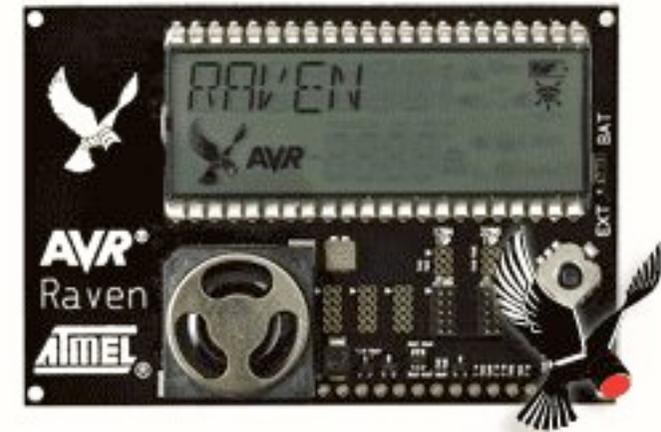


# Contiki-SNMP

Contiki-SNMP is an implementation of the Simple Network Management Protocol for resource constrained devices running the Contiki embedded operating system.



## Features

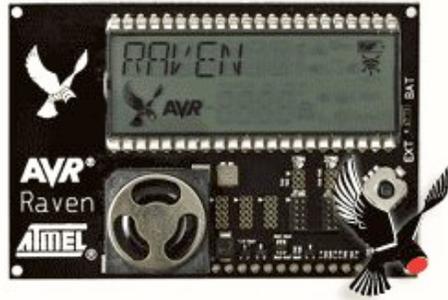
- SNMP messages up to 484-byte length
- Get, GetNext and Set operations
- SNMPv1 and SNMPv3 message processing models
- USM security model, no VACM access control model
- API to define and implement managed objects
- The SNMP engine is written in C
- It is built on the Contiki uIPv6 stack.

## Implementation

The implementation carries SNMP messages over UDP/IPV6 using the 6LoWPAN adaptation layer for IEEE 802.15.4 wireless links. The implementation has been designed to be modular and extensible and currently supports the Get, GetNext and Set operations, the SNMPv1 and SNMPv3 message processing models and user-based security model (with the HMAC-MD5-96 authentication and the CFB128-AES-128 symmetric encryption protocols).

The implementation provides an interface to define and configure accessible managed objects. A couple of objects from existing MIB modules have been implemented as part of the agent, such as the SNMPv2-MIB, IF-MIB, ENTITY-MIB and ENTITY-SENSOR-MIB. In a separate project, MIB modules for the new RPL routing are being prototyped.

The `show system info` command retrieves some general system information



The AVR Raven Hardware is an ATmega1284PV micro controller. The micro controller runs at 20MHz and consists of 16K of RAM and 128K of Flash ROM.

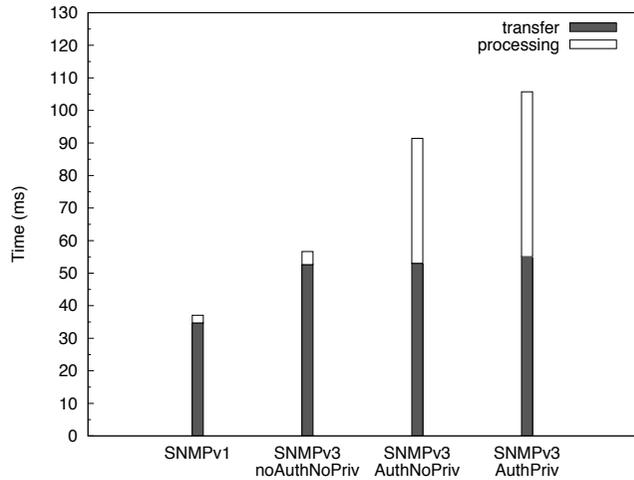
The screenshot shows how a standard SNMP command line tool interacts with the Contiki SNMP implementation.

```
100 scli version 0.4.0 (c) 2001-2010 Juergen Schoenwaelder
(2001:638:709:a:11:22ff:fe17:c810) scli > show system info
Name: sysman-test
Agent: snmp://public@[2001:638:709:a:11:22ff:fe17:c810]:
1610//
Description: Contiki 2.5
Contact: admin@eecs.jacobs-university.de
Location:
Vendor: Jacobs University <http://www.jacobs-university.de/>
Services: datalink network transport application
Agent-Boot-Time: 2011-10-31 20:04:56 +01:00
Interfaces: 1
```

The `show entity containment` command displays the containment hierarchy exported via the ENTITY-MIB.

```
100 scli version 0.4.0 (c) 2001-2010 Juergen Schoenwaelder
(2001:638:709:a:11:22ff:fe17:c810) scli > show entity containment
ENTITY CLASS CONTAINMENT
1 chassis ATMEL AVR Raven
2 cpu |- ATMEL ATmega1284p
3 cpu |- ATMEL ATmega3290p
4 port |- 802.15.4 Network Interface
5 sensor |- Temperature Sensor
6 sensor |- 802.15.4 RSSI Sensor
7 sensor |- S0 kWh Meter
```

# Request/Response Latency



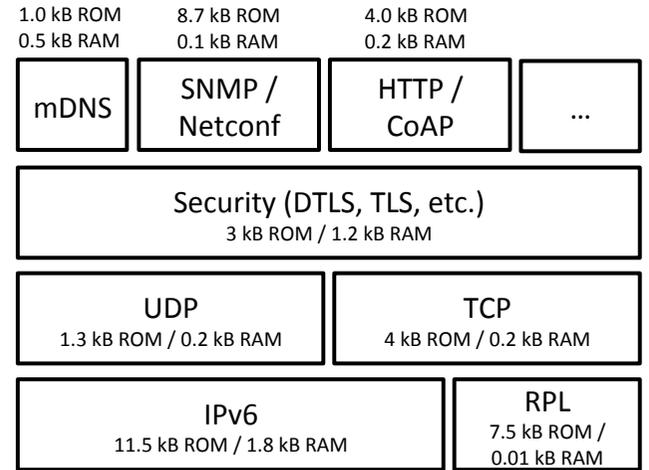
Varying Security

# Performance Evaluation

The evaluation of the implementation has been carried out on the AVR Raven hardware platform. The experimental results reveal that the request processing time for SNMPv1 and SNMPv3 with the **noAuthNoPriv** security level is relatively small compared to the transfer time. Enabling the authentication protocol results in a significant increase of the processing time, while the encryption protocol does not have that much impact on it.

The RAM and flash ROM usage has been estimated by using three different approaches. The stack usage is around 700 bytes for **noAuthNoPriv** messages and around 110 bytes for messages with security enabled. Approximately 16 bytes of heap storage is used for a numeric MIB object.

# Resource Requirements



# References

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In Proc. of the 5th International Conference on Autonomous Infrastructure, Management and Security (AIMS 2011), LNCS. Springer, June 2011.

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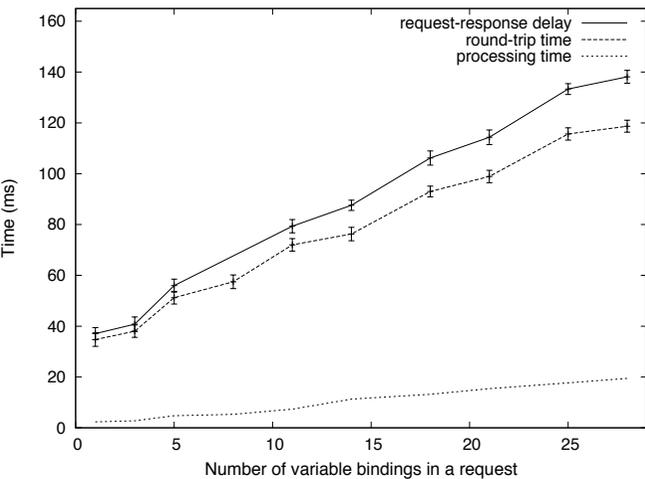
**SNMP Optimizations for Constrained Devices.**

Internet Draft <draft-hamid-6lowpan-snmp-optimizations-03.txt>, ETRI, Jacobs University, Ajou University, October 2010.

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**DNS SRV Resource Records for Network Management Protocols.**

Internet-Draft (work in progress) <draft-schoenw-opsawg-nm-srv-01>, Jacobs University, November 2010.



Varying Number of VarBinds



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