cloak.business

T2 — IRREVERSIBILITY

10 Case Studies — Problem Analysis & Solution Architecture

SOLID — Directly addressable through technical measures

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Transistor: T2 — IRREVERSIBILITY
Definition: Once PII propagates, it cannot be un-propagated.

01. Biometric immutability

Evidence refs: 1.3, 4.6, 15.9

Executive Summary

Biometric immutability represents a critical privacy challenge: You cannot change your face, fingerprints, or DNA after a breach. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

You cannot change your face, fingerprints, or DNA after a breach. Compromised faceprints are permanent — unlike passwords, there is no reset

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including biometric references, facial descriptions, fingerprint mentions, DNA identifiers. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: permanently removing biometric references ensures they cannot be compromised from document breaches — critical because biometric data cannot be reset. Encrypt provides an alternative — AES-256-GCM encryption enables authorized access while protecting at rest, providing the only reversible option for data that cannot be re-issued.

Architecture & Deployment

Zero-storage microservices process all data in-memory with no disk writes. All NLP models are self-hosted on German servers — no third-party API calls. Data residency is Germany-only.

Compliance Mapping

This pain point intersects with GDPR Article 9 special category biometric data, HIPAA protected health information. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

02. Backup persistence

Evidence refs: 3.3, 16.9

Executive Summary

Backup persistence represents a critical privacy challenge: Deleted from production but alive in nightly, weekly, monthly backups. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

Deleted from production but alive in nightly, weekly, monthly backups. Redis cache, Elasticsearch, Kafka topics, Snowflake all retain after 'deletion'

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including personally identifiable records, database field names, system identifiers. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: anonymizing data before it enters any storage system prevents the backup persistence problem at its source. Replace provides an alternative — substituting PII with anonymized alternatives before storage ensures backups contain no personal data. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

Zero-storage microservices with self-hosted NLP models (spaCy, Stanza, XLM-RoBERTa). All processing in-memory on German servers. No data ever written to disk, no third-party transfers.

Compliance Mapping

This pain point intersects with GDPR Article 17 right to erasure, Article 5(1)(e) storage limitation. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

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03. Third-party propagation

Evidence refs: 3.7

Executive Summary

Third-party propagation represents a critical privacy challenge: PII broadcast via RTB to thousands of unknown companies cannot be recalled. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

PII broadcast via RTB to thousands of unknown companies cannot be recalled. No mechanism to verify downstream deletion

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including names, email addresses, advertising IDs, device identifiers, behavioral profiles. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: anonymizing PII before sharing with third parties prevents propagation that makes recall impossible. Replace provides an alternative — substituting identifiers before third-party sharing maintains data utility while preventing individual tracking. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

The REST API (Business plan) provides programmatic access to 317 custom regex recognizers and 3 NLP engines. Session-based JWT auth for web/desktop; Bearer API key for MCP/REST integration.

Compliance Mapping

This pain point intersects with GDPR Article 28 processor obligations, Article 44 transfer restrictions. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

04. Shadow profiles

Evidence refs: 3.2

Executive Summary

Shadow profiles represents a critical privacy challenge: Facebook maintains profiles of non-users from contact uploads, Pixel browsing data, and Like button interactions. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

Facebook maintains profiles of non-users from contact uploads, Pixel browsing data, and Like button interactions. PII about you that you never provided

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including names, email addresses, phone numbers, contact information, browsing identifiers. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: removing identifying information prevents creation of shadow profiles by ensuring no third-party PII is included in shared data. Replace provides an alternative — replacing contact details with placeholders preserves document structure while protecting non-users. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

The Desktop App (Windows 10+, Tauri/Rust) processes documents locally. Combined with zero-storage server architecture, PII is processed and immediately discarded.

Compliance Mapping

This pain point intersects with GDPR Article 14 information for data subjects not directly collected from, Article 6 lawful basis. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

05. Git history

Evidence refs: 16.1

Executive Summary

Git history represents a critical privacy challenge: Committed secrets persist in version control permanently. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

Committed secrets persist in version control permanently. Bots detect exposed credentials within minutes. BFG Repo-Cleaner can't undo what was already scraped

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including API keys, access tokens, passwords, database credentials, private keys. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: removing credentials from code and documents before version control eliminates the exposure vector. Replace provides an alternative — substituting credentials with placeholder tokens maintains documentation while removing actual secrets. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

The MCP Server (9 tools) integrates with Claude Desktop and Cursor for PII detection in developer workflows including text/image analysis, anonymization, and session management.

Compliance Mapping

This pain point intersects with GDPR Article 32 security of processing, ISO 27001 access control. cloak.business’s GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

06. ML model memorization

Evidence refs: 15.5, 16.2

Executive Summary

ML model memorization represents a critical privacy challenge: GPT-style models memorize and reproduce training data — phone numbers, emails, PII baked into model weights that cannot be extracted or deleted. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

GPT-style models memorize and reproduce training data — phone numbers, emails, PII baked into model weights that cannot be extracted or deleted

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including names, emails, phone numbers, medical records, training data with PII. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Replace is recommended: substituting PII in training data with realistic synthetic alternatives preserves statistical properties while preventing memorization. Redact provides an alternative — removing PII entirely from training data eliminates memorization risk at the cost of reduced training diversity. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

Anonymizing training data before ML pipelines prevents PII memorization. The 390+ entity types with 317 custom regex patterns provide the most comprehensive coverage for training data decontamination.

Compliance Mapping

This pain point intersects with GDPR Article 25 data protection by design, Article 5(1)(c) minimization. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

07. De-indexing illusion

Evidence refs: 3.8

Executive Summary

De-indexing illusion represents a critical privacy challenge: Google removes search results but original page, cached copies, Wayback Machine copies remain. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

Google removes search results but original page, cached copies, Wayback Machine copies remain. Geographic limits: same search from outside EU returns full results

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including names, addresses, contact details, identifying descriptions, biographical information. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: anonymizing documents at creation prevents PII from appearing in any cached, indexed, or archived copy. Replace provides an alternative — substituting identifiers before publication ensures cached copies contain only anonymized data. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

The Desktop App (Windows 10+, Tauri/Rust) processes documents locally. Combined with zero-storage server architecture, PII is processed and immediately discarded.

Compliance Mapping

This pain point intersects with GDPR Article 17 right to erasure, Article 17(2) obligation to inform recipients. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

08. Breach databases

Evidence refs: 16.4

Executive Summary

Breach databases represents a critical privacy challenge: Have I Been Pwned: 13B+ breached accounts. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

Have I Been Pwned: 13B+ breached accounts. Once PII appears in a breach database, it persists indefinitely across the internet

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including email addresses, passwords, usernames, IP addresses, account identifiers. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Encrypt is recommended: AES-256-GCM encryption of credentials in documents enables authorized access for incident response while protecting at rest. Hash provides an alternative — SHA-256 hashing enables breach impact analysis without exposing original values.

Architecture & Deployment

Zero-storage microservices with self-hosted NLP models (spaCy, Stanza, XLM-RoBERTa). All processing in-memory on German servers. No data ever written to disk, no third-party transfers.

Compliance Mapping

This pain point intersects with GDPR Articles 33-34 breach notification, Article 32 security measures. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

09. Cache/index/warehouse copies

Evidence refs: 16.9

Executive Summary

Cache/index/warehouse copies represents a critical privacy challenge: After 'deletion': data in nightly backups, Redis, Elasticsearch, Kafka, Sentry, Amplitude, Mailchimp. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

After 'deletion': data in nightly backups, Redis, Elasticsearch, Kafka, Sentry, Amplitude, Mailchimp. Dozens of copies across dozens of systems

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including user records, analytics data, behavioral logs, transaction records. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: anonymizing data before it enters caching systems eliminates the dozens-of-copies problem. Replace provides an alternative — substituting identifiers before downstream systems enables analytics without PII copies in Redis, Elasticsearch, Kafka. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

Zero-storage microservices with self-hosted NLP models (spaCy, Stanza, XLM-RoBERTa). All processing in-memory on German servers. No data ever written to disk, no third-party transfers.

Compliance Mapping

This pain point intersects with GDPR Article 5(1)(e) storage limitation, Article 25 data protection by design. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

10. Surveillance advertising records

Evidence refs: 1.10

Executive Summary

Surveillance advertising records represents a critical privacy challenge: RTB bid streams processed 100B+ times daily. This pain point is driven by IRREVERSIBILITY — once pii propagates, it cannot be un-propagated. cloak.business addresses this through zero-storage microservices processing all data in-memory with no disk writes — PII cannot propagate from a system that never stores it.

The Problem

RTB bid streams processed 100B+ times daily. Records persist across ad exchanges, DSPs, DMPs. No recall mechanism exists

Root cause: T2 — IRREVERSIBILITY: Once PII propagates, it cannot be un-propagated.

The Solution: How cloak.business Addresses This

Detection Capabilities

cloak.business identifies 390+ entity types including advertising IDs, browsing history, location data, interest profiles, bid parameters. The dual-layer (317 custom regex + NLP) architecture uses 317 custom regex recognizers with context word analysis and confidence scoring 0.0–1.0 for structured identifiers and spaCy (25 languages) + Stanza (7 languages) + XLM-RoBERTa (16 languages) — all self-hosted for contextual references.

Anonymization Methods

Redact is recommended: removing identifiers before data enters advertising systems prevents permanent surveillance records. Replace provides an alternative — substituting advertising identifiers with non-trackable alternatives enables aggregate analytics without surveillance. For reversibility, Encrypt (AES-256-GCM) enables authorized recovery.

Architecture & Deployment

The REST API (Business plan) provides programmatic access to 317 custom regex recognizers and 3 NLP engines. Session-based JWT auth for web/desktop; Bearer API key for MCP/REST integration.

Compliance Mapping

This pain point intersects with GDPR Article 6 lawful basis, ePrivacy consent requirements, Article 21 right to object. cloak.business's GDPR (Article 25 Privacy by Design), ISO 27001:2022 compliance coverage, combined with Germany only, no third-party transfers, ISO 27001:2022 certified hosting, provides documented technical measures for regulatory submissions.

Product Specifications

Platform Version Analyzer 6.9.1, Image Redactor 5.3.0

Entity Types 390+ (519 documented)

Detection Layers 317 custom regex + 3 NLP engines (all self-hosted)

Languages 48 UI languages, 37 OCR language packs

Anonymization Methods Replace, Redact, Mask, Hash (SHA-256), Encrypt (AES-256-GCM)

Architecture Zero-storage microservices (in-memory only)

Integration Points Web App, Desktop, Office Add-in, MCP Server (9 tools), REST API

Hosting Germany only, ISO 27001:2022, no third-party transfers

Compliance GDPR Article 25, ISO 27001:2022

Other Products Addressing This Transistor

- anonym.plus (Licensed desktop)

Online versions available at:
https://anonym.community/cloak.business/