SQL SERVER DATABASE DEVOPS

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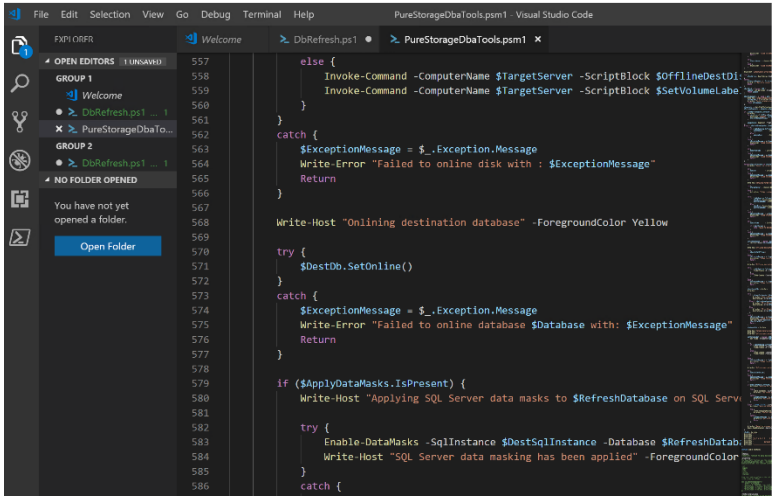
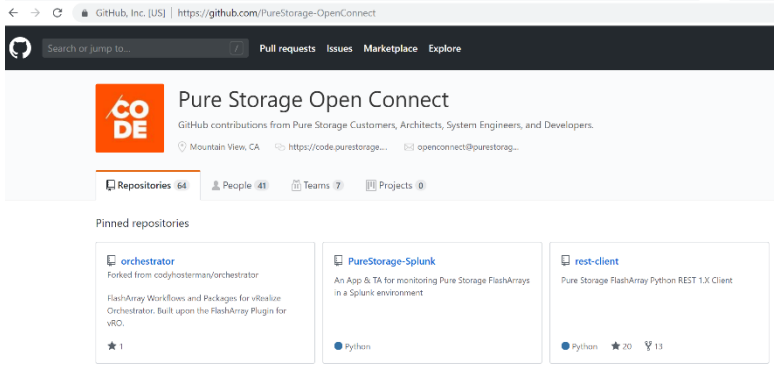
HOW DEVELOPERS VIEW THE WORLD





developers also tend to work in teams . . .

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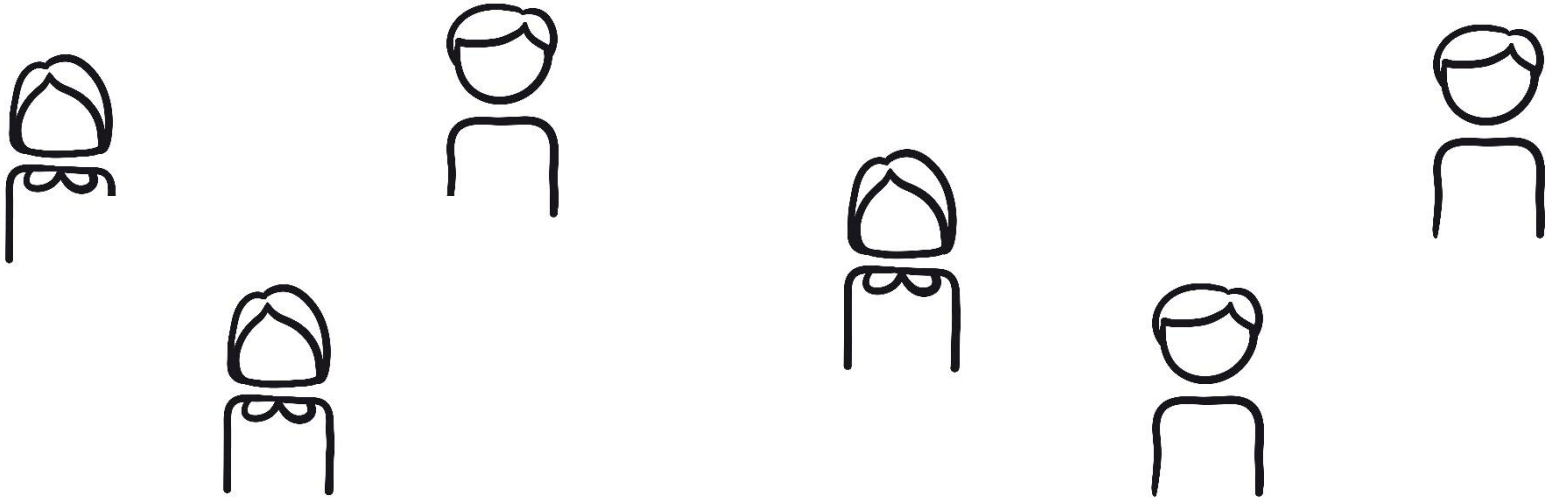
TEAM BASED SOFTWARE DEVELOPMENT



How do you **integrate** changes from multiple developers into a single coherent piece of software that works ?

CONTINUOUS INTEGRATION (CI)

Continuous Integration (CI) is a development practice that requires developers to integrate code into a shared repository several times a day. Each check-in is then verified by an automated build, allowing teams to detect problems early.

CI PIPELINE 101

1. Check out code
2. Build artifact
3. Deploy artifact to target
4. Run tests

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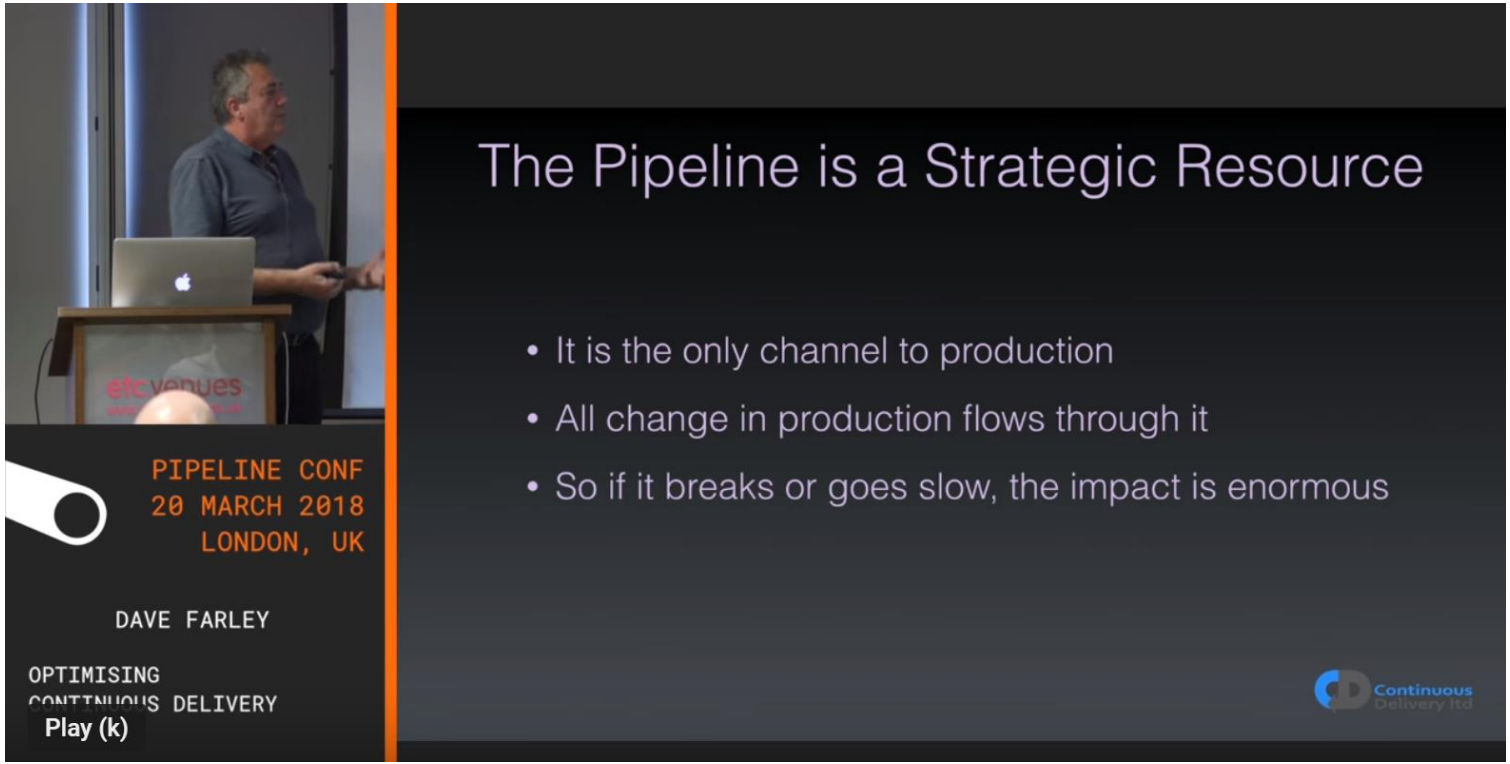
WHY DO CI PIPELINES MATTER ?



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SOMETHING NEEDS TO RUN THE PIPELINE

Continuous integration engines

circleci

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PIPELINE AS CODE, BUT WHY ?

Which approach leads to better reusability, extensibility, repeatable results and better automation ?

“TALK IS CHEAP, SHOW ME THE CODE”

LINUS TORVALDS
CREATOR OF LINUX AND GIT

STORING THE PIPELINE WITH THE SOURCE CODE

PureStorage-OpenConnect / Jenkins-Fa-Snapshot-Ci-Pipeline-Adv

Unwatch 8 | Star 0 | Fork 0

Code | Issues 0 | Pull requests 0 | Projects 0 | Wiki | Insights | Settings

Jenkins CI pipeline which illustrates testing and database refreshes in parallel

Edit

Manage topics

28 commits | 1 branch | 0 releases | 1 contributor | Apache-2.0

Branch: master | New pull request | Create new file | Upload files | Find File | Clone or download

chrisadkin Update Jenkinsfile — Latest commit f10c15e 18 hours ago

.vs/Jenkins-Fa-Snapshot-Ci-Pipeline-Adv/v15	Initial commit	a day ago
Jenkins-Fa-Snapshot-Ci-Pipeline-Adv	sqlproj file correction	a day ago
Jenkins-Fa-Snapshot-Ci-Pipeline-Adv.sln	Initial commit	a day ago
Jenkinsfile	Update Jenkinsfile	18 hours ago
LICENSE	Initial commit	a day ago
README.md	Initial commit	a day ago

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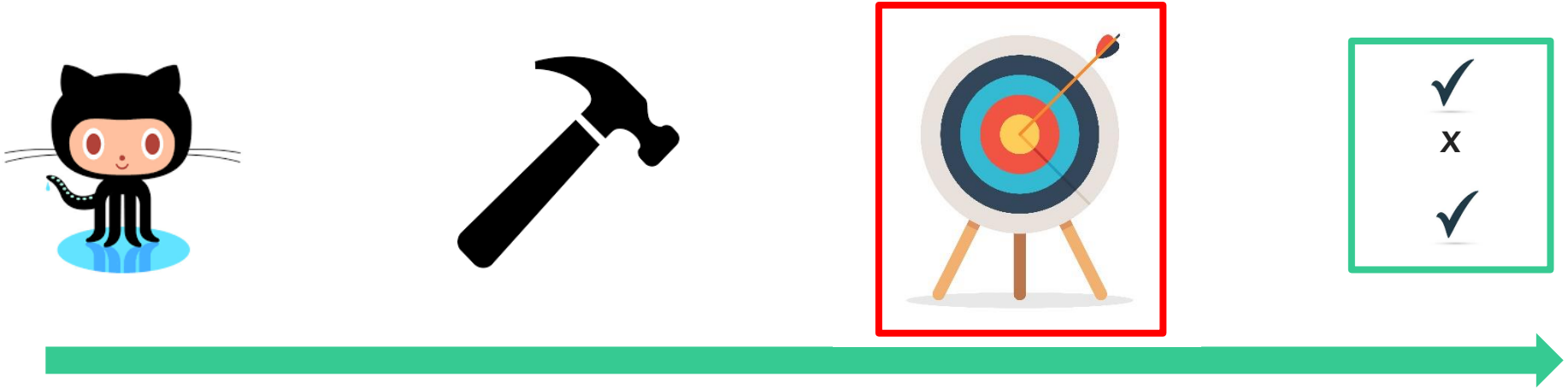
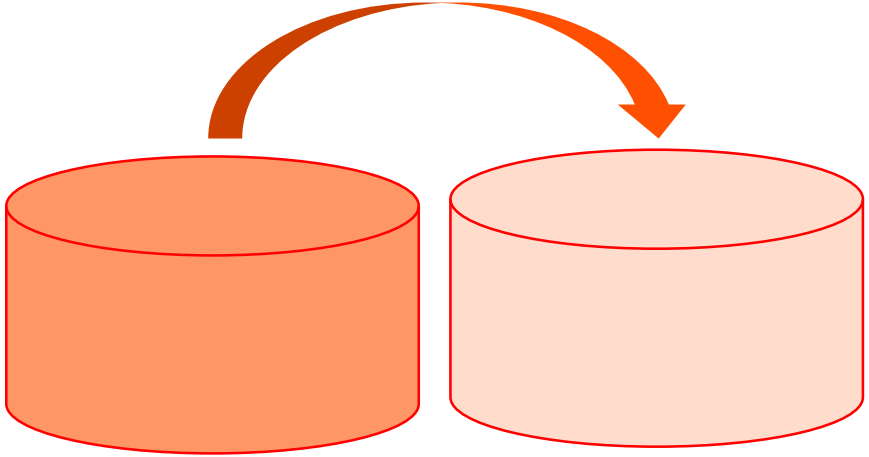
A COMMON PROBLEM



- Deployment target data differs from production data
- Deployment target is slow and cumbersome to provision or refresh

A SOLUTION



Use a snapshot based database refresh to refresh the target

WRITING SCRIPTS, A GOOD ANALOGY

A MODULE TO DO THE HEAVY LIFTING

```
Install-Module –Name PureStorageDbaTools

Get-Command –Module PureStorageDbaTools

Command Type   Name
------------   ----------------------------
Function       Invoke-DynamicDataMasking
Function       Invoke-PfaDbRefresh
Function       Invoke-StaticDataMasking
Function       Invoke-PfaDbSnapshot
```

FULLY SELF DOCUMENTED

```
Get-Help [Function]

Get-Help [Function] –Detailed

Get-Help [Function] –Full

Get-Help [Function] –Examples
```

SECURITY

```
$Pwd = Get-Content ‘C:\Temp\Secure-Credentials.txt’ | ConvertTo-SecureString
$Creds = New-Object System.Management.Automation.PSCredential("pureuser", $pwd)
Invoke-PfaDbRefresh -RefreshDatabase tpch-no-compression `
                    -RefreshSource   Z-STN-WIN2016-A\DEVOPSPRD `
                    -DestSqlInstance Z-STN-WIN2016-A\DEVOPSIAT `
                    -PfaEndpoint     10.225.112.10 `
                    -PfaCredentials  $Creds
```

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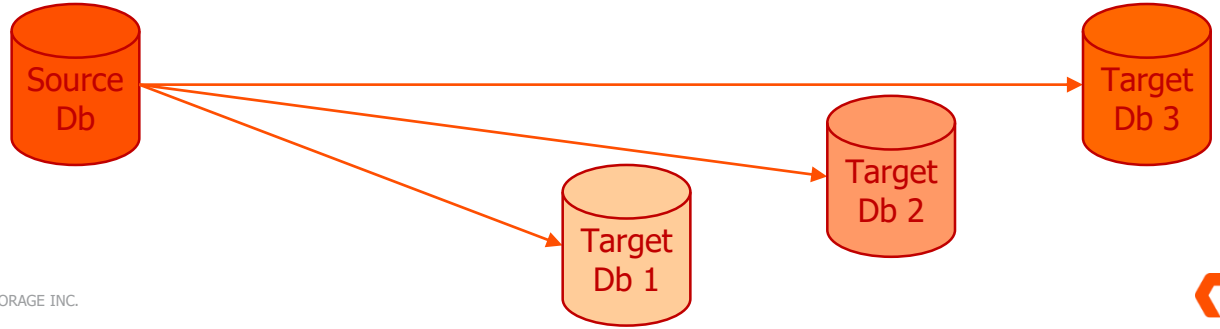
1:M DATABASE REFRESHES

```
$Pwd = Get-Content ‘C:\Temp\Secure-Credentials.txt’ | ConvertTo-SecureString
$Creds = New-Object System.Management.Automation.PSCredential("pureuser", `
                                                                  $pwd)
$Targets = @('Z-STN-WIN2016-A\DEVOPSDEV1’, `
             'Z-STN-WIN2016-A\DEVOPSDEV2’, `
             'Z-STN-WIN2016-A\DEVOPSDEV3’)
Invoke-PfaDbRefresh -RefreshDatabase tpch-no-compression `
                    -RefreshSource   Z-STN-WIN2016-A\DEVOPSPRD `
                    -DestSqlInstance $Targets `
                    -PfaEndpoint     10.225.112.10 `
                    -PfaCredentials  $Creds
```



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SNAPSHOT A DATABASE

```
$Pwd = Get-Content ‘C:\Temp\Secure-Credentials.txt’ | ConvertTo-SecureString
$Creds = New-Object System.Management.Automation.PSCredential("pureuser", `
                                                                $pwd)
New-PfaDbRefresh -Database       tpch-no-compression `
                 -SqlInstance    Z-STN-WIN2016-A\DEVOPSPRD `
                 -PfaEndpoint    10.225.112.10 `
                 -PfaCredentials $Creds
```

DATA MASKING: STATIC

```
New-DbaDbMaskingConfig -SqlInstance z-sql-prd `
                       -Database tpch-no-compression `
                       -Path D:\apps\datamasks\z-sql-prd.tpch-no-compression.tables.json

StaticDataMaskFile = "D:\apps\datamasks\z-sql-prd.tpch-no-compression.tables.json"
$Targets = @("z-sql2016-devops-tst", "z-sql2016-devops-dev")
Invoke-PfaDbRefresh -$RefreshDatabase    tpch-no-compression `
                    -RefreshSource       z-sql-prd `
                    -DestSqlInstance     $Targets `
                    -PfaEndpoint         10.225.112.10 `
                    -PfaCredentials      $Creds `
                    -StaticDataMasksFile $StaticDataMaskFile
```


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DATA MASKING: DYNAMIC

```
$Targets = @("z-sql2016-devops-tst", "z-sql2016-devops-dev")
Invoke-PfaDbRefresh -$RefreshDatabase tpch-no-compression `
                    -RefreshSource    z-sql-prd `
                    -DestSqlInstance  $Targets `
                    -PfaEndpoint      10.225.112.10 `
                    -PfaCredentials   $Creds `
                    -ApplyDataMasks
```

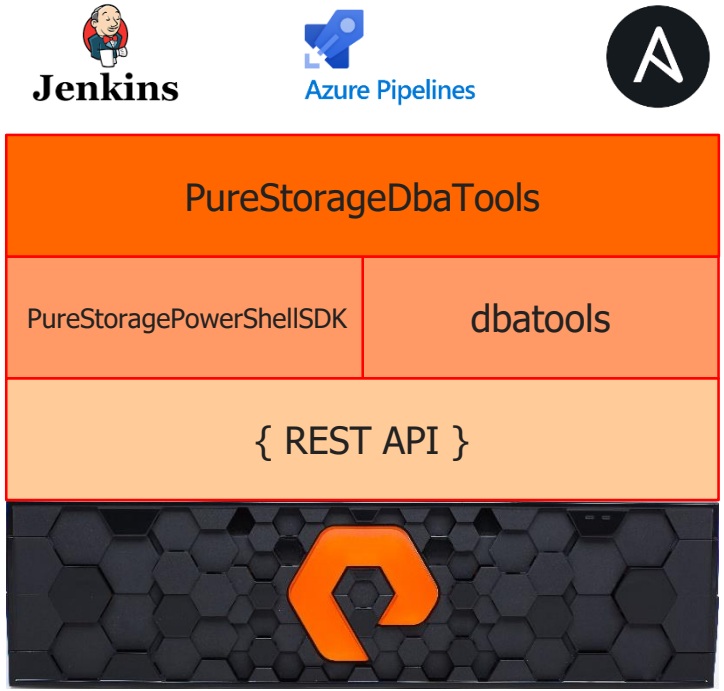
Leverages SQL Server dynamic data masking

DB REFRESH ORCHESTRATION VIA ANSIBLE

BLOG POST LINK

```yaml
- name: PowerShell MS SQL Database refresh
hosts: z-stn-win2016-a
gather_facts: no
vars_files:
- vars/ps.yaml

tasks:

# Include Pure Storage PowerShell DBA tools
- include: tasks/setupPS.yaml

# PowerShell database refresh
- name: PowerShell Database Snapshot
win_shell: |
$Pwd   = Get-Content 'C:\Temp\Secure-Credentials.txt' | ConvertTo-SecureString
$Creds = New-Object System.Management.Automation.PSCredential ("pureuser", $pwd)
New-PfaDbSnapshot -Database tpch-no-compression `
                  -SqlInstance {{ dbSource }}   `
                  -PfaEndpoint {{ pEndpoint }}  `
                  -PfaCredentials $Creds
args:
chg_dir: "{{ tgt_dir }}"
register: snapshot

# - debug:
# msg: "Refreshing database using snapshot name {{ snapshot }}"

- set_fact:
sName: "{{snapshot.stdout_lines | select('match','name.*') | list | first}}"

- set_fact:
snapName: "{{ sName[10:] }}"

# - debug:
# msg: "Refreshing database using snapshot name {{ snapName }}"

- name: PowerShell Database Refesh
win_shell: |
$Pwd = Get-Content 'C:\Temp\Secure-Credentials.txt' | ConvertTo-SecureString
$Creds = New-Object System.Management.Automation.PSCredential ("pureuser", $pwd)
Invoke-PfaDbRefresh -RefreshDatabase tpch-no-compression `
                    -RefreshSource   {{ snapName }}      `
                    -DestSqlInstance {{ dbTarget }}      `
                    -PfaEndpoint     {{ pEndpoint }}     `
                    -PfaCredentials  $Creds              `
                    -RefreshFromSnapshot                 `
                    -NoPsRemoting
register: refresh

- debug: msg="{{ refresh.stdout_lines }}"
```

LAYERS OF THE "SOLUTION STACK"



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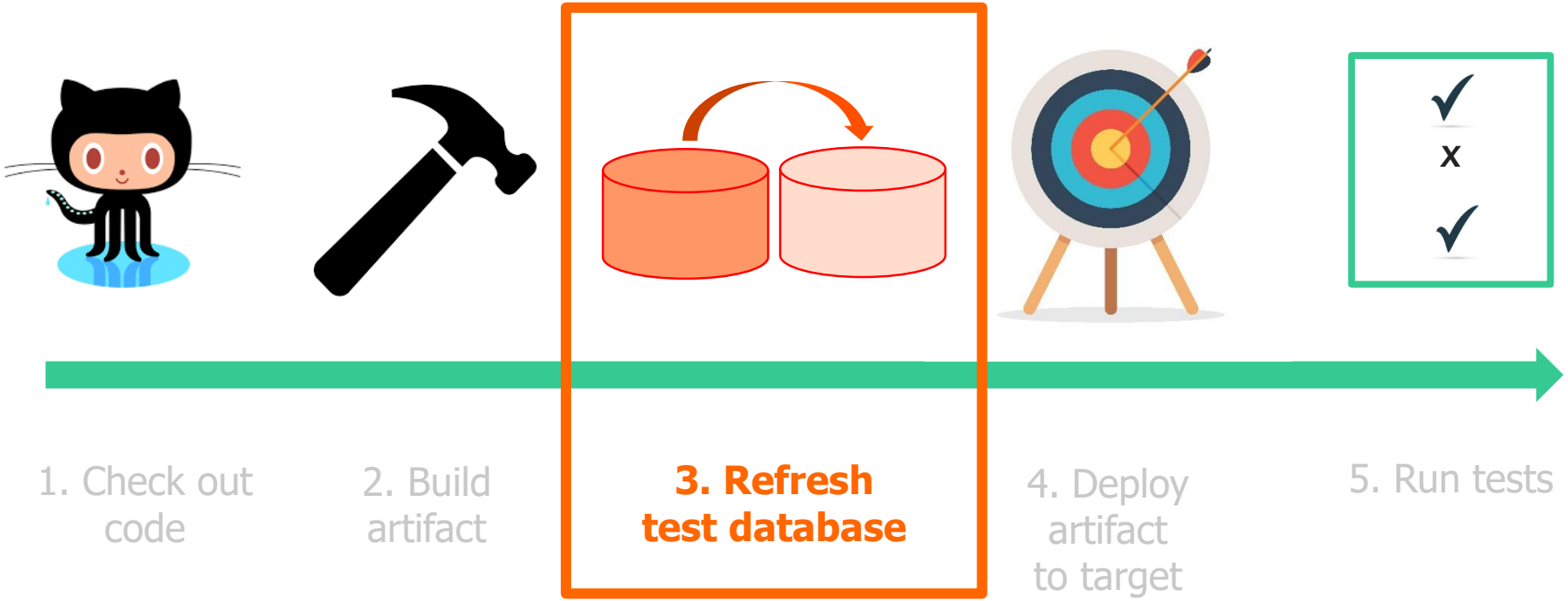
INTEGRATES EASILY INTO CI PIPELINES



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DATABASE REFRESH WITH JENKINS

```
stage('Refresh test from production')
{
    timeout(time:5, unit:'MINUTES') {
        withCredentials([string(credentialsId: 'PfaCredentialsFile', variable: 'PfaCredentialsFile'),
                         string(credentialsId: 'PfaUser'           , variable: 'PfaUser')]) {
            powershell 'Import-Module -Name PureStorageDbaTools; ' +
                       '\$Pwd = Get-Content ' + "${PfaCredentialsFile}" + ' | ConvertTo-SecureString;'  +
                       '\$Creds = New-Object System.Management.Automation.PSCredential(\"' + "${PfaUser}" + '\",\$Pwd); ' +
                       'Invoke-PfaDbRefresh -RefreshDatabase ' + "${params.Database}"       +
                                            ' -RefreshSource   ' + "${params.SourceInstance}" +
                                            ' -DestSqlInstance ' + "${params.DestInstance}"   +
                                            ' -PfaEndpoint     ' + "${params.PfaEndpoint}"    +
                                            ' -PfaCredentials  \$Creds'
        }
    }
}
```


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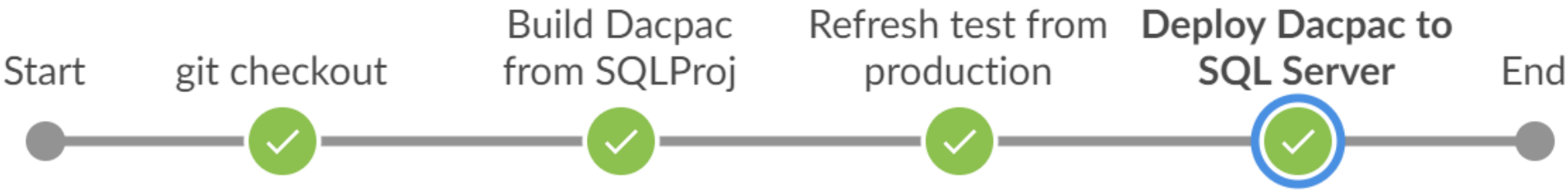
AZURE PIPELINE DATABASE REFRESH

```yaml
#
# Example Azure DevOps pipeline to:
#
# 1. Checkout a SQL Server data tools project
# 2. Build the project into a DACPAC
# 3. Refresh a development database from pseudo production, this is carried out by
#    a call to the Invoke-PfaDbRefresh function from the PureStorageDbaTools PoSH module
# 4. Apply the DACPAC to the development database
#
trigger:
- master

pool: $(agentPool)

steps:
  - task: MSBuild@1
    displayName: 'Build DACPAC'
    inputs:
      solution: 'AzureDevops-Fa-Snapshot-CI-Pipeline.sln'
      msbuildArguments: '/property:OutDir=bin\Release'
  # Create a secret variable
  - powershell: |
      $securePassword = ConvertTo-SecureString -String '$(pfaPassword)' -AsPlainText -Force
      $pfaCreds = New-Object System.Management.Automation.PSCredential '$(pfaUsername)', $securePassword
      Invoke-PfaDbRefresh -RefreshDatabase $(refreshDatabase) `
                          -RefreshSource   $(refreshSource) `
                          -DestSqlInstance $(refreshTarget) `
                          -PfaEndpoint     $(pfaEndpoint) `
                          -PfaCredentials  $pfaCreds
```

A SIMPLE EXAMPLE



GitHub repo

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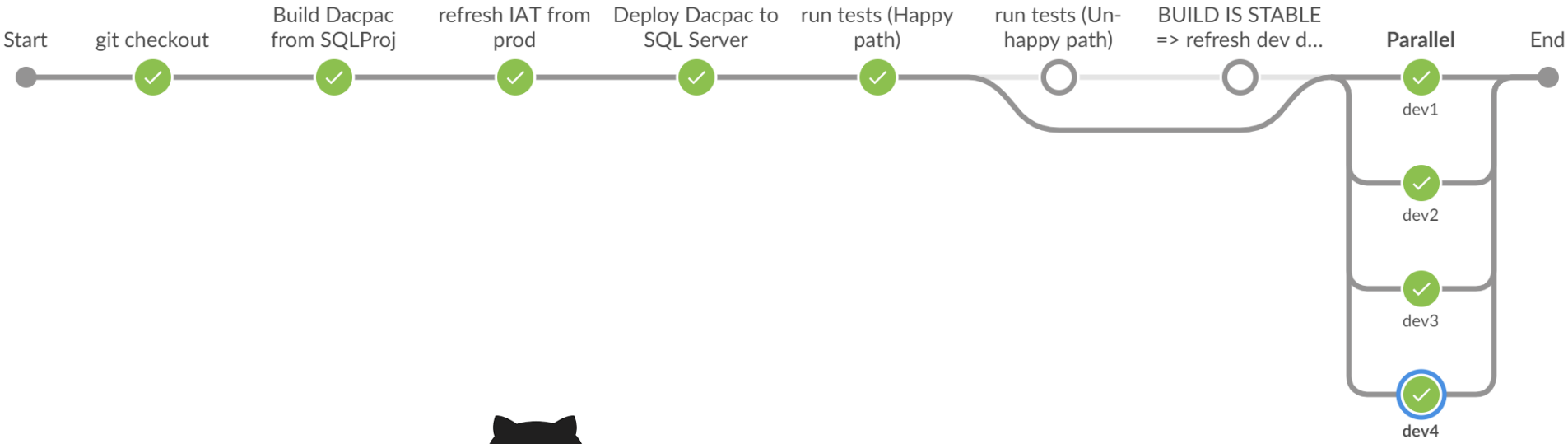
A MORE COMPLEX EXAMPLE



GitHub repo

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Leveraging The Public Cloud

AN EXAMPLE PIPELINE

Refreshing four development database in parallel following a successful build and test

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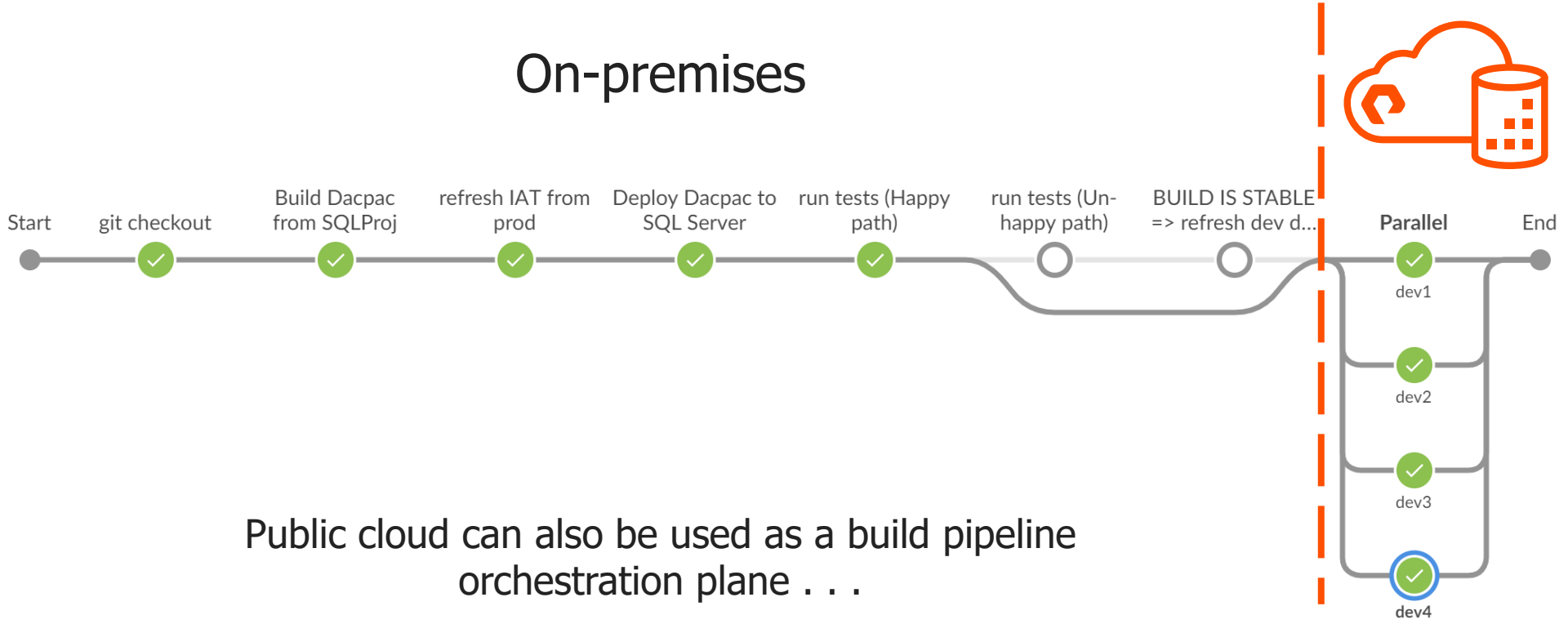
DEVELOPMENT DATABASES IN THE CLOUD

On-premises



Public cloud can also be used as a build pipeline orchestration plane . . .

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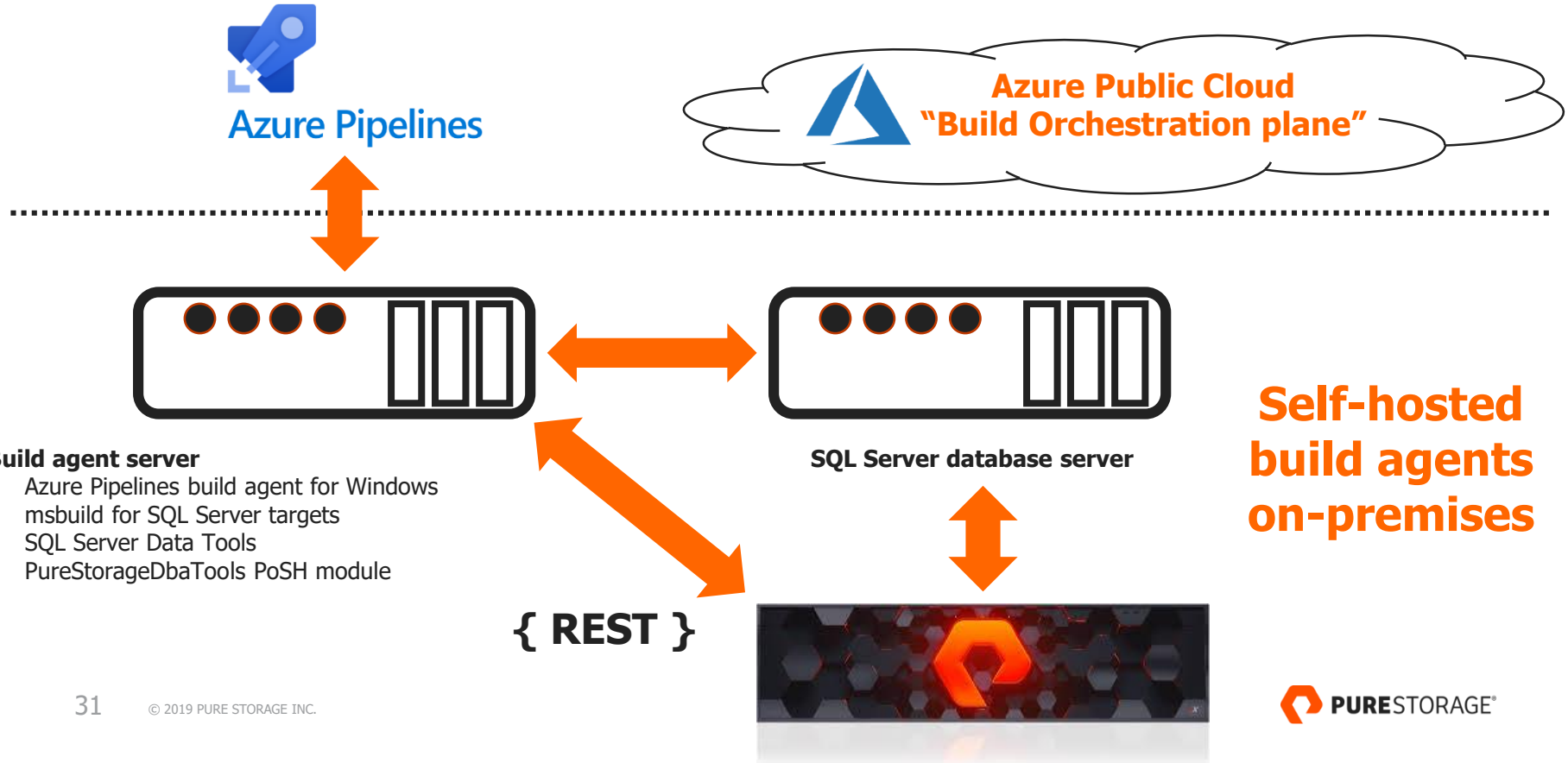
ON-PREM PIPELINE ORCHESTRATED IN THE AZURE CLOUD



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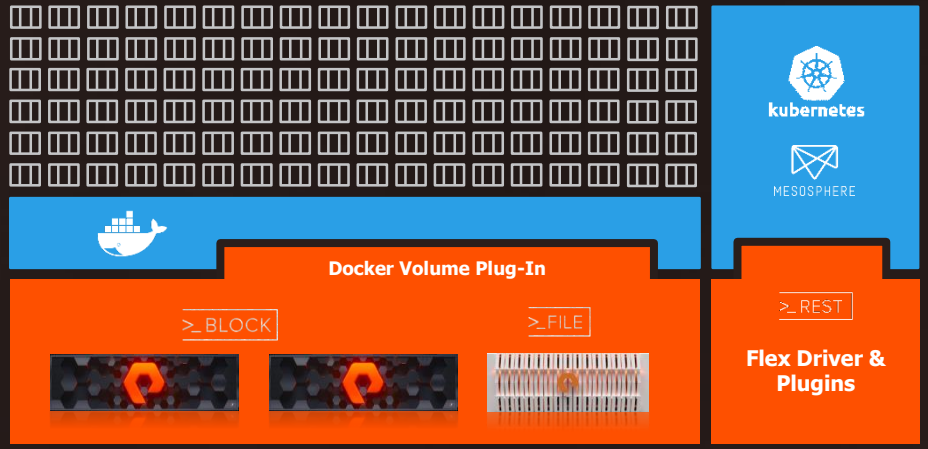
CONTAINERS

A GOOD ANALOGY

PURE
SERVICE ORCHESTRATOR



docker

VOLUME PLUG-IN

MESOSPHERE

ORCHESTRATION PLUG-INS

docker CERTIFIED Plugins

RED HAT OPENSHIFT PRIMED

AGENTS

- **“Build agents”**
  - Pull code from repos
  - Turn code into deployable artifacts
  - Run tests
  - Can run in a variety of ways

AGENTS AS CONTAINERS

```
pipeline {
    agent {
        docker { image 'node:7-alpine' }
    }
    stages {
        stage('Test') {
            steps {
                sh 'node --version'
            }
        }
    }
}
```

AZURE PIPELINES AGENT POOLS

https://dev.azure.com/cadkin/_settings/agentpools?poolId=9&_a=agents

Azure DevOps cadkin / Organization Settings / Agent pools Search

New Organization Permissions Settings Page: We have updated the Permissions settings user experience. Try out this Preview feature! Try it! Not now

Organization Settings

General
- Overview
- Projects
- Users
- Billing
- Global notifications
- Usage
- Extensions
- Azure Active Directory

New agent pool...

- All agent pools
  - Default
  - Hosted
  - Hosted macOS
  - Hosted macOS High Sierra
  - Hosted Ubuntu 1604
  - Hosted VS2017
  - Hosted Windows 2019 with ...
  - Hosted Windows Container
  - Self Hosted Win2016

Agents for pool Self Hosted Win2016 Download agent

Agents Roles Details Settings Maintenance history

Enabled	Name	State	Current stat
☑	Z-SQL-UTIL	Online	Idle

Requests Capabilities

ID	Type	Pipeline	Name	Date queued
162	Build	chrisadkin.AzureDevO...	20190412.2	4/12/2019 9
161	Build	PureStorage-OpenCon...	20190218.25	2/18/2019 4
160	Build	PureStorage-OpenCon...	20190218.24	2/18/2019 4
159	Build	PureStorage-OpenCon...	20190218.23	2/18/2019 4
158	Build	PureStorage-OpenCon...	20190218.22	2/18/2019 4
157	Build	PureStorage-OpenCon...	20190218.21	2/18/2019 4
156	Build	PureStorage-OpenCon...	20190218.20	2/18/2019 4

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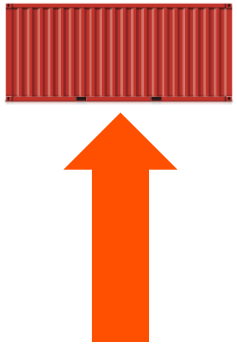
SIDECARS

"This pattern is named *Sidecar* because it resembles a sidecar attached to a motorcycle. In the pattern, the sidecar is attached to a parent application and provides supporting features for the application."

From Azure architecture patterns

‘SIDECARS’ IN A CI PIPELINE

Spin ‘Sidecar’ container deployment target up



Tear ‘Sidecar’ container deployment target down

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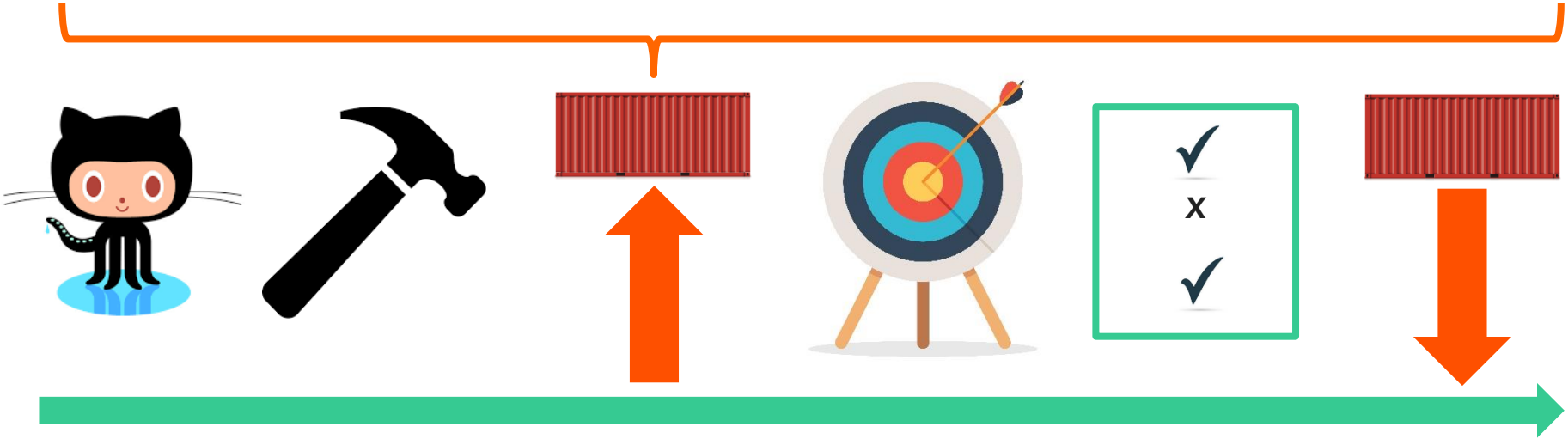
STATEFUL ‘SIDECARS’ IN A CI PIPELINE

```
docker run -v ${VOLUME_NAME}:/var/opt/mssql -e "ACCEPT_EULA=Y" -e "SA_PASSWORD=P@ssword1"
--name ${CONTAINER_NAME} -d -i -p ${PORT_NUMBER}:1433 microsoft/mssql-server-linux:2017-GA
```



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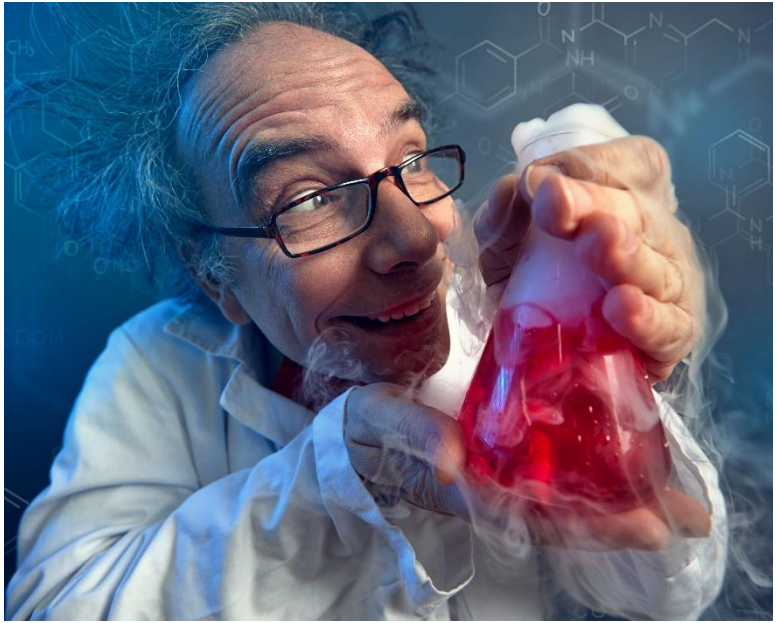
Demonstrations



Takeaway Points

1. The CI pipeline is the conduit of software delivery from development to production,
2. How FlashArray can be leveraged in CI pipelines,
3. Value of CI-pipelines-as-code,
3. REST API as a starting point for solutions,
4. Patterns for leveraging the public cloud in CI pipelines,
5. Use of containers and PSO in CI pipelines.

USEFUL RESOURCES

- PureStorageDbaTools – available from the PowerShell gallery
- Orchestrating SQL Server Database Refreshes with Ansible
- Jenkins FlashArray Db Refresh 'Basic' Pipeline
- Jenkins FlashArray Pipeline with parallel dev database refresh
- Azure DevOps FlashArray Pipeline
- Pure Service Orchestrator