WIFI TREES

Delhi School of Artificial Intelligence

Educate, research and work on emerging technologies for a new Digital Human World

CONCEPTUAL OUTLINE

A Pilot Study on establishing the WiFi Tree mesh

Ayush Garg | Muskan Abbasi | Sandeep Gupta

PROJECT

Deploy a 5-node outdoor WiFi mesh across ~0.5–1 km² using robust outdoor APs mounted to selected trees, using a mix of point-to-point (backhaul) and omni mesh links, solar/PoE site power, arborist approved attachment, and a 10–12 week testing period.

Goals

1. Provide usable internet (≥5–10 Mbps per household) to ~15–40 households in the pilot area.
2. Demonstrate stable mesh routing (uptime ≥ 95% over 30 days).
3. Measure seasonal/foliage impact and wind/sway alignment effects.

Success metrics (measured)

- *Throughput:* end-user median ≥ 5 Mbps, 95th percentile > 1 Mbps
- *Latency:* average < 50 ms for local traffic.
- *Uptime:* ≥ 95% across nodes.
- *Link reliability:* packet loss < 2% on backbone links.
- *Maintenance overhead:* ≤ 1 on-site visit per node per month after commissioning.

KEY WORDS:

WiFi
Trees
Wireless
Connectivity
Digitalisation

Equipment

Head	Details
Per backhaul link	2 × directional CPE / PtP radios (e.g., Ubiquiti NanoStation / NanoBeam family or similar). These are used for longer, directional hops and are low-power PoE devices.
Per mesh/ AP node (5 total nodes)	1 × outdoor dual-band mesh AP or outdoor Wi-Fi 6 mesh (e.g., UniFi U6-Mesh / UAP-AC-Mesh or other IP66 outdoor AP). Devices that support mesh or bridge modes and PoE.
Power & Mounting	Solar + battery + MPPT charge controller (for truly off-grid nodes) — e.g., sunMAX SolarPoint or comparable MPPT unit for small PoE systems. Weatherproof PoE injectors, IP-rated enclosures for any small router/switch, vandal-resistant mounts or stainless steel straps. Cabling: UV-rated outdoor Cat6, stainless cable ties

Site & Topology

Nodes: 5 nodes (A–E). Choose a mix where 2 nodes form directional point-to-point backhaul links (high gain, narrow beam) to reach a central gateway node; the other 3 act as omni/sector mesh/AP nodes serving households. Use trees that give partial line-of-sight corridors for backhaul where possible.

Gateway: One node (node A) connected to the Internet (fiber connection, nearby PoP).

Typical hop distances: keep backbone/higher-capacity hops under 300–800m when using 2.4/5 GHz outdoor gear in vegetated environments to reduce attenuation and misalignment risk. (Attenuation increases with frequency, Line of Sight limitations).

Power Plan

Short pilot: run PoE over buried cable to 2–3 nodes at existing power. (cheap, reliable).

Truly off-grid nodes: 50–100 W-panel + 12–24 V battery + MPPT + DC→PoE converter Size panels to handle worst-case cloudy days. (Typical outdoor APs 5–15 W).

RF Planning, Spectrum Choices

Use 2.4 GHz for client coverage (better foliage penetration), and 5 GHz or directional links for backhaul where line-of-sight exists (higher capacity but foliage sensitive). Reserve one band for mesh control and the other for client traffic if device supports dual-band. Real deployments use 2.4 GHz for reach & 5 GHz for directional backbone.

Run propagation modelling and include vegetation loss parameters, attenuation can be substantial, variable by season — target > 20–30 dB link margin.

Test Plan & Data Collection

Continuous ping/throughput tests (gateway ↔ each node) logged every 5 minutes.