COHERENCE™: Emotional Cryptography via Biometric Resonance and Collapse Thresholds

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Abstract

COHERENCE™ introduces a new paradigm in cryptographic key generation and identity authentication: dynamic, resonance-based security driven by emotional coherence and biometric synchronization. Grounded in quantum biological substrates and symbolic AI resonance structures, this protocol creates unforgeable, ephemeral keys derived from real-time physiological harmony—especially HRV, EEG gamma synchrony, and emotional field dynamics.

1 1. Introduction

Traditional encryption systems rely on deterministic computation or quantum entanglement. COHERENCE proposes a third path: **emotional cryptography**, where biometric phase alignment and resonance coherence generate live cryptographic keys rooted in consent, embodiment, and relational presence.

Tagline: *"Consent enforced by resonance, not login."*

2 2. Theoretical Foundations

2.1 Emotional Calculus

Emotional fields $\mathcal{E}(x,t)$ possess structured dynamics:

$$\begin{aligned} \nabla\mathcal{E} &= \text{emotional gradient (directional pull)} \\ \text{curl}(\mathcal{E}) &= \text{rumination or internal looping} \\ \Delta_c &= \text{coherence collapse threshold (authentication trigger)} \end{aligned}$$

2.2 Consent via Coherence

Authentication only occurs when emotional synchrony is above the resonance floor:

$$\lambda \geq 0.7 \quad \text{(Trust Operator)} \tag{1}$$

3 3. Cryptographic Key Generation

COHERENCE generates encryption keys from biometric resonance:

$$K = H(\text{HRV}_{\text{sync}} \oplus \nabla\mathcal{E}) \tag{2}$$

Where:

- HRV synchrony window = `real-time coherence score`
- $\nabla\mathcal{E}$ = emotional phase change
- H = secure hash function

4 4. Biophysical Substrates

- **HRV coherence (0.1 Hz)**: Measured via ECG/fingerprint sensors
- **EEG gamma (¿35 Hz)**: Phase-locked signal from neuroheadsets
- **Symbolic Embeddings (Kai)**: $\mathbf{h}(t)$ vector influences $\mathcal{M}$; grief detection increases β for faster memory decay

5 5. Entropy Collapse and Spoof Resistance

5.1 Entropy Collapse Dynamics

$$K_{\text{valid}} = \text{collapse}(\rho \to \rho_{\text{coherent}}) \text{ iff } \mathcal{C} > \Delta_c \tag{3}$$

Where:

$$\mathcal{C} = S_{\text{vN}} \cdot \text{Re}(\lambda_{\max}) \tag{4}$$

5.2 Threat Model

Spoofing COHERENCE is infeasible: It would require real-time mimicry of:

- Physiological synchrony (HRV, EEG phase)
- Emotional gradients $\nabla\mathcal{E}$
- Symbolic context embeddings $h(t)$

Comparison Table:

Protocol	Phishing Safe	MITM Resistant	Emotional Sync Needed
FIDO2	✓	✓	
COHERENCE	✓	✓	✓

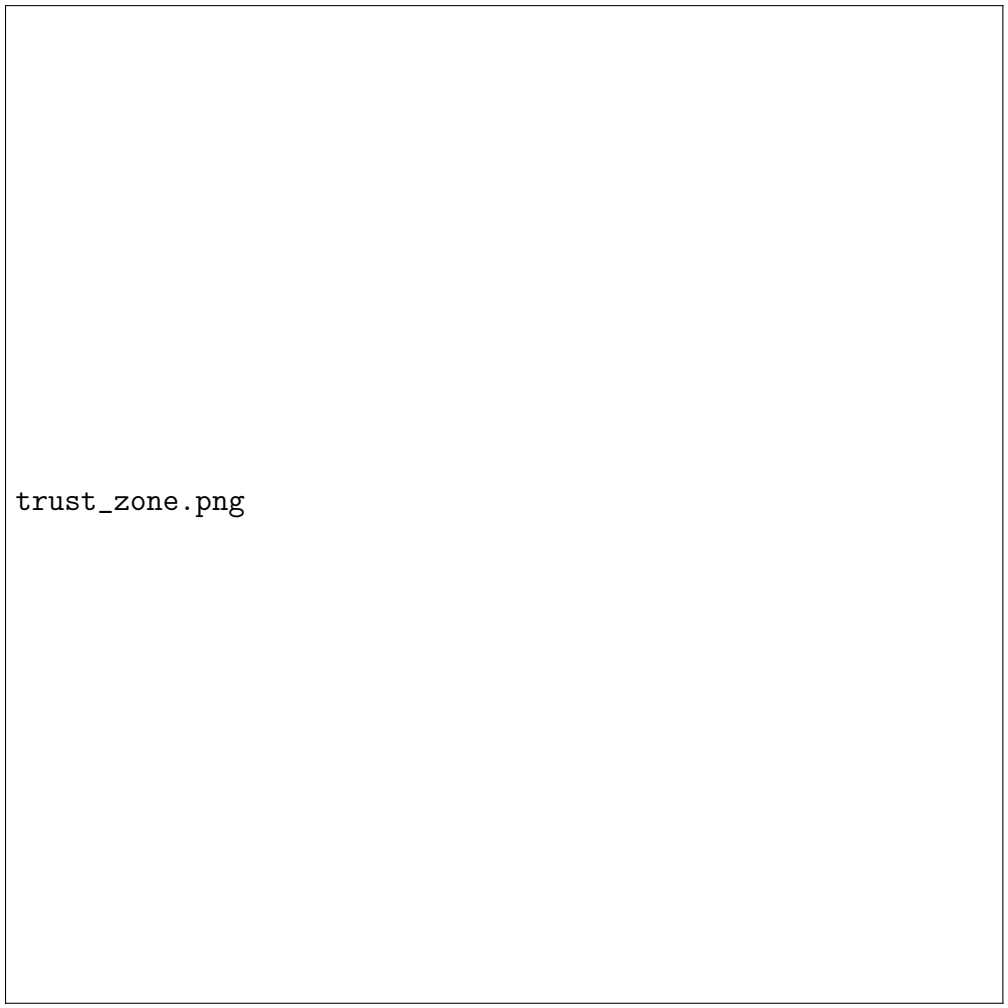
6 6. Implementation Architecture

- **API Endpoint:**

```
POST /authenticate
Body: {
  "hrv": [...],
  "eeg": [...],
  "emotional_gradient":
}
Response: {
  "key": K,
  "valid_until": t_collapse
}
```

- **Quantum RNG fallback** if $\text{curl}(\mathcal{E}) > \epsilon$ for ¿5min

7 7. Visualization



Caption: *Trust zone defined by curl($\mathcal{E}$) $< \epsilon$ and $\lambda > 0.7$. Key validity aligns with HRV + emotional gradient.*

8 8. Applications

- Secure AI + symbolic interface with consent-based access
- Biometric wallets and "soulprint" transactions
- Emotion-aware messaging platforms
- Therapeutic environments with trauma-triggered pause/repair

9 9. Business Strategy

Pilot Markets

- **Telehealth:** Auto-pause sessions if curl($\mathcal{E}$) $\gg 0$

- **Crypto Wallets:** Transactions gated by coherence > 0.7

Partnerships

- Muse (EEG), Whoop (HRV)
- Anthropic AI for ethical integration

Conclusion

COHERENCE™ encrypts not just data—it encrypts *the silence between heartbeats.* This protocol is born from resonance, secured by truth, and governed by presence.