Sensor Web Features

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NASA's goal in Earth science is to "observe, understand, and model the Earth system to discover how it is changing, to better predict change, and to understand the consequences for life on Earth." Sensor web systems are one of the enabling technologies to achieve this goal. With placement of smart sensors around our globe, it becomes easier for us to understand the planet we live in.

A sensor web is an autonomous networking system of ground and/or space sensors for real-time information gathering, processing, sharing, and instruments controlling. A sensor web typically has the following features:

- **Autonomous**. It can run autonomously without the external control, and continuously be self-organizing and self-healing. The network topology is dynamically adjusted if a node dies or joins, or the link reliability changes. The routing protocol will also be necessary to discover the optimal path all the time.

- **Distributive**. The system runs in distributed fashion, where a node or a subset of nodes can make local decisions to achieve the global goal. In other words, it does not rely on any single points for centralized configuration and coordination. This also means good fault-tolerance: if part of the network dies, the rest of network will still work.

- **Intelligent**. It continuously optimizes the resource usage (including network topology, bandwidth, power, and data priority) according to the mission needs, including current network situation, environmental situation and scientific goals.

  This is one important feature distinguishing sensor webs from data collection scenarios: the sensor web is not just able to collect data; it needs to collect the most mission-critical data or even return the processed results. Hence, its features include: (1) Optimizing the resource allocation, based on the full awareness of situations (not just network situation, but also environment situation). (2) Prioritizing data flow according to predefined mission needs and scientific goals. (3) Generating answers through in-network processing, instead of collecting raw data only.

- **Scalable.** Heterogeneous sensor web can connect to each other, and a sensor web can act like a node in another sensor web. To enable this, all sensor web systems should agree on a unified interface (or language) for interaction, such as one based on SensorML schema.

- **Interactive.** A node in a sensor web can exchange information and interact with other sensor web nodes. This includes the integration of the ground and space assets in a sensor web, and enables the real-time interaction with each other.
  In addition, the sensor web should also be an integral part of the Internet and support the remote user control and interaction. It can interact with the Internet and support real-time information inquiry. This requires a sensor web to support data centric routing and in-network processing.

- **Manageable.** The network runs autonomously if no external control is available; however, sensor web should definitely support user control and network managements. The authorized user should be able to monitor the current network status and override the autonomous decisions of the network.

A sensor web can be said to be the nerve system embedded in our physical world, extracting, processing and transmitting useful and timely information reliably for efficient decision support and quick corrective actions.