CLI-DOS: Collaborative Counteraction against Denial of Service in the Internet of Things

Status, Main Results and Plan

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  - Flooding a server hosts with messages.
  - Exhaust server resources (e.g. bandwidth, processing, energy)
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- Denial of Service (DoS) in IoT
  - Flooding a server hosts with messages.
  - Exhaust server resources (e.g. bandwidth, processing, energy)
  - Less reactive or even unable to serve legitimate requests
- Countermeasure categories: router-based and host-based.

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- Completely shut down the connection from outside world to save energy

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- Reducing the impact of DoS attacks against a victim device, and
- Offloading a computational expensive filtering at the IoT unit to a much more powerful gateway, while at the same time...

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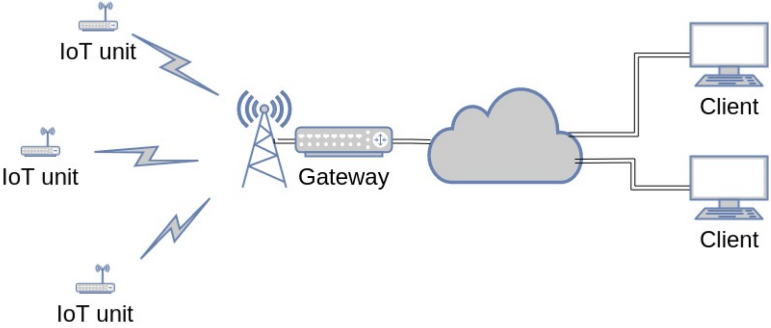
The rationale:

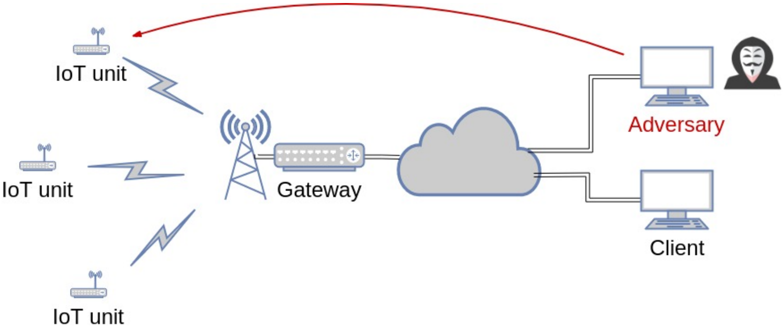
- Reducing the impact of DoS attacks against a victim device, and
- Offloading a computational expensive filtering at the IoT unit to a much more powerful gateway, while at the same time...
- Allowing legitimate request to be served to the best possible extent

CLI-DOS(Scenario)



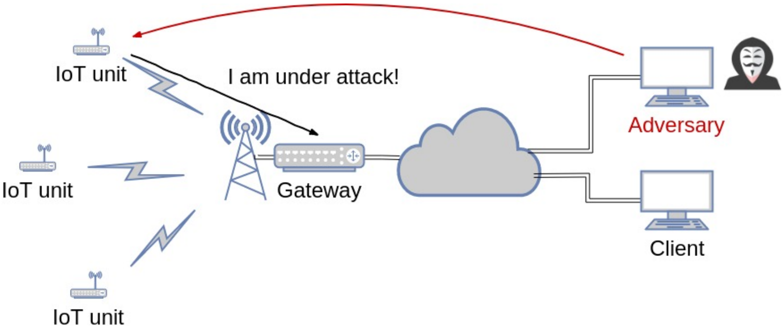
A resource-constrained, wireless IoT-units are connected and able to serve requests.

CLI-DOS



An adversary repeatedly send bogus messages to the IoT units, trying to induce the device to worthlessly commit resources.

CLI-DOS

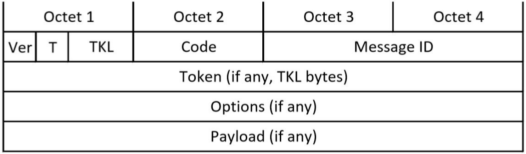


The IoT unit send a request to the gateway to start a security filtering mechanism, i.e. block ranges of IP, block all traffic but CoAP, etc. The request also contains time S as a sleeping period (victim server shutting down the radio communication).

CLI-DOS

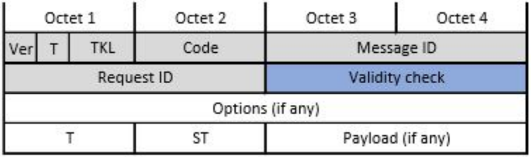
To distinguish the valid and invalid messages, the victim uses a short MAC (Message Authentication Code)[1]embedded in token field of the CoAP.

Default CoAP packet format:



Octet 1			Octet 2	Octet 3	Octet 4
Ver	T	TKL	Code	Message ID	
Token (if any, TKL bytes)					
Options (if any)					
Payload (if any)					

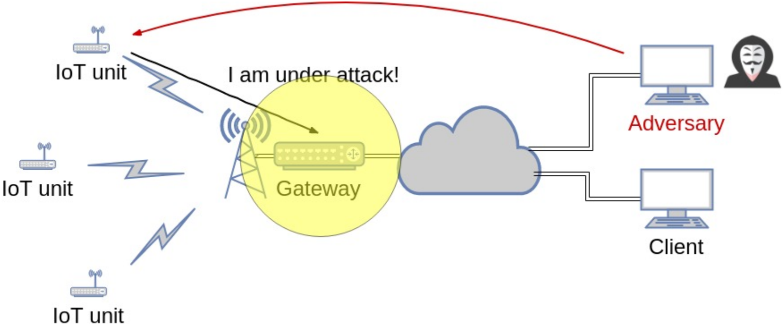
CoAP with short MAC:



Octet 1			Octet 2	Octet 3	Octet 4
Ver	T	TKL	Code	Message ID	
Request ID				Validity check	
Options (if any)					
T			ST	Payload (if any)	

[1] C. Gehrmann, M. Tiloca and R. Höglund, "SMACK: Short message authentication check against battery exhaustion in the Internet of Things"

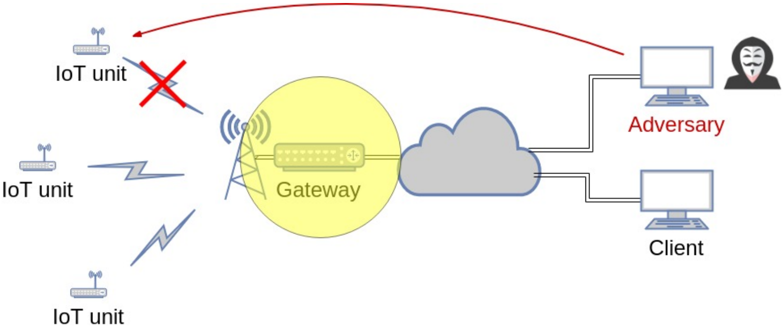
CLI-DOS



The gateway now:

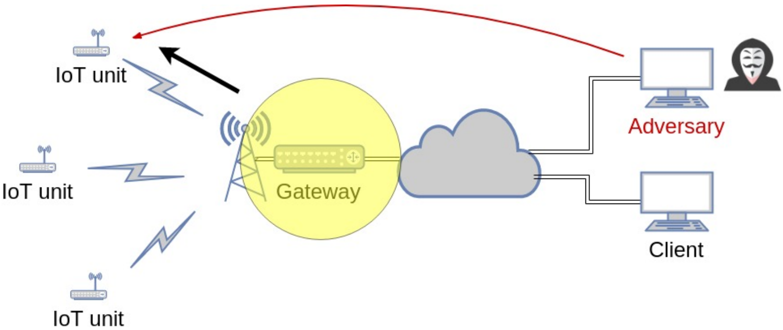
- Proceses the received information to calculate a new filtering rule.
- Measure the number of valid/invalid packets targetting the victim.
- Store the valid packet in internal buffer.

CLI-DOS



The IoT unit goes into sleep mode and only comes into active mode after agreed sleep period S.

CLI-DOS



After sleep period S is over, if invalid messages are below threshold, the gateway forwards all the packets from the buffer. Otherwise, the gateway updates its filtering rule to a more restrictive setting without forwarding any packets to the IoT unit. If it still continue, it sends a general warning to the system responsible.

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- Experimental evaluation on a local testbed.

Experimental Evaluation (On progress)

Measured values:

- Round Trip Time.
- Energy usage.

Variation of:

- Attack intensity
- Number of clients
- Gateway policies

The End

Thank you! Questions?