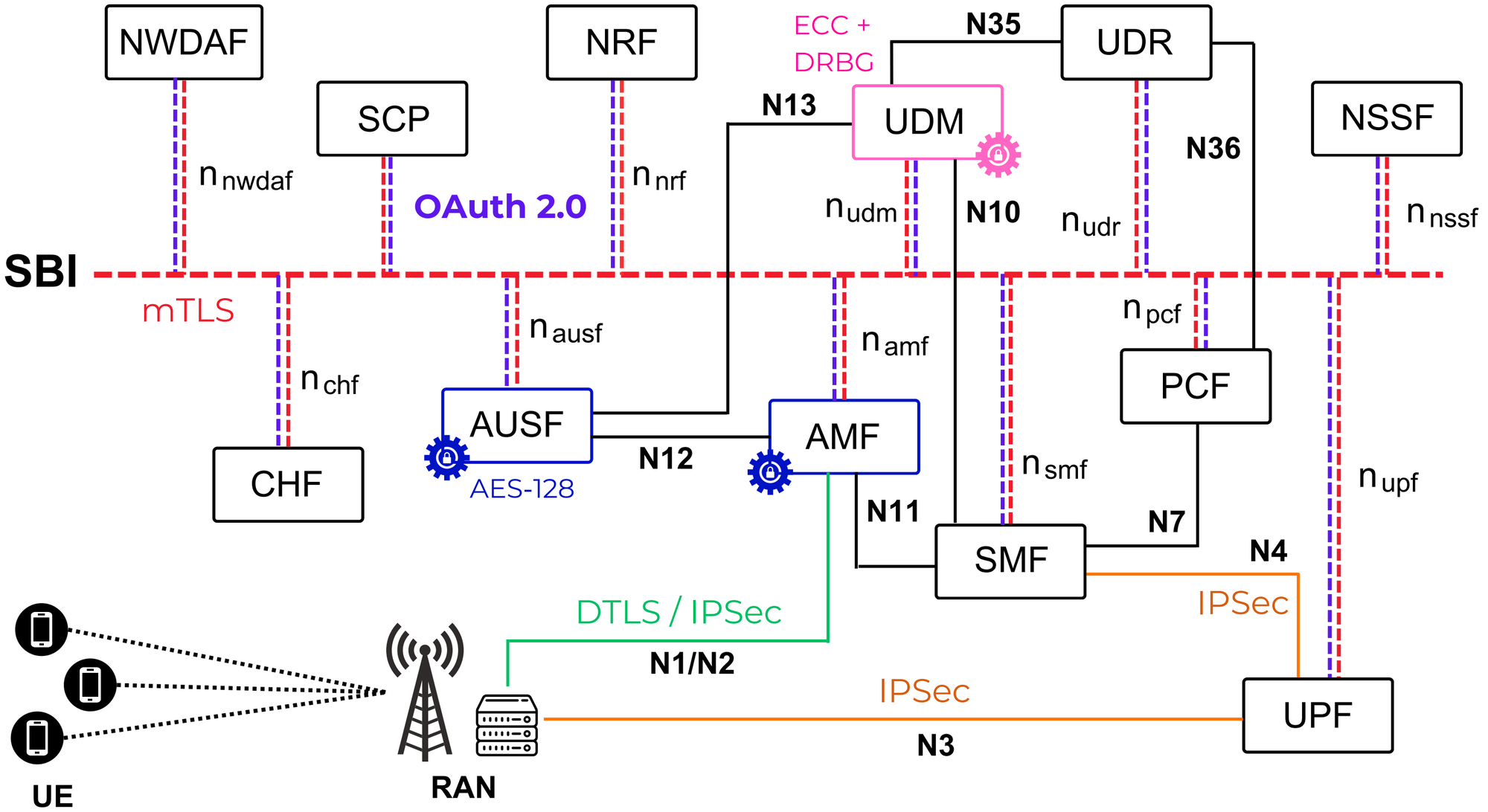
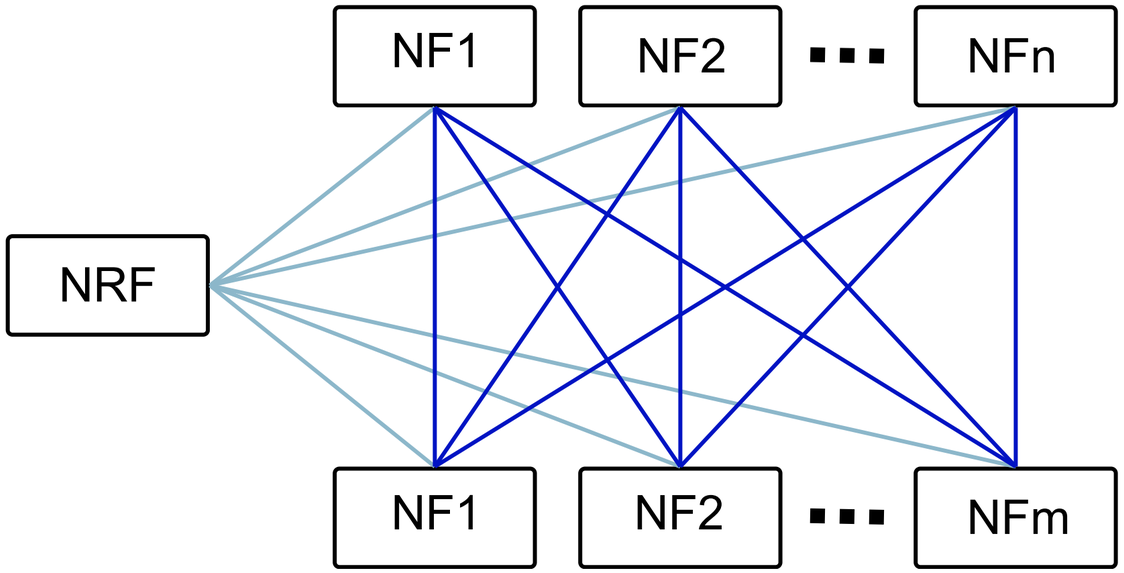
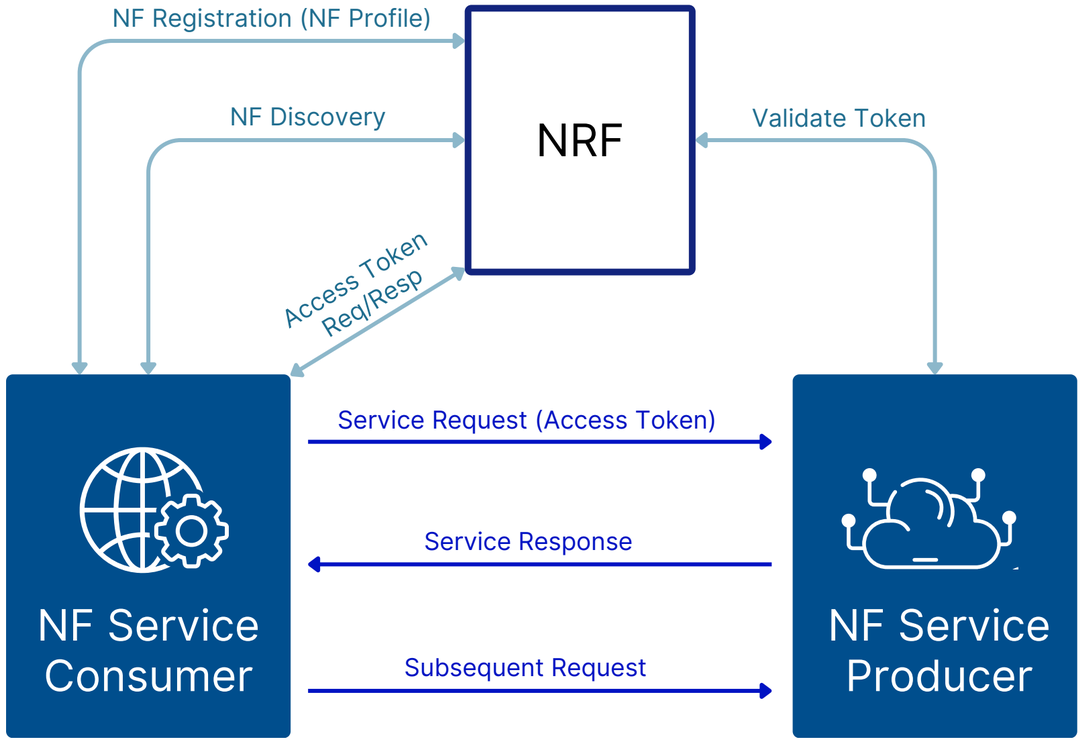
Blockchain-Based OAuth 2.0 Authorization in Telecom with Hyperledger Fabric

Classical Security in 5G Core



Oauth2.0 Authorization in NRF (Model B)

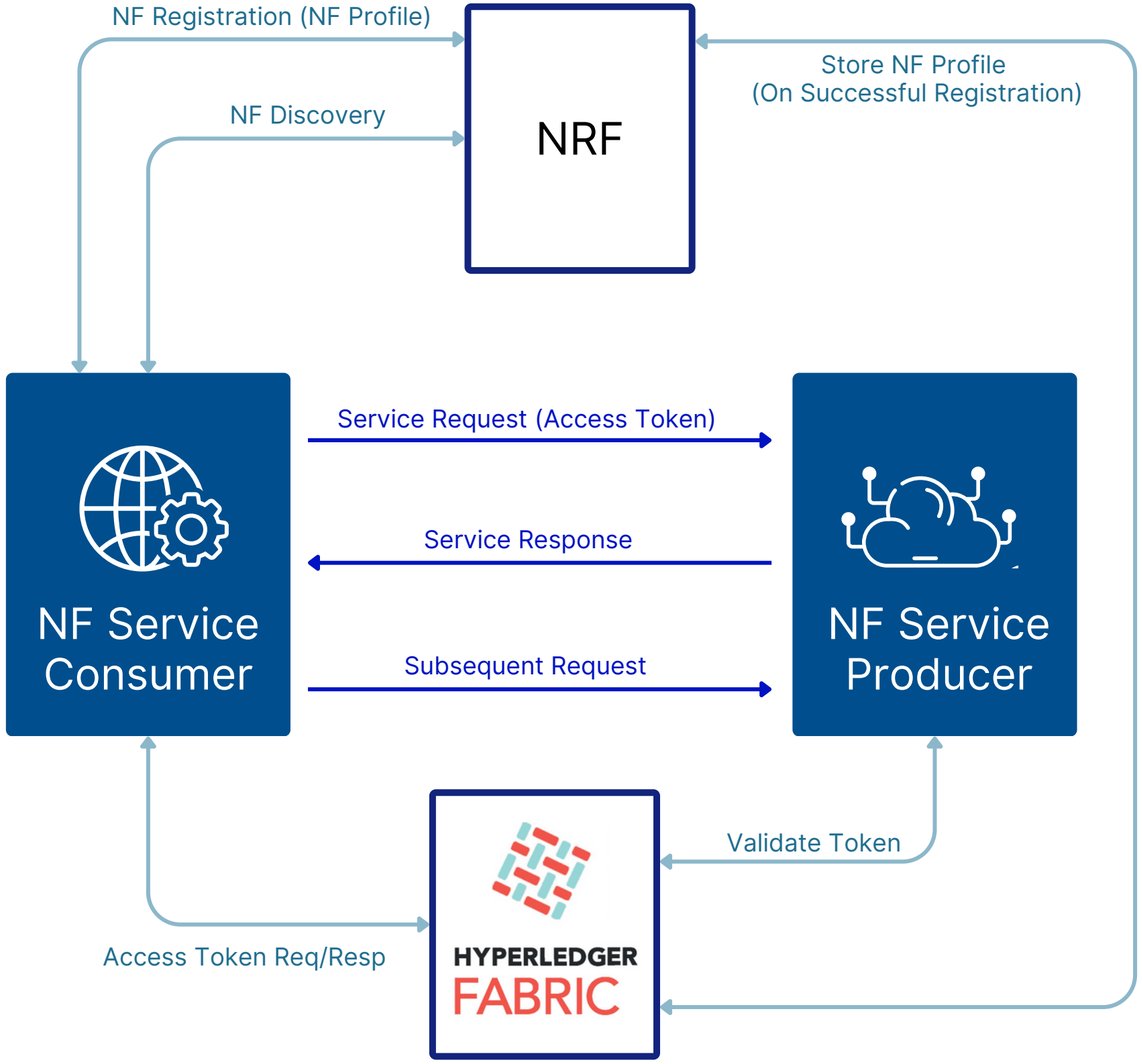




Vulnerabilities

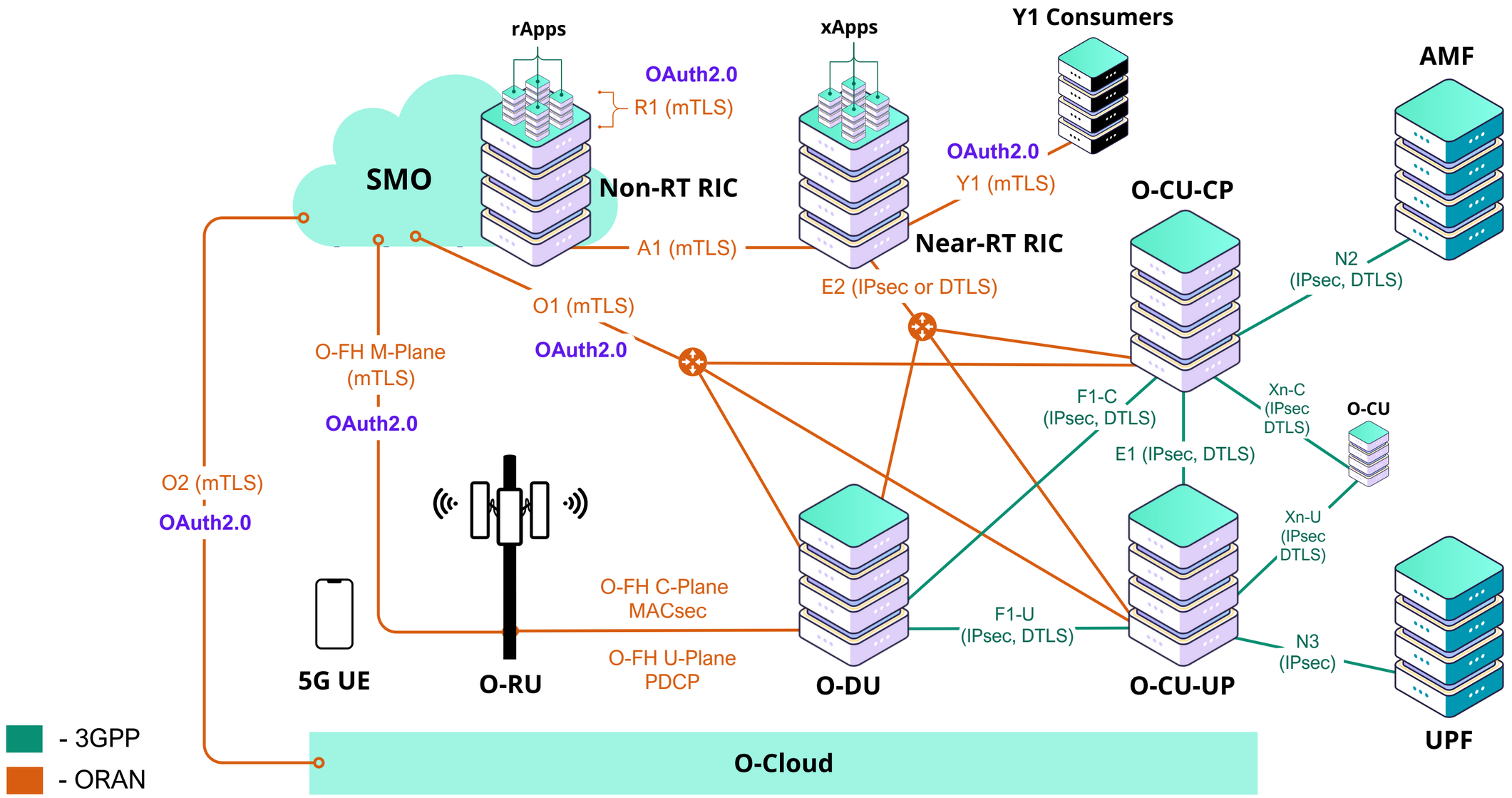
- **Single Point of Failure** - If the NRF fails, NF authentication and authorization collapse
- **Service Disruptions** - NF services become unavailable if the NRF is down/unavailable
- **Unauthorized Access** - A hacked NRF can approve rogue NFs, leading to security threats
- **Data Tampering Risk** - Storing sensitive NF profiles in one location makes them vulnerable
- **Latency in Authentication** - Heavy load on the NRF can slow down NF authorization

Blockchain based OAuth2.0 Authorization

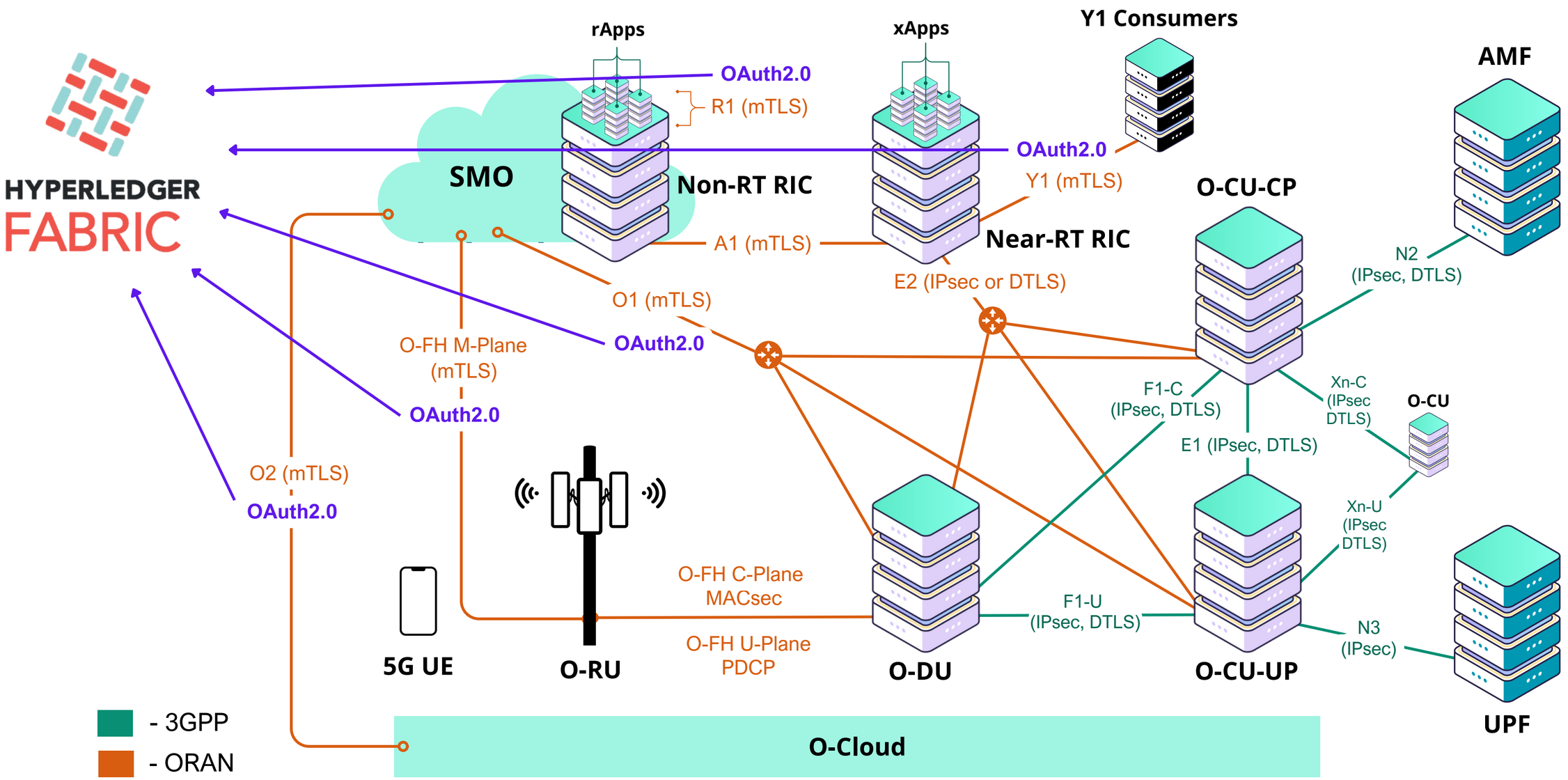


- **Eliminating Single Point of Failure in NF Authentication -** NF Id/public key and profiles are stored on a distributed ledger
- **Immutable & Tamper-Proof NF Profiles for Enhanced Trust -** Once an NF is registered, its profile is stored in an immutable blockchain record
- **Real-Time, Distributed Access Token Verification -** NF Producers validate the access tokens from the blockchain instead of querying the NRF
- **Blockchain-Managed Smart Contract for Automated & Decentralized Authorization -** Replaces NRF's function with automated, decentralized token issuance

Classical Security in O-RAN



Blockchain based OAuth2.0 in O-RAN



PQC integration in Blockchain based OAuth2.0

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- Replacing classical JWT Access Token with **Blockchain based PQ-JWT** (JWT with PQ Support)
  - **OAuth2.0 in 5G Core** – Securing NRF with PQ-based authentication
  - **OAuth2.0 in O-RAN** – PQ integration across R1, O1, O2, A1, and Y1 interfaces
- Replacing classical Certificate Authority with quantum-resistant alternatives (**PQ-CA**)
- **Utilizing ML-DSA and other PQ-signature schemes** instead of classical signature schemes such as Ed25519, Ed448, etc
- Leveraging **QRNG/TRNG for high entropy key generation**
- **Upgrading AES-128 to AES-256** for enhanced security

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Thank You