Efficient Wireless Incremental Updates to Resource-Constrained Devices

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Abstract (Summary)

Wirelessly updating resource-constrained devices - like nodes within a Wireless Sensor Network - is necessary to fix on-board firmware bugs and alter program functionality. Primarily due to RF transceiver usage, updating may consume significant energy resources of a device. However, this cost may be minimized by intelligently reducing update sizes, like through only sending a patch containing bytewise differences between current on-device firmware and new firmware; i.e. an incremental update.

Research shows that compressed incremental updates reduce energy usage significantly; especially those which use the *diff* algorithm BSDiff. In this thesis, a prototype implementation using said algorithm is carried out to encounter, document and overcome challenges of incrementally updating particularly memory limited resource-constrained devices.

Some problems encountered in incrementally updating a memory-constrained device consist of determining how to patch firmware without reducing the maximum allowed patch size, dealing with flash write minimum erasure units, and page alignment. The corresponding solutions synthesized to counter these challenges consist of patching firmware in-place over old firmware, using parts of the received patch to store otherwise overwritten and lost old firmware needed for the patching process, and altering the structure of patch files.

Altogether, these solutions allow for an incremental implementation that requires no additional memory other than that which stores old firmware and the received patch. Furthermore, due to transmitting smaller updates, and the negligible patch size increase due to reformatting, the incremental mechanism should tend to result in significant energy savings.