

Problem Statement: Establishing Technical Metrics to Evaluate the 'Decentralization' of Blockchain Networks

Context

Major jurisdictions are actively developing comprehensive regulatory frameworks for digital assets. A core challenge in these efforts is how to classify digital assets, as this classification can significantly alter the applicable regulatory regime and legal obligations.

- In the **United States**, the proposed "Digital Asset Market Clarity Act of 2025" (CLARITY Act) attempts to clarify jurisdiction by proposing specific criteria for a "mature blockchain system." Regardless of the bill's legislative outcome, the need for objective criteria to determine an asset's nature remains a top priority for regulators.
- In **Japan**, the Financial Services Agency (FSA) is considering a classification system that distinguishes assets based on their use for fundraising and acknowledges that an asset's category may change as its underlying project decentralizes.
- In the **United Kingdom**, the government is pursuing a phased approach to bring various crypto-asset activities within the existing financial services perimeter. This approach also acknowledges that the degree of decentralization is a key factor in determining whether an asset or activity fits within traditional regulatory categories, leaving the specific criteria for this distinction as a critical area for development.
- **Other jurisdictions** also face similar challenges. The EU's Markets in Crypto-Assets Regulation (MiCA), for example, excludes services that are "provided in a fully decentralised manner" from its scope, yet the technical criteria for making this determination remain undefined.

These global developments indicate that legal frameworks are increasingly attempting to use the technical reality of a blockchain, specifically its degree of decentralization, as a basis for legal classification.

Gap

A significant gap exists between the regulatory concepts of "maturity," "decentralization," and "control," and the **Technically Verifiable Metrics** needed to objectively evaluate them.

Current legal discussions remain conceptual and qualitative, lacking a common framework to answer critical technical questions, which may include the following:

- **Measuring Control:** How can network control be measured? Is token-based voting power sufficient? How should the influence of core developers, the operators of key infrastructure like RPC nodes or sequencers, and off-chain governance structures be quantified and incorporated into the assessment?
- **Evaluating Diversification:** How can the distribution of token holders be accurately assessed? Is a simple count of wallet addresses adequate? How can we estimate the true distribution of beneficial ownership, accounting for assets held in custody on exchanges and the potential for Sybil attacks?
- **Demonstrating Utility:** How can on-chain data, including metrics like transaction volume, smart contract executions, and active user counts, be interpreted to distinguish between speculative demand and genuine use?

This gap is particularly pronounced in dynamic events such as **hard forks** or projects undergoing **progressive decentralization**. A forked network may share the same code as its predecessor but have an entirely different governance and control structure, making its classification under ambiguous criteria extremely difficult.

Impact

If this gap remains unaddressed, it could lead to several significant challenges:

- **Hindrance to Innovation:** Project developers face legal uncertainty, unable to predict when their network might be deemed "mature" or "decentralized." This stifles development and can lead to a **"brain drain" and business exodus** as projects move to jurisdictions with clearer regulations.
 - **Reduced Regulatory Effectiveness:** Without clear technical standards, the application of regulations becomes highly discretionary, risking **arbitrary and inconsistent enforcement**. This can erode trust among market participants.
 - **Inadequate User Protection:** Users and investors cannot determine the legal status of their assets, which makes **proper risk assessment difficult**.
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Objective

The objective of the discussion is to establish a **technical framework and a set of metrics to evaluate the "maturity and decentralization" of a blockchain**, thereby providing valuable input for regulatory discourse.

Specifically, we aim to achieve the following:

1. **Establish a Common Vocabulary:** Identify a set of technically definable and measurable parameters that correspond to legal concepts like "control," "diversification," and "utility."

2. **Standardize Evaluation Methodologies:** Discuss and propose standard methods for analyzing and quantifying these parameters using on-chain and other publicly available data, for instance, the Nakamoto Coefficient, Gini coefficient, and network topology analysis.
3. **Develop a Dynamic Assessment Model:** Define the requirements for an assessment model that can adapt to dynamic network events, such as hard forks and governance changes.

Ultimately, this discussion aims to lay the groundwork for a **"technical toolkit"** that allows all stakeholders, such as regulators, developers, auditors, and investors, to assess a network's level of decentralization more objectively and predictably. This will help bridge the gap between legal principles and technical reality, fostering both sound innovation and effective user protection. Furthermore, such a framework would provide a valuable reference for jurisdictions that are in the early stages of developing their own digital asset regulations.