What is a proxy storage collision?

A proxy storage collision is a bug in upgradeable contracts where the proxy and its implementation disagree on the storage layout, so a variable written by one overwrites a different variable in the same storage slot. Because the proxy holds the state and `delegatecall`s the implementation's code, a mismatch can corrupt critical values, including the proxy admin or owner slot, leading to takeover or bricking. The fix is standardized storage slots (EIP-1967) and disciplined, append-only storage layouts. It maps to SWC-124.

HOW IT WORKS

01 How it works and example

Two collision patterns:

- Proxy vs implementation: the proxy stores its `admin` in slot 0, and the implementation also uses slot 0 for a normal variable. A user action that writes that variable overwrites the admin, an attacker sets themselves as admin and upgrades to malicious code.
- Upgrade layout drift: a new implementation inserts or reorders state variables, so existing storage now maps to the wrong fields, corrupting balances or permissions.

The fix pattern (EIP-1967) puts admin/implementation in pseudo-random slots to avoid overlap. Documented for defensive context.

> SLOTS MUST LINE UP
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> *Proxy and implementation share the same storage slots. If their layouts do not match exactly, writing a normal variable can overwrite the admin slot. Use EIP-1967 slots and append-only layouts.*

HOW TO DEFEND

- Use standardized storage slots (EIP-1967) for admin and implementation addresses so they never collide with logic variables.
- Use audited upgradeable proxy libraries rather than custom proxies.
- Keep storage append-only across upgrades: never reorder or remove existing variables, only add new ones at the end (use storage gaps).
- Run upgrade-safety checks that compare storage layouts between versions.
- Audit every upgrade for layout compatibility, not just the logic changes.

SOURCES

[1] SWC Registry: Smart Contract Weakness Classification

[2] Ethereum.org: Smart contract security

[3] Solidity docs: Security considerations