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ON THE APPLICATION OF PEER-TO-PEER NETWORK ARCHITECTURE FOR GLOBAL ECOLOGICAL INFORMATION AND MONITORING SYSTEMS

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Today there exist a wide variety of ecological problems and tasks, whose solutions require the distributed system, dedicated to collecting a multitude of data in real-time in geographically spanned area. The typical task of this kind would be monitoring of the atmospheric conditions in urban areas, monitoring the water properties and pollution rates in river basins etc. And the typical solution involve central processing unit (usually, a corporate or institution-based server) with all the communications hardware necessary plus the distributed grid of mostly identical field units, each of which will periodically send its collected data to the central server for processing and storage.

Many technologies is used as a medium to communicate between field and central unit. In urban areas these could be telephone network, dedicated or trunk radio channels, cellular mobile network etc. In rural or hard to access areas such as sea or ocean surface far from shoreline and mountainous areas the preferable communication method could be satellite link.

We assume that the legacy of computer networks greatly influences the design considerations used in development of such ecology-monitoring systems. By such legacy we understand the principle of "client-server" interaction that was in broad usage since the introduction of computer networks and up to the beginning of XXI century.

We suggest that distributed ecology-monitoring systems could greatly benefit from implementing modern peer-to-peer principles in the design of their communication means. The core concepts of peer-to-peer architecture are the absence of central server (which, however, does not directly affect the proposed idea) and the possibility of intercommunication between regular neighboring nodes of system.

Given the proper spatial distribution of system nodes this would effectively eliminate the need for each node to maintain the link to processing server directly by implementing data relay between nodes in specific range. In this scheme, only few nodes from practically unlimited number will need to carry the equipment for long-range server link, whereas the rest of nodes could utilize their own interconnects. Various methods for dynamic routing would also allow minimum efforts for installing new or removing existing nodes. It is also possible to not have permanent link from any of the nodes in the grid to the server, but instead to collect data from them periodically using mobile transceiver installed on a car or aircraft.

One of technical challenges encountered in the design of field units is power supply. Regardless of the power source used (battery, solar etc) replacing far-reaching transceiver required in classical client-server scheme with significantly less powerful local-range transceiver used in peer-to-peer scheme will allow to reduce production cost even despite some additional complexity resulting from improvements of software of field unit.

In general we assure that implementation of peer-to-peer technologies in global ecology-monitoring distributed systems will allow for greater performance, scalability and flexibility at unchanged or reduced production and maintenance costs.

References

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