Defining *Hacking* in the Lindian Levels of Functionality Model

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1 Introduction

The Lindian Levels of Functionality framework (page 10 of *A Treatise on Reality*) introduces two key scalar quantities for each level ω_n:

- The **population** of actors at that level, $\mathfrak{o}_n$.
- The **aggregate influence/power** they wield, Φ_n.

This paper asks which of their derivatives best captures the cybersecurity notion of "hacking."

2 Key Quantities

Symbol	Measures	Definition	Intuition
$\mathfrak{o}_n$	Actor population at level ω_n	$\mathfrak{o}_n = \int_{x=n}^{n+1} \omega_x \, d(-\infty) \gg \mathfrak{o}_{n+1}$	How *many* agents operate at that level.
Φ_n	Aggregate influence/power	$\Phi_n = \iint_{x=n}^{n+1} \omega_x \, d(-\infty) \, d(+\infty) \ll \Phi_{n+1}$	How much *leverage* their actions exert system-wide.

Table 1: Scalar fields defined for each level of functionality.

3 Desired Semantics of "Hacking"

Hacking is typically a *small, asymmetric intervention* that produces an outsized systemic effect:

- It manifests as a rapid change in **influence** ($\Delta\Phi$).
- It does *not* require a large change in the **actor population** ($\Delta\mathfrak{o}$).

Candidate	Mathematical Form	Fit to “Hacking”
$\frac{\partial \Phi}{\partial t}$ **or** $\nabla_\omega \Phi$	Rate of change of influence/power	✓ Captures the sudden leverage shift produced by an exploit, independent of head-count.
$\frac{\partial \mathfrak{o}}{\partial t}$ **or** $\nabla_\omega \mathfrak{o}$	Rate of change of actor population	× Reflects recruitment or botnet growth—useful for *scaling* attacks but not for the essence of hacking.

Table 2: Evaluating derivatives against the intuitive meaning of hacking.

4 Derivative Candidates

5 Formal Definition

$$\boxed{\text{Hacking} := \frac{\partial \Phi}{\partial t} \quad \text{or} \quad \nabla_\omega \Phi} \tag{1}$$

This definition:

1. **Aligns with leverage** — it directly measures redistribution of power.
2. **Is scale-free** — a lone actor can generate a large $\partial\Phi$ even if $\partial\mathfrak{o} \approx 0$.
3. **Matches security intuition** — an exploit appears first as a spike in effective control, not as new head-count.

6 Implications and Future Work

The derivative of $\mathfrak{o}$ remains valuable for quantifying *mobilization* (e.g., botnet expansion or mass social-engineering campaigns). Future research can explore coupled dynamics:

$$\frac{d}{dt}\begin{bmatrix}\Phi \\ \mathfrak{o}\end{bmatrix} = \mathbf{F}(\Phi, \mathfrak{o}, \dots),$$

where feedback loops between influence and population growth determine the sustainability of hacking campaigns.

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