Build a 12 factor microservice with MicroProfile

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@nottycode

12 Factors in a nut shell

- A methodology
- Best Practices
- Manifesto

https://12factor.net/ by Heroku

THE FACTORS

1. Codebase
2. Dependencies
3. Config
4. Backing Services
5. Build, Release, Run
6. Processes
7. Port binding
8. Concurrency
9. Disposability
10. Dev / Prod parity
11. Logs
12. Admin Processes

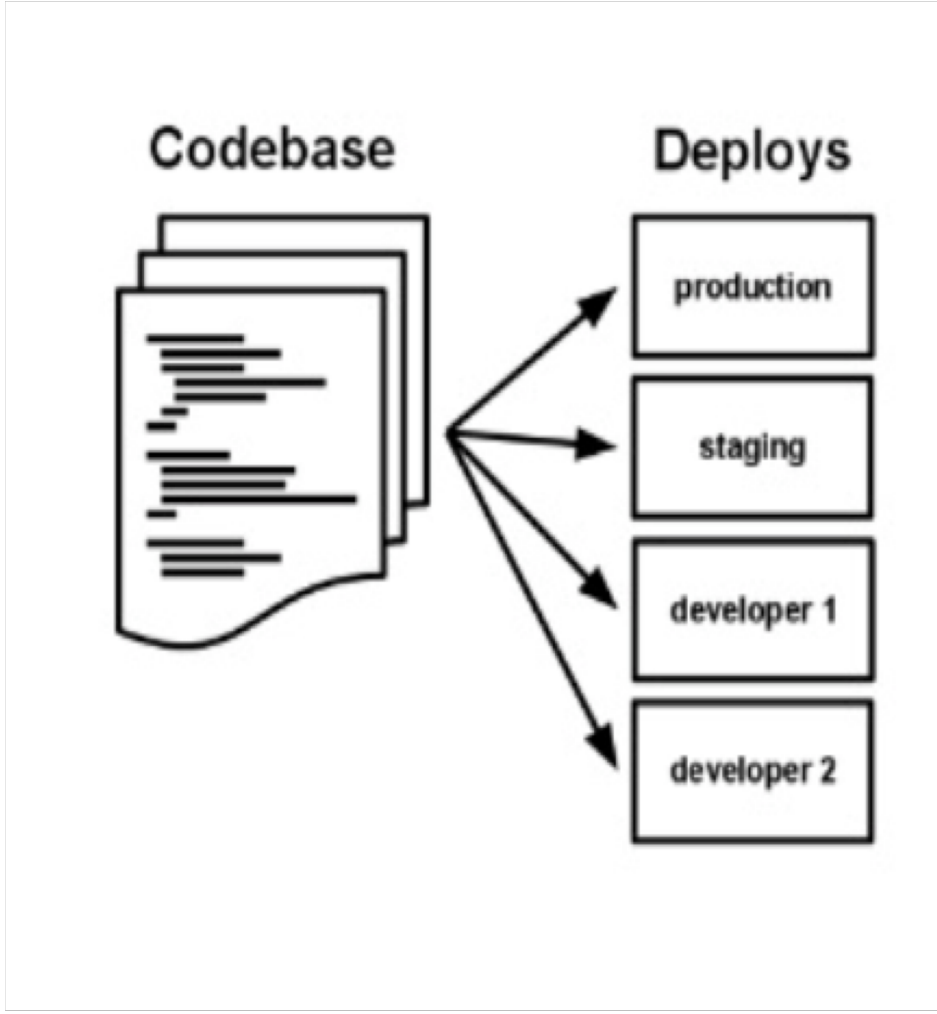
I. Codebase

"One codebase tracked in revision control, many deploys."

- Dedicate smaller teams to individual applications or microservices.
- Following the discipline of single repository for an application forces the teams to analyze the seams of their application, and identify potential monoliths that should be split off into microservices.

➢Use a single source code repository for a single application (1:1 relation). Deployment stages are different tags/branches

➢i.e. use a central git repo (external Github/GitHub Enterprise also suitable)



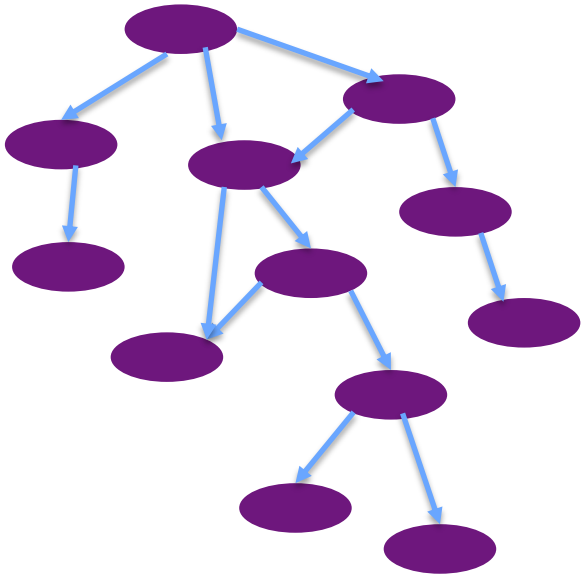
II. Dependencies

"Explicitly declare and isolate dependencies"

A cloud-native application does not rely on the pre-existence of dependencies in a deployment target.

Developer Tools declare and isolate dependencies

- Maven and Gradle for Java



➢Each microservice has its own dependencies declared (e.g. pom.xml)

III. Config

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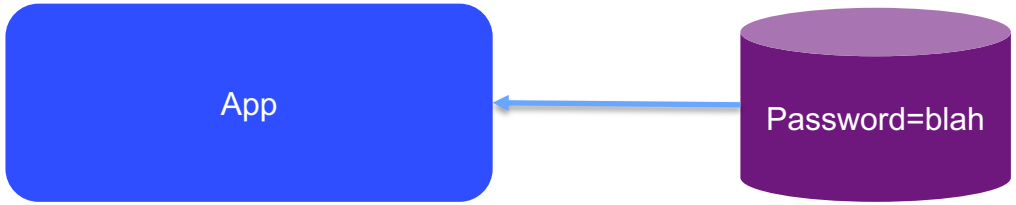
"Store config in the environment"

- Changing config should not need to repackage your application
- Use Kubernetes configmaps and secrets for container services, rather than environment variables specified in the container image
- Use MicroProfile Config to inject the config properties into the microservices



IV. Backing services

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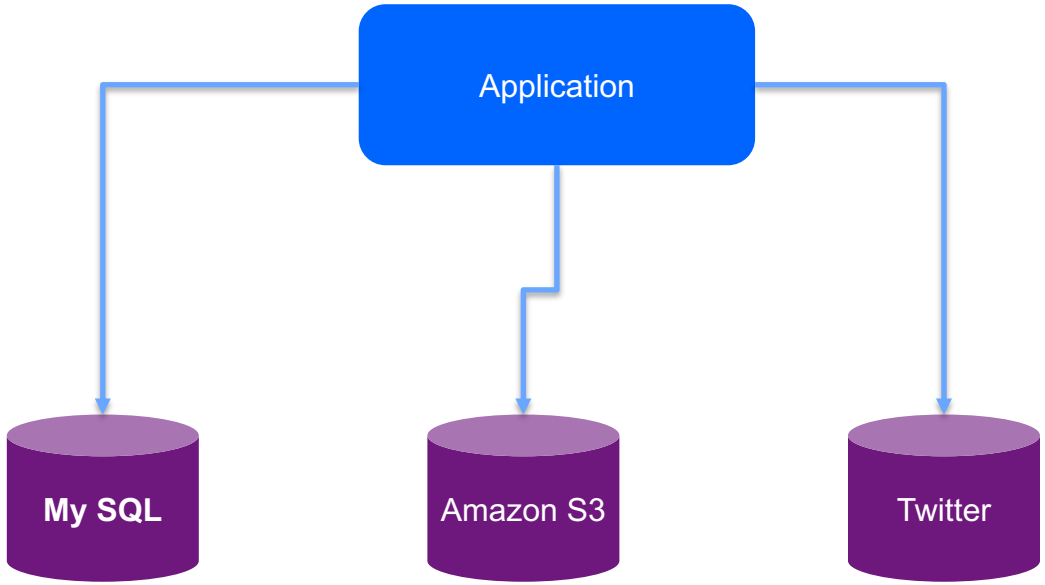
"Treat backing services as attached resources"



V. Build, release, run

"Strictly separate build and run stages"

- Source code is used in the build stage. Configuration data is added to define a release stage that can be deployed. Any changes in code or config will result in a new build/release
- Needs to be considered in CI pipeline

IBM
- UrbanCode Deploy
- IBM Cloud Continuous Delivery Service

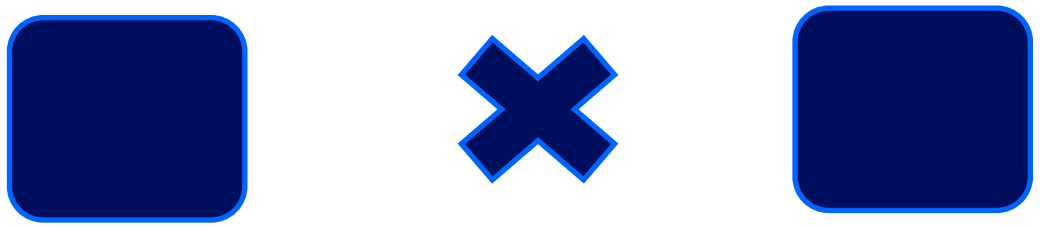
AWS
- AWS CodeBuild
- AWS CodeDeploy
- AWS CodePipeline (not yet integrated with EKS)

Azure
- Visual Studio Team Services (VSTS) (includes git)
- Web App for Containers feature of Azure App Service

VI. Processes

“Execute the app as one or more stateless processes”

- Stateless and share-nothing
- Rest API



VII. Port binding

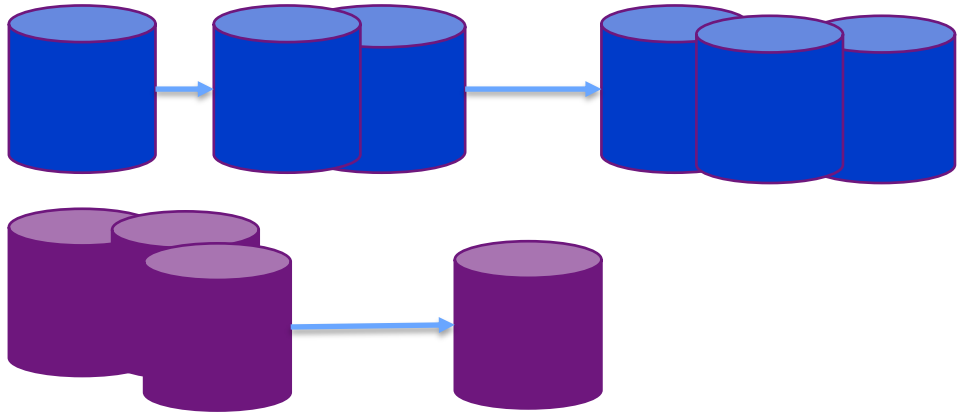
“Export services via port binding”

- Applications are fully self-contained and expose services only through ports. Port assignment is done by the execution environment
- Ingress/service definition of k8s manages mapping of ports

VIII. Concurrency

"Scale out via the process model"

- Applications use processes independent from each other to scale out (allowing for load balancing)
- To be considered in application design
- Cloud autoscaling services: [auto]scaling built into k8s
- Build microservices



IX. Disposability

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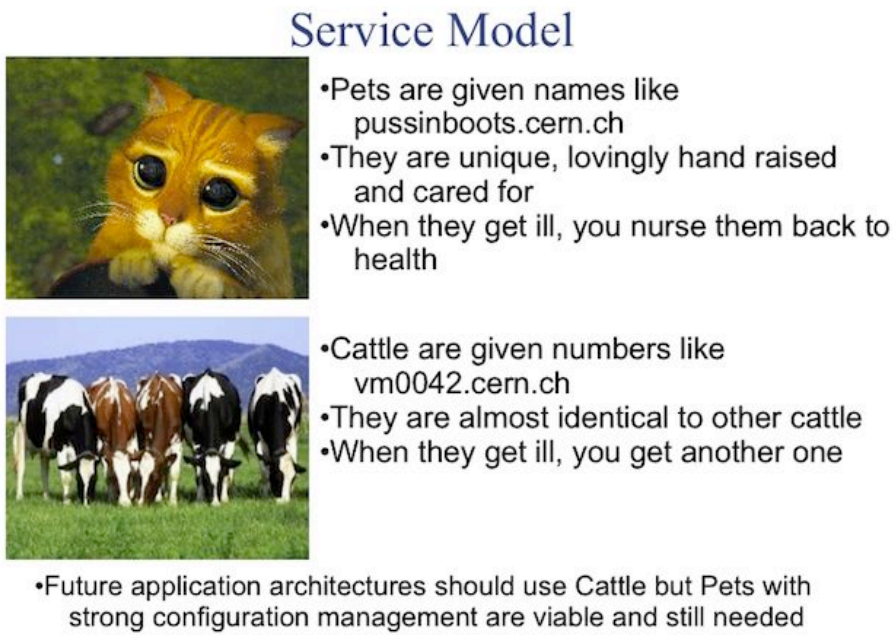
"Maximize robustness with fast startup and graceful shutdown"

- Processes start up fast.
- Processes shut down gracefully when requested.
- Processes are robust against sudden death
  - Use MicroProfile Fault Tolerance to make it resilient



From "*CERN Data Centre Evolution*"

X. Dev/prod parity

“Keep development, staging, and production as similar as possible”

- Development and production are as close as possible (in terms of code, people, and environments)
- Can use helm to deploy in repeatable manner
- Use (name)spaces for isolation of similar setups

XI. Logs

“Treat logs as event streams”

- App writes all logs to stdout
- Use a structured output for meaningful logs suitable for analysis. Execution environment handles routing and analysis infrastructure

XII. Admin processes

“Run admin/management tasks as one-off processes”

- Tooling: standard k8s tooling like “kubectl exec” or Kubernetes Jobs
- Also to be considered in solution/application design
- For example, if an application needs to migrate data into a database, place this task into a separate component instead of adding it to the main application code at startup

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MicroProfile Config

Why?

– Configure Microservice without repacking the application

How?

– Specify the configuration in configure sources

– Access configuration via

- Programmatically lookup

```
Config config =ConfigProvider.getConfig();

config.getValue("myProp", String.class);
```

- Via CDI Injection

```
@Inject
@ConfigProperty(name="my.string.property")
String myPropV;
```

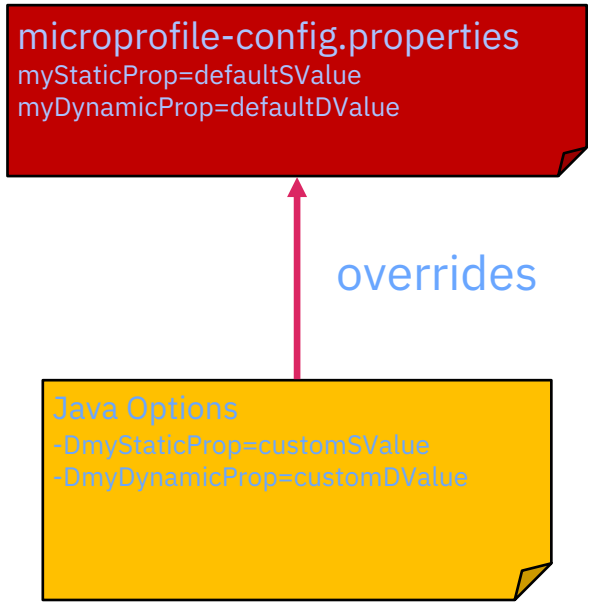
MicroProfile Config

Static Config

```
@Inject
@ConfigProperty(name="myStaticProp")
private String staticProp;
```

Dynamic Config

```
@Inject
@ConfigProperty(name="myDynamicProp")
private Provider<String> dynamicProp;
```



MicroProfile Fault Tolerance

A solution to build a resilient microservice

- Retry - `@Retry`
- Circuit Breaker - `@CircuitBreaker`
- Bulk Head - `@Bulkhead`
- Time out - `@Timeout`
- Fallback - `@Fallback`

References

- Code sample to demonstrate 12-factor app
  - https://github.com/Emily-Jiang/12factor-deployment
  - https://github.com/Emily-Jiang/12factor-app-a
  - https://github.com/Emily-Jiang/12factor-app-b
- http://microprofile.io
- http://openliberty.io
- https://www.12factor.net/