

## 1. Develop Azure Compute Solutions

### └ 1.1 Implement Containerized Solutions

#### └ 1.1.1 Create and Manage Container Images for Solutions

1. What is the correct structure of a Dockerfile?
2. How do you optimize a Dockerfile for size and performance?
3. How do multi-stage builds work?
4. What commands are used to build an image locally?
5. How do you tag versions appropriately?
6. What is the correct format for image names (registry/repository:tag)?
7. How do tags work and how are they used in CI/CD pipelines?
8. How do you create and configure an ACR?
9. What are the SKU tiers and when do you use them?
10. How do you push/pull images using Docker CLI?
11. How do you authenticate to ACR (admin account, service principal, managed identity)?
12. What is az acr login and when is it required?
13. How does Azure App Service, AKS and ACI consume images from ACR?
14. What are the permission requirements for pulling from ACR?
15. How do you scan images for vulnerabilities?
16. What tools or services are used to harden container images?
17. How do you manage image versions across environments?
18. How do you clean up unreferenced or old images in ACR?
19. How can ACR tasks automate image builds?
20. How do you use az acr task to create scheduled or event-driven builds?
21. What are the pros and cons of storing images publicly vs privately?
22. How do you configure access control for image repositories?

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### 1. What is the correct structure of a Dockerfile?

```
FROM <base_image>
[ENV <key>=<value> ...]
[WORKDIR <directory>]
[COPY <src> <dest>]
[RUN <command>]
[EXPOSE <port>]
[CMD ["executable", "param1", ...]]
```

#### Key Points:

- FROM must be first (defines base image).
- WORKDIR sets working directory inside container.
- COPY adds files to the image from build context.
- RUN executes shell commands (e.g., install packages).
- EXPOSE is optional metadata; doesn't actually open ports.
- CMD defines default container startup command (only one allowed; last one wins).

## 2. How do you optimize a Dockerfile for size and performance?

1. Use slim/minimal base images:  
Prefer FROM mcr.microsoft.com/dotnet/aspnet:7.0-alpine over full images.
3. Leverage multi-stage builds:  
Build in one stage, copy only final output to runtime stage to reduce size.
4. Minimize layers:  
Group related RUN commands and clean up temp files in the same layer:
4. Avoid unnecessary files:  
Use .dockerignore to exclude files (e.g., .git, node\_modules).
5. Set only needed environment variables and permissions:  
Avoid excessive ENV or USER changes unless required.

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## 3. How do multi-stage builds work?

Reduce final image size by separating build and runtime stages.

- Define multiple FROM statements in one Dockerfile.
- Use an alias for the build stage (AS build).
- Copy only needed artifacts from the build stage into the final image.

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## 4. What commands are used to build an image locally?

```
docker build -t <name>:<tag> <path>
```

e.g. docker build -t myapp:latest .

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## 5. How do you tag versions appropriately?

Use semantic tags like:

latest, v1.0.0, dev, staging

e.g. docker build -t myapp:v1.0.0

Tag meaning should reflect version or environment for clarity and traceability.

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## 6. What is the correct format for image names?

<registry>/<repository>:<tag> :

myregistry.azurecr.io/myapp:v1.0.0

Registry is optional for local images. Tag defaults to latest if omitted.

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## 7. How do tags work and how are they used in CI/CD pipelines?

Tags identify image versions. Pipelines use tags to pull, test, and deploy specific builds:

docker push myapp:staging → used in staging environment.

latest often used in dev, versioned tags in prod.

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## 8. How do you create and configure an ACR?

- Create ACR: `az acr create --name <acr-name> --resource-group <rg> --sku Basic`
- Enable admin access: `az acr update -n <acr-name> --admin-enabled true`
- Login: `az acr login --name <acr-name>`

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## 9. What are the SKU tiers and when do you use them?

- Basic – Dev/test, low-cost, limited features
- Standard – Prod-ready, geo-replication support
- Premium – High-scale, content trust, private endpoints, more throughput

## 10. How do you push/pull images from/to ACR using Docker CLI?

Push:

1. `docker tag myapp myacr.azurecr.io/myapp`
2. `docker push myacr.azurecr.io/myapp`

Pull:

`docker pull myacr.azurecr.io/myapp`

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## 11. How do you authenticate to ACR (admin, service principal, managed identity)?

- Admin account:  
Enable with `az acr update --admin-enabled true`, then use provided username/password.
  - Service principal:  
Assign `AcrPush/AcrPull` role, login with `docker login` using SP credentials.
  - Managed identity:  
Grant role to identity, Azure services (e.g., App Service) authenticate automatically.
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## 12. What is `az acr login` and when is it required?

`az acr login --name <acr-name>`

Authenticates Docker CLI with ACR.

Required for manual Docker pushes/pulls. Not needed for Azure services using managed identity.

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## 13. How do App Service, Kubernetes Service (AKS), and Container Instances consume ACR images?

- App Service: Configure container settings with ACR URL; use managed identity or admin acc.
  - AKS: Enable ACR integration via `az aks update` or use `imagePullSecrets`.
  - ACI: Reference image with full ACR path; grant access via identity or admin credentials.
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## 14. What are the permission requirements for pulling from ACR?

The identity must have **AcrPull** role on the ACR.

Can be assigned to:

- User
  - Service principal
  - Managed identity (App Service, AKS, etc.)
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## 15. How do you scan images for vulnerabilities?

Use Microsoft Defender for Cloud with ACR integration. It scans images on push and shows CVEs in the portal.

Enable under Defender plans > Container registries.

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## 16. What tools or services are used to harden container images?

- Microsoft Defender for Cloud – vulnerability scanning
  - Dockerfile best practices – minimize layers, use minimal base images
  - Content trust – ensure image integrity
  - Private ACR – restrict access
  - ACR Tasks – automate secure builds
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## 17. How do you manage image versions across environments?

Use consistent tagging strategy (e.g., dev, staging, v1.0.0).

Promote images by re-tagging and pushing to ACR for each stage.

## 18. How do you clean up unreferenced or old images in ACR?

Use ACR Tasks with retention policies or manual cleanup via:

```
az acr repository delete --name <acr> --image <repo>:<tag>
```

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## 19. How can ACR tasks automate image builds?

ACR Tasks can auto-build images on source code or base image changes:

az acr task create with --source and --cmd "docker build"

Supports triggers (e.g., Git push) and scheduling.

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## 20. How do you use az acr task to create scheduled or event-driven builds?

Event-driven:

```
az acr task create \  
  --name mytask \  
  --registry myacr \  
  --image myapp:{{.Run.ID}} \  
  --context https://github.com/org/repo.git \  
  --file Dockerfile \  
  --git-access-token <token>
```

Scheduled:

```
az acr task create \  
  --name mytask \  
  --registry myacr \  
  --schedule "0 2 * * *" \  
  --image myapp:nightly \  
  --context https://github.com/org/repo.git \  
  --file Dockerfile
```

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## 21. What are the pros and cons of storing images publicly vs privately?

Public: Easy access, no auth needed — but insecure, no access control.

Private: Secure, controlled access — but needs auth, may cost more.

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## 22. How do you configure access control for image repositories?

Assign AcrPull or AcrPush roles to users, service principals, or managed identities using Azure RBAC on the ACR resource.