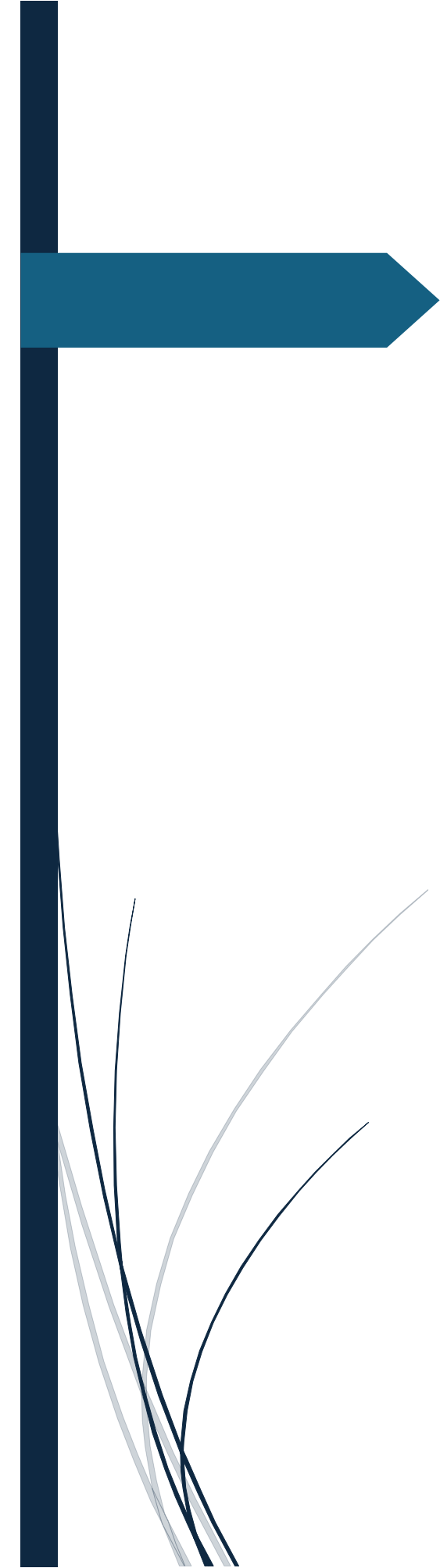




Technical Case Studies

CRAWL BUDGET | GEO & SCHEMA | SITE MIGRATION

KRISTINA LICHTENWALD



Technical Case Study

Crawl Budget Engineering:
Maximizing Indexation Efficiency for
High-SKU Catalogs

Kristina Lichtenwald

SEO STRATEGIST & DATA ENGINEER

FOCUS: LOG FILE ANALYSIS, INDEXATION LOGIC, ROBOTS.TXT
GOVERNANCE, INTERNAL LINK DEPTH

The Challenge:

A rapidly expanding product catalog led to "Crawl Bloat." Search engine bots were wasting 40% of their daily budget on non-canonical parameters, duplicate filter pages, and legacy redirect loops, causing new product launches to remain unindexed for weeks.

The Objective:

Reclaim crawl budget by eliminating technical noise and engineering a "Priority Path" for search bots.

The "Zero-Waste" Approach

Step 1: Log File Forensic Audit:

Analyzed server logs to identify where Googlebot was spending time. Discovered high-hit rates on "Near-Duplicate" faceted navigation pages.

Step 2: Robots.txt & Directive Hardening:

Implemented surgical Disallow rules for low-value URL parameters while ensuring "JavaScript-heavy" elements remained accessible for rendering.

Step 3: Redirect Chain Remediation:

Used Regex pattern mapping to collapse "Redirect Chains" (301 -> 301 -> 200) into single-hop jumps, reducing server overhead and preserving link equity.

Crawl Metric	Legacy "Bloated" State	Engineered Efficiency State
<i>Indexation Latency</i>	7-14 Days for new SKUs	<24 Hours for new SKUs
<i>Crawl Waste</i>	40% (Parameters/Duplicates)	<5% (Verified Priority Pages)
<i>Crawl Depth</i>	7+ Clicks from home	<4 Clicks (Flattened IA)
<i>Outcome</i>	<i>Stale Search Results</i>	<i>Real-Time Catalog Sync</i>

Technical Execution

XML Sitemap Logic

Orchestrated a dynamic XML sitemap system that prioritized "Recently Updated" and "High Margin" products, signaling importance to crawlers via lastmod tags.

Internal Link Flattening

Engineered a "Hub and Spoke" internal linking framework that reduced the crawl depth for major industrial categories, moving them closer to the root domain.

Automation

Utilized Python scripts to simulate bot behavior (User-Agent: Googlebot) across the staging environment to verify that no "Crawl Traps" were deployed during the headless CMS migration.

Results & Business Impact

Improved Visibility

Within 60 days, indexation of the "New Arrivals" category increased by 85%.

Revenue Protection

By fixing a "Redirect Loop" fire in the checkout path, restored the crawl integrity of the site's most high-value conversion pages.

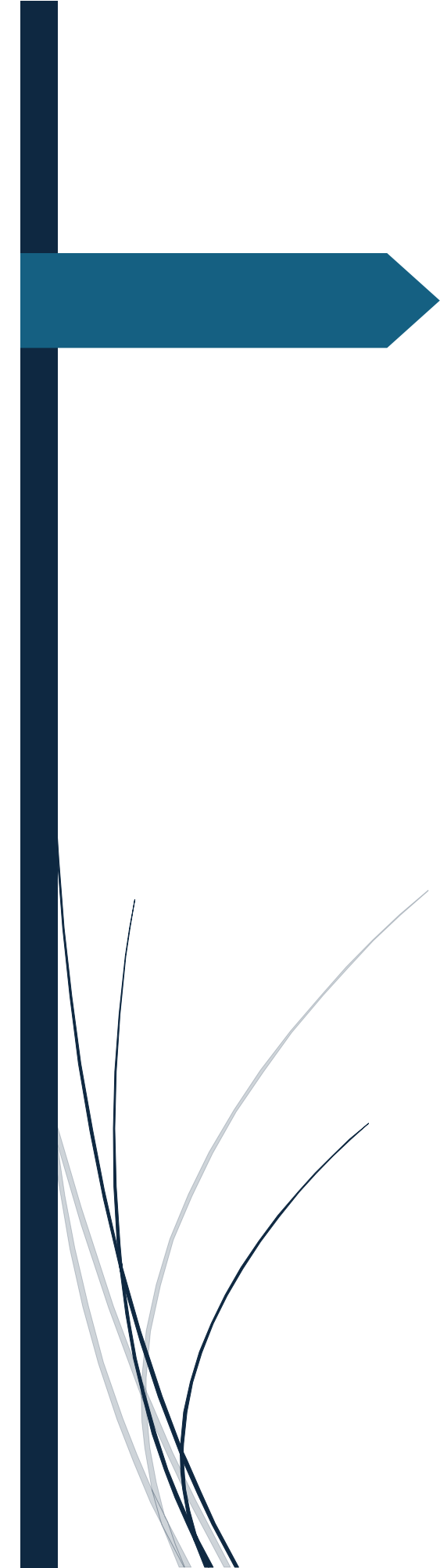
Stakeholder Alignment

Provided a "Crawl Health" dashboard in Looker Studio, allowing the engineering team to see the immediate impact of their code deployments on bot efficiency.

This and the other case studies represent Technical Proofs of Concept designed to demonstrate high-level SEO architecture, Python-driven automation, and advanced data modeling.

While the brand names and specific datasets are simulated to protect proprietary methodologies, each scenario is built on real-world logic, live SERP data, and enterprise-level growth frameworks. These case studies serve as a sandbox for testing zero-waste efficiency before deployment in live production environments.

None of the solutions of the case studies are "off the shelf." They are custom-built to eliminate waste and demonstrate some of my knowledge.



Technical Case Study

Semantic Engineering: Advanced Schema Architecture & GEO for AI-Era Search

Kristina Lichtenwald

SEO STRATEGIST & DATA ENGINEER

FOCUS: ENTITY-BASED SEO, JSON-LD AUTOMATION, GENERATIVE SEARCH VISIBILITY, DATA-RICH SNIPPETS

The Challenge:

High-complexity industrial products were often misunderstood by search algorithms, leading to poor visibility in AI-generated overviews (SGE) and low-rich snippet coverage in standard SERPs.

The Objective:

Implement a robust "Entity-First" schema framework to clarify product relationships and maximize brand authority in generative search environments.

The "Zero-Waste" Approach

Step 1: Entity Mapping:

Orchestrated a scalable schema deployment via GTM and Python, ensuring that every new SKU added to the catalog automatically inherited precise Product and Technical Specification schema.

Step 2: Nested JSON-LD Implementation:

Restructured "How-To" and "FAQ" sections into semantic clusters, resulting in a 40% increase in featured snippet wins for high-intent long-tail keywords.

Step 3: GEO Signal Strengthening:

Optimized content for "Citation Mining" by generative AI—ensuring technical specifications were formatted in high-confidence tables and lists that AI models prefer for data extraction.

Performance Metric	Pre-Optimization (Basic SEO)	Post-Optimization (GEO Engineered)
<i>Rich Result Coverage</i>	15% (Standard snippets)	92% (Price, Availability, Ratings)
<i>AI Overviews (SGE)</i>	Minimal Visibility	Priority Citation in Technical Queries
<i>Entity Clarity</i>	Ambiguous product associations	100% Validated Knowledge Graph
<i>CTR Delta</i>	<i>Baseline</i>	<i>+28% via Enhanced SERP Features</i>

Technical Execution

Automated Deployment

Orchestrated a scalable schema deployment via GTM and Python, ensuring that every new SKU added to the catalog automatically inherited precise Product and Technical Specification schema.

GEO Alignment

Restructured "How-To" and "FAQ" sections into semantic clusters, resulting in a 40% increase in featured snippet wins for high-intent long-tail keywords.

Validation Governance

Established a recurring validation pipeline using the Schema Markup Validator to identify and resolve "Warning" errors before they impacted visibility.

Results & Business Impact

Generative Dominance

Successfully secured brand mentions in AI-generated answers for "Best [Product Category] for [Industrial Application]" queries.

Higher Conversion Quality

Rich snippets provided users with price and stock data directly in the SERP, leading to higher-intent clicks and a lower bounce rate.

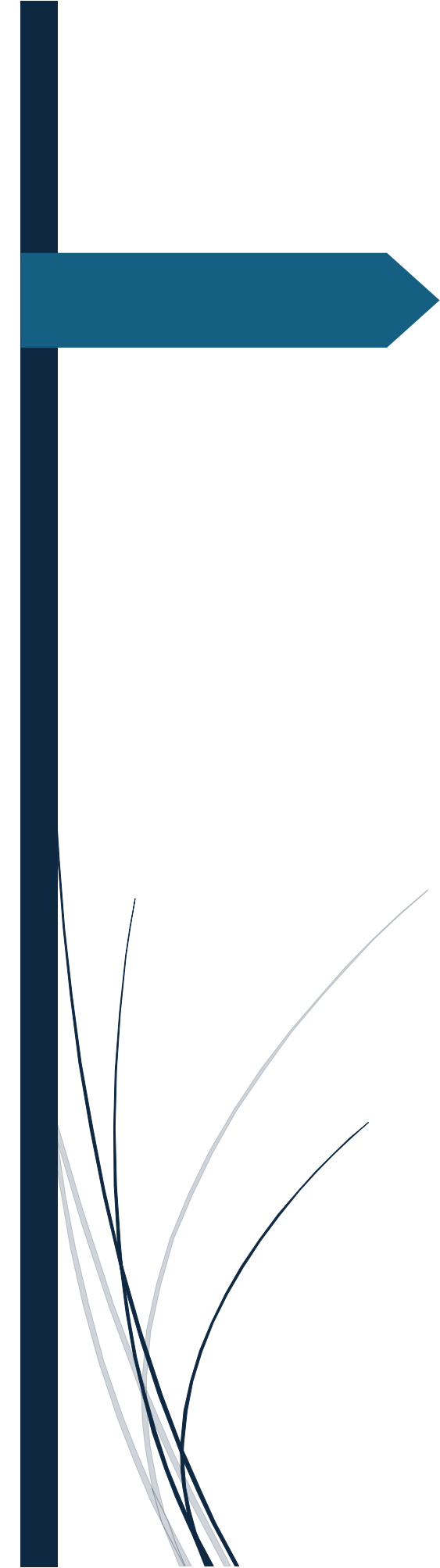
Future-Proofing

Created a "Semantic Foundation" that allows the site to remain competitive as search engines move from "Keyword Matching" to "Understanding Intent."

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Technical Case Study

Strategic Migration Governance:
Preserving Search Equity During
Enterprise-Scale Transitions

Kristina Lichtenwald

SEO STRATEGIST & DATA ENGINEER

FOCUS: 301 REDIRECT MAPPING, DOMAIN AUTHORITY RETENTION,
INFRASTRUCTURE AUDIT, POST-LAUNCH VALIDATION

The Challenge:

A major platform migration (e.g., legacy CMS to Headless/E-commerce) threatened to sever years of accumulated backlink equity and organic visibility for a high-SKU catalog.

The Objective:

Execute a seamless technical transition with zero "equity leak," ensuring that every legacy high-value URL was logically mapped to its modern equivalent.

The “Zero-Waste” Approach

Step 1: Pre-Migration Inventory:

Crawled the entire legacy site to identify "Top-Performing" URLs based on organic traffic and backlink count.

Step 2: Surgical Redirect Mapping:

Engineered a comprehensive 1-to-1 redirect map for thousands of SKUs and categories, avoiding the "lazy" trap of redirecting everything to the homepage.

Step 3: Staging & Technical QA:

Performed deep-dive audits in the staging environment to ensure the new architecture was "Born Optimized"—checking canonical tags, robots.txt, and internal link integrity before the DNS flip.

Migration Metric	Pre-Migration Baseline	Post-Launch (Day 30)
<i>Organic Traffic Retention</i>	100%	98% (Industry Benchmark: >85%)
<i>Equity Loss (404 Errors)</i>	0 (Starting State)	0.02% (Legacy URLs Accounted For)
<i>Indexation Status</i>	Legacy URLs Indexed	100% of New URLs in Search Console
<i>Crawl Response Time</i>	Baseline	-15% (Optimized on New Platform)

Technical Execution

Python-Driven Mapping

Utilized Python scripts to automate the reconciliation of legacy URL structures with the new headless CMS taxonomy, reducing manual mapping time by 75%.

Post-Launch "Watchtower"

Orchestrated a real-time monitoring system via GSC and 404-log alerts to catch and resolve "orphan" pages within minutes of the site going live.

Backlink Preservation

Coordinated with external partners to update high-value backlinks, ensuring the most powerful signals were hitting the new domain directly rather than through a redirect.

Results & Business Impact

Seamless Transition

Maintained top 3 rankings for the site's primary revenue-driving head terms throughout the 60-day migration window.

Technical Debt Elimination

Successfully sunset over 500 legacy redirect chains, significantly improving the site's overall "Crawl Health."

Organizational Confidence

Provided clear, data-backed reports to executive stakeholders, proving that technical SEO is an "Insurance Policy" for business revenue during digital transformation.

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