Architecture and Evaluation of an Unplanned 802.11b Mesh Network evaluates the design and performance of a wireless mesh architecture. In particular, the authors study Roofnet, which is a network of 37 nodes deployed in Cambridge, Massachusetts. This mesh architecture has 4 significant design decisions:

(1) Unplanned node placement that should work well regardless of the topology.
(2) Links are formed using omni-directional antennas instead of directional antennas. The later requires advance knowledge and planning, whereas the former allows nodes to route through whatever neighbors they find.
(3) The architecture allows for multi-hop routing, which can make up for the lack of coverage typically present in unplanned networks.
(4) Routing should optimize for throughput.

This unplanned mesh design has several benefits. These include an easier deployment process, as the architecture requires minimal preplanning. It is decentralized, and does not require coordination or significant technical expertise to deploy and operate the network. Additionally, the proposed routing protocol (Srcr) is able to eliminate short, low throughput links because of the mesh architecture.

The Srcr routing protocol attempts to find the highest throughput route between any two Roofnet nodes. Srcr uses the estimated transmission time (ETT) to choose these routes. ETT is a prediction of the time it would take for a packet to travel across a route. The ETT for a path is the sum of the ETTs for each individual link on that path. The authors concede that this metric is reasonable for short paths, with at most one hop sending at a time. In other words, the ETT calculation is correct for short routes where spatial reuse is not present.

However, the ETT sum will not work with multiple concurrent flows because of interference. It will provide an overestimate. The lack of consideration of this case is a limitation of the paper. It is difficult to accurately judge the performance of the architecture without considering multiple concurrent flows, because without it, we cannot get a full understanding of the impact of interference.

Because of the omni-directional antennas, the network requires a higher density than what would be needed with directional antennas. The experiments in the paper show that as the number of nodes in the network grows, so does the average throughput. These measurements do not inlaced experiments with multiple concurrent flows. In this case, the higher density would presumably result in higher interference, which would hurt performance. Hence, the measurements may not present an accurate picture of the performance of the network under realistic scenarios.

While this paper was published in 2005, the ideas presented in it are still relevant. In modern networks, we see this mesh architecture being adopted in certain scenarios (the Google home mesh, for example). This phenomenon is not entirely uncommon in the networking space - the value of ideas is not realized until years later, like in the case of Bluetooth. However, this mesh architecture might not be ideal for all scenarios. In particular, it could be particularly difficult to deploy it for a 5G network. Its success is largely dependent on the choice of 5G antenna.