# Team 2

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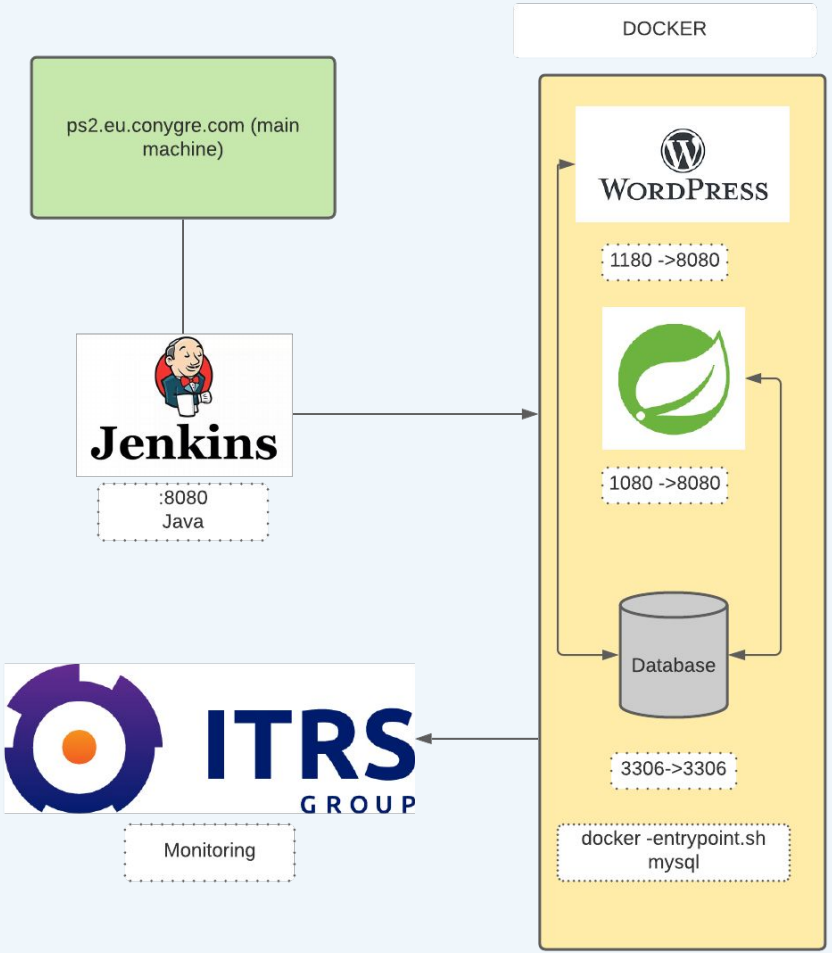



# Architecture

Our main machine, ps2.eu.conygre.com has Jenkins on Port 8080.

Jenkins is an open source automation server. It helps automate the parts of software development related to building, testing, and deploying. It facilitates continuous integration and continuous delivery.

We have our applications  Wordpress and Petclinic which connect to the MySQL Database in the Docker container within Jenkins.

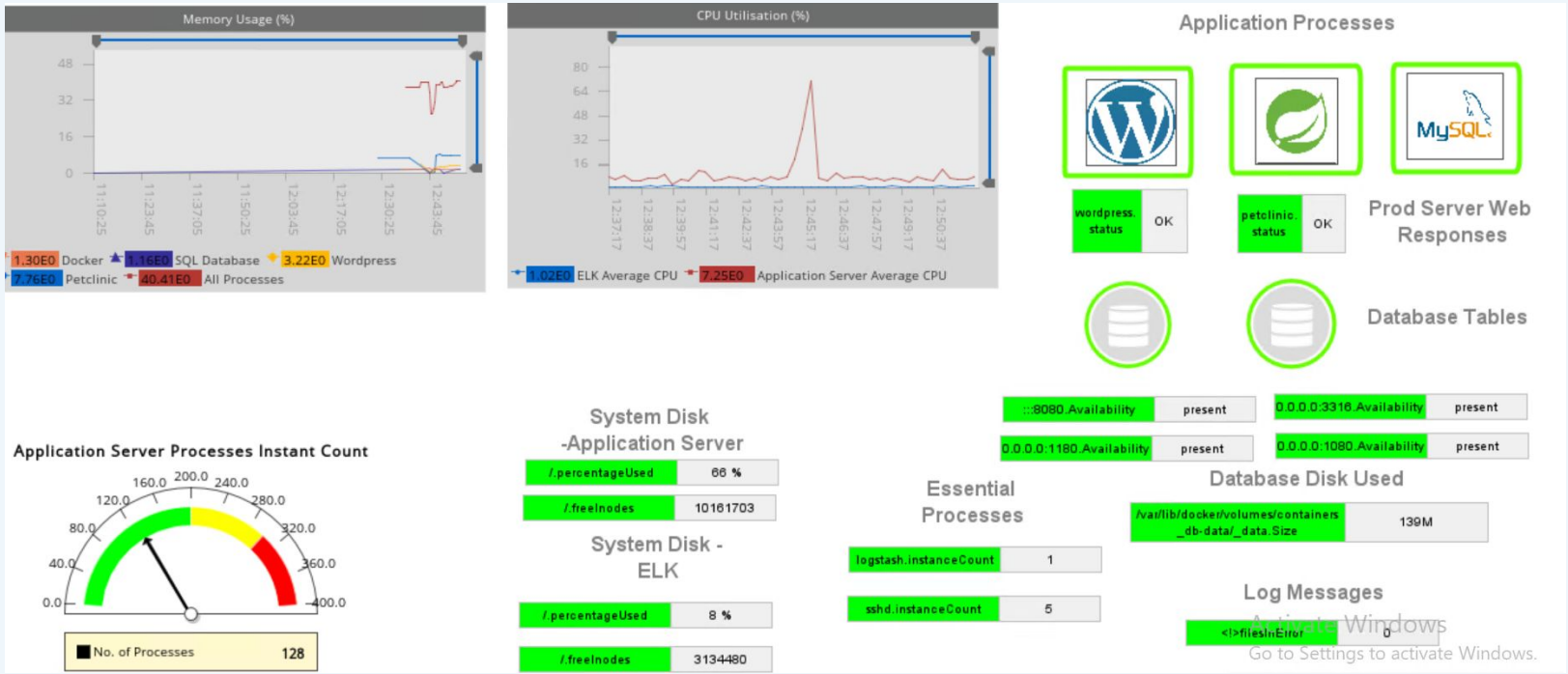
Wordpress  is accessible on the main machine through port 1180 which is forwarded to a virtual machine port 8080.

Petclinic is accessible on the main machine through port 1080 which is forwarded to a virtual machine port 8080.

ITRS is our monitoring tool, which we will go into more detail about throughout the presentation.

# Monitoring

For monitoring our application, we created an active dashboard which allows us to view the status of our processes and applications. We shared the dashboard .adb file in the Bitbucket repository This will allow the team to see when a process is down to allow early detection and prevention to causing further issues.

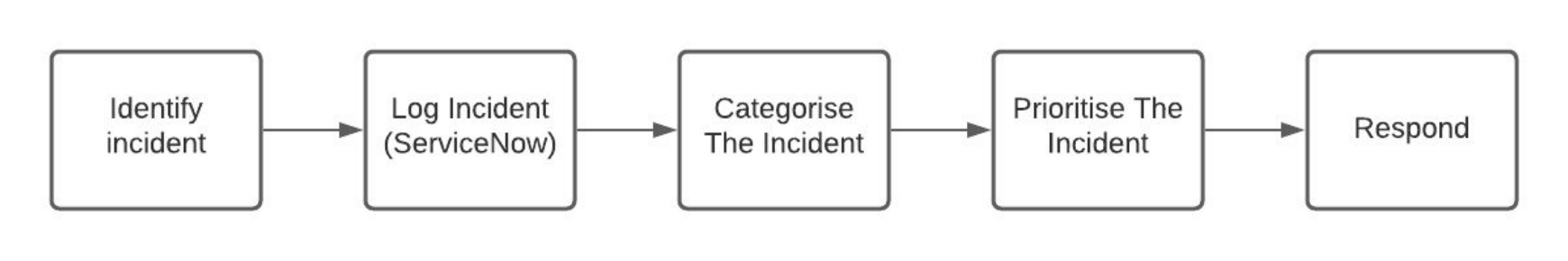


Below is the Active Dashboard after the Database has been taken down. We can see that the MySQL Application Processes has turned red, the database tables have turned grey, this is because they do not exist without the database. We can also see our Port :3316 connection is absent which is the port the database listens on.

## Incident Management

- Incidents could be discovered from our monitoring systems including ITRS through the active dashboard, other employees/team members or clients.
- ITRS provides a level of concern including Warning and Critical. This could be used to help determine the incident severity level.

Incident Management Process



# Jenkins

Jenkins helps automate the parts of software development related to building, testing, and deploying, facilitating continuous integration and continuous delivery.

# Jenkins dashboard

Jenkins

search | 1 | 2 | Administrator | log out

Dashboard

- New Item
- People
- Build History
- Manage Jenkins
- My Views
- Lockable Resources
- New View

**Build Queue**

No builds in the queue.

**Build Executor Status**

1 Idle
2 Idle
3 Idle
4 Idle

add description

All | Build | Maintenance | Start | Stop | +

| S | W | Name ↓ | Last Success | Last Failure | Last Duration |
|---|---|---|---|---|---|
| | | Build Projects | 1 day 0 hr - #32 | 7 days 3 hr - #18 | 0.52 sec |
| | | Compile All | N/A | N/A | N/A |
| | | Database Backup PetClinic | 7 min 8 sec - #41 | 2 hr 7 min - #40 | 1.9 sec |
| | | Database backup wordpress | 1.7 sec - #14 | 1 hr 5 min - #13 | 1.4 sec |
| | | Docker up all | 1 day 5 hr - #3 | N/A | 9.1 sec |
| | | Launch Database | 52 min - #16 | 7 days 2 hr - #5 | 4.7 sec |
| | | Launch Monitoring | 2 mo 19 days - #1 | N/A | 3.5 sec |
| | | Launch PetClinic App | 52 min - #44 | 7 days 2 hr - #29 | 6.4 sec |
| | | Launch Wordpress | 52 min - #40 | N/A | 6.3 sec |
| | | Restore Database petclinic | 21 hr - #5 | 23 hr - #4 | 3.4 sec |
| | | Restore Database wordpress | 21 hr - #113 | 1 day 5 hr - #109 | 2.8 sec |
| | | StartDB,Wordpress,PetClinic | 1 day 3 hr - #9 | N/A | 2 min 7 sec |
| | | Stop PetClinic | 1 day 21 hr - #16 | 7 days 1 hr - #12 | 12 sec |
| | | Stop Wordpress | 1 day 5 hr - #5 | N/A | 3.3 sec |
| | | StopDatabase | 2 hr 27 min - #8 | N/A | 5 sec |
| | | StopDB,Wordpress,PetShop | 6 days 22 hr - #6 | 6 days 22 hr - #3 | 17 sec |

# Source code management

Our group decided to use Bitbucket as a repository to store all of the scripts used to start and stop the containers. This would ensure that these instructions weren't lost in case Jenkins was reset or lost its data.

Using a git repository in Jenkins also provides a method of version control as git will always keep copies of our previous builds.

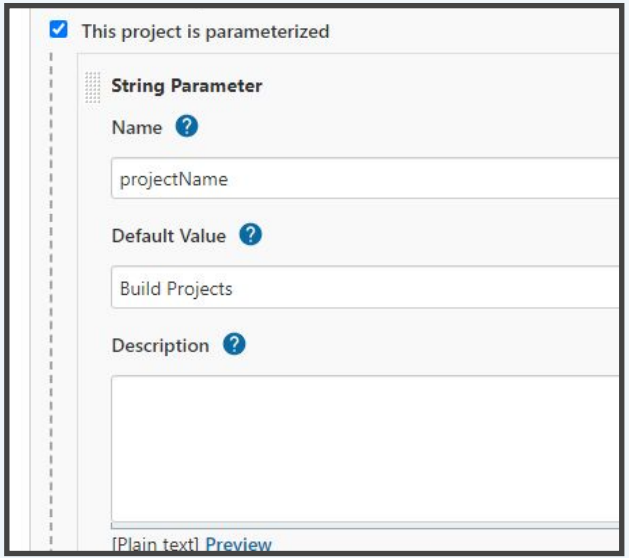
hackathon3 / startpet

```
#!/bin/bash

cd "/var/lib/jenkins/workspace/${projectName}"
cd containers
docker-compose up -d petclinic

```

The first step was adding the parameter "projectName" to replace the original name which was "Build Projects". This ensures that the process name can easily be changed in the future.



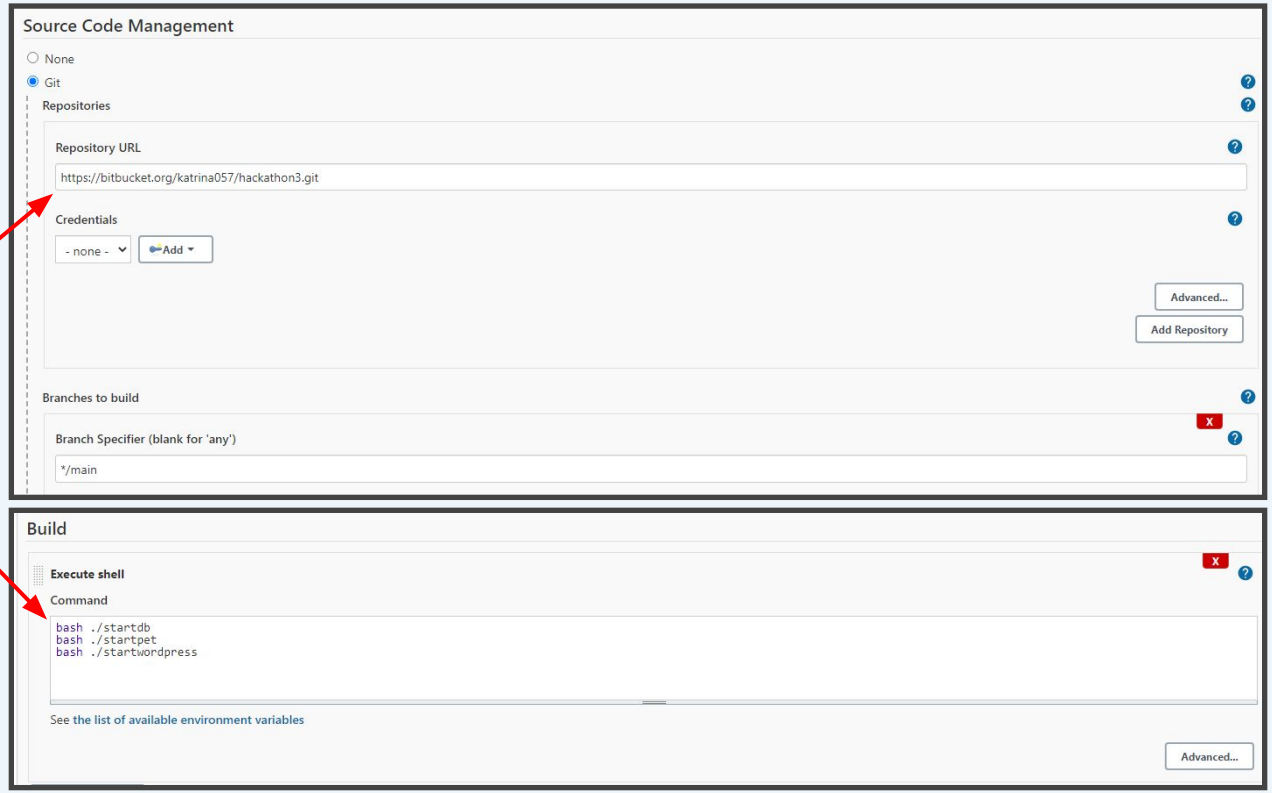
# Source code management

This is an example of how we got Jenkins to read from our git repository.

The git repository link is entered in Jenkins

The Jenkins shell only has the titles of the bitbucket files rather then the source code

Additionally, some Jenkins projects (such as the one pictured) were made to run multiple scripts at once to reduce manual touch.



# Release

## Roll Back

Source Code Management

None

Git

Repositories

Repository URL

https://github.com/stevshil/monitoring-lab.git

Credentials

- none -

Add

Advanced...

Add Repository

Branches to build

Branch Specifier (blank for 'any')

*/main

Add Branch

Branches to build

Branch Specifier (blank for 'any')

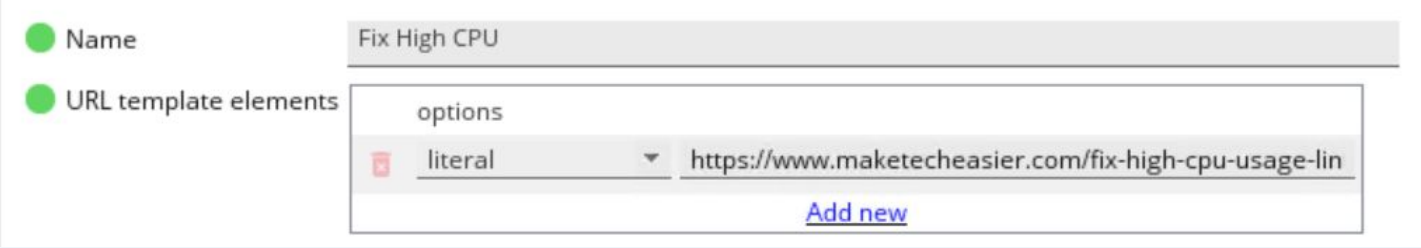
*/dcrestart

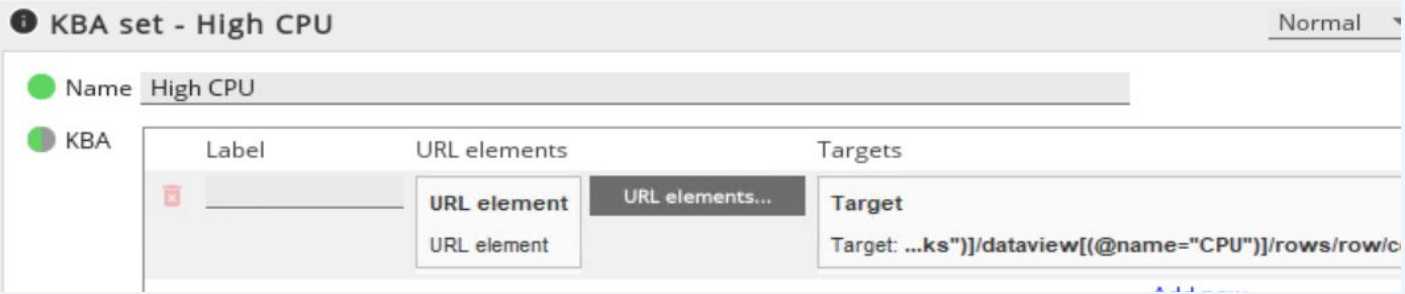
# ITRS

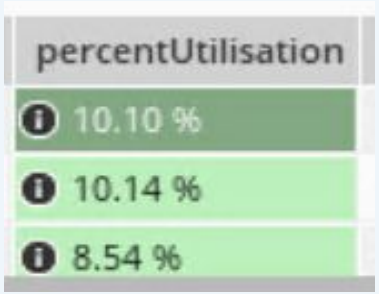
A **real-time application performance monitoring tool** that helps you manage the increasingly complex interdependencies between your infrastructure, applications and business services.

# ITRS Knowledge Base

We added a knowledge base to the percent utilisation for the CPU. This is useful for when the value hits the warning threshold as  when you click the knowledge base it links you to a website explaining what to do if a linux machine's CPU is high. The knowledge base is denoted by an "i" on the cells which include one.

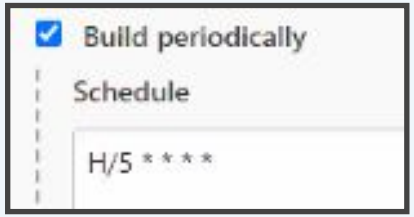


# Petclinic/Wordpress application status monitoring and automation

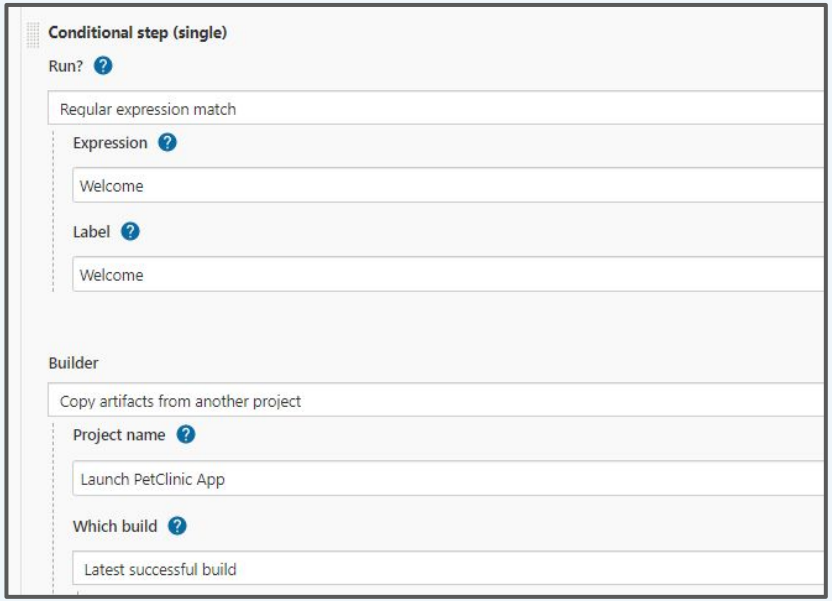
Originally there was a build per application in Jenkins which was automated to run every 5 minutes to check if the site was still up.




The way the status was checked on both Petclinic and WordPress was by searching for the word “Welcome”

# Petclinic/Wordpress application status monitoring and automation

If the first shell script could not find the word “Welcome” it relaunched the latest stable build of the application



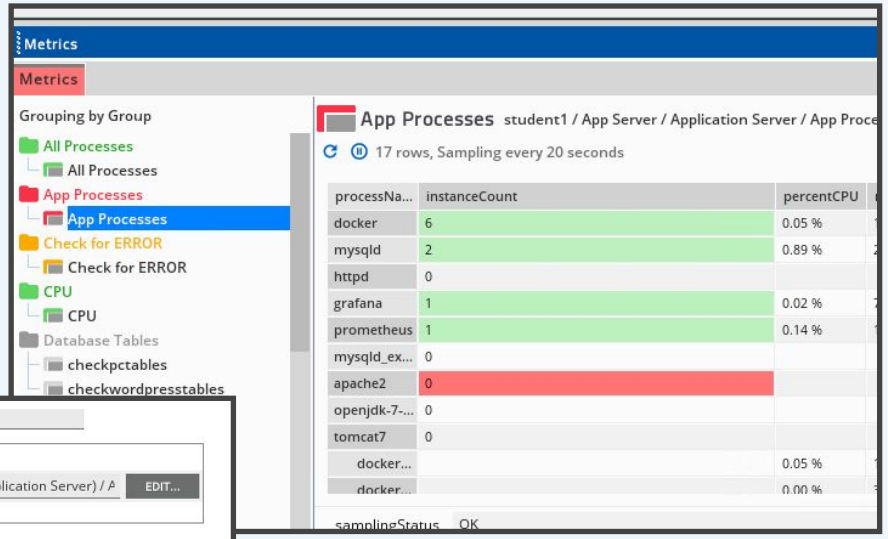

The issue with using Jenkins was that building a project every 5 minutes to check the status of the site meant that it checked less frequently than ITRS could (it could check more frequently but this would use a very high level of resources to run), and there was also no way to delay samples. The responsibility for checking if the sites were up was moved to ITRS, however, the launch-related parts of the projects were kept on Jenkins for the advantage of git source code management.

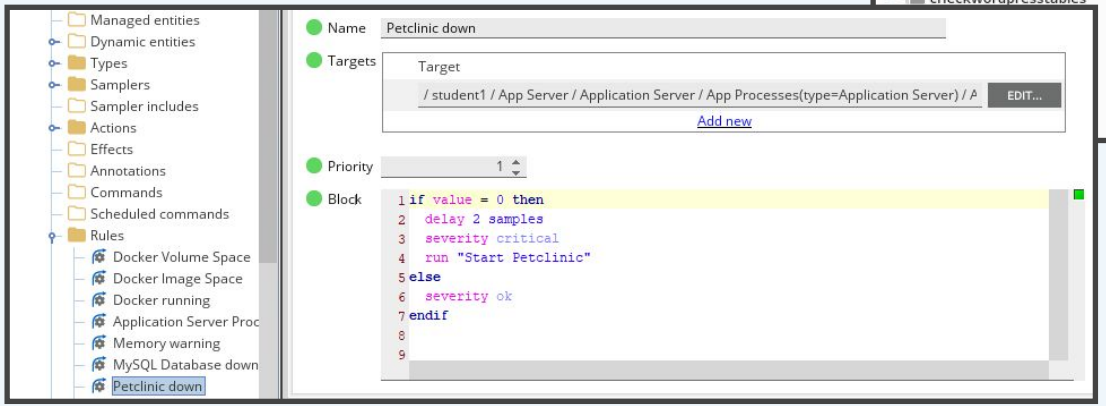
A disadvantage of moving the automation to ITRS is that Jenkins has the option to launch only the last stable build. ITRS will attempt to launch the latest build. A rollback plan would need to be implemented in future builds when using ITRS.

# Petclinic/Wordpress application status monitoring and automation

ITRS now checks the applications are up every 20 seconds using the ‘instanceCount’ feature

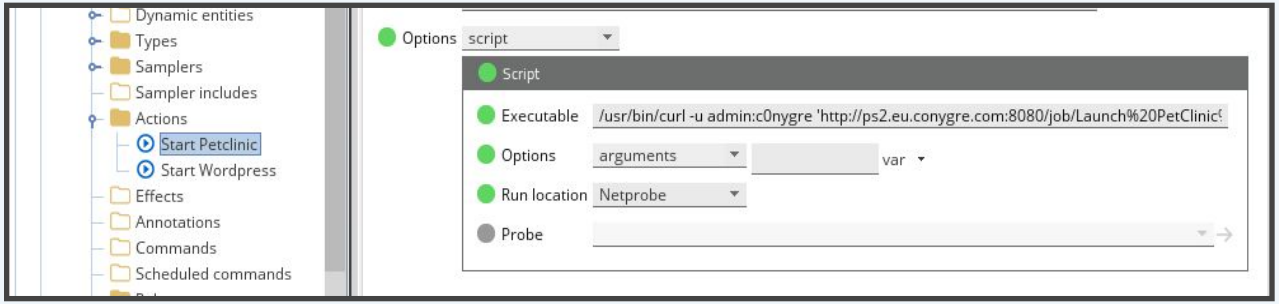
A rule was set so that if the instances become 0 then the severity would be marked critical (highlighted red in the previous screenshot) and ITRS would run an action to restart the application

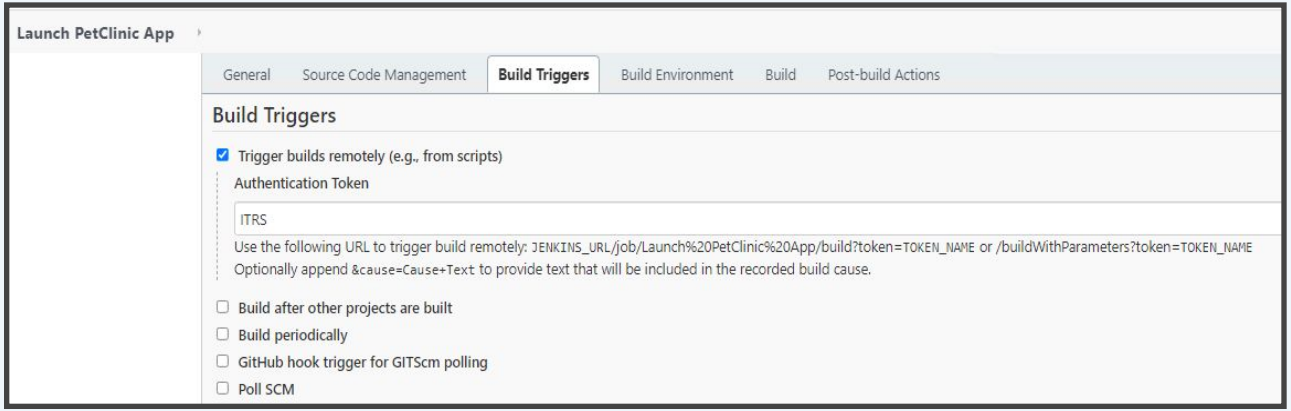


# Petclinic/Wordpress application status monitoring and automation

The action ran by the previous rule links to a Jenkins build to launch the relevant application



# Resiliency

All of the Jenkins jobs created to build, start and stop the containers were stored on a Bitbucket repository and referenced via parameters

hackathon3 / startpet

```
#!/bin/bash

cd "/var/lib/jenkins/workspace/${projectName}"
cd containers
docker-compose up -d petclinic

echo "Petclinic Container version is ${BUILD_NUMBER}"
```

Source Code Management

None

Git

Repositories

Repository URL

https://bitbucket.org/katrina057/hackathon3.git

Credentials

- none - Add

Advanced...

Add Repository

Branches to build

Branch Specifier (blank for 'any')

*/main

This project is parameterized

String Parameter

Name

projectName

Default Value

Build Projects

Description

[Plain text] Preview

Build

Execute shell

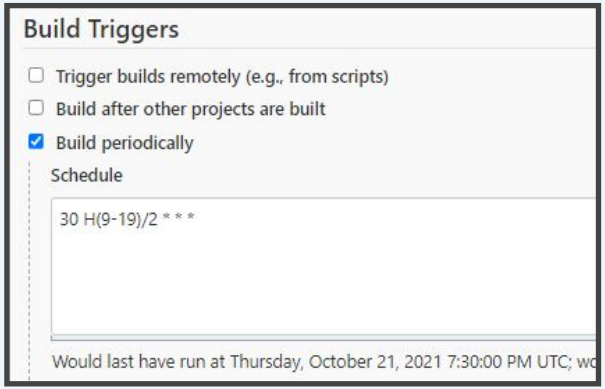
Command

```
bash ./startdb
bash ./startpet
bash ./startwordpress
```

See the list of available environment variables

# Backing up application databases

Backing up the database is done via a scheduled Jenkins project. The schedules were based around potential business needs, for example, PetClinic is set to back up every 2 hours 30 minutes past the hour between 9:30-7:30 as it is designed to be used internally by a vet clinic.




The code for the backup would look for a current backup directory and make one if it doesn't already exist. It would then take the copy of the relevant sql database and put it into the backup directory.

# Backing up application databases

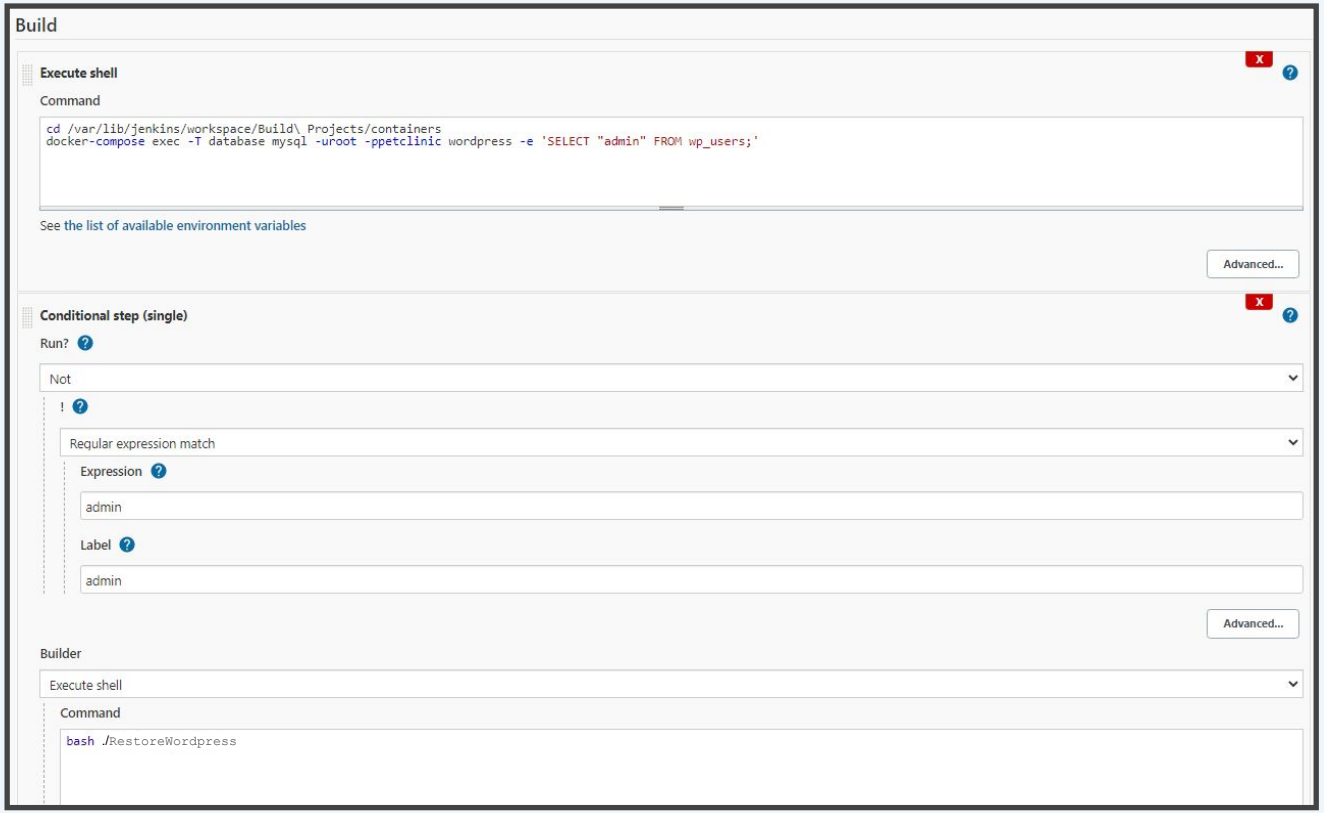
The code for the backup would look for a current backup directory and make one if it doesn't already exist. It would then take the copy of the relevant sql database and put it into the backup directory.


Backing up of the database is still done entirely through Jenkins for both applications. In a future build it would be more ideal to move this code over to git in case the Jenkins job is ever lost.

# Monitoring application databases

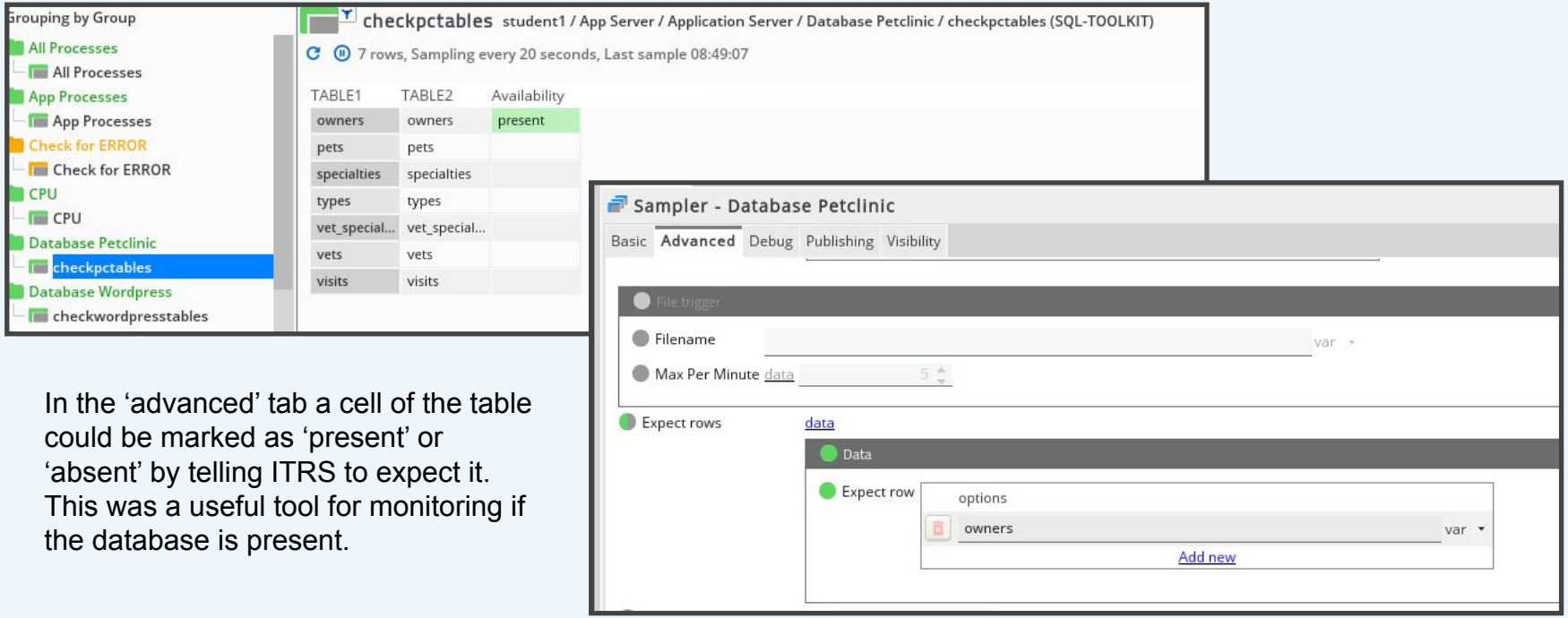
Backups would not be as useful if there is not a way to restore the databases from the created backup directories.

Originally, an automation was set up in Jenkins which would search for a word in the body of one of the tables inside the database on a set schedule. If it could not find the word then it would run an additional shell script (from the bitbucket repository) to restore the database from the backup. Displayed is the Jenkins automation to both check and restore the backup. It ran every 5 minutes on a schedule.



# Monitoring application databases

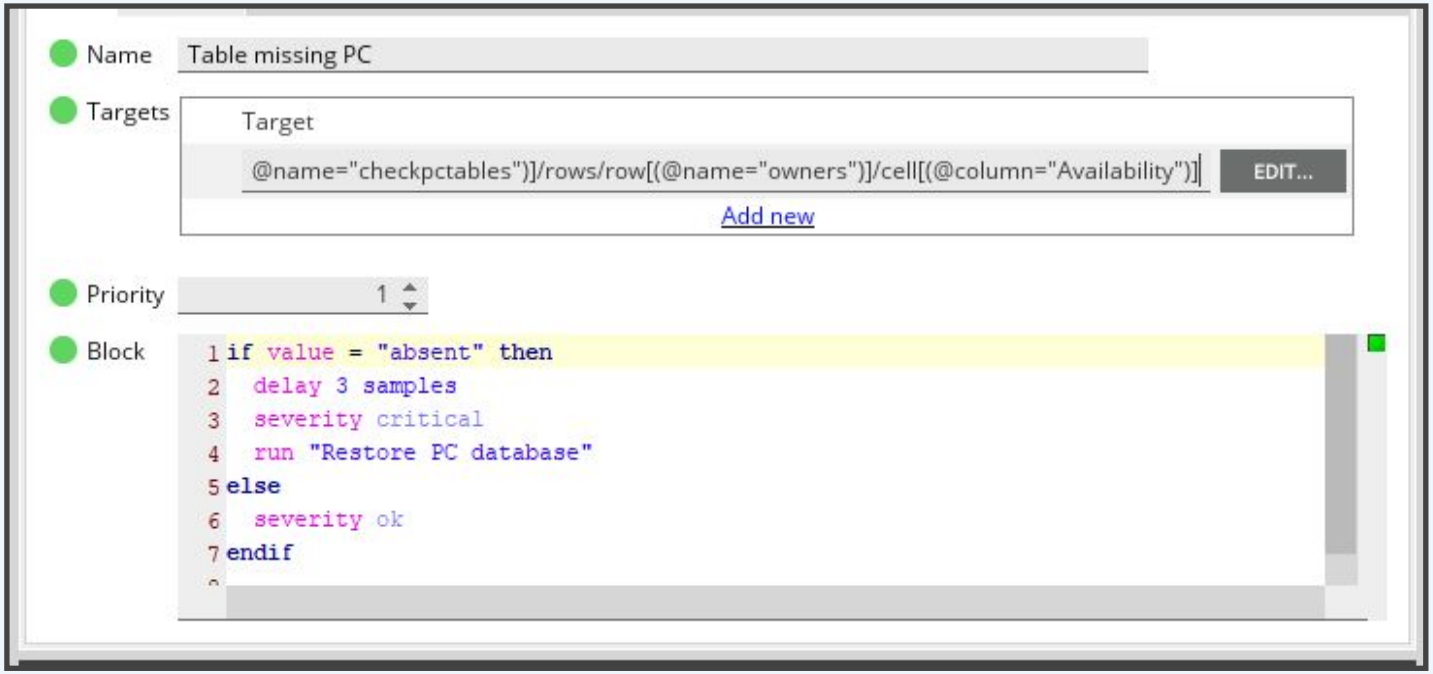
The Jenkins build/automation wasn't practical as the build running every 5 minutes would use a lot of resources; there was also no easy way to snooze the automation from running if you needed to take the database down for a period of time. For this reason the first part of the automation (checking the database still exists) was moved to ITRS.




In the 'advanced' tab a cell of the table could be marked as 'present' or 'absent' by telling ITRS to expect it. This was a useful tool for monitoring if the database is present.

# Monitoring and automating application databases

The rule set checks to see if the value of ‘owners’ is present in the table. If it is not then it delays 3 samples (checks 3 times over 20 seconds each check) then will mark the severity as critical (turns the cell red) and run the action to restore the PetClinic database.



# Monitoring and automating application databases

The action ‘Restore PC Database’ links back to the edited original Jenkins job which runs from a git repository.

**Build Triggers**

- [x] Trigger builds remotely (e.g., from scripts)

Authentication Token

ITRS

Use the following URL to trigger build remotely: `JENKINS_URL/job/Restore%20Database%20petclinic/build?token=TOKEN_NAME` or `/buildWithParameters?token=TOKEN_NAME`
Optionally append `&cause=Cause+Text` to provide text that will be included in the recorded build cause.

- [ ] Build after other projects are built
- [ ] Build periodically
- [ ] GitHub hook trigger for GITScm polling
- [ ] Poll SCM

**Build Environment**

- [ ] Delete workspace before build starts
- [ ] Use secret text(s) or file(s)
- [ ] Provide Configuration files
- [ ] Send files or execute commands over SSH before the build starts
- [ ] Send files or execute commands over SSH after the build runs
- [ ] Abort the build if it's stuck
- [ ] Add timestamps to the Console Output
- [ ] Execute shell script on remote host using ssh
- [ ] SSH Agent

**Build**

Execute shell

Command

```
bash ./RestorePetclinic
```

Name: Restore PC database

Options: script

Script

Executable: /usr/bin/curl -u admin:c0nygre 'http://ps2.eu.conygre.com:8080/job/Restore%20Databas

Options: arguments var

Run location: Netprobe

Probe:

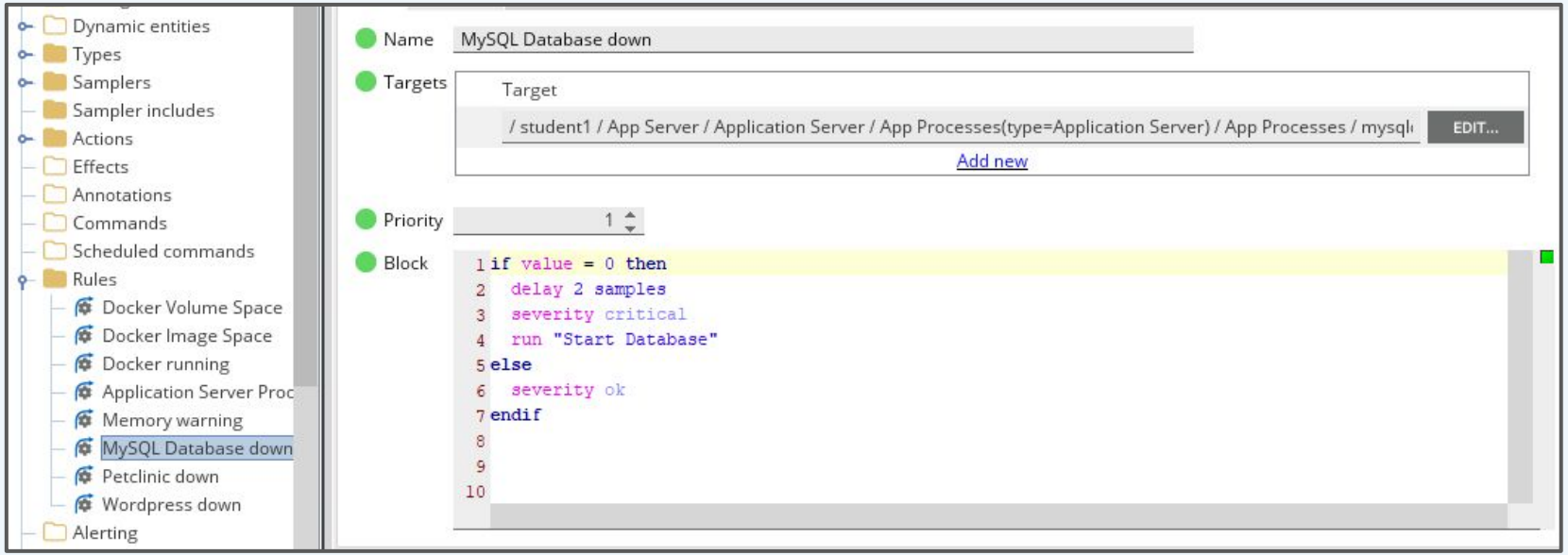
hackathon3 / RestorePetclinic

```
cd "/var/lib/jenkins/workspace/${projectName}"
cd containers

docker-compose exec -T database mysql -uroot -ppetclinic -e "create database petclinic;"
docker-compose exec -T database mysql -uroot -ppetclinic petclinic </var/tmp/dbbackups/petclinic.sql
```

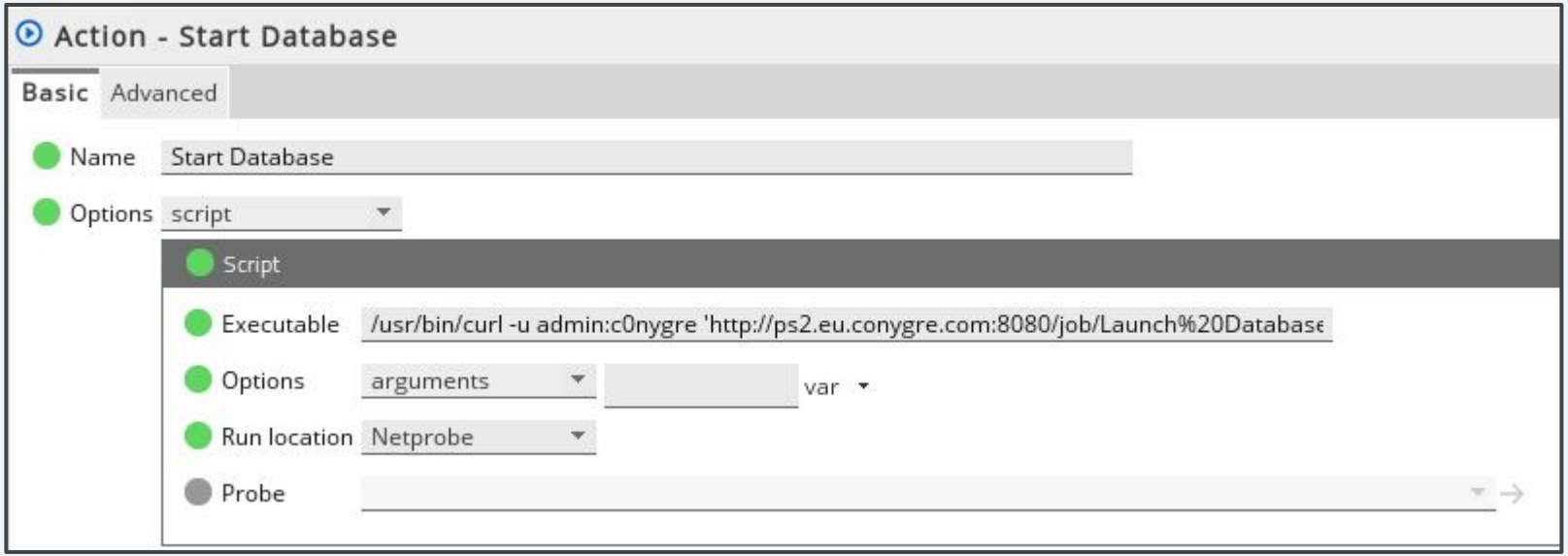
# Database status monitoring and automation

A rule was set so that if the instances become 0 then the severity would be marked critical and ITRS would run an action to restart the application.



# Database status monitoring and automation

The action ran by the previous rule links to a Jenkins build to launch the relevant application



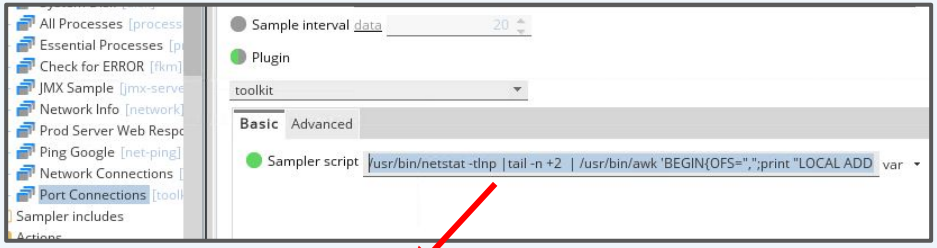
# Monitoring and automating application databases, future build recommendations

- In a future build the automation for restoring the database could be improved by alerting when it has had to restore and/or including another automation which prevents it from attempting to restore too many times in a row. There is a risk with automating the database to restore from backup that it could restore from a corrupted backup or get stuck in a loop of always trying to restore without enough warning that this is happening.

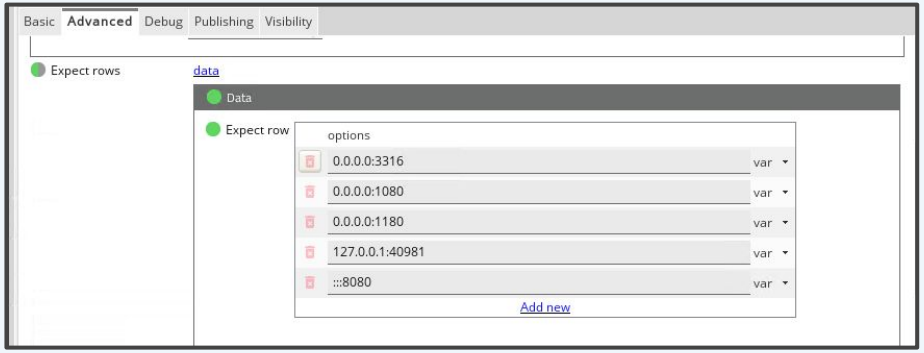
- A way to keep several backups on the system would also be useful in this case as currently every time the database backs up it overwrites the previous backup. A better roll back plan is needed for if an incident happens and the quality of the backup has been compromised.

# Monitoring port connections

| LOCAL ADDRESS | PID/PROGRAM | Availa... |
|---|---|---|
| 127.0.0.1:40981 | 3174/containerd | present |
| 0.0.0.0:1080 | 4407/docker-proxy | present |
| 0.0.0.0:1180 | 4462/docker-proxy | present |
| :::8080 | 4150/java | present |
| 0.0.0.0:3316 | | absent |




```
/usr/bin/netstat -tlnp |tail -n +2  | /usr/bin/awk 'BEGIN{OFS=",";print "LOCAL ADDRESS,PID/PROGRAM"}{print $4,$NF}'
```




A new type was added to monitor if there was anything on the expected ports. This means that if one of the containers goes down the local address would be marked as critical.

This was made with the idea that it could be built upon in a future build where the name connected to the port could be monitored to make sure the applications are running on the expected ports.

# Capacity

For considerations of increased capacity for the application, we would look at the following:

- Consider container storage ecosystem (CaaS, PaaS etc)
  - CaaS (Container as a Service) is the most common allowing reduction in operating expenses, scaling up or down as needed and developers can respond quickly deploying new or updated software
- Changing to Openshift over using Docker Compose
  - Allows for easy deployment and scaling of containers
  - Adds management tools for containers
  - Abstracted cluster orchestration (used for control and automating containers life cycle)
- Increasing resources
  - Increasing the resources available if it becomes a bottleneck for the application functioning
  - Use of load balancers to help with distribution of application traffic across many servers - increase capacity and reliability of the applications

## Cyber (Future Improvements)

Runtime Hardening - securing the container with rules and giving it the lowest level of privileges/access possible for it to be able to adequately carry out its job.

1. SELinux
2. Capabilities
3. File Systems
4. Seccomp

Image Hardening (also known as Image Stripping) - getting rid of any unnecessary files and services within the image that aren’t being utilised.

# Questions

# Thank you for listening!