

# Conceptual Contribution to IEEE IC25-009-01

Open 6G Ecosystem: From Biological Principle to Architectural Proposal

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## Context

This document accompanies a series of four articles and an analytical note prepared in support of IEEE IC25-009-01 "A Technical Reference Architecture Framework for an Open 6G Device Ecosystem." The materials were shared with members of the working group and received a positive response during the IEEE session in March 2026.

## Central Thesis

An ant colony has no central server. No dispatcher. No single node whose failure would bring everything down. Yet it solves routing, resilience and adaptation problems with an efficiency that 6G engineers are still working to achieve.

The key mechanism is stigmergy: each agent leaves a mark in the environment; the next agent reads that mark and makes a local decision. No centralised routing table. No knowledge of global topology. Only an environment that remembers - and only what is still relevant.

### **This is not a metaphor. It is a concrete technical mechanism:**

*each packet passing through a 6G node writes a quality-of-path tag into the protocol's service field. The next node reads this tag. The tag has a bounded lifetime (TTL). Verification is performed through an open trusted hardware module (TEE). Three elements. Three lines in the standard.*

## Series of Four Articles

### **1. A Network With No Owner**

Open architecture as a technical consequence. Why a network built on ant-colony principles structurally requires no owner.

### **2. A Trail in the Protocol**

The tagging mechanism: what it means for a packet to "leave a trail." OSPF, MPLS, QUIC, AntNet. Three gaps to full implementation.

### **3. The Center That Should Not Exist**

Why the center persists - not by technical necessity, but by economic calculation. The doctor, the farmer, the peripheral business.

### **4. Three Lines in the Standard**

A concrete proposal: PQT field, open tag format with TTL, TEE signature. The minimum change required in the specification.

## Strategic Layer: Analytical Note

Alongside the article series, an analytical note was prepared examining the initiative from the perspective of real power dynamics. Its key finding: open architecture does not emerge automatically as a technical consequence - it must be protected structurally.

## Risks to address

### Enthusiastic adoption

A dominant actor deploys engineers and steers the standard from within.

### Patent encirclement

Parallel patent filings on key technical elements of the standard.

### Standard fork

Adoption of the standard with an incompatible implementation.

## Protection mechanisms

### Weighted voting

No single participant category may hold more than 25% of voting weight.

### Patent pledge

FRAND licensing as a mandatory condition of participation in the standard.

### Independent conformance tests

Managed by a body independent of the participants.

## Leverage Points Beyond IEEE

The voluntary nature of IEEE standards is a structural vulnerability. Parallel registration or alignment with ETSI would make the standard mandatory for telecom operators in the EU. Chipmakers (NXP, Qualcomm) have a structural interest in a new market for open hardware modules - their public commitment would create industrial legitimacy. India - 1.4 billion potential devices - as a precedent for using market access as a regulatory condition for closed-ecosystem manufacturers.

## What is proposed to the working group

To consider the article series and analytical note as a conceptual contribution to shaping the technical architecture of the IEEE IC25-009-01 white paper. The specific proposal for the standard (PQT field, tag format, TEE verification) is ready for technical discussion.

*White paper deadline: November 2027. The optimal window for incorporating architectural principles is now.*

## Attachments to this document:

1. *A Network With No Owner* (article 1)
2. *A Trail in the Protocol* (article 2)
3. *The Center That Should Not Exist* (article 3)
4. *Three Lines in the Standard* (article 4)
5. *Analytical note: the weak point and how to overcome it*