Opal sensor network platform

Adaptable, reliable, inexpensive sensor nodes.

Versatile, robust, scalable sensor networks.

Through our years of experience with real world sensor network deployments, we have found that the best performance of a sensor network comes from adapting the nodes and communication methods to the local environment and the application.

CSIRO's Opal sensor nodes offer:

- a wide set of finely tunable communication parameters that can be adjusted on the fly

- a highly flexible, scalable processor that goes from extreme energy conservation to high load computational tasks

- battery recharging under fluorescent light.

Opal sensor nodes have been tested in lab environments and outdoors. They are at a mature stage of development and the first 1,000 nodes are in production.

Features

Multiple antennas

Opal sensor nodes show significantly improved link quality and system capacity by having multiple antennas and switching technology that automatically selects the best receive antenna for each data packet.

Band diversity

We have improved resistance to radio interference by developing algorithms that select the optimum radio frequency for any given time.

Our intelligent protocols optimise the trade-off between frequency and data rates to support a particular application's requirements in terms of throughput and range. Using all the transmitters simultaneously makes data rates of more than 3 Mbps possible.

Because the Opal platform uses multiple frequency bands, it can be easily integrated with existing infrastructure.

Long range

The Opal platform has optional power amplifiers on the transmitter side. This allows:

- high data rate communications over distances of more than 12 km,

- rapid network reprogramming,

- boosting of link quality in poor propagation environments.
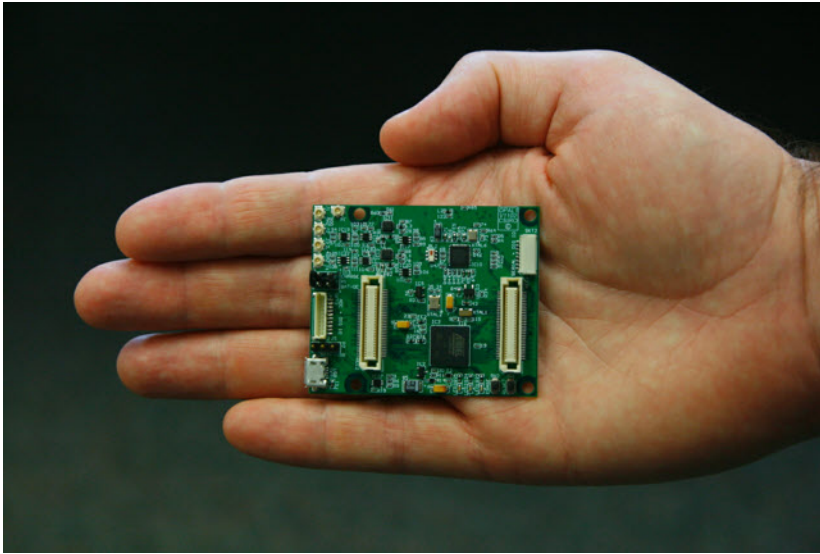
Security

Opal sensor nodes use commercially available Trusted Platform Module (TPM) chips as asymmetric crypto engines to allow efficient symmetric key distribution. An embedded secure key storage reduces the risk of reverse engineered key recovery.

Operating system

The supported operating system is currently TinyOS 2.x, allowing Opal sensor nodes to interact with other low power sensing systems such as TELOSB, IRIS and MICAz. Our hardware platform is not operating system specific: a port to Contiki will be available soon.

The protocol stack interacts fully with existing collection tree based networks on 900 MHz or 2.4 GHz without the need for reprogramming or redeploying the network.

Opal features

- Multiple antennas, U.FL connections
- Automatic receive antenna switching
- Optional power amplifiers >20 dBm on 900 MHz >15 dBm on 2.4 GHz (measured at the antenna socket)
- Multiradio support 900 MHz Atmel AT86RF212 2.4 GHz Atmel AT86RF231 433 MHz / 900 MHz CC1101RTKR
- Data rates >3 Mbps (combined)
- Optional TPM chipset
- Low power 32 bit ARM MCU with 256 Kb Flash, 48Kb SRAM and <= 96 MHz (Atmel SAM3U4E)
- Highly efficient lithium ion charging circuit (power from USB, solar cell etc)
- Energy harvesting connector
- Micro-USB connection

Data storage

Opal sensor nodes have a Micro-SD card slot allowing gigabytes of data to be stored, including recording acoustic or image data.

Expansion boards

A 120-pin expansion bus makes it easy to adopt Opal senor nodes to individual sensing scenarios, including miniature cameras and microphones.

Our plug and play system allows individual identification of daughterboards and the stackable design means multiple expansion boards can be used and the node will still fit in its housing.

Opal sensor node offer

CSIRO seeks:

- Manufacturers to integrate Opal sensor nodes into final products.
- Research partners to use the Opal platform.

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Reference

Kusy B, Richer C, Hu W, Afanasyev M, Jurdak R, Bruenig M, Abbott D, Huynh C, and Ostry D. ''Radio diversity for reliable communication in WSNs.'' *IPSN '11: Proceedings of the 10th international conference on Information processing in sensor networks.*

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