MeshDApp: Blockchain-enabled Crowdsourced Internet Access Platform for Mesh Networks

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Routing of data + economic flows

- Forwarding of data traffic
- Forwarding of economic traffic
- In an operational and sustainable network
- Inspired by the economic compensation in the guifi.net community network
Contribution

- An **automated** mechanism where diverse participants, resource providers and consumers, can pool these resources
- with the confidence that the **consumption** of resources is accounted **fairly**,
- and that these calculations and money transfers are **automated**, **irreversible**, **inexorable** and shared across different participants,
- to avoid the cost, delays, errors and potential mistrust from manual accounting and external payments.
Concepts

- Automation = occurring as a necessary consequence
- Fairness = impartial, no discrimination
- Irreversible, irrevocable, unalterable
- Inexorable = inevitable
Conceptual architecture

Mesh Network Island

Access Point

Gateway

Monitoring System

NodeDB

User

R1

R2

R3

R4

S1

S2

Blockchain Network

Mediator

Blockchain Network

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Economic compensation

- Fairly distribute the economic value of the connectivity supplied by the network among providers: the nodes and services \{AP, R, GW, S\} who contributed to deliver that value.

- **Retailers** (service providers) get Funds in exchange of forwarded Bytes:

\[
\text{Collected}(t) = \sum_{r=1}^{R} \sum_{c=1}^{C} (B_{r,c}, F_{r,c}) = (B, F) \text{ in period } p_t
\]

where: 
- \( r \) is a retailer among the set \( R \)
- \( c \) is a customer among the set \( C \)
Wholesale

\[ Owed(t) = \sum_{0 < f < F} \text{Settle}_n(B(t, f), F(t, f)) \text{ at period } p_t \]

\textit{where:} \ f \text{ is a forwarder among the set } F \\
\text{ } n \text{ is a settlement event for period } p_t

Mediator

Payments spread across the value/service chain of network devices, achieved according to idea of fairness of settlements, such as proportional share or Shapley value.

\[ \text{maximize } U_i \ (\forall \text{ consumer } c, \text{ device } f, \text{ time } t) \]

\[ \text{subject to } U(c, t) > 0, \ c = 1, \ldots, C, \]
\[ U(f, t) > 0, \ f = 1, \ldots, F, \]
\[ Owed(f, t) - \text{Price}(f, t) \geq 0, \ t = 0, \ldots, T \]
Smart contracts

User Service (US$_C$)
Service Factory (SF$_C$)
Forwarding (FW$_C$)
Oracle (OR$_C$)
ERC721$_C$
ERC20$_C$

Consumption Contracts
Provision Contracts
Contracts

- Decentralized Autonomous Organization
- Fungible connectivity tokens ERC20
- Non-fungible device ownership tokens ERC721
- Oracle
- Service Factory
- User Service contract
- Forwarding Contract

- *Local Ethereum PoA network (permissioned)*
Processes

- Bootstrapping a new network
- Registering (Minting) a new device
- Establishing an Internet connection
- Economic compensation
Implementation
Value flows

![Graph showing value flows over iterations for Client funds, Reserve account, Router, and Gateway.]
Discussion

- Coupling of Data and Value Flows
- Service pricing and incentives
- Diversity and quality
- Private Blockchain pros and cons
Conclusions

- Automated routing of data + economic flows
- Future:
  - Return of investment
  - Cost vs profit oriented
  - Charging policies, differentiation?
  - Pilots
  - Token economy, local currencies
  - Check requirements for identity, anonymity, authorization, traceability