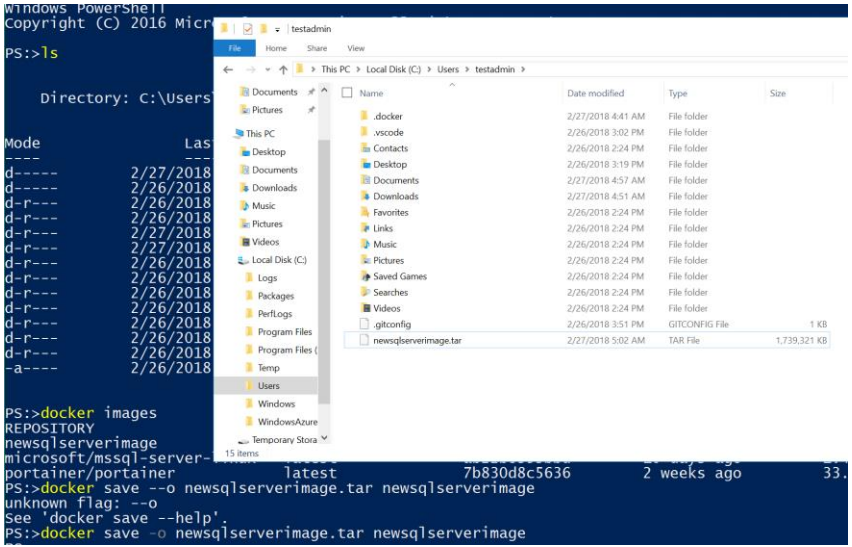
Export Images

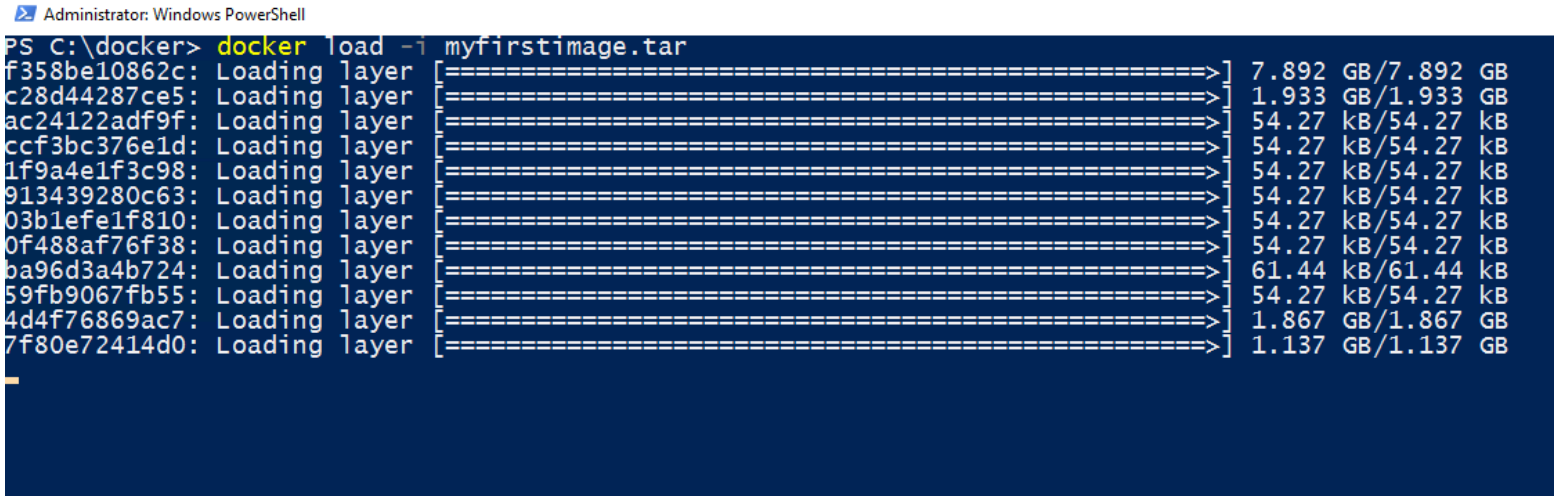
Share locally

docker save -o newsqlserverimage.tar newsqlserverimage



Import Images

docker load -i newsqlserverimage.tar

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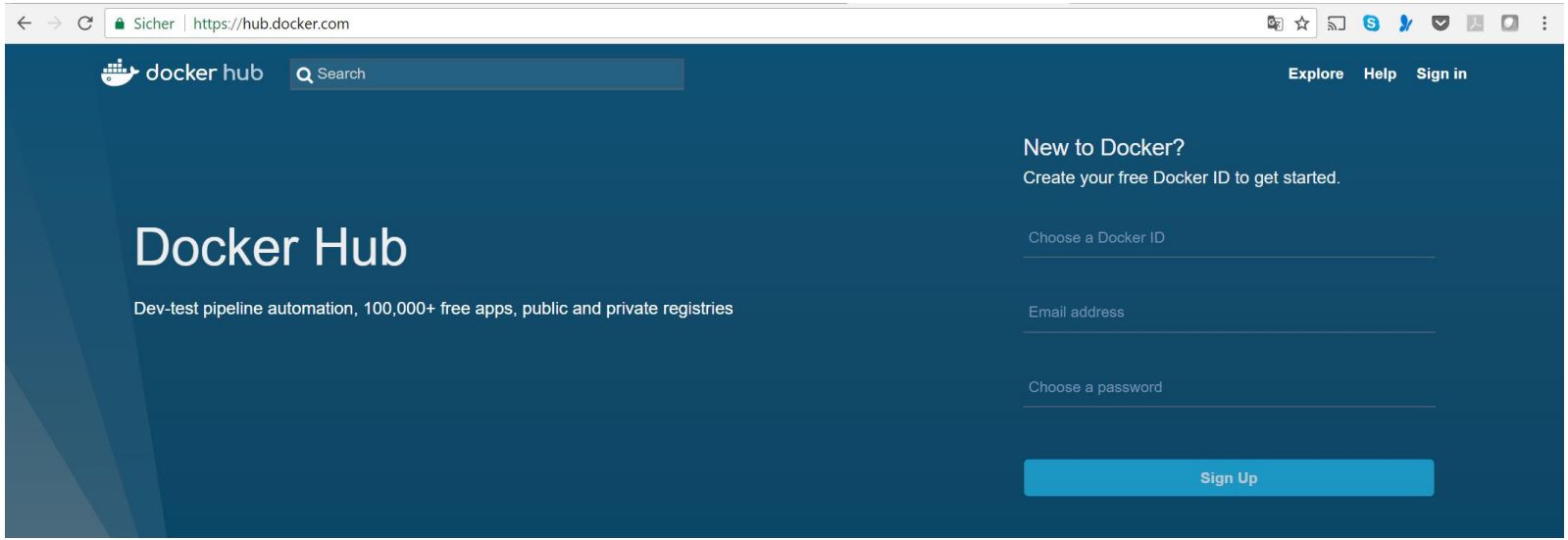
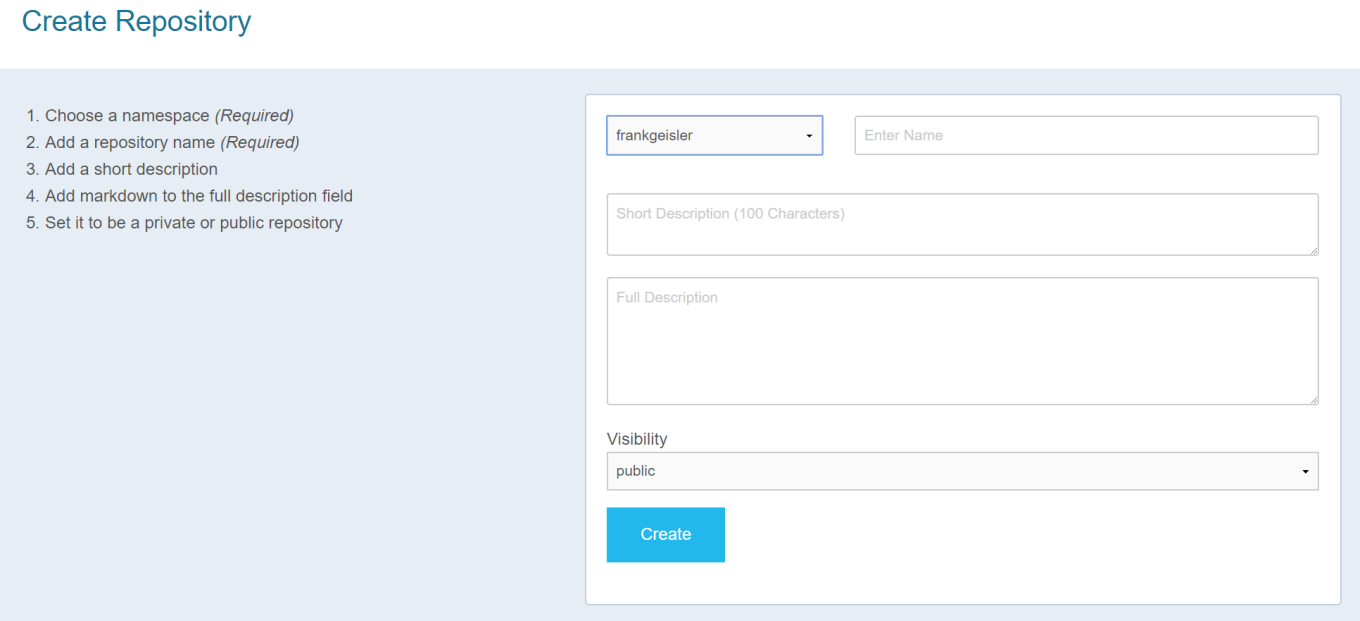
Publish customized images on docker hub

Docker Hub

https://hub.docker.com



Create a repository



Tag an image

docker tag newsqlserverimage frankgeisler/newsqlserverimage:v1

```
PS:>docker tag newsqlserverimage frankgeisler/newsqlserverimage:v1
PS:>
```

Log into Docker Hub

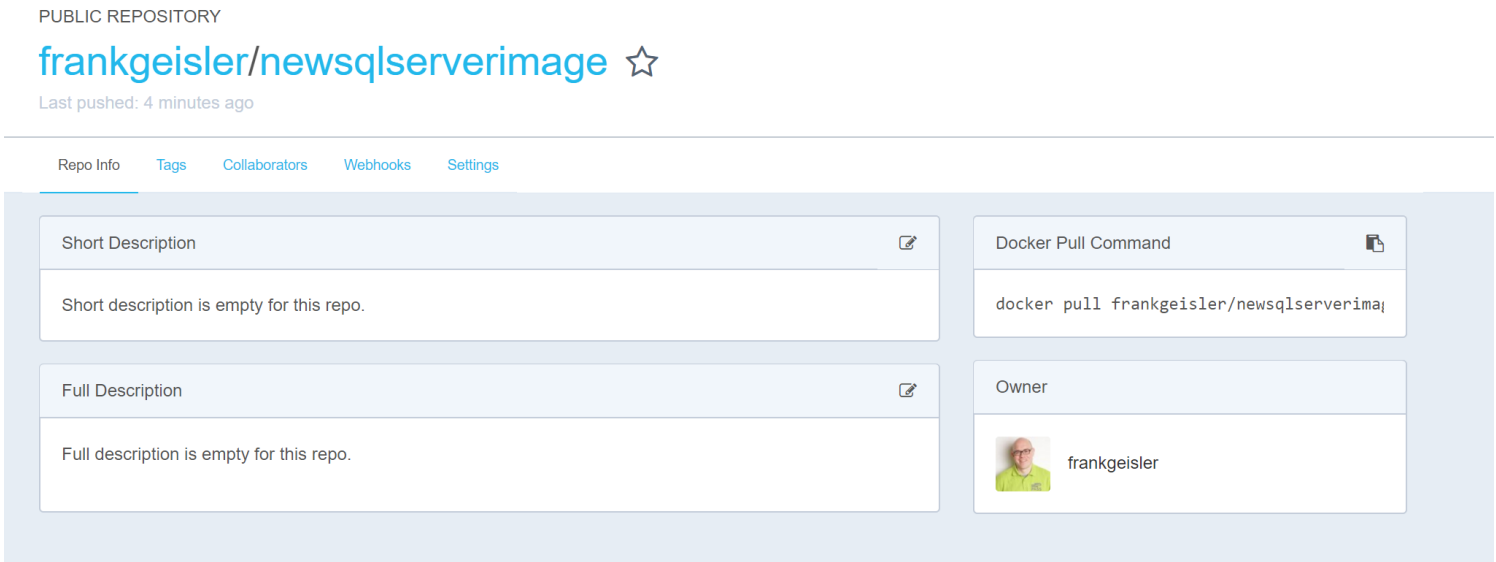
docker login

```
PS:>docker login
Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over to https:/
ub.docker.com to create one.
Username: frankgeisler
Password:
Login Succeeded
PS:>
```

Upload Docker image

```
PS:>docker push frankgeisler/newsqlserverimage:v1
The push refers to repository [docker.io/frankgeisler/newsqlserverimage]
aacc577327d3: Pushed
1b938a328b45: Pushed
541171b43e86: Pushed
2c2b7e5b6217: Mounted from microsoft/mssql-server-linux
01249431b734: Mounted from microsoft/mssql-server-linux
45feb6b3c7be: Mounted from microsoft/mssql-server-linux
912a24c355e6: Mounted from microsoft/mssql-server-linux
bb83128af95f: Mounted from microsoft/mssql-server-linux
49907af65b0a: Mounted from microsoft/mssql-server-linux
4589f96366e6: Mounted from microsoft/mssql-server-linux
b97229212d30: Mounted from microsoft/mssql-server-linux
cd181336f142: Mounted from microsoft/mssql-server-linux
0f5ff0cf6a1c: Mounted from microsoft/mssql-server-linux
v1: digest: sha256:8850682e806e1356637878402eb3012670936a7b7bd262775fad96d987a3ebe7 size: 3041
PS:>
```

Published Image in Docker Hub

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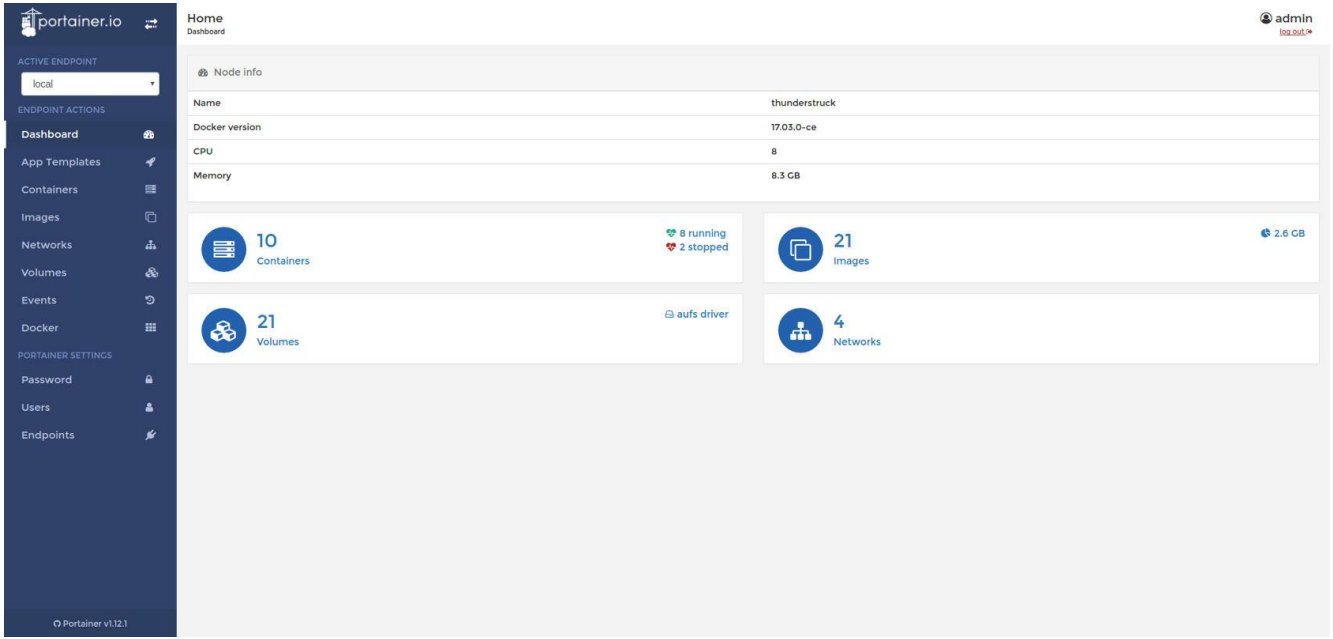
A nice GUI for Docker

Portainer

- http://portainer.io
- Open Source Projekt
- Is executed in Docker itself
- Two commands to start:
  - docker volume create portainer_data
  - docker run -d -p 9000:9000 -v /var/run/docker.sock:/var/run/docker.sock -v portainer_data:/data portainer/portainer

Portainer


portainer.io
ACTIVE ENDPOINT
local
ENDPOINT ACTIONS
Dashboard
App Templates
Containers
Images
Networks
Volumes
Events
Docker
PORTAINER SETTINGS
Password
Users
Endpoints
Portainer v1.12.1
Home
Dashboard
admin
log out
Node info
Name
thunderstruck
Docker version
17.03.0-ce
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8
Memory
8.3 GB
10
Containers
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2 stopped
21
Images
2.6 GB
21
Volumes
aufs driver
4
Networks


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Scenarios where you can use Docker

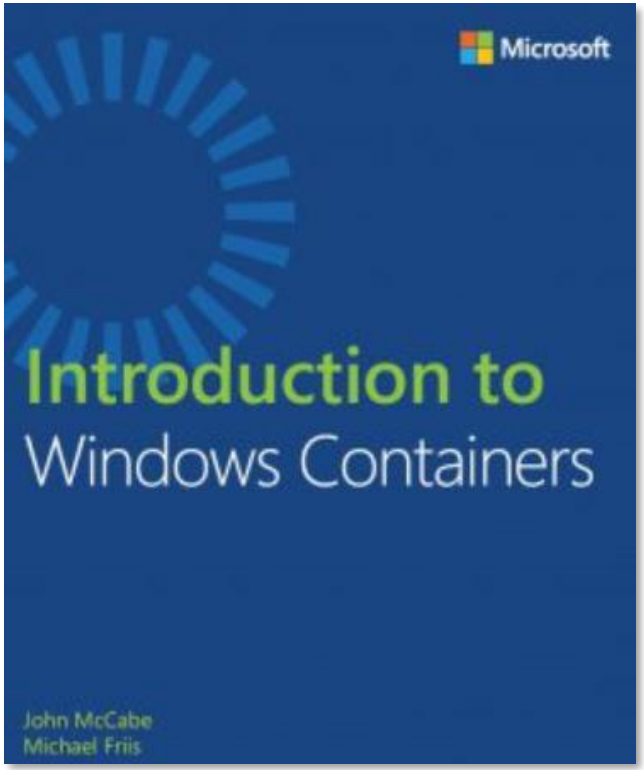
Scenarios where you can use Docker

- Dev / Test
- DevOps
- No knowledge on the server application
- Scaling scenarios

References

Free E-Book

Free E-Book:
https://blogs.msdn.microsoft.com/microsoft_press/2017/08/30/free-ebook-introduction-to-windows-containers/



Weblinks

- Docker Blog Series on our Website www.gdsbi.de (in german)
- SQL Server Sample Docker Container: https://github.com/Frank-Geisler/SQL-Server-Sample-Docker-Container
- SQL Server Samples auf Docker Hub: https://hub.docker.com/u/frankgeisler/


Thank
You