CS-548: Cloud-native Software Architectures

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Website: https://www.csd.uoc.gr/~hy548/

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Assignment 2: Kubernetes

1. (*20% grade*) Provide the YAML that runs a Pod with Nginx `1.27.4-alpine` as well as the `kubectl` commands needed to:
    a. Install the manifest on Kubernetes and start the Pod.
    b. Forward port 80 locally, so that it answers calls through a browser (or `curl` or `wget`). What is the answer?
    c. See the logs of the running container.
    d. Open a shell session inside the running container and change the first sentence of the default page to "Welcome to MY nginx!". Close the session. Validate the change.
    e. From your computer terminal (outside the container), download the default page locally and upload another one in its place. Validate the change.
    f. Stop the Pod and remove the manifest from Kubernetes.

2. (*40% grade*) The command `wget -E -k -p <url>` lets you download a complete site in a folder.
    a. Provide a YAML that creates a Job using Ubuntu `24.04`, which when started will run a script (defined in a ConfigMap) that will download the `csd.uoc.gr` site. Which command can you use to confirm that the Job completed successfully?
    b. Extend the previous YAML with an Nginx Pod, a CronJob that will refresh the content every night at 2:15, as well as a volume so that the Nginx Pod will show the content downloaded by the Jobs instead of the default page. Briefly describe how data is communicated between containers.
    c. Use a Deployment to start Nginx. Add an init container to start the Nginx container after the web page is finished downloading. Validate that it works as expected.

3. (*40% grade*) Using the same `wget` command logic:
    a. Create your own container based on the Nginx one that will download a user-defined site on startup. Provide the Dockerfile and upload the image to your Docker Hub account.
    b. Provide a YAML that uses your custom container to run 2 Pods serving the `csd.uoc.gr` site in a Deployment, as well as a Service that allows the result to be externally accessible. Provide the commands needed to validate that it works with minikube (you may need to run `minikube tunnel`).
    c. Extend the previous YAML with another Deployment/Service pair serving the `math.uoc.gr` site. Add an Ingress object that routes `/csd` to the first service and

`/math` to the second. Provide the commands needed to validate that it works with minikube (you will need to enable the ingress addon).

Notes:

- The assignment is personal.
- All exercises contribute equally to the overall grade (unless individual percentages are defined).
- A day/time will be set for answering questions and giving clarifications.
- Write down your answers in a Markdown-formatted text file in either Greek or English and commit it (along with any other files) in a private GitHub repository before the exercise's deadline. Share the repository with the instructor (username "chazapis").