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SERICS SECURITY AND RIGHTS IN THE CYBERSPACE

Processi Flessibili su Blockchain

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Joint work with Nawaz Abdullah Malla (UNIFI/UNICAM), Alessandro Marcelletti (UNICAM), Andrea Morichetta (UNICAM)

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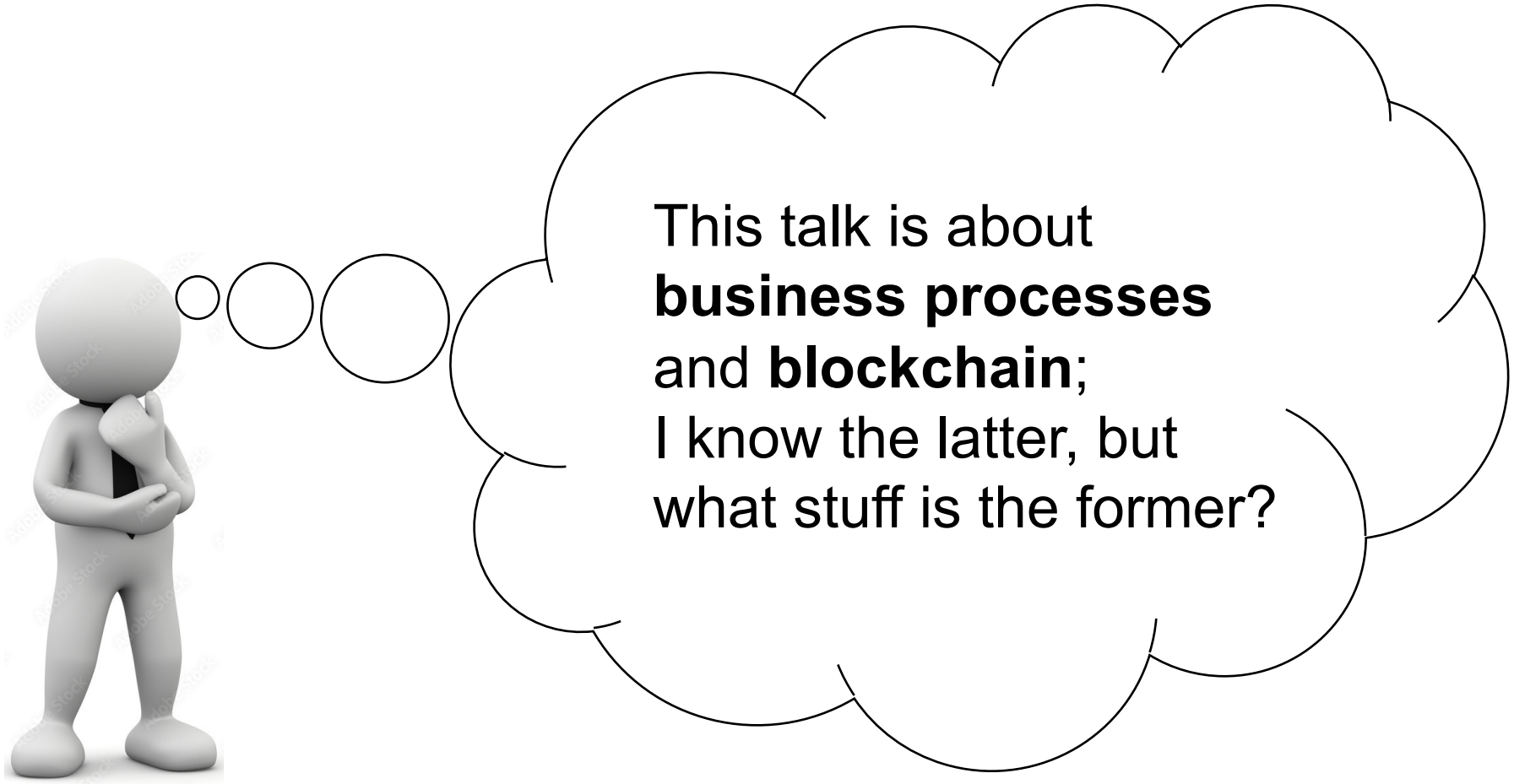
General Context: Business Processes and Blockchain



Business Processes

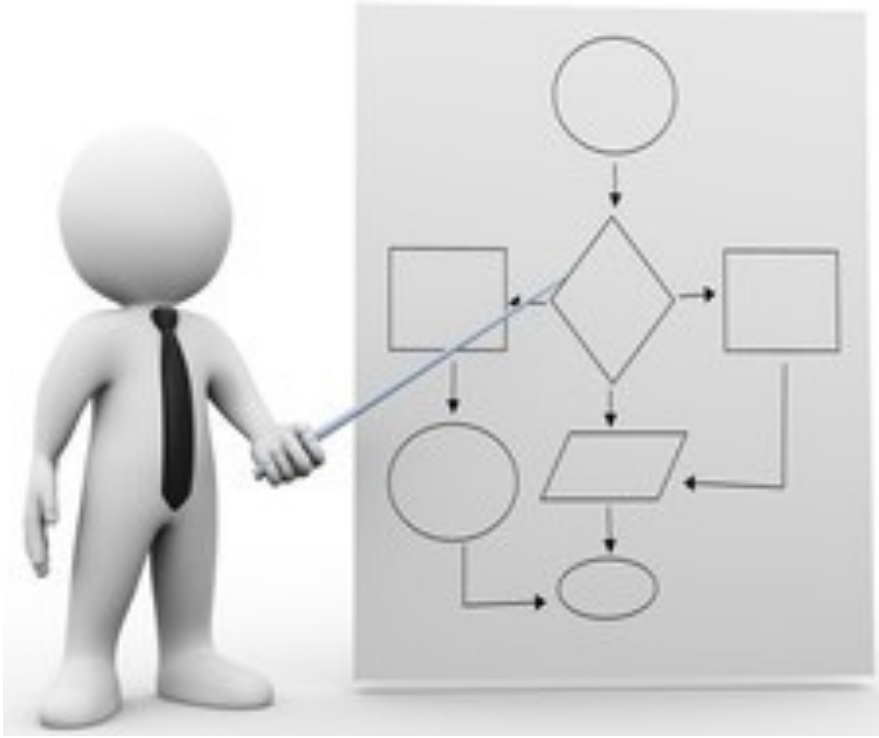
Business Processes

Ways to make money!

Business Processes

A **Business Process** is characterized as

"a collection of related and **structured activities** undertaken by one or more organizations in order to pursue some particular goal"



We can find business processes in several **application domains**:

financial, healthcare, public administration, logistics, robotics, transportation, supply chain, educational, etc.

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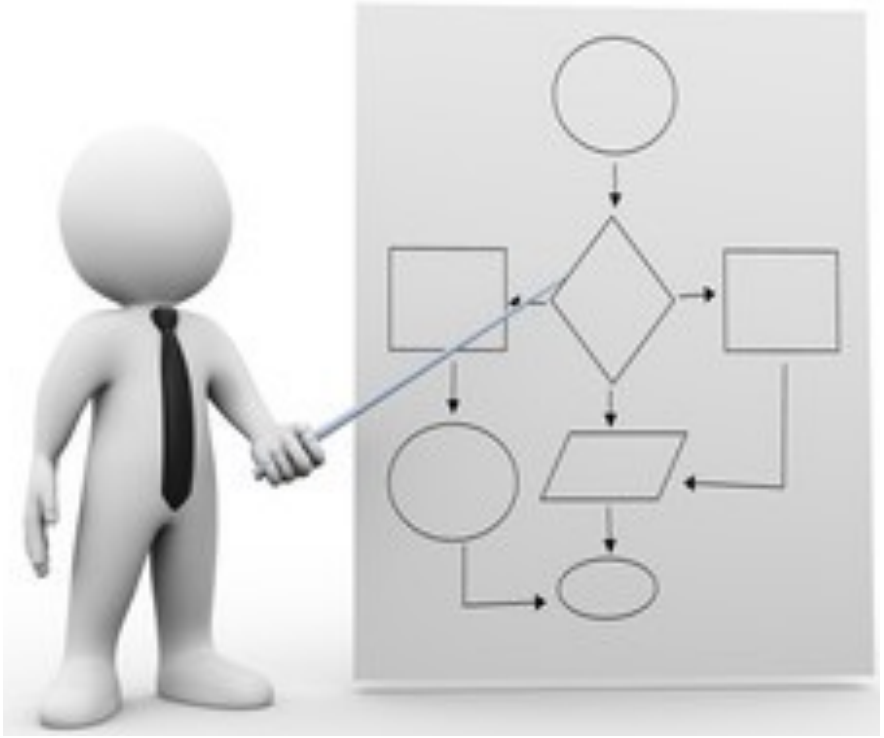

We can find business processes in several **application domains**: financial, healthcare, public administration, logistics, robotics, transportation, supply chain, educational, etc.

Multi-Party Business Processes

Business processes can involve **different parties** that exchange messages and cooperate to reach a *shared business objective*

Business process collaborations

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Business Process Model and Notation

BPMN™ OMG OBJECT MANAGEMENT GROUP®

- OMG standard (v.2.0.2 - Sept. 2013)
- Wide acceptance by industry and academia (de facto standard)
- Intuitive graphical notation
- Informal token-based semantics
- Supported by a wide spectrum of tools
  - modelling
  - analysis
  - enactment

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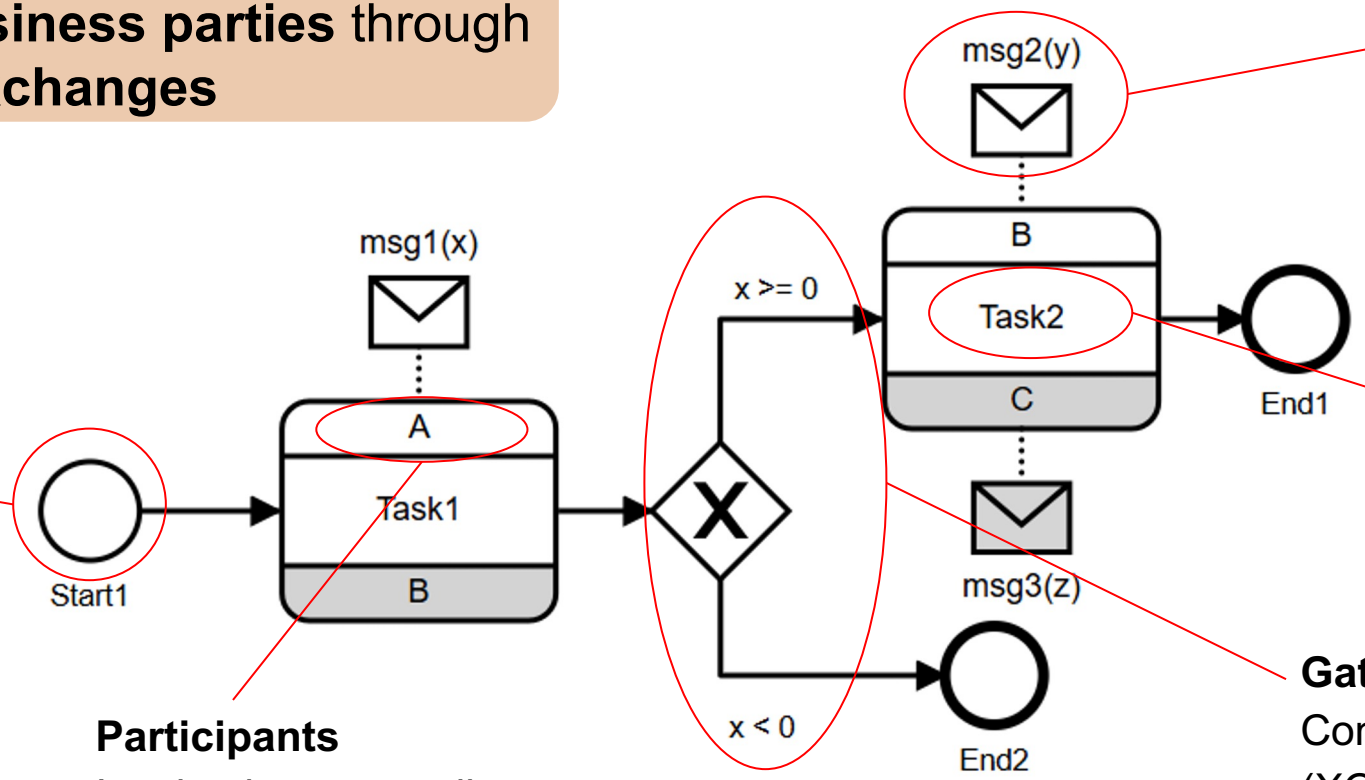
BPMN Choreographies

Defines the **interactions** occurring between **business parties** through **message exchanges**



Messages
Data to be sent from a party to another

Start/End Events
Begin and end choreography

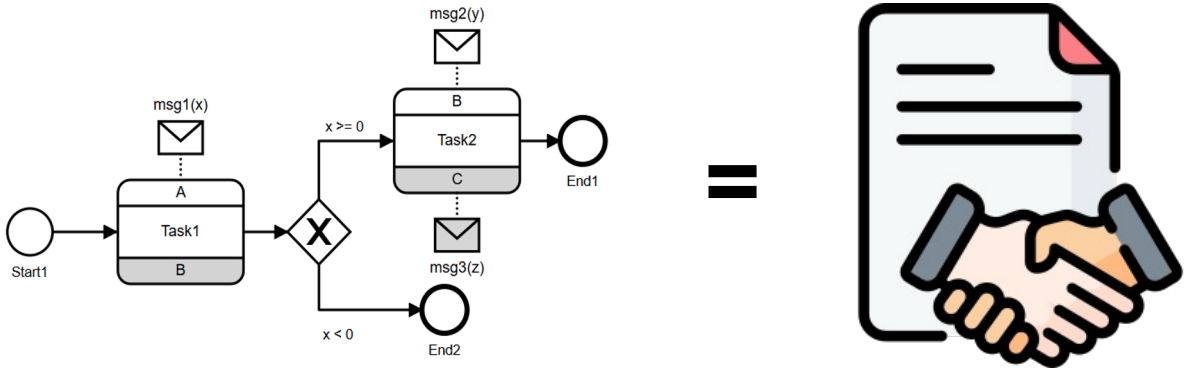
Task
describes the interactions

Participants
Involved party sending messages

Gateways
Control flow (XOR, AND)

Choreographies as Contracts

A choreography can be thought of as a **contract** between the involved parties



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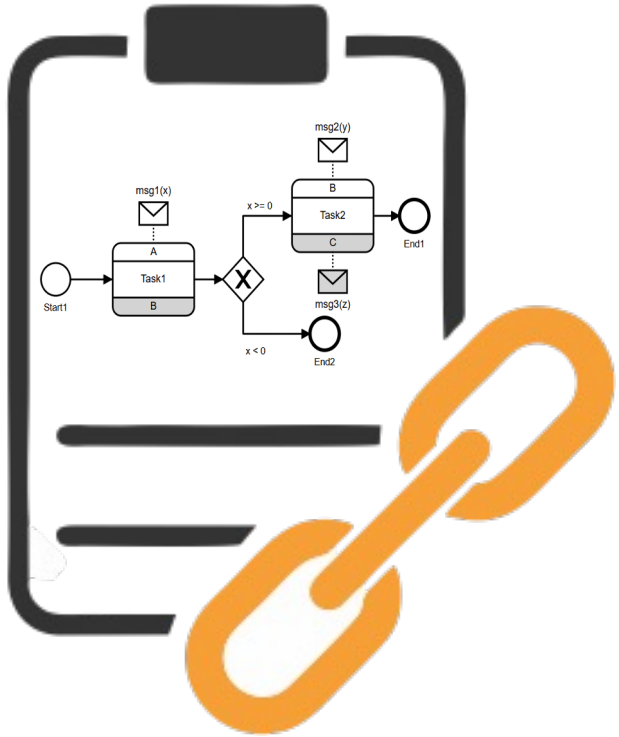
Business Processes & Blockchain

Choreography diagrams can be used *for supporting the execution of multi-party business processes*

- Are equipped with *formal semantics*
- Are mapped to **smart contracts** for enabling **trustworthy and tamper-proof execution** of distributed interactions *without relying on a third party*



The challenge

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The challenge: flexibility

Real-world Contracts and Processes are **flexible**

- Contracts with banks, telephone companies, energy companies, etc. may change (often unilaterally)
- Flexibility is desirable to deal with factors exogenous and endogenous to processes, e.g. new laws, market dynamics, or changes in customers' attitudes

Flexibility can allows an enterprise to remain competitive in the market and succeeds in its business goals

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The challenge: flexibility in the blockchain

Blockchain introduces new challenges, with **flexibility** one of the most critical

Due to immutability, smart contract code cannot be directly updated once deployed, making it challenging to deal with runtime changes

Our objective

Enable the flexible execution of BPMN choreographies over a public blockchain while preserving trust, modularity, and semantic clarity

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Algorand Blockchain

Algorand is a public permissionless blockchain with two major advantages:

Fixed transaction costs, opening solutions for optimizations and fast finality

Smart contracts can be **updated at runtime** with a predictable cost

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Our Proposal

Algorand-based approach for flexible and trusted execution of multi-party business processes specified in terms of BPMN choreographies

Modular Design and Semantics-Driven Translation

→ Improve readability and trust in the process logic

Runtime Flexibility

→ Avoid complex proxy patterns

→ Preserve process continuity (all references to the contract remain valid)

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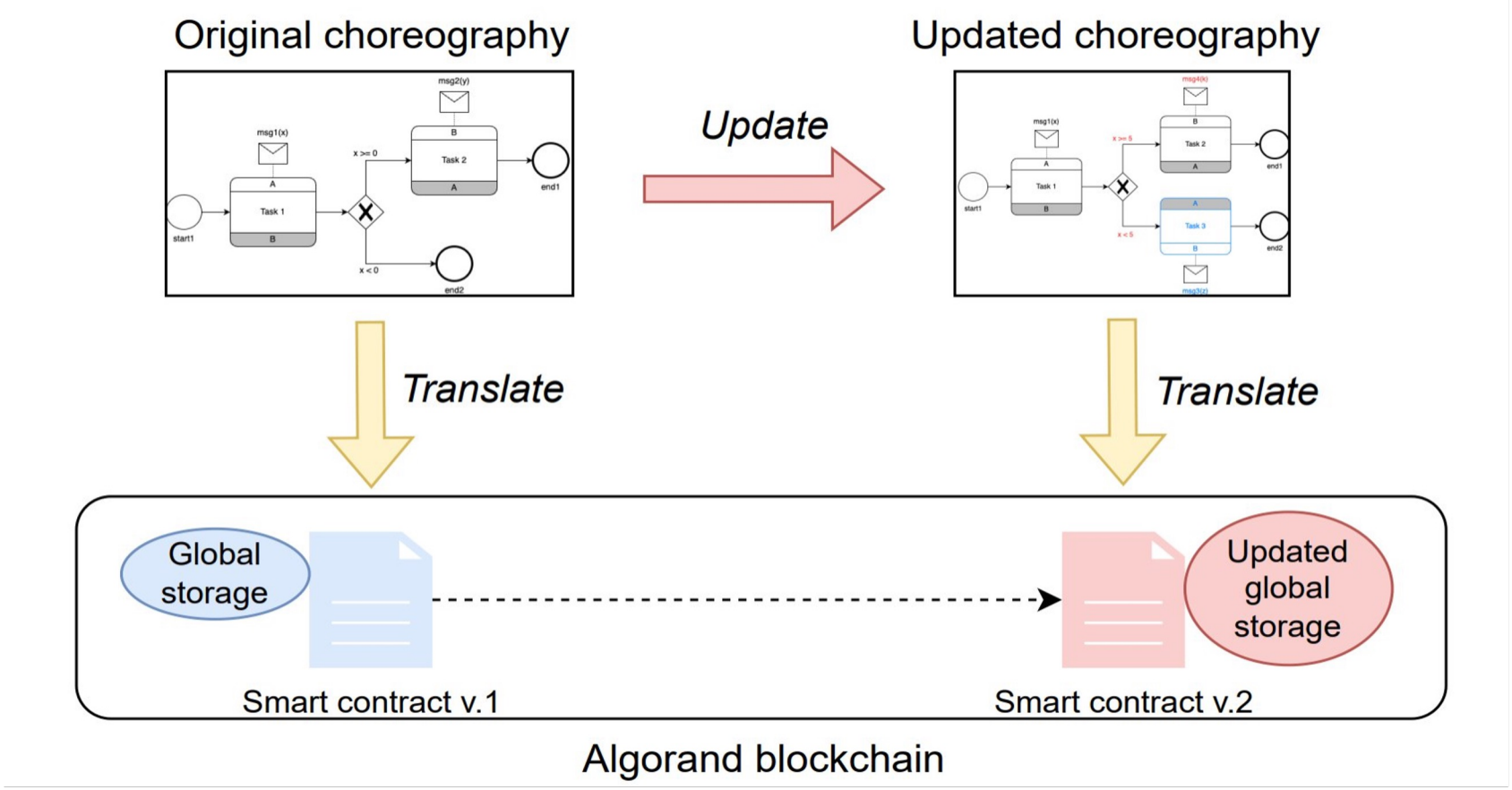
The Approach



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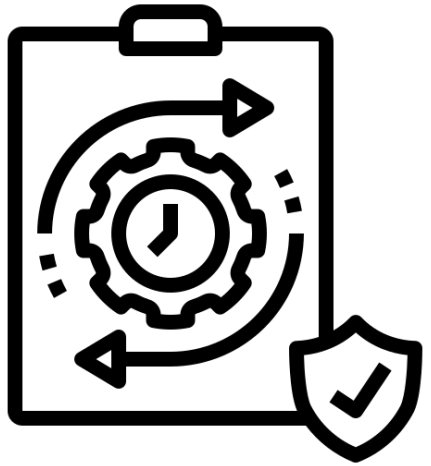
Policy-driven update



The **update mechanism** of the smart contract can be governed through a **policy-based control mechanism**

The policy can authorize/deny an update request according to given conditions

- e.g., once Task1 is executed the choreography update is disabled

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Thank you!

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