If the true north metric of a bitcoin treasury company is BTC yield, what is the true north metric for a Bittensor treasury company that stakes both TAO and alpha?

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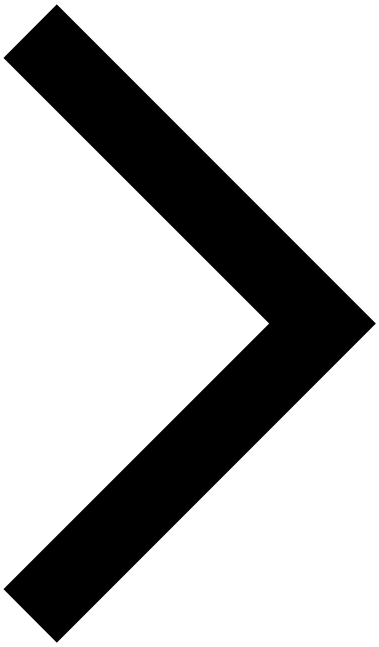

To determine the true north metric for a Bittensor treasury company that stakes both TAO and alpha tokens, we start by understanding the concept of a "true north metric" and how it applies in a similar context. For a Bitcoin treasury company, the true north metric is BTC yield, which represents the return or growth in Bitcoin holdings achieved through strategies like staking, lending, or other yield-generating activities. This metric guides the company's decisions to maximize its Bitcoin-based returns. By analogy, the true north metric for a Bittensor treasury company should reflect its primary goal in managing and growing its holdings within the Bittensor ecosystem, specifically through staking TAO and alpha tokens.

Understanding Bittensor and Staking

Bittensor is a decentralized network designed for machine learning models, where TAO serves as the native token, similar to BTC in the Bitcoin ecosystem. Alpha tokens, on the other hand, are unique to each subnet within Bittensor—specialized segments of the network focused on specific tasks or models. Staking in Bittensor involves two key assets:

- **TAO**: The primary token, which can be staked directly in subnet 0 (the root network) to earn TAO rewards or exchanged for alpha tokens when staked in other subnets.
- **Alpha Tokens**: Subnet-specific tokens received when TAO is staked in a subnet. These alpha tokens can then be staked with validators within that subnet to earn additional alpha token rewards.

The staking process in Bittensor works as follows:

- The treasury company stakes TAO in a chosen subnet, exchanging it for that subnet's alpha tokens based on an automated market maker (AMM) pool's exchange rate.
- The alpha tokens are then staked with a validator in the subnet to earn rewards, paid in additional alpha tokens.
- When unstaking, the alpha tokens are withdrawn from the validator and can be converted back to TAO via the AMM pool, with the exchange rate determined by the ratio of TAO to alpha tokens in the pool.

The company earns rewards, or emissions, from this staking activity:

- In subnet 0, emissions are paid in TAO, distributed based on the amount staked.
- In other subnets, emissions include both TAO (allocated to the subnet based on its total staked TAO) and alpha tokens (2 per block per subnet, distributed to participants like validators and their delegators).

Since the treasury company stakes both TAO and alpha, its portfolio consists of TAO held directly, alpha tokens staked in various subnets, and the rewards earned from these activities.

Defining the True North Metric

The true north metric should encapsulate the company's success in generating returns from its staking strategy, mirroring how BTC yield measures returns for a Bitcoin treasury company. In Bittensor, staking rewards are tied to emissions, which are influenced by:

- The amount of TAO staked in a subnet, affecting the subnet's weight and its share of network-wide TAO emissions.
- The alpha tokens staked with validators, determining the share of subnet-specific emissions.

The rewards are received as:

- TAO from staking in subnet 0 or from subnet allocations.
- Alpha tokens from staking in other subnets, which can be converted back to TAO.

Given that TAO is the primary currency of the Bittensor network—similar to BTC in Bitcoin—the most consistent and practical way to measure the treasury's performance is in TAO terms. Alpha tokens, while valuable within their subnets, derive their worth from their exchangeability with TAO, and their price fluctuates based on subnet performance and staking activity. Thus, the true north metric should focus on the growth or return of the treasury's holdings, expressed as TAO.

Calculating the Metric: TAO Yield

For a Bitcoin treasury company, BTC yield is typically the percentage increase in Bitcoin holdings over time, often annualized as an annualized percentage yield (APY). Similarly, for a Bittensor treasury company, the TAO yield can be defined as the rate at which its total holdings increase in TAO terms through staking rewards. This includes:

- **TAO Rewards**: Earned directly from staking TAO in subnet 0 or as part of subnet emissions.
- **Alpha Token Rewards**: Earned from staking alpha tokens in other subnets, converted to their TAO equivalent based on the current AMM exchange rate.

The TAO yield can be expressed as the **annualized percentage yield (APY)**, which measures the effective return on the initial TAO staked. For example:

- If the company stakes 100 TAO across various subnets, it might earn 5 TAO from subnet 0 and alpha tokens equivalent to 10 TAO from other subnets over a year.
- The total return is 15 TAO on an initial 100 TAO, yielding an APY of 15%.

This APY accounts for:

- Emissions received directly in TAO.
- The TAO equivalent of alpha tokens earned, reflecting their current convertible value.
- The compounding effect of reinvesting rewards, if applicable.

Why TAO Yield?

Several factors support TAO yield as the true north metric:

- **Consistency with BTC Yield**: Just as BTC yield focuses on returns in Bitcoin, TAO yield focuses on returns in TAO, providing a unified measure for a TAO-based ecosystem.
- **Portfolio Management**: A treasury company needs a single, liquid metric to assess its performance across diverse staking positions (TAO in subnet 0, alpha in various subnets). TAO, as the network's base currency, fits this role.
- **Practicality**: Platforms like Taostats and Tao Yield already provide APY calculations for Bittensor staking, typically in TAO terms, suggesting this is a standard approach.
- **Strategic Alignment**: Maximizing TAO yield aligns with growing the treasury's assets, whether by accumulating more TAO directly or optimizing alpha token staking for high TAO-equivalent returns.

While alpha token appreciation could be a factor (since their value depends on subnet success), it's secondary to the yield from emissions, as the company can choose to hold or convert alpha tokens. The current TAO equivalent of rewards provides a clear, immediate measure of performance, akin to BTC yield's focus on realized returns.

Conclusion

The true north metric for a Bittensor treasury company that stakes both TAO and alpha tokens is the **TAO yield**, specifically the annualized percentage yield (APY) from its staking activities. This metric captures the total return in TAO terms, including TAO earned directly and the TAO equivalent of alpha token rewards, guiding the company to maximize the growth of its holdings within the Bittensor ecosystem. Just as BTC yield drives a Bitcoin treasury company, TAO yield serves as the north star for its Bittensor counterpart.

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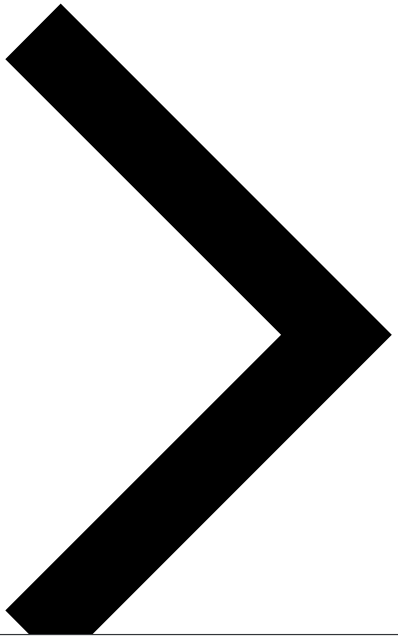
What is the formula to calculate TAO Yield?



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To calculate the **TAO Yield** for a Bittensor treasury company, we need a formula that reflects the return on TAO staked across different subnets. This yield accounts for both direct TAO rewards and rewards from alpha tokens, which are converted back to TAO. The approach is analogous to traditional yield calculations, such as Bitcoin yield, where the yield is the percentage increase in holdings over time based on rewards relative to the initial investment.

Formula for TAO Yield

The TAO Yield is defined as the total rewards earned in TAO terms divided by the total initial TAO staked. Here's the formula:

TAO Yield = $(R_0 + \sum^{n}_{i=1} (R\_\{A_i\} \times E_i)) / (S_0 + \sum^{n}_{i=1} S_i)$

Variables Explained:

- **R_0**: The TAO rewards earned from staking directly in subnet 0 (in TAO).
- **$R\_\{A_i\}$**: The alpha token rewards earned from staking alpha tokens in subnet *i* (where *i* ranges from 1 to *n*, representing subnets other than subnet 0).
- **E_i**: The current exchange rate of alpha tokens to TAO for subnet *i* (e.g., TAO per alpha token, based on the subnet's AMM pool ratio at the time of calculation).
- **S_0**: The initial amount of TAO staked in subnet 0.
- **S_i**: The initial amount of TAO staked in subnet *i* (for *i* = 1 to *n*).
- **n**: The number of subnets (excluding subnet 0) where TAO is staked.

Breakdown of the Formula:

- **Numerator (Total Rewards in TAO Terms)**:
  - **R_0**: Direct TAO rewards from subnet 0.

- $\sum_{i=1}^{n} (R_{A_i} \times E_i)$: The sum of alpha token rewards from all other subnets, converted to TAO using each subnet's current exchange rate. For each subnet *i*, staking TAO yields alpha tokens (A_i), which are then staked with validators to earn additional alpha tokens (R_{A_i}). These rewards (R_{A_i}) are converted to TAO by multiplying by E_i.

- **Denominator (Total Initial TAO Staked)**:
  - $S_0 + \sum_{i=1}^{n} S_i$: The total amount of TAO initially staked across all subnets, including subnet 0 and subnets 1 through *n*.

How It Works

- **Subnet 0**: TAO is staked directly, earning TAO rewards (R_0). The yield contribution from subnet 0 is straightforward: R_0 / S_0.
- **Other Subnets (i = 1 to n)**: TAO (S_i) is staked to receive alpha tokens (A_i) via an AMM pool. These alpha tokens are then staked with validators, earning additional alpha tokens (R_{A_i}). The TAO equivalent of these rewards is $R_{A_i} \times E_i$, and the yield contribution from subnet *i* is $(R_{A_i} \times E_i) / S_i$.
- **Total Yield**: Combines all rewards into a single TAO value and divides by the total TAO staked, giving a portfolio-wide yield.

Annualized Yield (APY)

The TAO Yield calculated above is for a specific period. To express it as an **Annual Percentage Yield (APY)**:

- If rewards (R_0 and R_{A_i}) are earned over a time period *t* (in years), the APY is:

APY = (1 + TAO Yield)^(1/t) - 1

- For example, if the rewards are measured over one year, the TAO Yield equals the APY. For shorter or longer periods, adjust *t* accordingly (e.g., *t* = 0.5 for 6 months).

Notes

- **Exchange Rate (E_i)**: This is typically the current TAO-to-alpha-token ratio in the subnet's AMM pool (e.g., TAO in pool / alpha tokens in pool). It may fluctuate, so the yield reflects the value at the time of calculation.
- **Simplification**: The formula focuses on rewards (R_0 and R_{A_i}), not the return of the principal (initial TAO or alpha tokens), consistent with standard staking yield definitions.

This formula provides a clear and comprehensive way to calculate the TAO Yield, capturing both direct TAO rewards and alpha token rewards converted to TAO, relative to the initial TAO investment.