Microservices URL Management

12/28/2025

I have .net core multiple microservices .. This company project is just in dev phase ..no…

Good question — this is a common pain point. Below I’ll give a concise, practical strateg…

Use just the nginx server for routing as the uat preprod prod team utilises nginx for api…

Your instinct to use nginx in DEV to mirror UAT / preprod / prod is correct. That decision…

1,2,3,4 all

Below is a complete, production-aligned DEV setup that covers all four items (1–4) exac…

1,2,3,4 give all

Below is a complete, production-grade implementation of all four items (1–4) using ngin…

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I have .net core multiple microservices .. This company project is just in dev phase ..no uat preprod or prod has started yet... So api gateway is given by another team for uat / preprod / prod systems... But the issue is that during Dev when we are developing in our local windows system I am running each microservices on different port and utilising that urls with all different ports in my frontend flutter... But when I will migrate to uat there will be too many changes in url for frontend... So what should be my approach for now best practises

Good question — this is a common pain point. Below I'll give a concise, practical strategy you can adopt immediately (no large rework), followed by concrete examples and best practices you can apply during dev and when you move to UAT/preprod/prod.

Short recommendation (what to do now)

1. **Never hardcode service URLs in the Flutter app.** Use a configuration mechanism that can be swapped per-environment at runtime (preferred) or at build-time (acceptable for mobile builds).
2. **Simulate the API Gateway locally.** Run a lightweight reverse-proxy or local gateway (Ocelot / YARP / nginx) that exposes the same stable paths your real gateway will expose. Point your frontend to that single local gateway URL. When UAT provides the real gateway, the frontend only needs to change one base URL (or none if you use relative paths).
3. **Use a stable, path-based contract.** Agree with the gateway team on a stable upstream path pattern (for example `` `/api/service1/...` ``, `` `/api/service2/...` ``) so frontend code uses the same paths across environments.
4. **Automate environment switching.** For Flutter web use a runtime `` `config.json` `` loaded at startup; for mobile use flavors / `` `--dart-define` `` or remote config for changing base URLs without code changes.
5. **Practice contract testing & OpenAPI.** Keep OpenAPI/Swagger specs for each service and run basic contract checks so gateway routing changes don't unexpectedly break the frontend.

Why this works

- Frontend sees a **single gateway endpoint** (or stable relative paths) instead of many per-service URLs.
- Local gateway/reverse proxy mirrors UAT/prod routing so you catch issues early (CORS, path rewrites, auth headers).
- Runtime config avoids rebuilding apps for each environment (important for web; mobile may need flavors or a remote config mechanism).

Concrete options & examples

1) Local gateway / reverse-proxy (recommended)

Run a local gateway that routes upstream paths to your running services. This gives one URL for the frontend.

Ocelot (ASP.NET Core) example `ocelot.json`

json

Copy code

```json
{
  "Routes": [
    {
      "DownstreamPathTemplate": "/api/service1/{everything}",
      "DownstreamScheme": "http",
      "DownstreamHostAndPorts": [{ "Host": "localhost", "Port": 5001 }],
      "UpstreamPathTemplate": "/api/service1/{everything}",
      "UpstreamHttpMethod": [ "GET", "POST", "PUT", "DELETE" ]
    },
    {
      "DownstreamPathTemplate": "/api/service2/{everything}",
      "DownstreamHostAndPorts": [{ "Host": "localhost", "Port": 5002 }],
      "UpstreamPathTemplate": "/api/service2/{everything}",
      "UpstreamHttpMethod": [ "GET", "POST" ]
    }
  ]
}
```

Run Ocelot locally on `http://localhost:8080`. Frontend uses `http://localhost:8080/api/service1/...`.

nginx reverse-proxy example (simple)

nginx

Copy code

```nginx
server {
    listen 8080;
    server_name localhost;

    location /api/service1/ {
        proxy_pass http://localhost:5001/;
        proxy_set_header Host $host;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
    }

    location /api/service2/ {
        proxy_pass http://localhost:5002/;
    }
}
```

This also produces a single base (`` `http://localhost:8080` ``) for the frontend.

2) Flutter: runtime config (preferred for web & flexible)

Create `` `assets/config.json` `` and load at app start so you don’t rebuild for each env.

assets/config.json

json Copy code

```json
{
  "apiBase": "http://localhost:8080"
}
```

main.dart (load config)

dart Copy code

```dart
import 'dart:convert';
import 'package:flutter/services.dart' show rootBundle;

late final String apiBase;

Future<void> main() async {
  WidgetsFlutterBinding.ensureInitialized();
  final configString = await rootBundle.loadString('assets/config.json');
  final config = json.decode(configString);
  apiBase = config['apiBase'] as String;
  runApp(MyApp());
}
```

Your networking code uses `` `apiBase + '/api/service1/...'` ``.

3) Flutter: build-time (mobile)

For mobile, you can use flavors or `` `--dart-define` ``:

bash Copy code

```bash
flutter run --flavor dev -t lib/main_dev.dart --dart-define=API_BASE_URL=http://localhost:8080
```

In code:

dart Copy code

```dart
const apiBase = String.fromEnvironment('API_BASE_URL', defaultValue: 'http://localhost:8080');
```

4) Use relative paths where possible

If your gateway will serve the frontend (e.g., same host), use relative URLs like `` `/api/service1/endpoint` ``. That eliminates changing the host entirely across environments. Only the gateway host must be updated.

5) CORS / Auth / Host headers

- If your frontend calls services directly in dev, you'll see CORS. Use the local gateway (reverse proxy) to avoid CORS, or enable CORS in dev on each service for `http://localhost:xxxx`.
- Ensure your proxy/gateway forwards authentication headers (Authorization, cookies) and sets Host and X-Forwarded-* headers correctly (the gateway in UAT will do this; mirror it locally).

6) OpenAPI / Mock server

- Keep OpenAPI (Swagger) for each service. The frontend can use a mock server (WireMock / mockoon) based on the contract so frontend work can proceed even when certain services aren't running.
- This also lets frontend developers work against expected responses while backend is still in development.

Recommended workflow (practical sequence)

1. **Agree with the gateway team** on upstream path pattern (e.g., `/api/{service}/{...}`) and auth header expectations.
2. **Create a local gateway/reverse-proxy** (Ocelot/YARP/nginx) that mirrors that pattern and add it to the dev repo (or as a docker-compose service).
3. **Switch frontend to runtime config** (web) or flavors/dart-define (mobile). Point to the local gateway URL.
4. **Document environment variables** and config file layout so everyone uses the same mechanism.
5. **Expose/consume OpenAPI specs** and enable contract tests before UAT.
6. **When UAT gateway is available**: change only the base gateway URL in the frontend config (or rely on relative paths), and validate end-to-end.

Tools & tech suggestions

- Reverse proxy / local gateway: **Ocelot** (ASP.NET Core), **YARP** (Microsoft), **nginx**, **Traefik**.
- Mocking/contract: **WireMock**, **mockoon**, **Pact** for consumer-driven contract tests.
- Flutter config: runtime `config.json`, **flavors** + `--dart-define`, or remote config (Firebase Remote Config) for production toggles.

Quick checklist for you to act on now

- ☐ Implement a simple local proxy (nginx or Ocelot) and document it in the repo.
- ☐ Move all frontend URLs to a single base (`apiBase`) loaded from config.

- ☐ Add OpenAPI for each service (if not present) and share with frontend team.
- ☐ Confirm with gateway team the upstream path patterns and auth behavior.
- ☐ Add a short dev README showing how to run services + local gateway.

If you want, I can:

- Provide a ready-to-use `docker-compose.yml` that runs your services plus an Ocelot gateway and nginx to simulate production routing.
- Or produce the exact `ocelot.json` and a small `Program.cs` skeleton to run Ocelot locally.

Tell me which of those you prefer and I’ll create it now.

Use just the nginx server for routing as the uat preprod prod team utilises nginx for api gateway too .so dev server and there server will be having consistency across it....also I want to know api gateway will check for urls like api/service1/* ...so in my service1 my APIs should be in this format too api/service1/* or it should be directly /* since remaining first 2 words will be used for redirecting to current microservices just or should I keep that first 2 tooo

Your instinct to **use nginx in DEV to mirror UAT / preprod / prod** is correct. That decision alone will eliminate most migration friction later.

Now to the **key architectural question** you raised — this is important, so I will be very explicit.

Direct answer (TL;DR)

Your microservices should NOT include `/api/service1` in their internal routes.

They should expose APIs as:

```bash
/health
/users
/orders/{id}
```

The API Gateway (nginx) should own `/api/service1/*`.

```bash
/api/service1/*  →  service1/*
/api/service2/*  →  service2/*
```

This is the **industry-standard and correct approach**.

Why this is the best practice

1. Separation of concerns

Layer	Responsibility
API Gateway (nginx)	URL shaping, routing, security, auth, rate-limiting
Microservice	Business logic only

If microservices embed gateway paths (`/api/service1`), they become **coupled to the gateway topology**, which is undesirable.

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2. Gateway should be replaceable

If tomorrow:

- `` `/api/service1` `` becomes `` `/v2/service-one` ``
- Or gateway changes (Kong, APISIX, Azure APIM)

You **do not want to redeploy microservices**.

With clean internal routes, only nginx config changes.

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3. Easier local development & testing

Your service can run standalone:

```bash
http://localhost:5001/users
```

Instead of:

```bash
http://localhost:5001/api/service1/users
```

This simplifies:

- Swagger testing
- Postman
- Unit/integration tests

---

4. Consistent gateway behavior across environments

DEV nginx ≈ UAT nginx ≈ PROD nginx

Only **upstream IP/port changes**, not API shapes.

Correct routing design (recommended)

Microservice 1 (ASP.NET Core)

```csharp
[ApiController]
[Route("users")]
public class UsersController : ControllerBase
{
    [HttpGet]
    public IActionResult GetUsers() => Ok();
}
```

Service runs at:

```bash
http://localhost:5001/users
```

---

nginx API Gateway (DEV / UAT / PROD)

```nginx
server {
    listen 80;
    server_name api.company.com;

    location /api/service1/ {
        proxy_pass http://service1:5001/;
        proxy_set_header Host $host;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_set_header X-Forwarded-Proto $scheme;
    }

    location /api/service2/ {
        proxy_pass http://service2:5002/;
    }
}
```

Important detail

Note the trailing slash behavior:

```nginx
location /api/service1/ {
    proxy_pass http://service1:5001/;
}
```

This strips `/api/service1` automatically.

Resulting behavior

External request	Internal request
`/api/service1/users`	`/users`
`/api/service1/orders/12`	`/orders/12`

Perfect decoupling.

What NOT to do (anti-pattern)

❌ Microservice routes:

bash Copy code

```bash
/api/service1/users
```

❌ nginx routes:

bash Copy code

```bash
/api/service1 → /api/service1
```

This causes:

- Hard coupling
- Duplicated path logic
- Painful versioning later
- Swagger pollution

Swagger/OpenAPI best practice (important)

Your Swagger should expose **internal routes only**:

bash Copy code

```bash
/users
/orders/{id}
```

Then configure Swagger's `Servers` section to show gateway URL:

json Copy code

```json
"servers": [
  {
    "url": "https://api.company.com/api/service1",
    "description": "API Gateway"
  }
]
```

This way:

- Service remains clean
- Consumers see gateway paths

Versioning recommendation

Put versioning **at gateway level**, not service routes:

```bash
/api/v1/service1/*
/api/v2/service1/*
```

nginx:

```bash
/api/v1/service1 → service1 v1
/api/v2/service1 → service1 v2
```

Microservice:

```bash
/users
/orders
```

Final recommendation checklist

✔ Use nginx as API Gateway in DEV
✔ Microservices expose clean root-based APIs (`` `/users` ``, `` `/orders` ``)
✔ Gateway owns `` `/api/serviceX` `` prefixes
✔ Frontend calls only gateway URLs
✔ Swagger shows gateway base URL
✔ Same nginx structure in DEV / UAT / PROD

If you want, next I can:

- Design a **complete DEV nginx config** for multiple microservices
- Show **docker-compose + nginx** to exactly match UAT
- Explain **auth headers / JWT propagation** through nginx
- Show **CORS setup** correctly at gateway level

Tell me what you want to tackle next.

1,2,3,4 all

Below is a **complete, production-aligned DEV setup** that covers **all four items (1–4)** exactly as you requested, using **nginx only**, and keeping **100% consistency with UAT / preprod / prod**.

I will structure this as a reference architecture you can directly implement.

1️⃣ Complete DEV nginx configuration (multiple microservices)

Target architecture

lua Copy code

```lua
Flutter (Web / Mobile)
        |
        v
NGINX API Gateway  (DEV / UAT / PROD)
        |
        +--> Service1 (.NET Core) :5001
        +--> Service2 (.NET Core) :5002
        +--> Auth Service         :5000
```

Frontend **never talks directly to services**.

---

nginx.conf (API Gateway)

nginx Copy code

```nginx
server {
    listen 80;
    server_name localhost;

    # ------------------------
    # Common proxy headers
    # ------------------------
    proxy_set_header Host $host;
    proxy_set_header X-Forwarded-Host $host;
    proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
    proxy_set_header X-Forwarded-Proto $scheme;

    # ------------------------
    # AUTH SERVICE
    # -------------------------
    location /api/auth/ {
        proxy_pass http://auth-service:5000/;
    }

    # -------------------------
    # SERVICE 1
    # -------------------------
    location /api/service1/ {
        proxy_pass http://service1:5001/;
    }

    # -------------------------
    # SERVICE 2
    # -------------------------
    location /api/service2/ {
        proxy_pass http://service2:5002/;
    }

    # -------------------------
    # HEALTH CHECK (optional)
    # -------------------------
    location /health {
        return 200 "API Gateway OK";
    }
}
```

Critical nginx rule (do NOT miss this)

```nginx
location /api/service1/ {
    proxy_pass http://service1:5001/;
}
```

Trailing slash on `proxy_pass` is mandatory

This ensures:

```bash
/api/service1/users  →  /users
```

2️⃣ docker-compose (DEV identical to UAT topology)

Even if UAT uses Kubernetes, this still maps 1:1 logically.

docker-compose.yml

yaml

```yaml
version: "3.9"

services:
  nginx:
    image: nginx:latest
    container_name: api-gateway
    ports:
      - "8080:80"
    volumes:
      - ./nginx/nginx.conf:/etc/nginx/conf.d/default.conf
    depends_on:
      - service1
      - service2
      - auth-service

  service1:
    image: service1-api
    container_name: service1
    ports:
      - "5001:5001"

  service2:
    image: service2-api
    container_name: service2
    ports:
      - "5002:5002"

  auth-service:
    image: auth-api
    container_name: auth-service
    ports:
      - "5000:5000"
```

Frontend points to:

arduino

```arduino
http://localhost:8080
```

This **will not change** in UAT except hostname.

3️⃣ .NET Core microservice design (correct routing)

❌ WRONG (do not do this)

csharp

```
[Route("api/service1/users")]
```

✅ CORRECT

csharp

Copy code

```csharp
[ApiController]
[Route("users")]
public class UsersController : ControllerBase
{
    [HttpGet]
    public IActionResult Get() => Ok("Service1 users");
}
```

Why

- Microservice remains **gateway-agnostic**
- Can be tested standalone
- Swagger remains clean
- Zero redeployment if gateway paths change

ASP.NET Core – forwarded headers (important)

Add this so HTTPS, auth, IPs work correctly behind nginx.

Program.cs

csharp

Copy code

```csharp
builder.Services.Configure<ForwardedHeadersOptions>(options =>
{
    options.ForwardedHeaders =
        ForwardedHeaders.XForwardedFor |
        ForwardedHeaders.XForwardedProto;
});

app.UseForwardedHeaders();
```

4️⃣ Swagger/OpenAPI – correct gateway visibility

Goal

- Internal APIs stay clean

- Swagger shows **gateway URL**, not service port

Program.cs (Swagger configuration)

```csharp
app.UseSwagger(c =>
{
    c.PreSerializeFilters.Add((swagger, httpReq) =>
    {
        swagger.Servers = new List<OpenApiServer>
        {
            new OpenApiServer
            {
                Url = $"{httpReq.Scheme}://{httpReq.Host}/api/service1",
                Description = "API Gateway"
            }
        };
    });
});
```

Result

Swagger UI shows:

```bash
GET /users
Base URL: http://localhost:8080/api/service1
```

Exactly what frontend expects.

5️⃣ Authentication & Authorization via Gateway (JWT)

Flow

```bash
Flutter
 → /api/auth/login
 ← JWT

Flutter
 → /api/service1/users (Authorization: Bearer <token>)
 → nginx
 → service1
```

nginx does NOT validate JWT (recommended)

JWT validation stays in microservices:

```csharp
builder.Services
    .AddAuthentication(JwtBearerDefaults.AuthenticationScheme)
    .AddJwtBearer();
```

nginx simply forwards headers.

6️⃣ CORS – where to configure (important)

Best practice

- **DEV**: enable CORS in services
- **UAT/PROD**: enable at gateway (optional)

ASP.NET Core DEV CORS

```csharp
builder.Services.AddCors(options =>
{
    options.AddPolicy("DevCors", policy =>
    {
        policy
            .AllowAnyOrigin()
            .AllowAnyHeader()
            .AllowAnyMethod();
    });
});

app.UseCors("DevCors");
```

If Flutter Web and nginx are on same domain later, CORS disappears.

7️⃣ Frontend URL strategy (zero future changes)

Frontend should use **ONE variable** only:

```dart
const apiBase = "http://localhost:8080";
```

Calls:

```bash
```

```
$apiBase/api/service1/users
$apiBase/api/service2/orders
```

In UAT:

arduino Copy code

```
https://uat-api.company.com
```

No code change. Only config.

8️⃣ Versioning (future-proof)

Handled **only at gateway level**:

bash Copy code

```
/api/v1/service1 → service1 v1
/api/v2/service1 → service1 v2
```

nginx example:

nginx Copy code

```
location /api/v1/service1/ {
    proxy_pass http://service1-v1:5001/;
}
```

Microservice routes stay unchanged.

Final authoritative rule-set (memorize this)

1. nginx owns **`/api/serviceX`**
2. Microservices expose root-level routes only
3. Frontend never knows service ports
4. DEV nginx ≈ UAT nginx ≈ PROD nginx
5. Swagger shows gateway base URL
6. Only hostname changes across environments

What I recommend next (optional but valuable)

- Add **rate limiting** in nginx
- Add **request/response logging** with correlation IDs
- Add **health-based upstream failover**
- Add **OpenAPI contract tests** for gateway routes

If you want, say **which one** and I’ll implement it fully.

1,2,3,4 give all

Below is a **complete, production-grade implementation** of **all four items (1–4)** using **nginx as the API Gateway**, fully aligned with how UAT / preprod / prod teams typically operate.

This is written so you can **copy-paste and use it in DEV today** with minimal adjustments later.

1️⃣ Rate Limiting (nginx – gateway level)

Why at gateway

- Protects all downstream services uniformly
- Prevents abuse and accidental load spikes
- Zero code change in microservices

Define rate-limit zones (top of nginx config)

nginx Copy code

```nginx
# Limit by client IP
limit_req_zone $binary_remote_addr zone=api_limit:10m rate=20r/s;

# Optional: stricter limit for auth endpoints
limit_req_zone $binary_remote_addr zone=auth_limit:10m rate=5r/s;
```

Apply rate limits per service

nginx Copy code

```nginx
server {
    listen 80;
    server_name localhost;

    # ---------- AUTH ----------
    location /api/auth/ {
        limit_req zone=auth_limit burst=10 nodelay;
        proxy_pass http://auth-service:5000/;
    }

    # ---------- SERVICE 1 ----------
    location /api/service1/ {
        limit_req zone=api_limit burst=50 nodelay;
        proxy_pass http://service1:5001/;
    }

    # ---------- SERVICE 2 ----------
    location /api/service2/ {
        limit_req zone=api_limit burst=50 nodelay;
        proxy_pass http://service2:5002/;
    }
}
```

Behavior

- Sustained traffic over the limit → **`429 Too Many Requests`**
- Burst allows short spikes without failures

2️⃣ Centralized Logging + Correlation IDs

Goal

- Every request gets a **Correlation-Id**
- Same ID appears in:
  - nginx logs
  - .NET logs
  - downstream services

---

nginx – generate / propagate correlation ID

nginx

Copy code

```nginx
map $http_x_correlation_id $correlation_id {
    default $http_x_correlation_id;
    ""      $request_id;
}

log_format api_logs
'$remote_addr - [$time_local] '
'"$request" $status '
'corr_id=$correlation_id '
'upstream=$upstream_addr '
'rt=$request_time';
```

```
access_log /var/log/nginx/api-access.log api_logs;
```

Forward to services

nginx Copy code

```nginx
proxy_set_header X-Correlation-Id $correlation_id;
```

ASP.NET Core – read correlation ID

Middleware

csharp Copy code

```csharp
app.Use(async (context, next) =>
{
    if (!context.Request.Headers.ContainsKey("X-Correlation-Id"))
    {
        context.Request.Headers["X-Correlation-Id"] = Guid.NewGuid().ToString();
    }

    context.Response.Headers["X-Correlation-Id"] =
        context.Request.Headers["X-Correlation-Id"];

    await next();
});
```

Logging usage

csharp Copy code

```csharp
var correlationId = HttpContext.Request.Headers["X-Correlation-Id"].ToString();
_logger.LogInformation("Request received. CorrelationId={CorrelationId}", correlationId);
```

Result

One request → traceable end-to-end across gateway + all services.

3️⃣ Health Checks + Upstream Failover (nginx)

Even in DEV, **design for failure**.

ASP.NET Core – health endpoint

csharp Copy code

```csharp
builder.Services.AddHealthChecks();

app.MapHealthChecks("/health");
```

---

nginx – upstream with health & failover

nginx Copy code

```nginx
upstream service1_cluster {
    server service1:5001 max_fails=3 fail_timeout=10s;
    server service1-backup:5001 backup;
}

server {
    listen 80;

    location /api/service1/ {
        proxy_pass http://service1_cluster/;
        proxy_next_upstream error timeout http_500 http_502 http_503 http_504;
    }
}
```

Behavior

- If primary fails → traffic automatically shifts
- Zero frontend impact
- Same config works in UAT / prod with multiple pods

Optional: active health checks (advanced)

If your org allows nginx plus / ingress, you can enable active checks. Otherwise passive checks above are sufficient.

4️⃣ OpenAPI Contract Testing (gateway safety net)

Goal

- Ensure gateway routing does **not break API contracts**
- Detect path mismatches **before UAT**

Step 1 – Each service exposes OpenAPI

bash

Copy code

```bash
http://service1:5001/swagger/v1/swagger.json
```

Step 2 – Gateway-based contract validation

Use **Prism** or **Dredd** (industry standard).

Example: Dredd (simple & effective)

Install

bash

Copy code

```bash
npm install -g dredd
```

Test command

bash

Copy code

```bash
dredd http://localhost:8080/api/service1/swagger/v1/swagger.json \
      http://localhost:8080/api/service1
```

What this validates

- Gateway paths are correct
- Request/response schemas match
- HTTP status codes are correct
- No accidental breaking change

CI recommendation

Run this in pipeline:

mathematica

Copy code

```mathematica
Build → Deploy DEV → Run Dredd → Promote to UAT
```

If gateway routing breaks → pipeline fails early.

Final Combined nginx (production-ready template)

nginx

Copy code

```
limit_req_zone $binary_remote_addr zone=api_limit:10m rate=20r/s;

map $http_x_correlation_id $correlation_id {
    default $http_x_correlation_id;
    ""      $request_id;
}

log_format api_logs
'$remote_addr - $request '
'$status corr_id=$correlation_id upstream=$upstream_addr';

server {
    listen 80;

    access_log /var/log/nginx/api.log api_logs;

    proxy_set_header Host $host;
    proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
    proxy_set_header X-Forwarded-Proto $scheme;
    proxy_set_header X-Correlation-Id $correlation_id;

    location /api/service1/ {
        limit_req zone=api_limit burst=50 nodelay;
        proxy_pass http://service1:5001/;
        proxy_next_upstream error timeout http_5xx;
    }

    location /api/service2/ {
        limit_req zone=api_limit burst=50 nodelay;
        proxy_pass http://service2:5002/;
    }
}
```

Authoritative Best-Practice Summary

- Rate limiting → **nginx**
- Logging & tracing → **gateway + service**
- Health checks & failover → **gateway**
- Contract safety → **OpenAPI tests**
- Microservices remain **gateway-agnostic**
- DEV = UAT = PROD (only hostnames change)

If you want next:

- JWT validation **at gateway**
- mTLS between gateway ↔ services
- Kubernetes-ready nginx ingress version
- Zero-downtime deploy strategy

Tell me which one and I’ll implement it fully.

Put above whole chat thread in this chat in a .pdf extension and give download option

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If you want, I can:

- Re-generate it including **full nginx configs and code blocks verbatim**
- Add a **cover page, table of contents, and architecture diagram**
- Export the same content as **DOCX** for easier editing or sharing

Just tell me your preference.