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*-chain: a framework for supplychain management

**Stefano Bistarelli, Andrea Marchini, Ivan Mercanti,
Paolo Mori, Francesco Santini e Carlo Taticchi**

7th DLT Workshop - 28/11/2025



Finanziato
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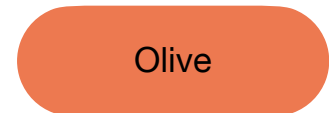


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- Automated framework for generating blockchain-based supply chain management systems
- Uses a Domain-Specific Graphical Language (DSGL) for intuitive graphical modelling
- Converts the graphical model into:
 - Smart contracts on the blockchain
 - Web-based interfaces for participants and consumers
- Key Features: Assets & Containers, Operations, Roles & Access Control

Domain-Specific Graphical Language



Asset: any item or object tracked within the supply chain



Crate

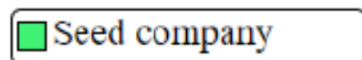
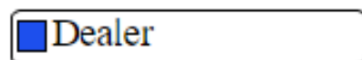
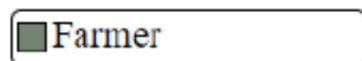
Container: an entity that holds or stores assets



Operations: actions that affect assets or link them together

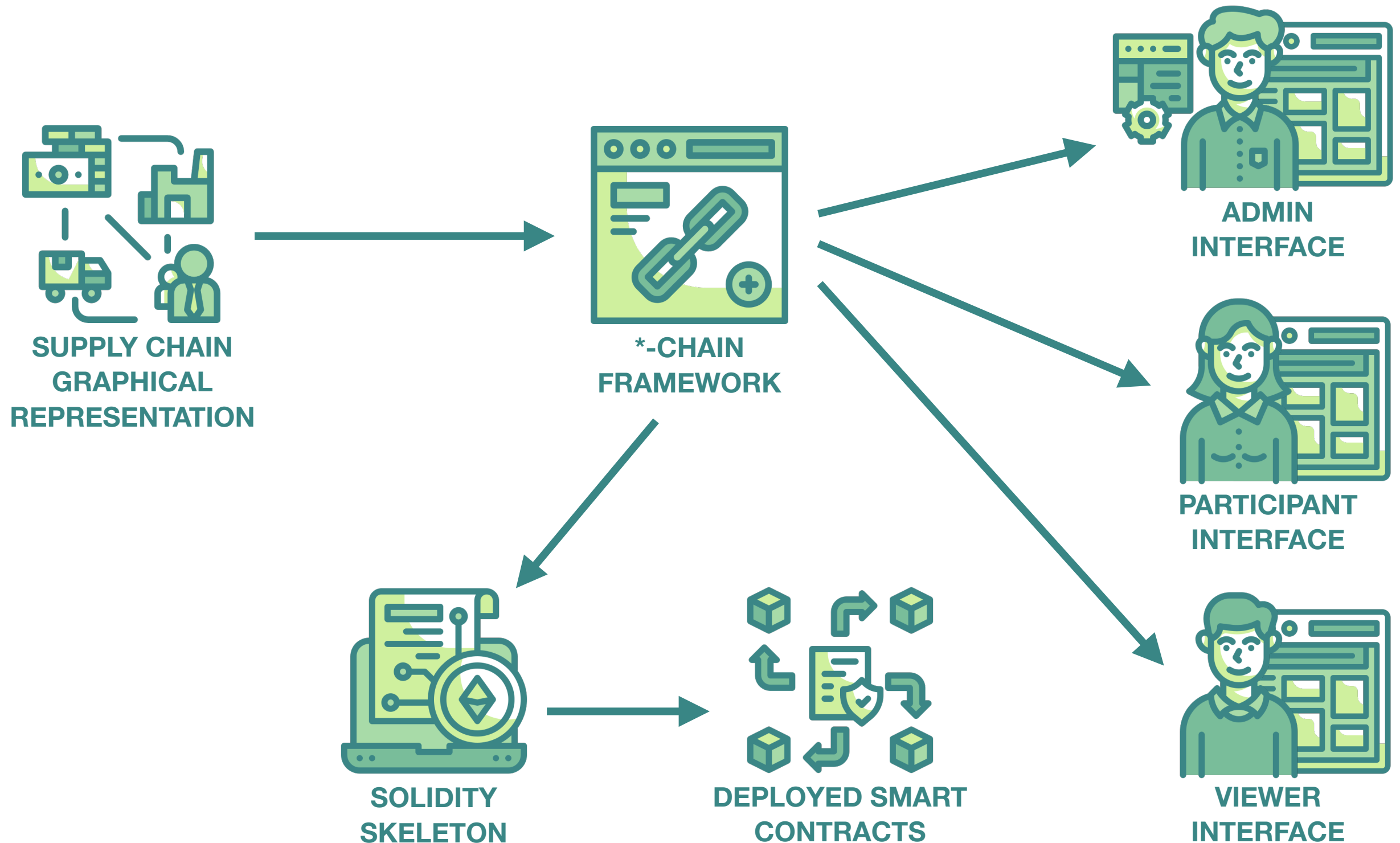


Properties: characteristics or attributes describing an asset

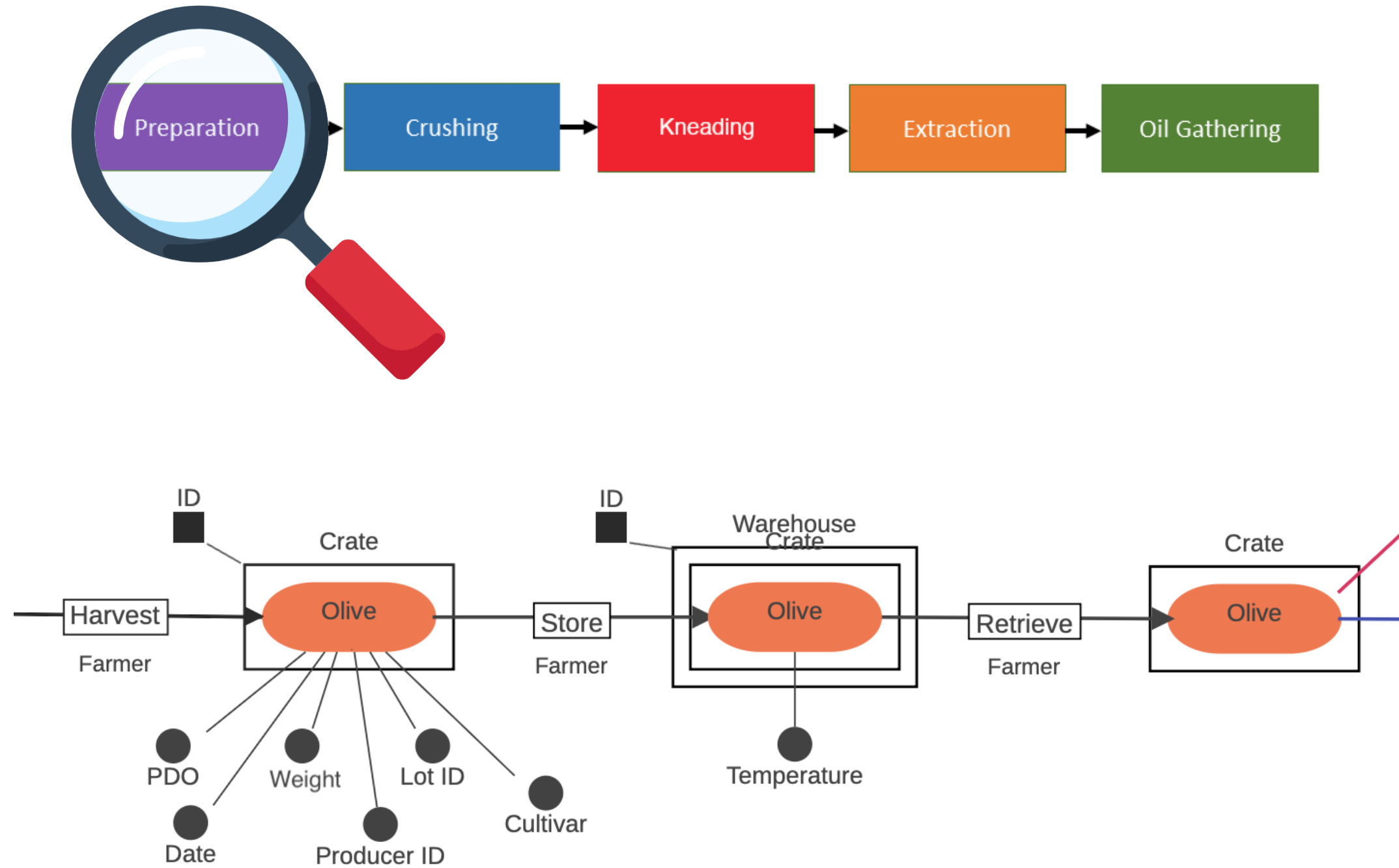


Roles: participants authorised to perform specific operations

The *-Chain Framework

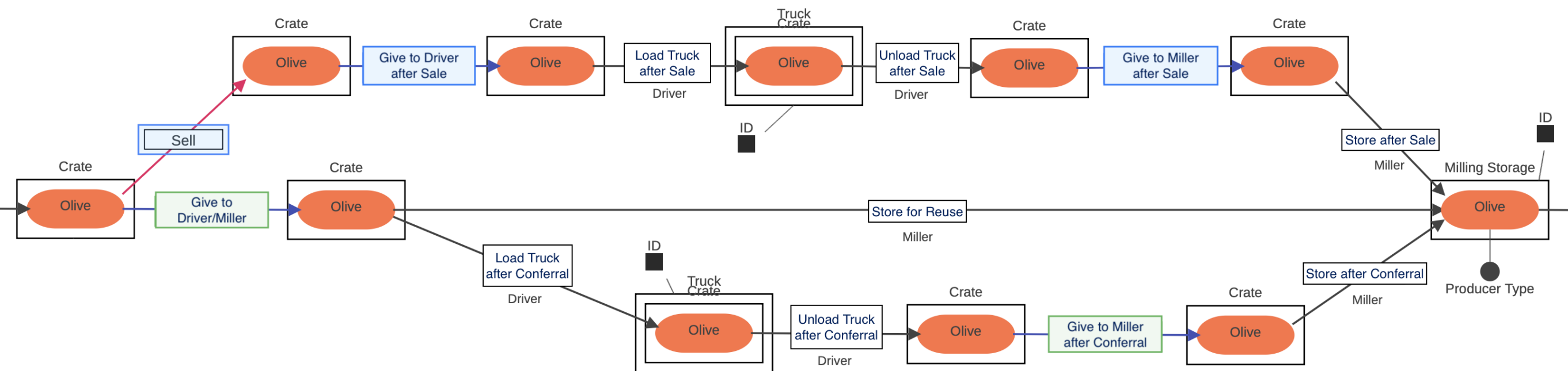


Use Case: Olive Oil Supply Chain



Sale - Reuse - Conferral

- Harvested olives takes one of three routes:
 - reuse (kept and used directly)
 - conferral (delivered to a third party)
 - or sale (transferred to a buyer)



Generated Solidity Code

```
contract contract_0lives {
    bytes32 public constant farmer = keccak256("farmer");
    ...
    enum asset_state { harvest_ed, store_ed, ... }

    function harvest(bytes32 propertiesHash) external {
        address sender = msg.sender;
        require(_roles_contract.hasRole(farmer, sender), "ERROR: incorrect role");
        uint256 _ID = store_0lives_s.length;
        store_0lives_s.push();
        store_0lives_s[_ID].owner = sender;
        store_0lives_s[_ID].controller = sender;
        store_0lives_s[_ID].propertiesHash = propertiesHash;
        store_0lives_s[_ID].state_of_0lives = asset_state.harvest_ed;
        emit asset_history_0lives(_ID, sender, sender, propertiesHash, asset_state.harvest_ed);
    }

    function store(uint32 _ID, bytes32 propertiesHash) external {
        require(store_0lives_s[_ID].state_of_0lives == asset_state.harvest_ed, "ERROR: incorrect state");
        require(store_0lives_s[_ID].controller == msg.sender);
        require(_roles_contract.hasRole(farmer, msg.sender), "ERROR: incorrect role");
        store_0lives_s[_ID].propertiesHash = propertiesHash;
        store_0lives_s[_ID].state_of_0lives = asset_state.store_ed;
        emit asset_history_0lives(_ID, store_0lives_s[_ID].owner, store_0lives_s[_ID].controller,
            propertiesHash, asset_state.store_ed);
    }
    ...
}
```

Admin Interface

Amministratore *.chain

Pagina di gestione dei ruoli per gli utenti del sistema

Lista dei ruoli

- _participant
- fattore
- molitore

Aggiungi Utente

Utente:

Natalina

Indirizzo:

0xc361fc33b99f88612257ac8cc2d852a5cee0e218

Invia

Lista Utenti

John	0x70997970C51812dc3A010C7d01b50e0d17dc79C8
Michael	0x3C44CdDdB6a900fa2b585dd299e03d12FA4293BC
Sarah	0x90F79bf6EB2c4f870365E785982E1f101E93b906
David	0x15d34AAf54267DB7D7c367839AAf71A00a2C6A65
Emma	0x9965507D1a55bcC2695C58ba16FB37d819B0A4dc
Sophia	0x976EA74026E726554dB657fA54763abd0C3a0aa9
Liam	0x14dC79964da2C08b23698B3D3cc7Ca32193d9955
Olivia	0x23618e81E3f5cdF7f54C3d65f7FBc0aBf5B21E8f
James	0xa0Ee7A142d267C1f36714E4a8F75612F20a79720

John

0x70997970C51812dc3A010C7d01b50e0d17dc79C8

Ruoli assegnati

_participant

Revoca

fattore

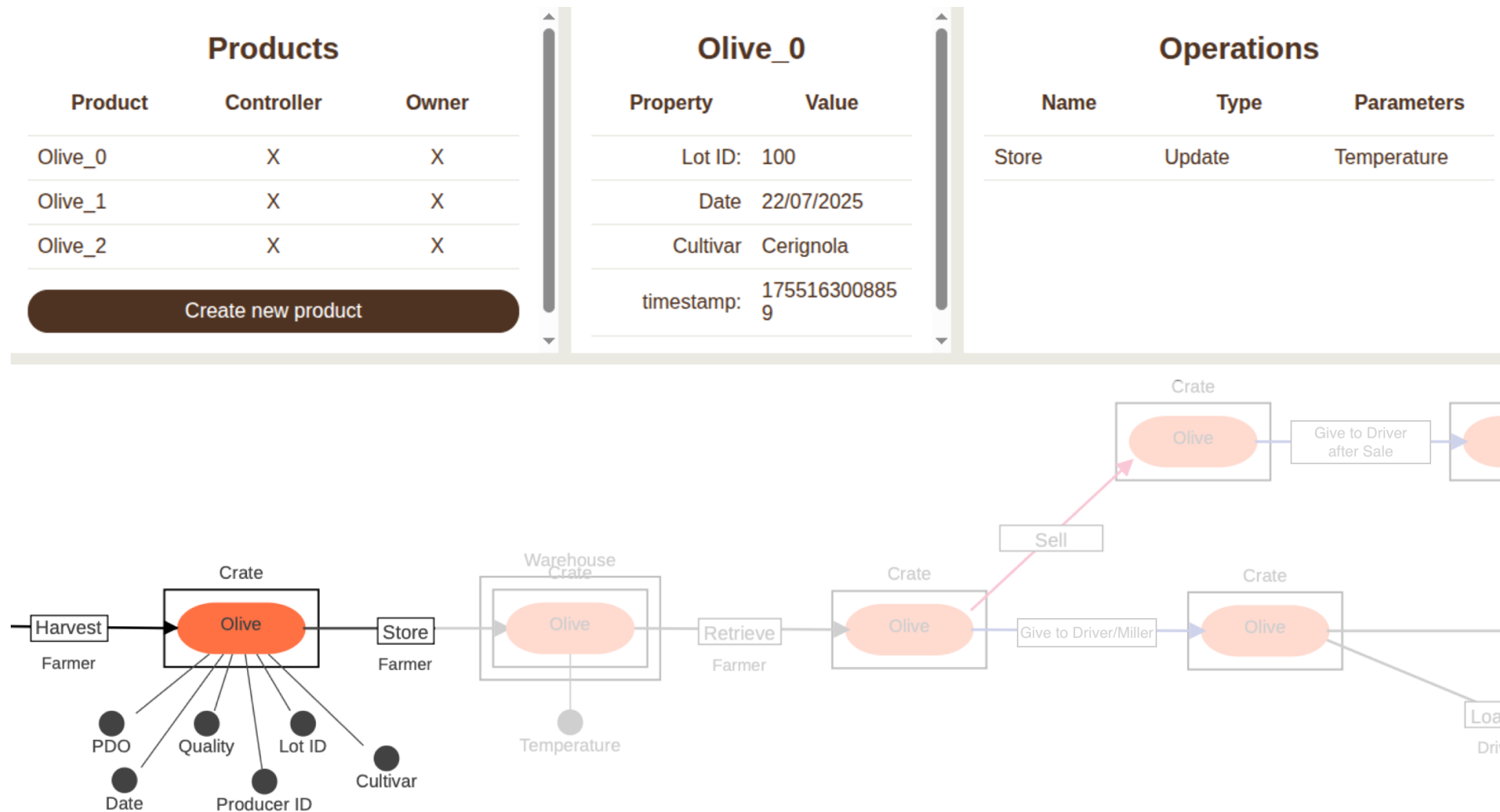
Revoca

Ruoli assegnabili

molitore

Assegna

Participant Interface



Cost Analysis

- Contract deployment is by far the dominant cost (>5M gas)*
- Routine operations are much cheaper (50k - 150k gas)
- The full sale path totals 925k gas, or about €10.5 on Ethereum, €0.04 on Arbitrum, and €0.005 on Polygon**

Operation	Type	Gas Used	Gwei (ETH)	Gwei (ARB)	Gwei (MATIC)	€ (ETH)	€ (ARB)	€ (MATIC)
DeployOlives	deploy	5,402,765	15,451,908	59,430.42	137,230,231	61.2382	0.2355	0.0288
DeployPaste	deploy	606,552	1,734,739	6,672.07	15,406,421	6.8750	0.0264	0.0032
set_contract_OlivePaste	set	44,700	127,842	491.70	1,135,380	0.5067	0.0019	0.0002
set_contract_Olives	set	44,611	127,587	490.72	1,133,119	0.5056	0.0019	0.0002
harvest0	create	123,198	352,346	1,355.18	3,129,229	1.3964	0.0054	0.0007
store0	update	63,975	182,969	703.73	1,624,965	0.7251	0.0028	0.0003
retrieve0	update	46,829	133,931	515.12	1,189,457	0.5308	0.0020	0.0002
give_driver_aftr_sale_prop	giveCtrl	68,899	197,051	757.89	1,750,035	0.7809	0.0030	0.0004
give_driver_aftr_sale_acc	giveCtrlAck	48,474	138,636	533.21	1,231,240	0.5494	0.0021	0.0003
load_truck_aftr_sale	update	46,818	133,899	515.00	1,189,177	0.5307	0.0020	0.0002
unload_truck_aftr_sale	update	46,831	133,937	515.14	1,189,507	0.5310	0.0020	0.0002
give_miller_aftr_sale_prop	giveCtrl	68,923	197,120	758.15	1,750,644	0.7812	0.0030	0.0004
give_miller_aftr_sale_acc	giveCtrlAck	48,454	138,578	532.99	1,230,732	0.5492	0.0021	0.0003
store_aftr_sale	update	46,897	134,125	515.87	1,191,184	0.5316	0.0020	0.0003
sell_prop	sell	68,956	197,214	758.52	1,751,482	0.7816	0.0030	0.0004
sell_acc	sell ack	48,081	137,512	528.89	1,221,257	0.5450	0.0021	0.0003
prepare0	update	47,714	136,462	524.85	1,211,936	0.5408	0.0021	0.0003
press0	transform	151,383	432,955	1,665.21	3,845,128	1.7159	0.0066	0.0008

* Daily gas prices are taken from <https://etherscan.io/gastracker>

** Token prices are taken from <https://coinbase.com> on 27 August 2025



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Grazie per l'attenzione! Domande?

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