STUYG + MARS

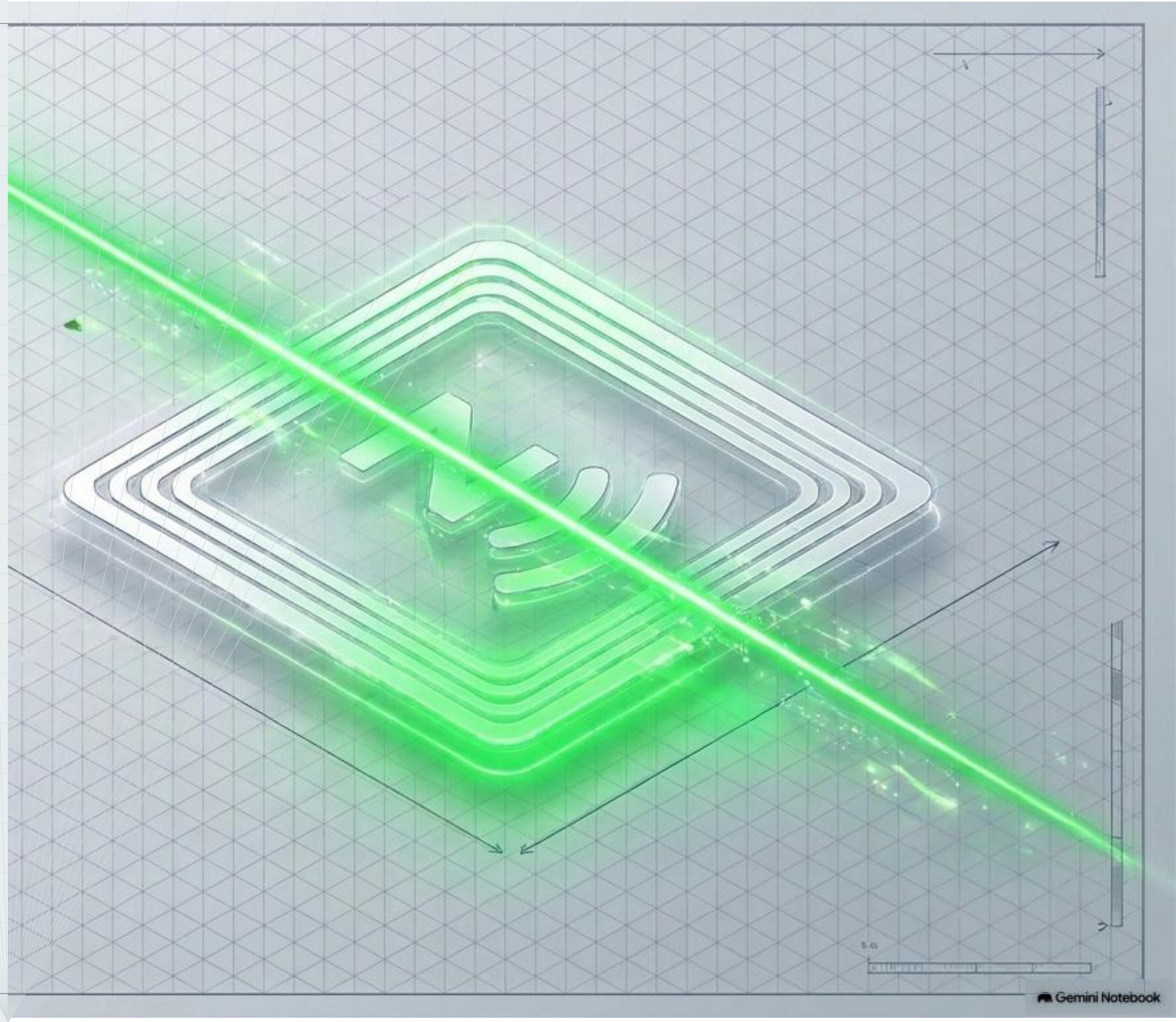
Digital Product Passports

Architecture overview

GS1 Digital Link
& content negotiation

STUYG + Mars

Original presentation follows unchanged

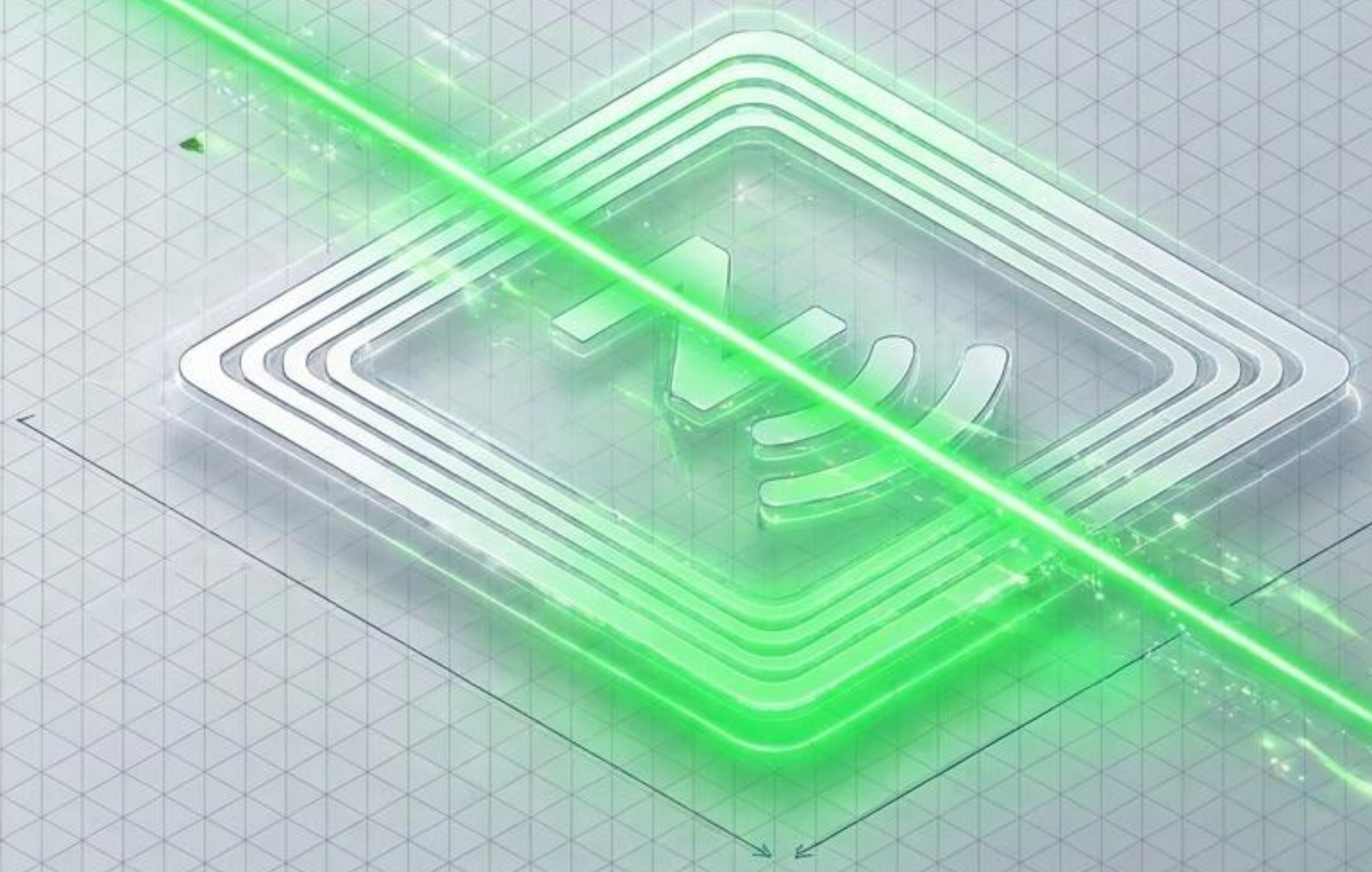


Architecture of the Digital the Product Passport (DPP)

Product URI Syntax & HTTP Content Negotiation

Im GS1 DataMaitrix Plot

A Technical Blueprint for GS1 Digital Link Routing & EU ESPR Compliance



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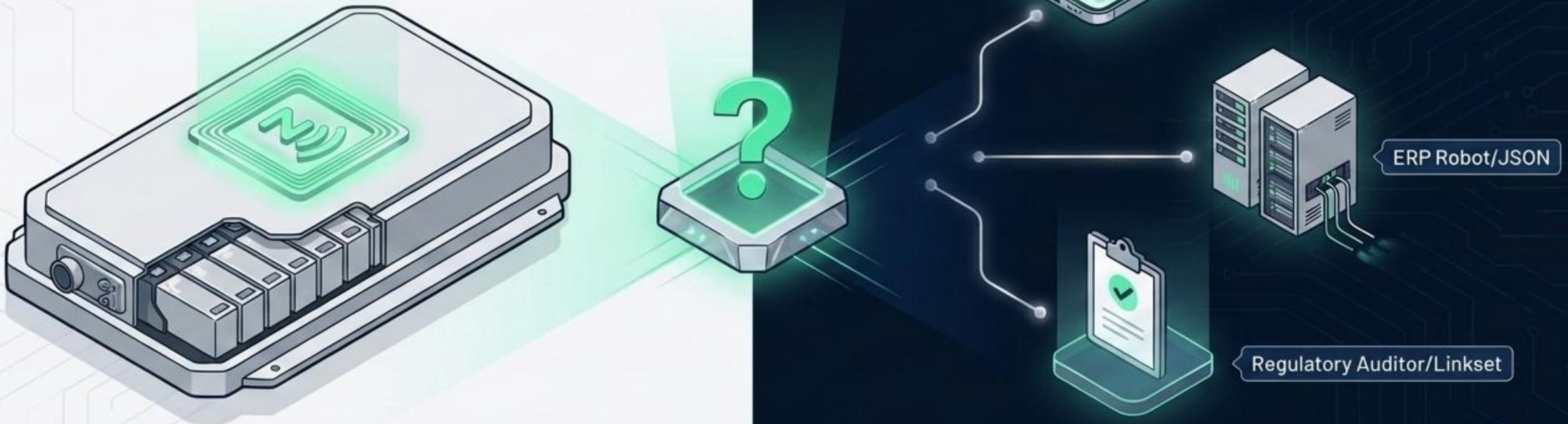
The Physical-to-Digital Bridge



The Problem

How do we link physical products to digital passports without relying on a centralized, proprietary database, while serving radically different data formats to different users from a single scan?

The Solution

The Product URI powered by Server-Side HTTP Content Negotiation.

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The Universal Identifier



The Universal Identifier: GS1 Digital Link

The Product URI is a standard, resolvable web address that transforms traditional commercial identifiers (like GTINs) into open web routing links.

Key Insight: It enables decentralized verification. No central database is required to locate a product's digital passport, aligning with strict UN mandates for open standards.

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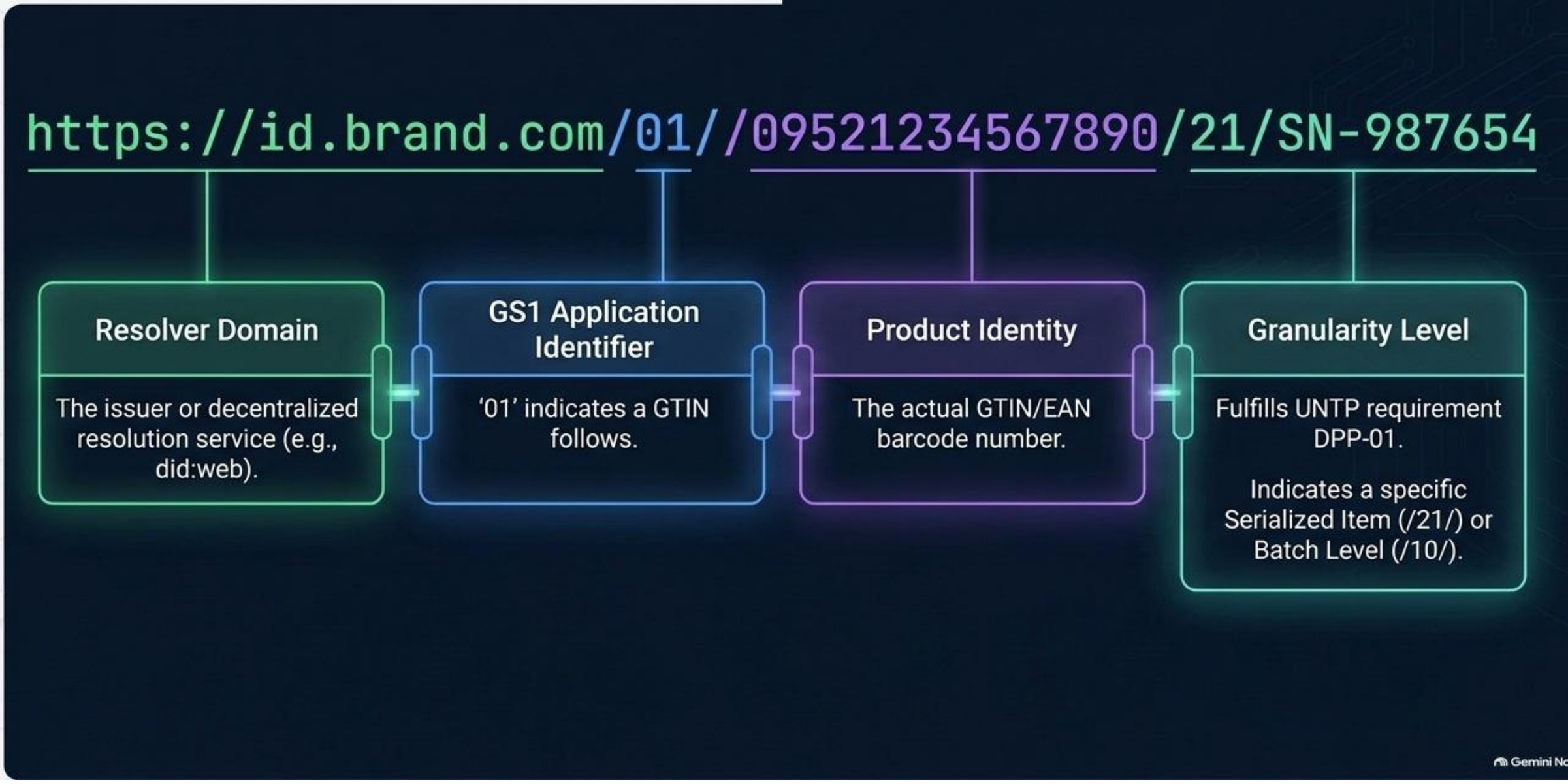
Product URI Architecture Breakdown



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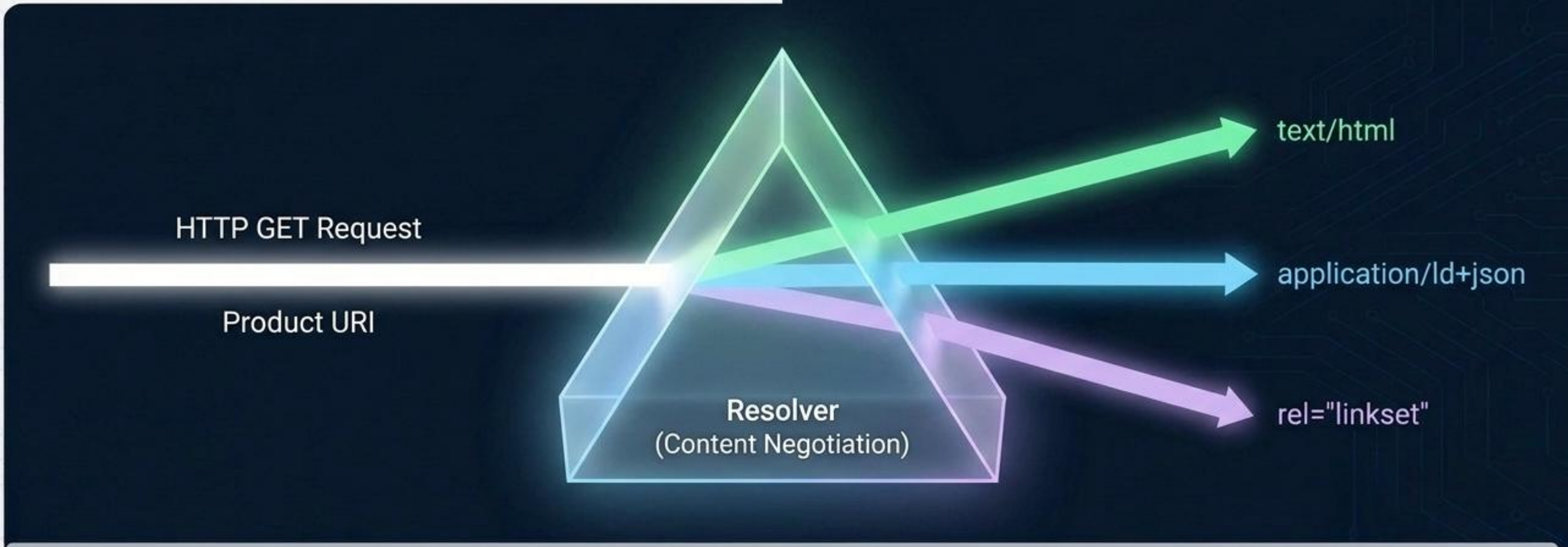
One Identifier. Multiple Destinations.



Resolver: Multiple Destinations

Concept: The Product URI is not a static webpage link. It utilizes HTTP Content Negotiation to dynamically route the requester based on their system capabilities and intent.

Mechanism: The server inspects the incoming 'Accept' header of the HTTP request to determine if the requester is a human rendering a screen or a machine processing raw semantic data.

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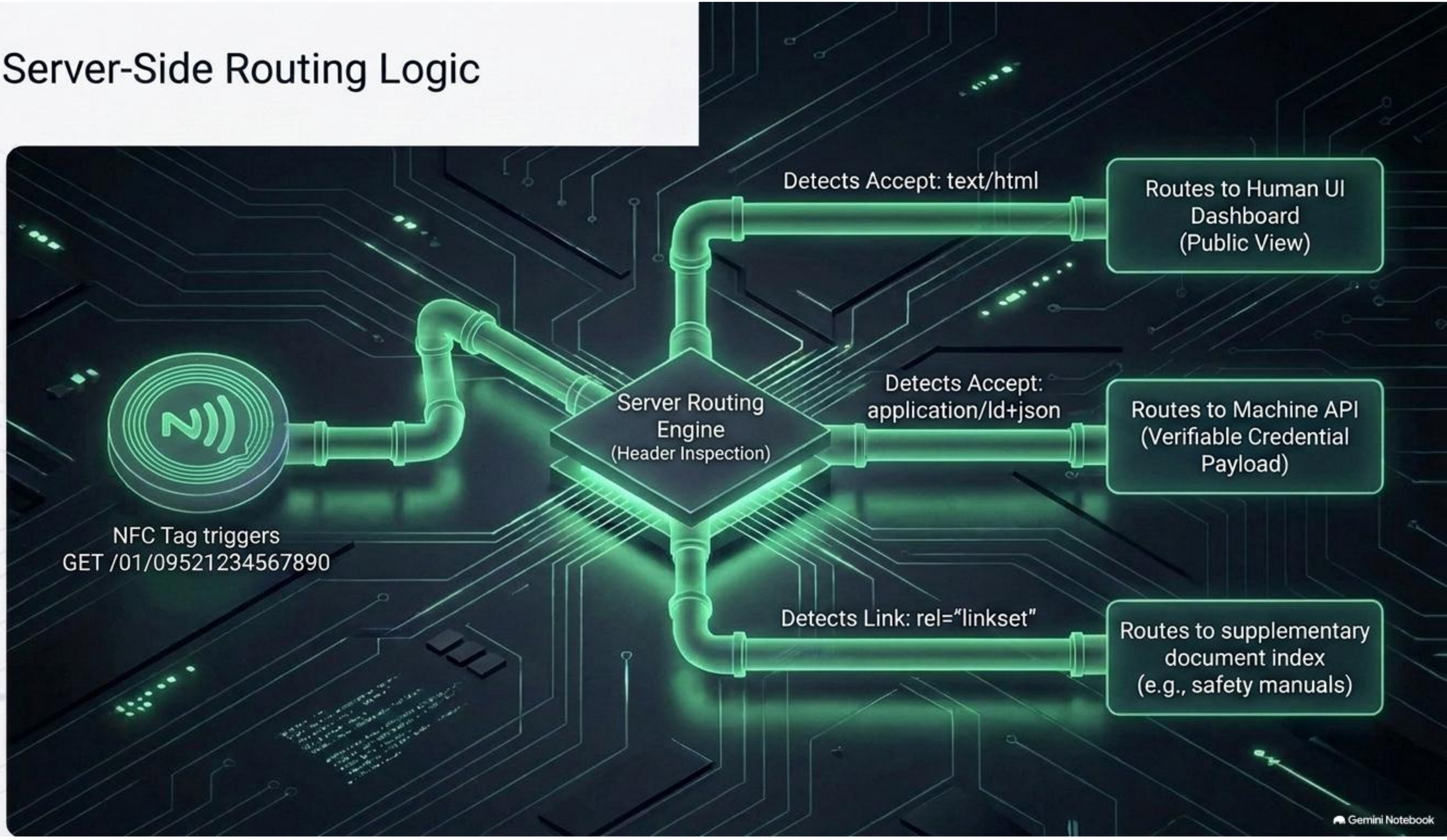
Server-Side Routing Logic



Path A: The Human Experience (text/html)

Core Function: Designed for consumers, customs agents, and quick visual regulatory checks.

EU ESPR Public View Modules:

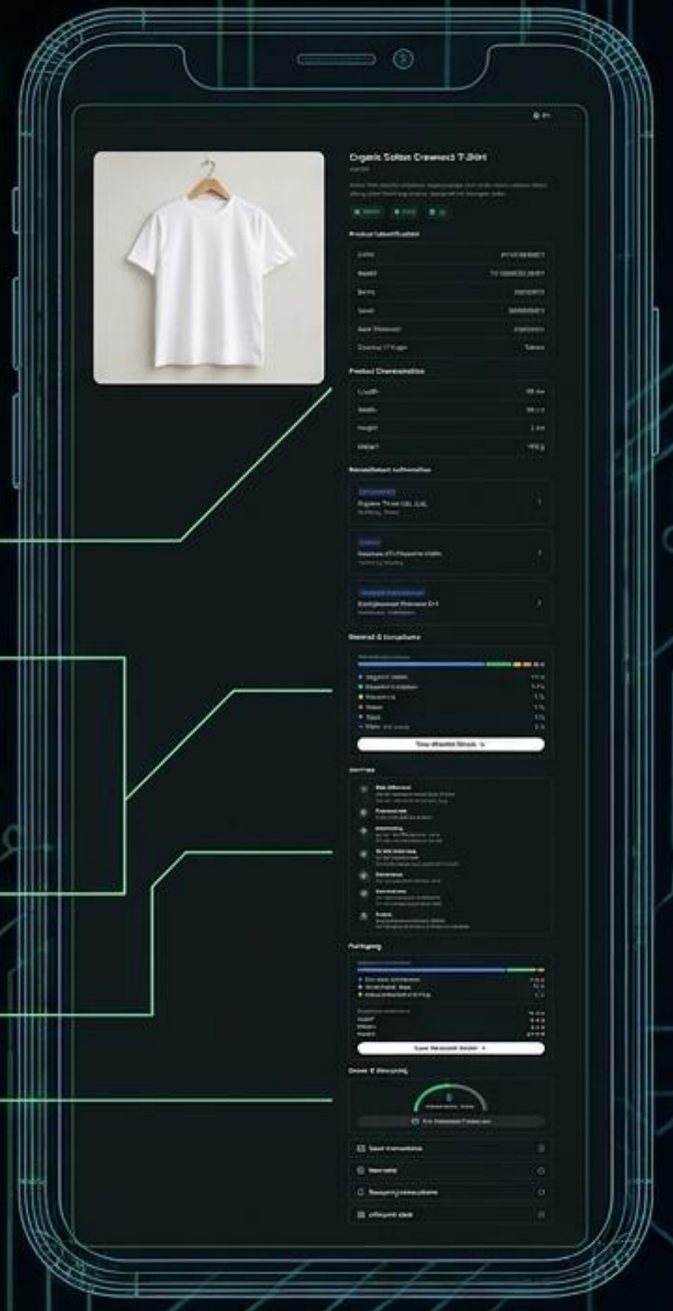
Identity: SKU, Manufacturer, Dates.

Materials: Composition, recycled content.

Circularity: Repairability index, end-of-life disposal guides.

Performance: Carbon Footprint, energy efficiency.

Traceability: Origin countries, verified claims.



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Path B: The Machine Experience (application/ld+json)

Core Function: Designed for automated ERPs, supply chain software, and auditing bots requiring structured data.

- **Semantic Interoperability**
  @context tagging ensures systems globally understand properties like waterproofRating or batteryCapacity.
- **Verifiable Credentials (VC)**
  Delivered as W3C standard VCs to ensure data portability.
- **Cryptographic Trust**
  Contains ED25519 or ECDSA digital signatures to mathematically prove data authenticity and issuer identity.



```
{
  "@context": [
    "https://www.w3.org/2018/credentials/v1",
    "https://untp.unece.org/spec/dpp/v0.6/"
  ],
  "id": "urn:uuid:dpp-123456789",
  "type": ["VerifiableCredential", "DigitalProductPassport"],
  "issuer": "did:web:example.com",
  "credentialSubject": {
    "id": "https://id.example.com/gtin/09521234567890",
    "name": "EV Battery Pack",
    "characteristics": [...]
  }
}
```

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Routing Protocol Diagnostic Matrix

	Human UI (text/html)	Machine API (ld+json)
Primary Consumer	Consumers, Customs Agents	ERPs, IoT Devices, Automated Auditors
Output Format	Rendered Web Page (HTML/CSS)	Structured Semantic Data (JSON-LD)
Core Focus	Accessibility & Data Visualization	System Interoperability & Cryptographic Proof
Security / Auth	Publicly readable	Supports token-based API authorization for sensitive supply chain data

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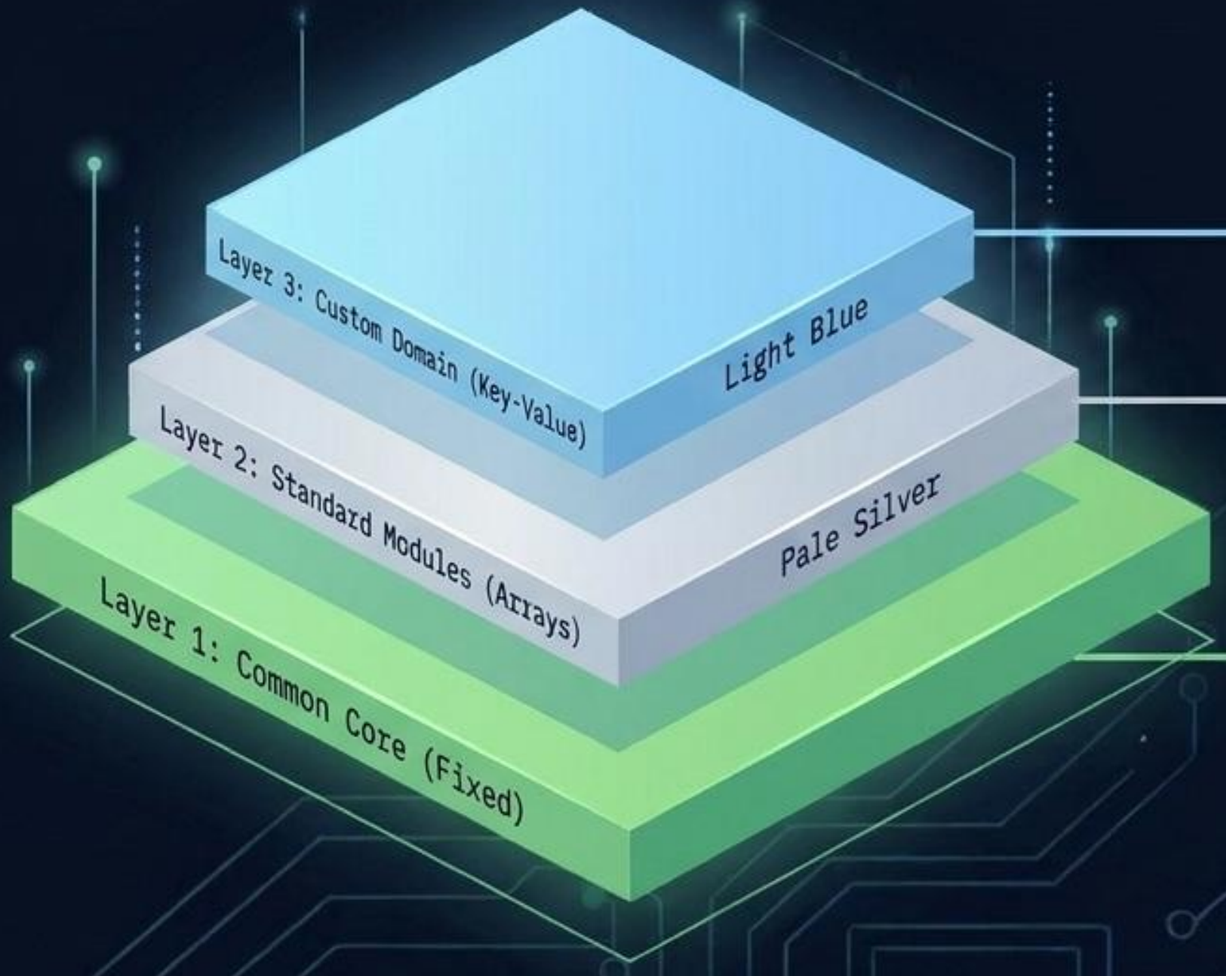
Payload Architecture: Layered Extensibility

How to structure data for drastically different products (e.g., a battery vs. a t-shirt) without breaking the standard.



The 'characteristics' extension point for industry-specific technical specs (e.g., battery voltage, fabric weave).

Flexible structures for common attributes (Materials Provenance, Dimensions, Carbon Claims).

Mandatory fields for all products (ID, Name, Manufacturer, Issue Date, Facility ID).

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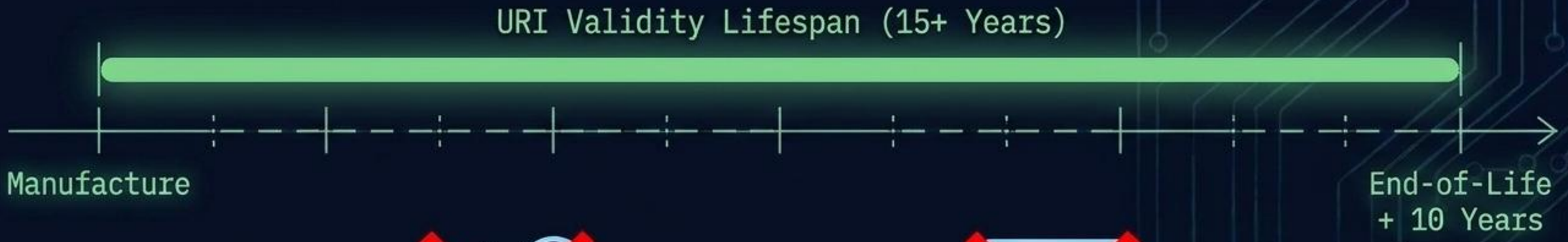
Regulatory Constraints: The Persistence Mandate





bit.ly / Shortlinks



Proprietary Silos

The Rule

Under EU ESPR, Product URIs must remain resolvable for the product's entire expected lifespan plus a statutory retention period.

No Link Rot

Strictly bans dynamic, volatile short-links or URLs tied to transient marketing campaigns.

Future-Proofing

Must rely on open standards (GS1, DIDs). Even if a brand renames or an IT vendor fails, the identifier must survive.

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ESPR Hosting & Failover Architecture



Pillar 1: Distributed Hosting

Economic Operators are legally responsible. Data is hosted locally or via 3rd-party DPP Service Providers.

Pillar 2: Central Backup

Core Unique Identifiers and Product URIs must be synchronized to the EU DPP Registry for basic redundancy and market surveillance.

Pillar 3: Data Escrow

If an Economic Operator faces insolvency, 3rd-party platforms must provide ‘Escrow’ archiving to maintain passport access until product end-of-life.

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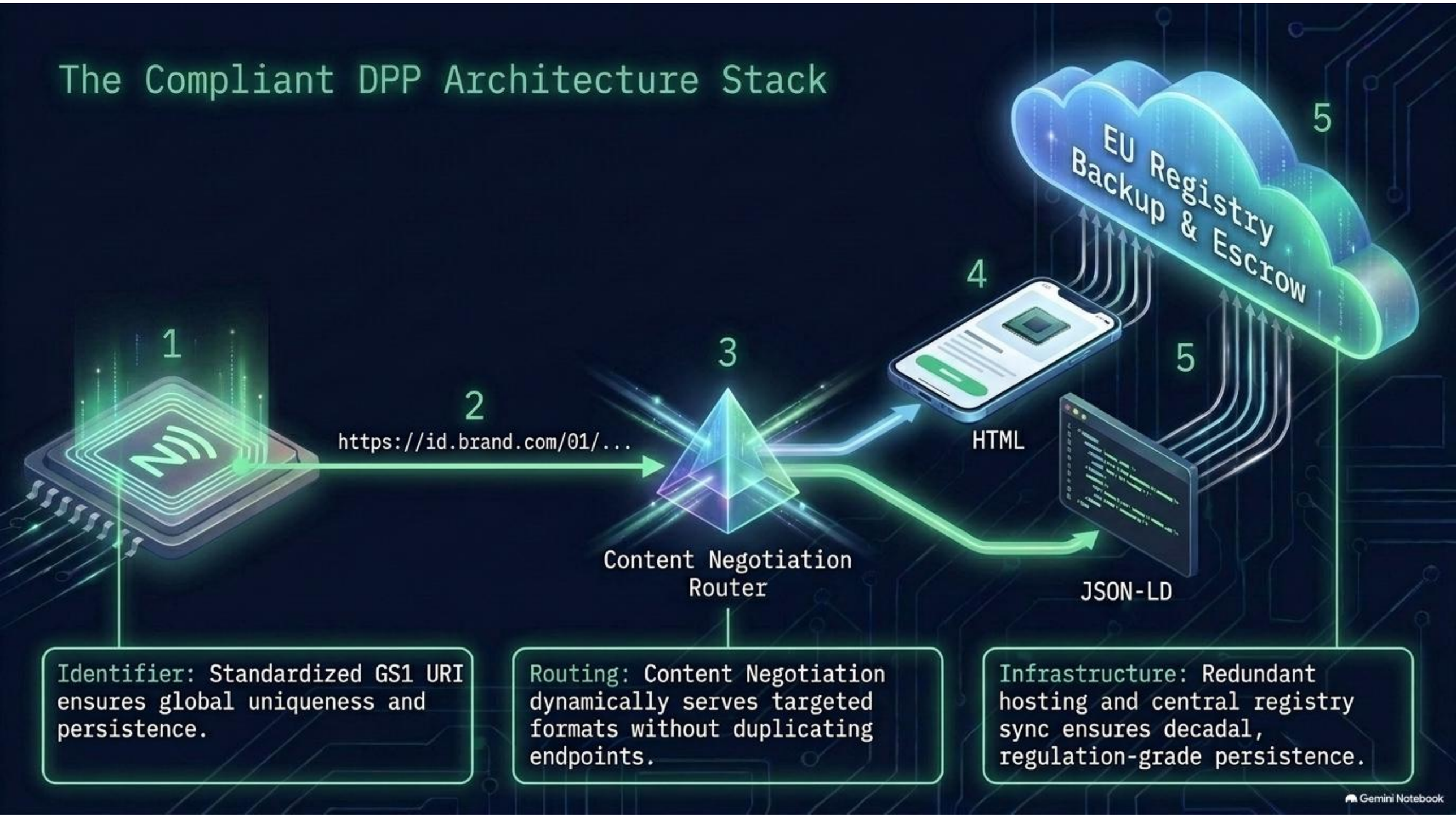
The Compliant DPP Architecture Stack



Identifier: Standardized GS1 URI ensures global uniqueness and persistence.

Routing: Content Negotiation dynamically serves targeted formats without duplicating endpoints.

Infrastructure: Redundant hosting and central registry sync ensures decadal, regulation-grade persistence.

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