🚀 Kubernetes Health Checks (Liveness & Readiness)

> Production-grade examples of **Liveness** and **Readiness** probes using **exec**, **HTTP**, and **TCP** methods with real YAML manifests.

📑 Table of Contents

🧠 What are Kubernetes Probes?

Kubernetes probes allow the **kubelet** to check container health.

Probe Type	Purpose
Liveness	Is the container alive? If not → restart
Readiness	Is the container ready to serve traffic?
Startup	Is the app finished starting?

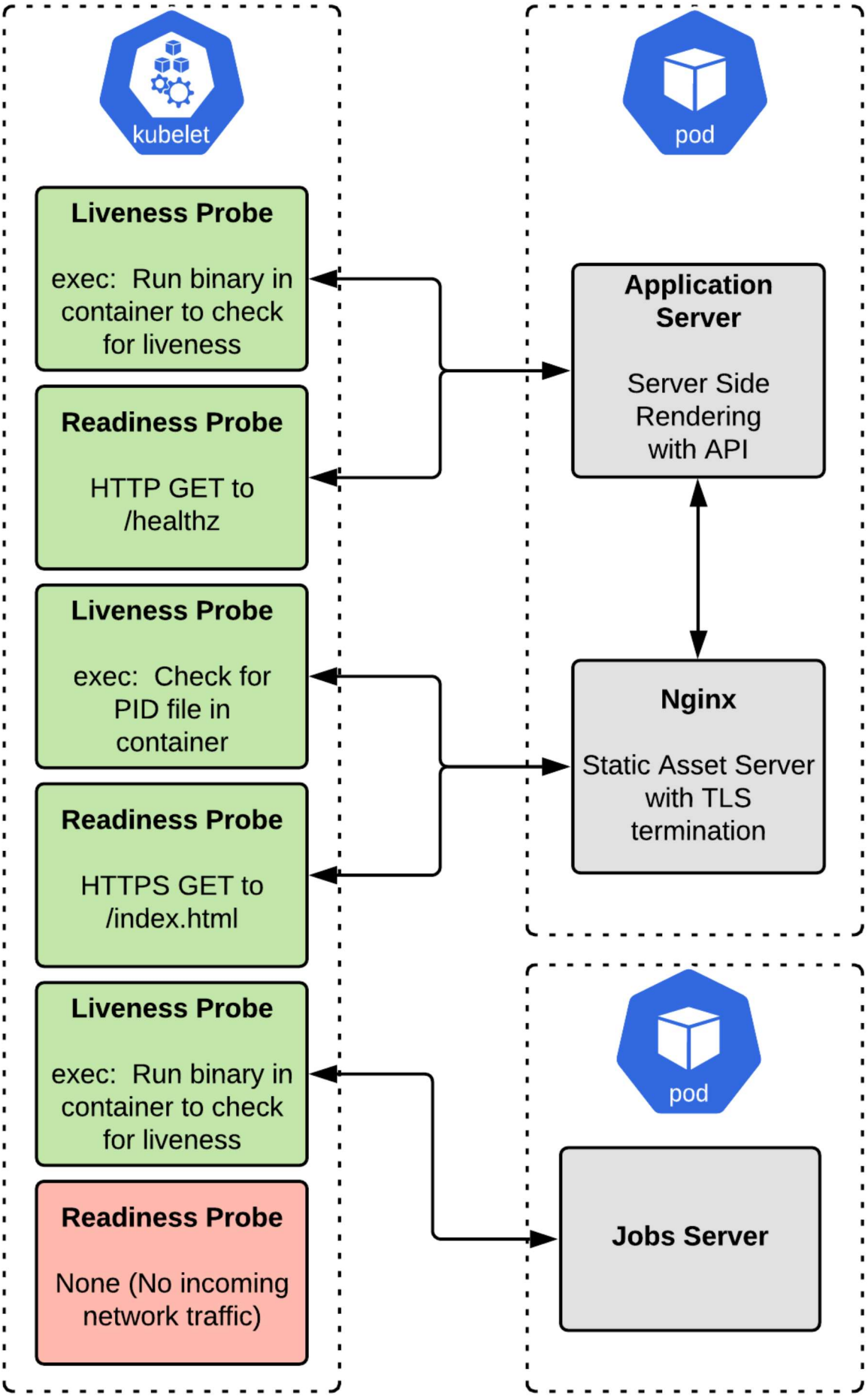
🔍 Liveness vs Readiness (Real Meaning)

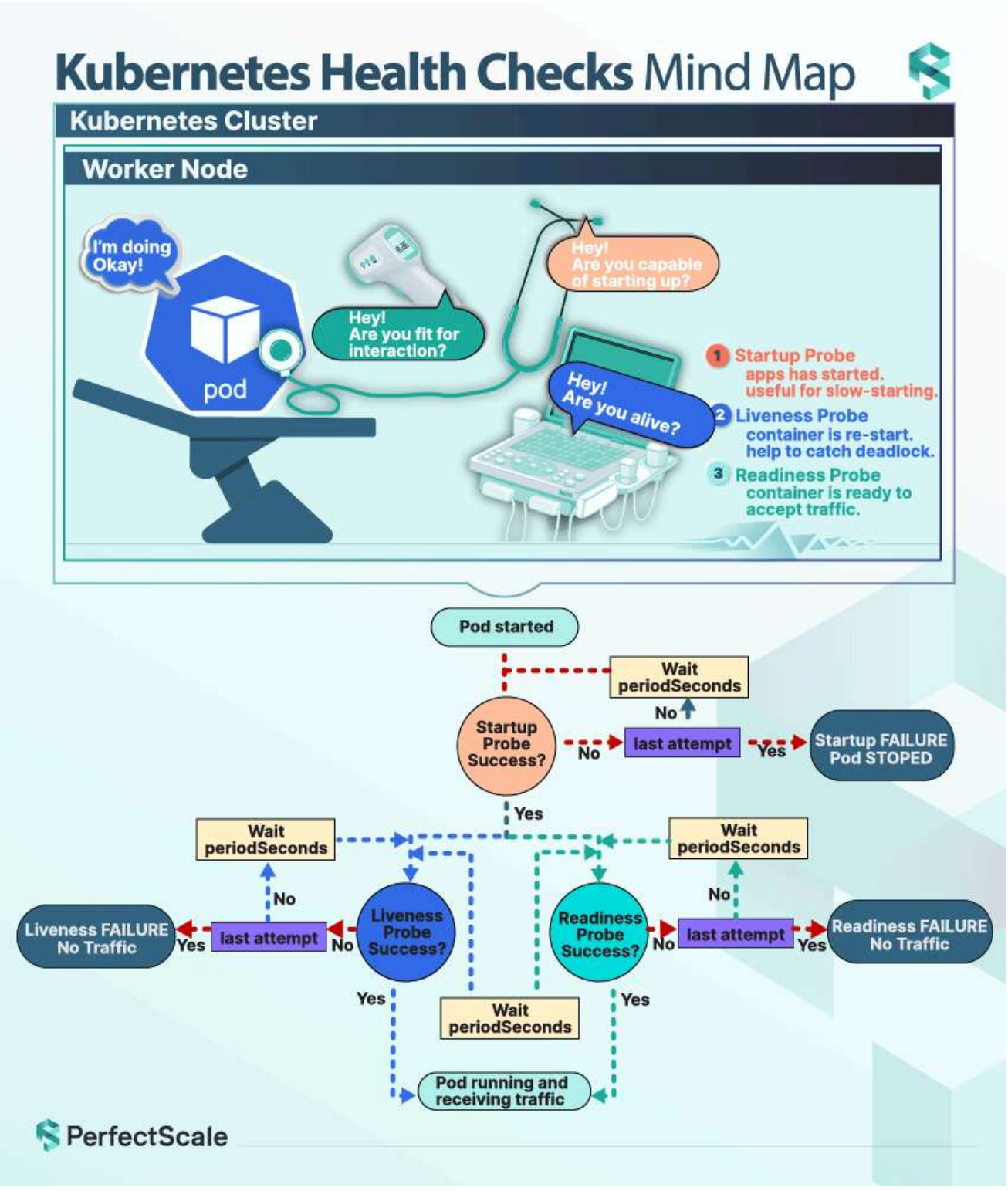
```
Liveness  → restart container
```

```
Readiness → remove pod from Service endpoints
```

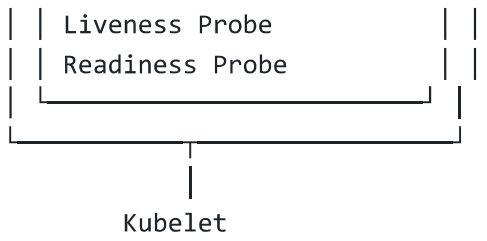
Scenario	Liveness	Readiness
App crashed	❌ restart	❌ no traffic
DB down	✅ running	❌ no traffic
Slow startup	❌ restart	❌ no traffic

Architecture Diagram – Probe Flow


kubelet
pod
Liveness Probe
exec: Run binary in container to check for liveness
Readiness Probe
HTTP GET to /healthz
Application Server
Server Side Rendering with API
Liveness Probe
exec: Check for PID file in container
Nginx
Static Asset Server with TLS termination
Readiness Probe
HTTPS GET to /index.html
Liveness Probe
exec: Run binary in container to check for liveness
pod
Readiness Probe
None (No incoming network traffic)
Jobs Server




```
┌─────────┐
│ Service │
└─────────┘
     │ (only Ready pods)
     ▼
┌──────────────────────────┐
│ Pod                      │
│  ┌──────── Container ──────┐ │
```



🔧 Probe Types Supported

Probe	Method	Example Use
Liveness	exec	Check process/file
Liveness	HTTP	App health endpoint
Liveness	TCP	DB / socket check
Readiness	HTTP	API ready check

📦 YAML Examples

🔹 1. Liveness Probe – Command (`liveness-command.yml`)

```yaml
livenessProbe:
  exec:
    command:
    - cat
    - /tmp/healthy
  initialDelaySeconds: 10
  periodSeconds: 5
```

✔️ Used when:

- Checking file existence
- Checking running process
- Lightweight checks

🔹 2. Liveness Probe – HTTP (NGINX) (`liveness-http-nginx.yml`)

```yaml
livenessProbe:
  httpGet:
    path: /
    port: 80
  initialDelaySeconds: 5
  periodSeconds: 10
```

✔️ Best for:

- Web servers
- REST APIs

🔹 3. Liveness Probe – HTTP Failure (`liveness-http-error.yml`)

```yaml
livenessProbe:
  httpGet:
    path: /healthz
    port: 8080
  failureThreshold: 3
```

❌ If endpoint returns **500 / timeout** → container restarts

🔹 4. Liveness Probe – TCP (`liveness-tcp.yml`)

```yaml
livenessProbe:
  tcpSocket:
    port: 3306
  initialDelaySeconds: 15
  periodSeconds: 20
```

✔️ Ideal for:

- MySQL
- Redis
- Kafka
- Any TCP service

🔹 5. Readiness Probe – HTTP (`readness-http.yml`)

```yaml
readinessProbe:
  httpGet:
    path: /ready
    port: 8080
  initialDelaySeconds: 5
  periodSeconds: 5
```

✔️ Pod receives traffic **ONLY after this passes**

🚀 Apply Manifests

```
kubectl apply -f liveness-command.yml
kubectl apply -f liveness-http-nginx.yml
kubectl apply -f liveness-http-error.yml
kubectl apply -f liveness-tcp.yml
kubectl apply -f readness-http.yml
```

🔎 Verification Commands (SRE Style)

```
kubectl get pods
kubectl describe pod <pod-name>
kubectl get events --sort-by=.metadata.creationTimestamp
```

Watch probe failures live:

```
kubectl logs <pod-name> --previous
```

💥 Failure Scenarios (Important!)

Failure	Result
Liveness fails	Container restarts
Readiness fails	Pod removed from Service
Both fail	Restart + no traffic
Probe misconfigured	CrashLoopBackOff

✅ Best Practices (Production)

✔ Always use **Readiness** with Services ✔ Keep Liveness **lightweight** ✔ Avoid DB checks in Liveness ✔ Use StartupProbe for slow apps ✔ Tune `initialDelaySeconds` carefully ✔ Monitor with Prometheus alerts

🧭 Real-World Recommendation

App Type	Recommended
API	HTTP Liveness + Readiness
Database	TCP Liveness
Legacy App	exec probe
Spring Boot	`/actuator/health`