# 🛠️ Markdown → PDF Microservice (KISS + Production Ready)

This document outlines a stateless, production-ready microservice that converts Markdown to PDF and (optionally) applies cryptographic verification. Designed to follow KISS principles and run cleanly in production.

## ✅ Goal

- Accepts Markdown via POST  
- Returns a binary PDF  
- Optionally adds cryptographic hash/signature metadata  
- Can be integrated with systems like n8n or used standalone  
- Runs anywhere via Docker

## 🧱 Core Tech Stack

|  |  |  |
| --- | --- | --- |
| Component | Tool | Purpose |
| Server Framework | Fastify / Express.js | Lightweight HTTP server |
| Markdown Parser | markdown-it | Fast + extensible Markdown → HTML |
| PDF Renderer | puppeteer / playwright | Chromium-based HTML → PDF engine |
| Signing (Optional) | Node crypto module | SHA-256, HMAC, ECDSA signing |
| Hosting | Railway / Fly.io / Docker | Stateless & easy to redeploy |

## 📦 Directory Structure

pdf-service/  
├── server.js # HTTP routes + logic  
├── pdf.js # Markdown → HTML → PDF stream  
├── signer.js # Optional: hash + sign output  
├── templates/ # Optional: HTML wrappers (header/footer)  
├── Dockerfile # Production container  
├── package.json  
└── README.md

## 🔌 API Specification

POST /generate

{  
 "markdown": "# Your Report\n\n- Bullet 1\n- Bullet 2",  
 "filename": "report.pdf",  
 "sign": true  
}

Response (signed):

{  
 "pdf": "<base64>",  
 "hash": "SHA256 hash",  
 "signature": "optional",  
 "timestamp": "ISO-8601"  
}

## 🔐 Design Constraints (KISS + Security)

- Stateless: No file writes. Use streams/memory only.  
- Ephemeral: No caching. No sessions.  
- Input size-limited: Prevent overloads.  
- Secure by default: No logging of content. No CORS. No file access in Puppeteer.  
- Rate-limited: Basic token or IP throttling.  
- Easy to extend: Templates, headers, CSS, watermarking.

## 🚀 Hosting Options

Docker (Local or Cloud):  
```bash  
docker build -t pdf-service .  
docker run -p 3000:3000 pdf-service  
```  
  
Railway / Render:  
- Connect Git repo  
- Set NODE\_ENV=production  
- Auto-deploy on push  
  
Fly.io:  
```bash  
fly launch  
```

## 🧠 Optional Features

- HTML preview endpoint (/preview)  
- VC proof of origin (using DIDs)  
- IPFS hash anchor or on-chain tx submission  
- QR code for PDF verification  
- Email PDF directly via webhook

## 📬 n8n Integration

1. Generate Markdown in workflow  
2. HTTP Request → POST /generate  
3. Receive binary application/pdf  
4. Pipe to Gmail or file storage

## ✅ TL;DR

A secure, minimal, portable service that:  
- Converts Markdown to beautiful PDFs  
- Adds optional signatures  
- Returns nothing but results  
- Runs in <50MB Docker container  
  
Perfect for:  
- Compliance tools  
- Hackathon prototypes  
- Decentralized document signing