ANT (network)

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ANT is a proprietary (but open access) multicast wireless sensor network technology designed and marketed by ANT Wireless (a division of Dynastream Innovations, in turn a wholly owned subsidiary of Garmin[1]). It defines a wireless communications protocol stack that enables hardware operating in the 2.4 GHz ISM band to communicate by establishing standard rules for co-existence, data representation, signalling, authentication, and error detection.[2] It is conceptually similar to Bluetooth low energy, but is oriented towards usage with sensors.

ANT

Developed by	Dynastream Innovations Inc. (http://www.dynastream.com), a subsidiary of Garmin
Industry	Wireless sensor networks

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Overview

ANT-powered nodes are capable of acting as slaves or masters within a wireless sensor network concurrently. This means the nodes can act as transmitters, receivers, or transceivers to route traffic to other nodes. In addition, every node is capable of determining when to transmit based on the activity of its neighbors.[2]

Typical applications

ANT is primarily incorporated into sports and fitness sensors, though it may additionally be used for other purposes. The transceivers are embedded in equipment such as heart rate monitors, watches, cycling power meters, cadence meters, and distance and speed monitors to form wireless personal area networks (PANs) monitoring a user's performance. ANT Wireless has been attempting to diversify the protocol's applications into other sectors, including health, home automation, and industrial applications.

Companies using ANT include:

- Adidas
- Fitbit[3]
- Garmin[4] (parent company of ANT Wireless)
- Geonaute[5]
- Nike
- Suunto
- Tacx[6]

Technical information

ANT can be configured to spend long periods in a low-power “sleep” mode (consuming of the order of microamps of current), wake up briefly to communicate (when consumption rises to a peak of 22mA (at -5dB) during reception and 13.5mA (at -5 dB) during transmission)[7] and return to sleep mode. Average current consumption for low message rates is less than 60 microamps on some devices.[7]

Each ANT channel consists of one or more transmitting nodes and one or more receiving nodes, depending on the network topology. Any node can transmit or receive, so the channels are bi-directional.[8]

ANT accommodates three types of messaging: broadcast, acknowledged, and burst. Broadcast is a one-way communication from one node to another (or many). The receiving node(s) transmit no acknowledgment, but the receiving node may still send messages back to the transmitting node. This technique is suited to sensor applications and is the most economical method of operation.[8]

Acknowledged messaging confirms receipt of data packets. The transmitter is informed of success or failure, although there are no retransmissions. This technique is suited to control applications.[8]

ANT can also be used for burst messaging; this is a multi-message transmission technique using the full data bandwidth and running to completion. The receiving node acknowledges receipt and informs of corrupted packets that the transmitter then re-sends. The packets are sequence numbered for traceability. This technique is suited to data block transfer where the integrity of the data is paramount.[8]

Comparison with Bluetooth, Bluetooth Low Energy, and ZigBee

ANT was designed for low bit-rate and low power sensor networks, in a manner conceptually similar to (but not compatible with) Bluetooth low energy.[2] This is in contrast with normal Bluetooth, which was designed for relatively high bit-rate applications with no power usage considerations.

ANT uses adaptive isochronous transmission[9] to allow many ANT devices to communicate concurrently without interference from one another, unlike Bluetooth SMART, which supports an unlimited number of nodes through scatternets and broadcasting between devices.

	ANT	Bluetooth	Bluetooth SMART	ZigBee
Standardisation	Proprietary	Standard	Standard	Standard
Topologies	Point-to-point, star, tree, mesh[2]	Point-to-point, scatternet	Point-to-point, star	
Range	30 metres at 0 dBm[10]	1–100 metres	10–100 metres	10–100 metres
Max data rate	Broadcast/Ack - 200 Hz[11] * 8 bytes * 8 bits = 12,8kbit/s Burst - 20 kbit/s[11] Advanced Burst - 60kbit/s[11]	1-3 Mbit/s[10]	1 Mbit/s[10]	250 kbit/s (at 2.4 GHz)
Application throughput	0,5 Hz to 200 Hz (8 bytes data)[11]	0.7-2.1 Mbit/s[10]	305 kbit/s[10]	
Max nodes in piconet	65533 per shared channel (8 shared channels) [10]	1 master and 7 active slaves, 200+ inactive[10]	1 master and 7 slaves (but scatternet unlimited)[10]	star - 65536[10]
Security	64 bit key	56-128 bit key	AES-128	AES-128
Modulation	GFSK	GFSK	GFSK	OQPSK

Interference immunity

ANT, ZigBee, Bluetooth, Wi-Fi, and some cordless phones all use the 2.4 GHz band (as well as 868- and 915 MHz for regional variants in the latter's case), along with proprietary forms of wireless Ethernet and wireless USB.

Wi-Fi/ZigBee and Bluetooth employ Direct Sequence Spread Spectrum (DSSS) and Frequency-Hopping Spread Spectrum (FHSS) schemes respectively to maintain the integrity of the wireless link.

ANT uses an adaptive isochronous network technology to ensure coexistence with other ANT devices. This scheme provides the ability for each transmission to occur in an interference free time slot within the defined frequency band. The radio transmits for less than 150 µs per message, allowing a single channel to be divided into hundreds of time slots. The ANT messaging period (the time between each node transmitting its data) determines how many time slots are available.[12]

ANT's adaptive isochronous scheme doesn't require a master clock. Transmitters start broadcasting at regular intervals but then modify the transmission timing if interference from a neighbor is detected on a particular time slot. This flexibility allows ANT to adapt to hostile conditions but ensures there is no overhead when interference is not present.

If the radio environment is very crowded, ANT can use frequency agility to allow an application microcontroller-controlled "hop" to an alternative 1 MHz channel in the 2.4 GHz band which can then be subdivided into timeslots.

ANT+

Main article: ANT+

ANT+ is an interoperability function that can be added to the base ANT protocol. This standardization allows for the networking of nearby ANT+ devices to facilitate the open collection and interpretation of sensor data. For example, ANT+ enabled fitness monitoring devices such as heart rate monitors, pedometers, speed monitors, and weight scales can all work together to assemble and track performance metrics.

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External links

- ANT (http://www.thisisant.com)
- Open-source communication tool (antpm) (http://code.google.com/p/antpm/)

Categories: Wireless sensor network
