# WHOO - Architecture

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**WHOO** (WSN Hybrid rOuting prOtocol) is a hybrid routing protocol that opportunistically exploits MANETs to speed up data collection of WSNs. Exploiting multi-homed mobile nodes allows to build an additional routing layer that has much higher bandwidth and lower latency than the one normally used on WSN (due to the constraints of low-power wireless interfaces), improving packet delivery performances and, in some cases, even saving energy.

Many WSN routing protocols, such as CTP and ZigBee, base their routing alogorithms on tree-like structures, that assign to each sensor node a gradient value. Data packets flow from higher to lower gradient nodes, enabling data collection. Mobile nodes running WHOO dynamically access the routing structure, advertising an efficient alternative routing path. As result, packets that should be routed faster (i.e.: urgent data), can "rise" on the alternative routing path and jump ahead of normal packets. This approach allows urgent data to be routed much faster than normal data, avoiding possibly congested WSN nodes. As matter of fact, WHOO provides a physical, high performance Out-Of-Band communication channel for WSNs.

In its current implementation, WHOO supports TinyOS's Collection Tree Protocol. Experimental results, available in the <u>download section</u>, show that WHOO can vastly improve the performances of collection protocols.
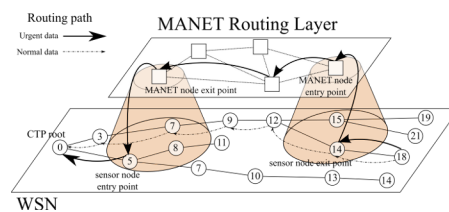


## 1 Software architecture

WHOO runs at the same time on sensor nodes and on MANET nodes. On sensor nodes, the operating system provides basic communication facilities, the CTP layer provides routing and forwarding facilities for data collection. WHOO runs on top of the CTP layer: it receives advertisements from available MANET nodes and mangles the forwarding engine to divert urgent packet to the MANET routing layer.
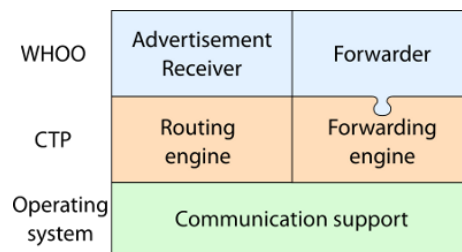


WHOO stack running on MANET nodes has two layers. The MANET-WSN layer manages the MANET-WSN integration: it sends advertisement packets to sensor nodes that let them know that there is a MANET routing layer available, and receives/sends

CTP packets from/to WSN. the MANET layer manages coordination with other MANET nodes: it elects a MANET coordinator and manages MANET routes (WHOO MANET Manager), keeps advertised MANET routing paths up to date (Cost Advertisement Manager) and discovers WSN topology.
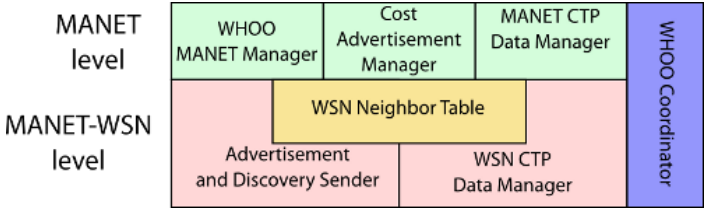


For further details, please refer to the documentation section.

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