> **Goal**: Provision your NTAG424 tag securely for Satnam NFC Physical MFA without a separate hardware bridge. All verification is performed by Satnam's Netlify Functions using local SUN/CMAC checks.

1) Choose your provisioning method

Recommended

Android (Boltcard App)

- Android phone with NFC
- App: Boltcard NFC Programming App
- Fastest for most users

Download: APK or Play Store

- Releases (APK): https://github.com/boltcard/bolt-nfc-android-app/releases
- Play Store: https://play.google.com/store/apps/details?id=com.lightningnfcapp

Desktop (NXP TagXplorer)

- Windows/macOS/Linux + compatible NFC reader (PN532 or NXP reader)
- Java app by NXP for low-level NTAG424 config

Docs: UM11133 Quick start

- PDF: https://www.nxp.com/docs/en/user-guide/UM11133.pdf
- Download via NXP DocStore (free account; search "TagXplorer")

Device (Bolty ESP32 + PN532)

- ESP32 + PN532 module flasher
- Dedicated provisioning d browser UI

Resources (LNbits wiki): https://github.com/lnbits/lnbits/w &-Building-with-LNbits

Web flasher: https://espressif.github.io/esptoo

> **Security critical**: Never share your provisioning blob (K0/K1/K2, SDM config) outside your secure device. Store it in a password manager. If you lose the keys after changing them on the tag, you will not be able to re-program that tag.

2) Get your provisioning blob from Satnam

In Satnam: Security → NFC Physical MFA → "Provision new tag". This calls `/nfc-unified/initialize` and provides a JSON blob (client-side only) with:

- `url_base` — the NDEF URL to write (e.g., https://www.satnam.pub/nfc/scan)
- `k0`, `k1`, `k2` — AES keys (hex)
- `sdm` — SUN/SDM enable + offsets (PICC/CMAC insertion)

3) Provisioning steps

Android (Boltcard App)

1. Install app (APK/Play) and enable NFC.
2. Open *Write* screen → set `url_base` from your blob.
3. Open *Key change* → apply `K0/K1/K2` exactly from blob.
4. Ensure SDM/SUN is enabled (dynamic `PICC/CMAC` appended to URL when read).
5. Optional: Enable UID randomization for privacy (irreversible).
6. Hold tag still on the phone until success.

Desktop (TagXplorer)

1. Install Java + TagXplorer; connect a compatible reader (avoid legacy ACR122U).
2. Detect tag → Change keys: set `K0/K1/K2` (EV2/AES).
3. Enable SDM on the chosen file; configure `PICC/CMAC` offsets per blob.
4. Write NDEF URL record to `url_base`.
5. Optional: Enable UID randomization.
6. Verify (see below).

Device (Bolty ESP32 + PN532)

1. Flash ESP32 with Bolty binaries via esptool-js (see LNbits wiki).
2. Reboot, join Wi-Fi `Bolty` (pass `wango123`), open `http://192.168.4.1`.
3. Load provisioning values (`url_base`, `K0/K1/K2`, SDM enable + offsets).
4. Write/program; keep tag stationary during key changes.
5. Optional: UID randomization → verify.

4) Verify your tag

- **Quick**: Tap with any NFC phone. The opened URL should include dynamic SDM params (e.g., CMAC/PICC).
- **Satnam end-to-end**: Tap → app opens Satnam → frontend calls `/nfc-unified/verify` with SDM fields → success response.
- **Low-level**: Use TagXplorer to confirm keys, SDM enable, and NDEF URL record.

5) How it integrates (at a glance)

```
User Tap → Phone opens NDEF url_base
   → Frontend captures SDM params (PICC/CMAC)
   → Netlify Function /nfc-unified/verify
   → Local SUN/CMAC verification (no third-party bridge)
   → Session/auth success
   → (Optional) LNbits Boltcards used for wallet/registry metadata only
```

6) Troubleshooting

- **Write failed / Tag moved**: Keep the tag fully still; retry. Ensure phone NFC coil aligns with tag antenna.
- **CMAC missing in URL**: SDM not enabled or offsets incorrect. Re-apply SDM config per blob.
- **Cannot re-program**: Keys changed but lost. The tag cannot be re-provisioned without correct keys.
- **Desktop reader issues**: Use PN532 or an NXP reader with NTAG424 support; avoid older ACR122U.
- **Android errors**: Reinstall app; ensure device NFC is on and no other NFC app is interfering.

7) Best practices

- Provision in a controlled environment (no unknown NFC devices nearby).
- Store the provisioning blob in a password manager; never email or chat it.
- Test with a spare tag first; record success logs from `/nfc-unified/verify`.