Co-City: blockchain enabled urban commons

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Abstract—**We present Co-City, an Urban Innovative Action project funded by the European Commission. Co-City proposes a collaborative management of urban commons to counteract poverty and socio-spatial polarization through the combined use of different actions. In particular, we are developing a Proof of Concept based on distributed ledger technology that enables the development of local economy models.**

Keywords— Blockchain, Distributed ledger, Urban Commons

I. INTRODUCTION

According to several studies, 54 per cent of the world's population live in urban areas. Although few studies have adopted an EU-wide perspective in the analysis of the effects of the economic crisis, its impact on incomes and European welfare states has been considerable. The importance of the need for innovation in social services has been recognized by the EC Bureau of Economic Policy Advisors' report In particular, the municipal welfare system, which since the early part of the twentieth century has guaranteed a certain degree of social cohesion and solidarity, is weakened as a result of the 2008 financial crisis.

From this scenario emerges the idea that citizens can take care of urban spaces which is motivating municipalities to find a social, economic and legal framework to encourage inhabitants to collaborate with the public administration, creating new jobs and new forms of welfare based on proximity, solidarity and cooperation. New forms of self-organized communities are rediscovering the old practices of the commons as described by the 2009 Nobel Prize winning economist Elinor Ostrom [1]. Moreover, technology is also changing the economy, even redefining the concept of labor in the new sharing economy, or rather gig economy as it is called due to its negative effects. While it allows the reuse of assets such as underused rooms, apartments and cars in a global market, the benefits mostly go to foreign near monopolists of the technological market. The users of such services end up in a state of self-exploitation as they freely give away value produced through their social relations and activities. The platforms extract value without sharing it with the peers who generated it.

II. CO-CITY PROJECT

Co-City [2] is the winner of the first Urban Innovation Action Call funded by European Commission. If proposes to break the self-reinforcing circle of poverty, social segregation in deprived neighbourhoods and lack of participation. It achieves this by supporting the development of an innovative, polycentric "commons-based urban welfare" composed of generative communities centred on urban commons, low-cost service co-production, social mixing, and care of public spaces. Co-city aims to provide:

- an unconventional legal framework to enable citizens to take care of urban commons

- an innovative ICT infrastructure for local social market and networking

- management tutoring towards economic sustainability

The classical authoritative approach is replaced by a collaborative one that considers citizens as potential changemakers, agents of virtuous circular processes of commoners' welfare. Meanwhile, the public sector evolves from being a service provider to be an enabler and a partner.

Within Co-city, the University of Turin is responsible for the Co-city Toolkit, involving different departments, such as the Department of Computer Science, Law, Economics, Culture, Politics and Society.

A. The Economy of Commons

Within the Co-city project, the new interdisciplinary group of the University of Turin on Blockchain technologies [3] is responsible of the study of a local collaborative decentralized environment in which citizens that collaborate to the reuse of urban commons can benefit of new forms of welfare by obtaining credits in a cryptocurrencies (sort of job vouchers) that can be used in local shops and workshops or exchanged with different kind of goods, like, coupons, gift cards, loyalty

points, aiming to create a sort of "local-based circular economy". Distributed Ledgers, and Blockchain technologies in particular, allow a qualitative leap in making several circuits interoperable. The availability of a personal wallet for citizen and the use of smart-contracts will allow the implementation of complex business logics, enabling new forms of local financial tools. Finally, we propose an integration with the civic social network FirstLife [4], that provides to the users a georeferenced tool to interact at a local scale, based on an interactive map and a timeline.

III. CoCity Proof of Concept

Since we need an instrument to enable Co-City goals, by means of the Blockchain Technology, we designed and developed a Proof of Concept Web application. This PoC aims at giving to end-users a "Blockchained" Experience on creating and trading local cryptocurrencies, to empower new local economies (Crowdfundings, Crowdsales...).

A. Frictionless UX

Our end-users have very limited or no experience at all in managing cryptocurrencies, starting from the basics of what a wallet is, how the tokens are created and stored in a blockchain, how they can be exchanged and converted, and so on. The PoC frontend interface is designed to create a use-case driven experience and a metaphor with existing real objects (e.g coupons) and patterns (crowdfunding). This approach should make people concentrate on project goals and activites, rather than worrying about how the Blockchain technology works.

Since different actors can access to the PoC Interface in many different physical spaces (offices, local stores, common open spaces), we chose and develop a responsive Web app interface. This approach diminished the effort of building native specific interfaces for mobile devices and unifies the interaction between different devices.

B. Modular Use Cases: The Smart Contract Co-City Ecosystem

Inside the PoC Web Interface, except from basic operations about the Token lifecycles, we decided to create a modular set of functionalities to end users. This modularity has been granted, developing a *Smart Contract Ecosystem*, based on *Factories* and *Templates*. Templates are Smart Contracts, from which one can create his own economic instruments and functionalities, like basic Pre-saled Tokens, Crowdsales, Coupon, and so on. Factories are helper Smart Contracts, that create single Smart Contract instances from Templates. Any Smart Contract Factory defines a new use case inside the web app. When a user creates his own economical instrument inside the web app, a form is filled with the data that describe the instance (e.g. for a new Token you have to choose a name, a unique Icon and a unique Ticker). When the form is submitted, the corresponding Factory is invoked and a new Smart Contract instance is created and assigned to the user as the Administrator of the Smart Contract. For security reasons, any Factory saves a mapping between every new Smart Contract instance and his

administrator(s). Only the administrators can call their Smart Contract single instances, so that no one can alter their wallet state.

IV. Co-City PoC Architecture

At this stage of the development we assume to run the first release of the PoC on a private blockchain, based on Ethereum architecture, but the current architecture is fully compatible both to test and main nets. Since actual technology solutions limits client-side wallet operation on mobile device, Ethereum wallets are created and stored on the backend side.

Communication and business logic between frontend and blockchain is driven by a backend set of API, that supports business logic, identity management and off-chain storage.

This set of API is based on REST communication from backend to frontend interface. It is built to be extensible and reusable, so that other applications can be developed over the same architecture. From the same API set, anyone could build native apps for mobile devices, simply invoking the REST API endpoints, from within the native app. On the other side, this backend architecture can host other set of functionalities, just extending the REST API set, according to the same communication pattern between frontend and backend.
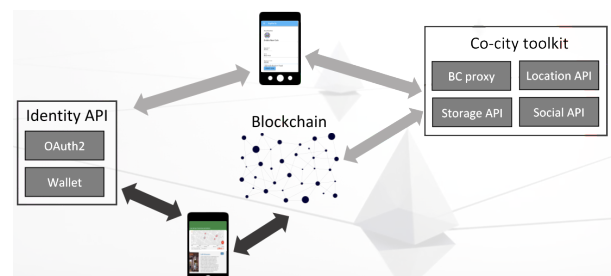

Fig. 1- Co-City PoC Architecture

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