OfflineMesh Simulation Demo

Proof-of-concept implementation of decentralized peer-to-peer message routing without internet infrastructure.

Project Overview

OfflineMesh is a decentralized communication concept designed for areas with no internet connectivity.

The system allows nearby devices to communicate directly using peer-to-peer mesh networking without relying on networks or Wi-Fi routers.

This notebook demonstrates a simulation of how offline message routing can work between multiple nodes.

```
class Node:
    def __init__(self, name):
        self.name = name
        self.neighbors = []
        self.message_buffer = []
        self.received_messages = set()

class Message:
    def __init__(self, sender, receiver, content):
        self.sender = sender
        self.receiver = receiver
        self.content = content
        self.hops = 0
```

```
def simulate(nodes, steps=5):
    for step in range(steps):
        print(f"\nStep {step + 1}")
        new_messages = {node: [] for node in nodes}

        for node in nodes:
            for msg in node.message_buffer:
                if msg.receiver == node.name:
                    if msg.content not in node.received_messages:
                        print(f"Message '{msg.content}' received by {
                        node.received_messages.add(msg.content)

                else:
                    msg.hops += 1
                    for neighbor in node.neighbors:
```

```
                        if neighbor.name != msg.sender:
                            new_messages[neighbor].append(msg)

        # Clear old buffers
        for node in nodes:
            node.message_buffer = new_messages[node]
```

```
A = Node("A")
B = Node("B")
C = Node("C")
D = Node("D")

A.neighbors = [B, C]
B.neighbors = [A, D]
C.neighbors = [A, D]
D.neighbors = [B, C]

nodes = [A, B, C, D]
```

```
nodes = [A, B, C, D]

# Inject initial message into the network
msg1 = Message("A", "D", "Emergency Alert")
A.message_buffer.append(msg1)

simulate(nodes, steps=3)
```

```
Step 1

Step 2

Step 3
Message 'Emergency Alert' received by D after 3 hops
```

Simulation Output Explanation

The message originates from Device A and travels through connected devices in a mesh-like structure.

This demonstrates how peer-to-peer routing can function even without centralized internet infrastructure.