

Cladari Universal Tagging Architecture: QR / NFC / RFID / NR Integration Blueprint

Core Objective:

Design Cladari to support universal tagging standards (QR, NFC, RFID, and NR codes) from day one, enabling seamless interoperability and scaling across commercial and scientific deployments-up to 10,000+ specimens per enterprise client.

1. Guiding Principle: One Cladari ID, Many Surfaces

Every plant is issued a unique Cladari ID (UPID), which can be expressed through multiple tagging technologies:

Tag Type	Use Case	Encoding Format	Read Method
QR Code	Low-cost, mobile-friendly	UUID or URL payload	Smartphone, webcam
NFC Tag	Consumer-friendly, lab-grade	NDEF record	Phone, NFC reader
RFID Tag	Bulk scanning in nurseries	EPC/UID	RFID scanner/gun
Numeric (NR)	Printed fallback	Plaintext (e.g. CLD-0001)	Manual or OCR

All tags point to the same Cladari record, allowing for fluid integration across devices and environments.

2. Architecture Overview

a. Unique Plant Identifier (UPID)

- Format: CLD-PLT-YYYYMMDD-XXXX
- Linked to: genotype, phenotype, history, tag types, and care data

b. Universal Tag Encoder Module

- Generates all formats (QR, NFC, RFID) for a single ID
- Option to print directly or export
- Supports batch generation

c. Reader-Agnostic Backend

- Accepts input from: smartphone cameras, NFC readers, RFID guns, Bluetooth barcode scanners
- Resolves input ID to correct plant record
- Syncs offline entries once reconnected

3. Scalable Logging Workflows

For Enterprise (10K+ Specimens):

- Bulk import tools (CSV, scanned batches)
- Cloning & propagation manager to duplicate known data and assign new tags
- Mobile batch scan mode (tap, snap, log)
- Auto-tag print queue integrated with Dymo, Zebra, or Epson label printers

For Individual Growers:

- Lightweight mobile app for NFC/QR logging
- Print-at-home QR/NFC-enabled tags
- Snap-and-log photo recognition (coming phase)

4. Hardware Compatibility

Supports:

- USB/Serial/Bluetooth barcode + NFC scanners
- Android + iOS devices w/ camera + NFC
- Desktop NFC writers
- RFID handhelds (UHF/RAIN compatible)
- Raspberry Pi scanning stations (nursery deployments)

Future Optionality:

- DNA watermark integration
- Synthetic tag substrates
- RFID-QR combo tags for redundancy

5. Implementation Steps

a. Airtable Schema Additions

- Fields: Cladari ID, QR Code, NFC UID, RFID EPC, Tag Batch

b. Universal Tag Generator Tool

- Script or UI to generate multi-format tags per Cladari ID
- Print/export options

c. Scanning Interface UI Mockups

- Simple modal for scan -> match -> record -> suggest
- Compatible with web, mobile, or embedded interfaces

Summary

Cladari will launch with a universal tagging system that future-proofs its infrastructure, accommodates enterprise clients, and supports broad adoption across conservation, horticulture, and commercial breeding.

By decoupling data from tag format and enabling multi-format recognition, Cladari becomes the most flexible and scalable provenance engine for living things.

Next Actions:

1. Begin development of Universal Tag Generator Module
2. Update Airtable to reflect tag fields
3. Build mockups for scanning UI
4. Begin sourcing recommended tagging hardware for pilot program