Attribute-based Communication meets Security

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University of Camerino

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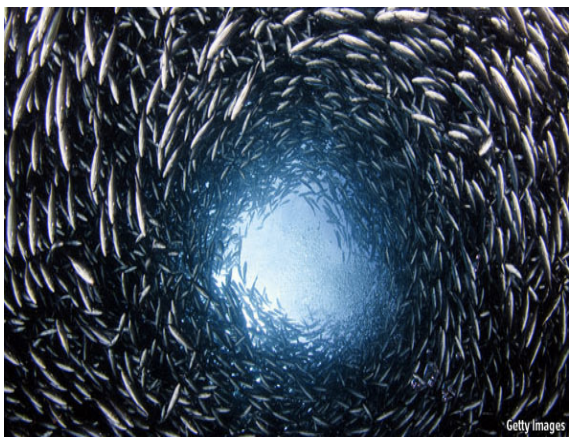

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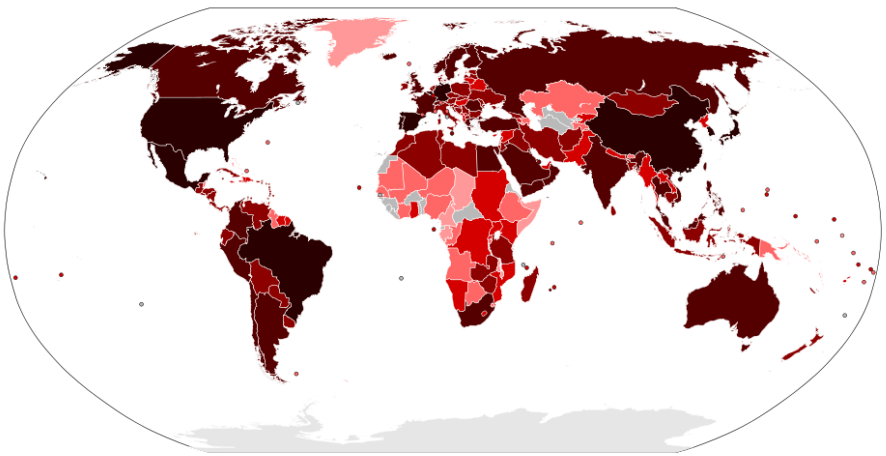

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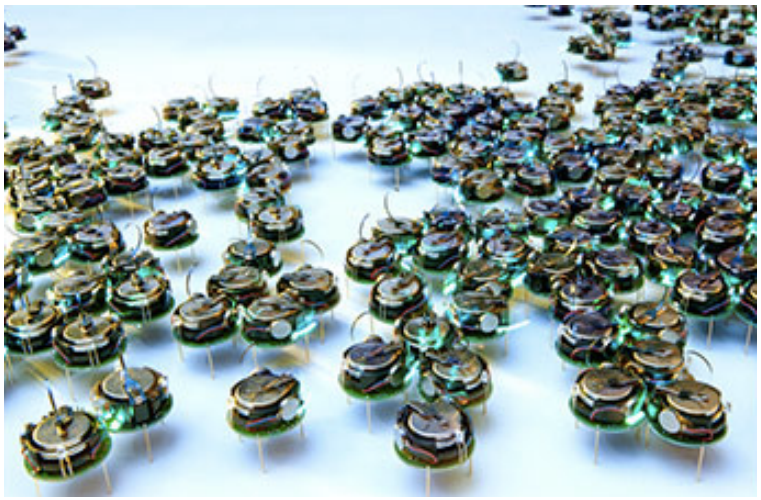

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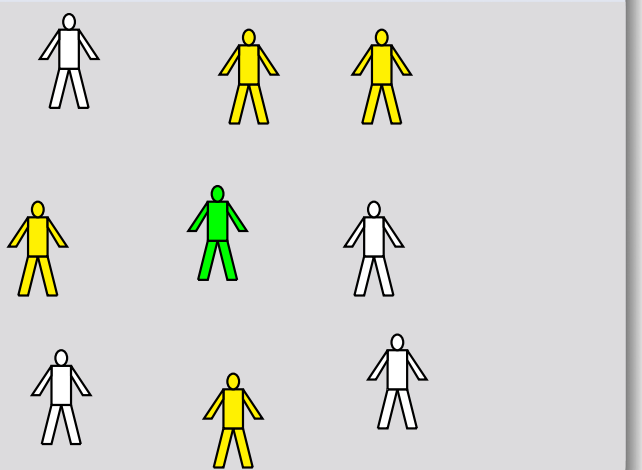

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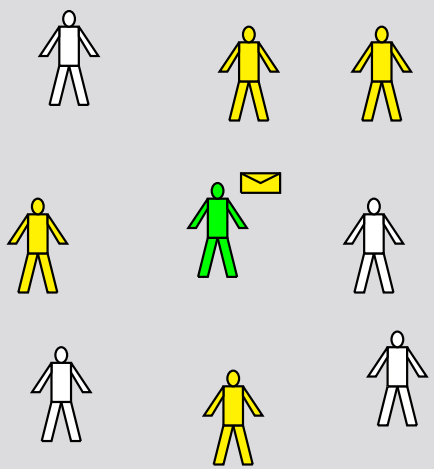

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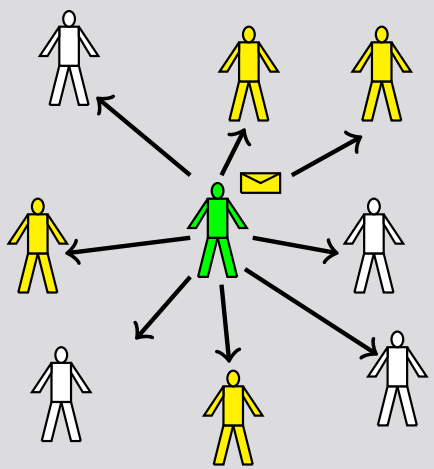

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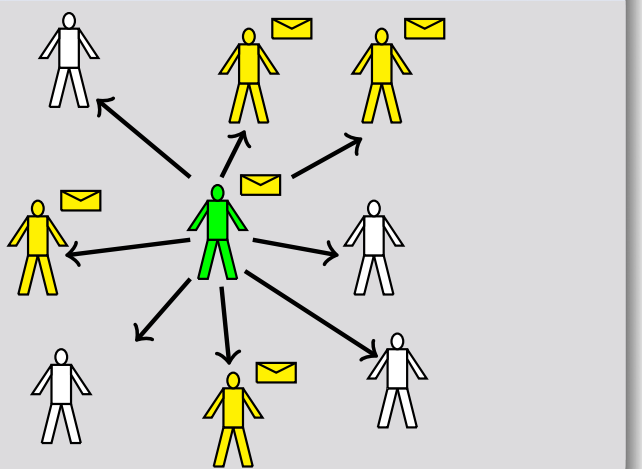

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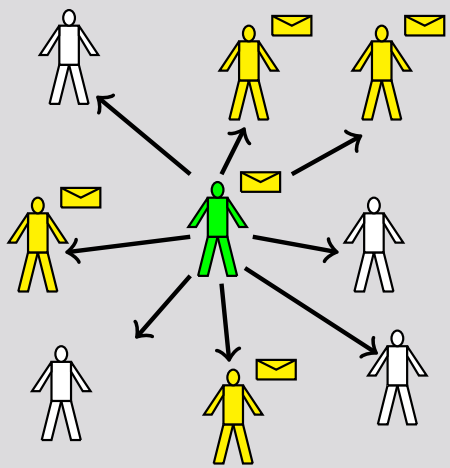

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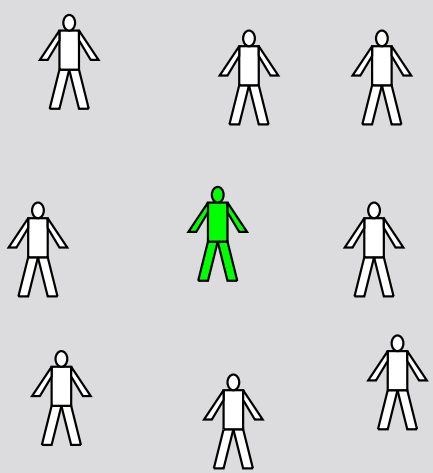

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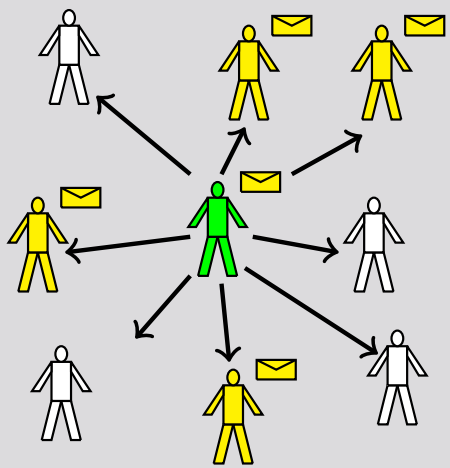

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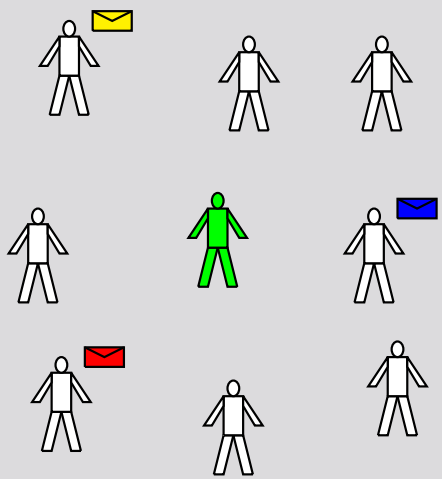

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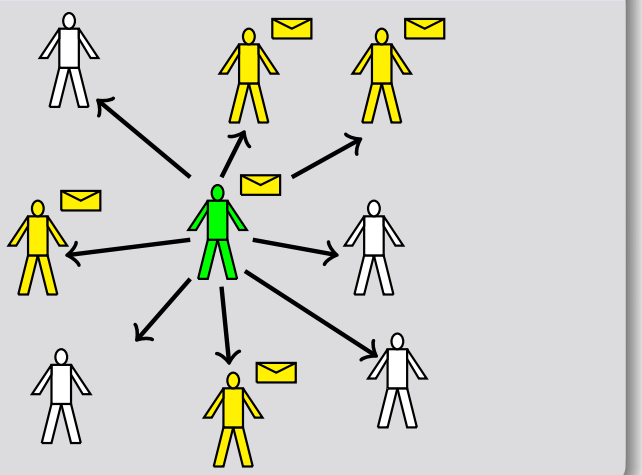

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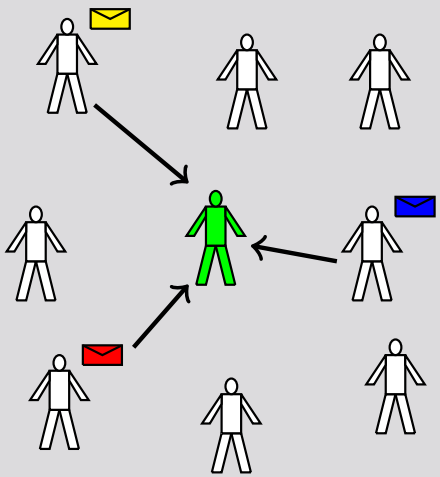

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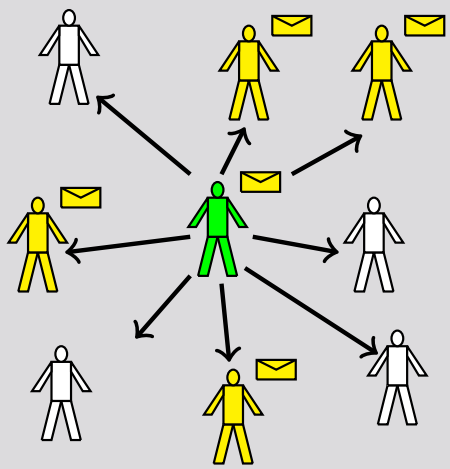

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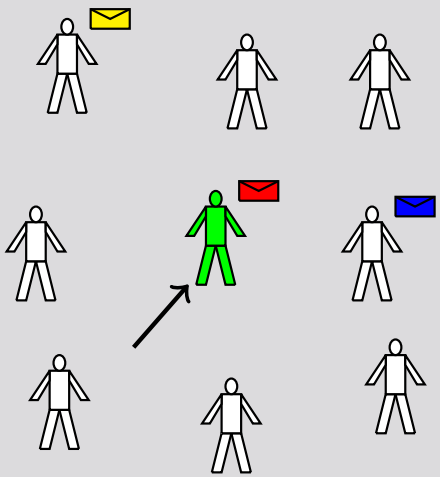

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Receivers filter incoming messages using predicates that specify properties of the sender and the delivered message.

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Components:

$$C ::= \quad [\Gamma \triangleright P]_\iota \mid C_1 || C_2$$

Γ is a function mapping attributes in $\mathbb{A}$ to values in $\mathbb{VAL}$.

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Output: the evaluation of $\tilde{e}$ is sent to all components satisfying π.

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Input: a value v is received from a component with attributes Γ if Γ satisfies $\pi[v/x]$.

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Attribute update: Attributes $\tilde{a}$ are set to $\tilde{e}$.

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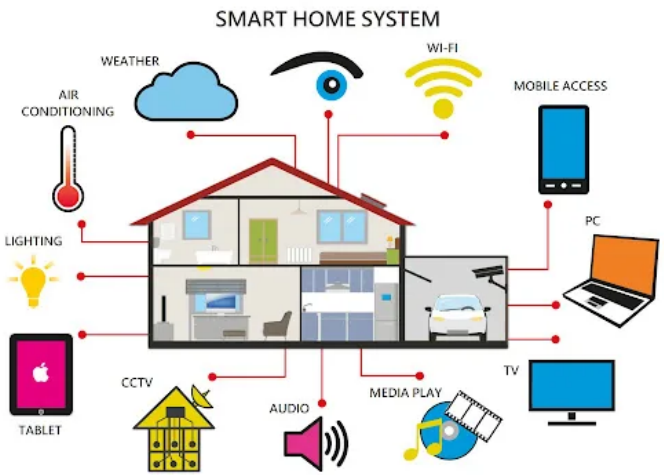

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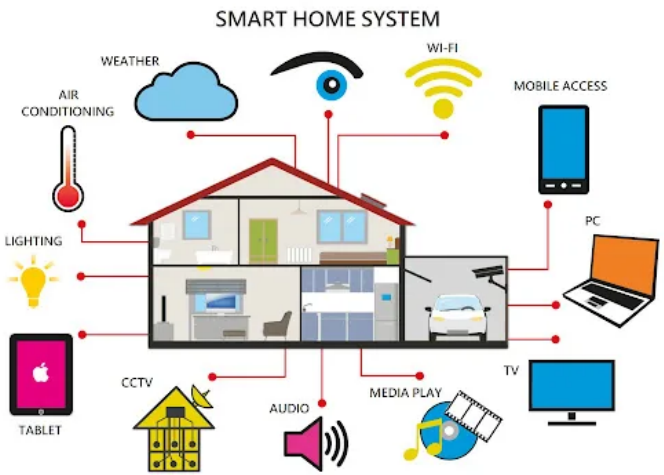

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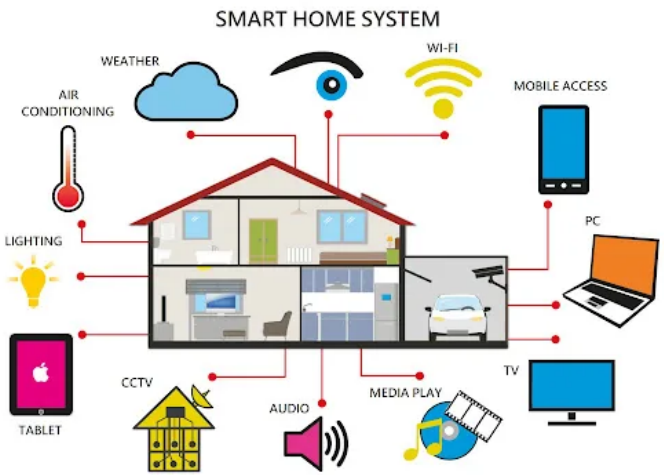

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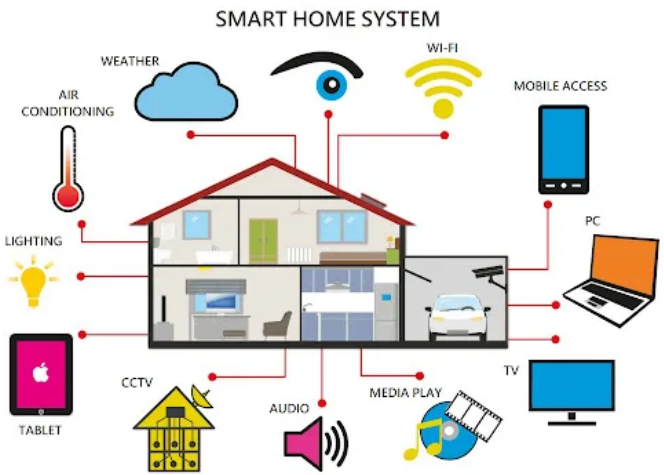

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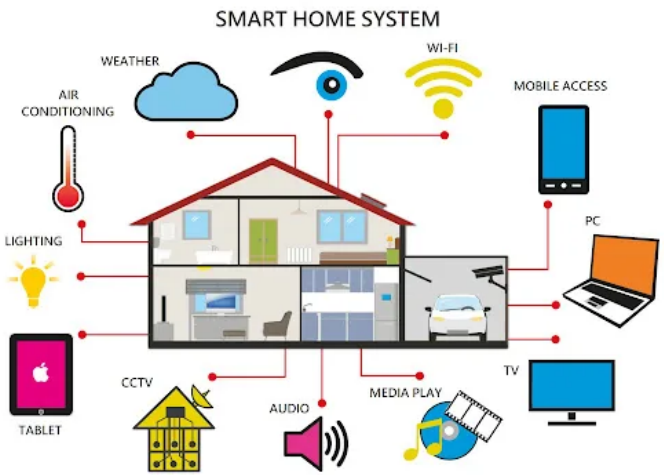

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Remark: new sensors, actuators and controllers can be transparently integrated!

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- Can we preserve the openendedness of AbC?
- Can we support distributed execution while guarantee preservations of security properties?

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Let $\mathbb{I} \subseteq \mathbb{VAL}$ denote the set of *identities*, $\{\!: v :\!\}_\iota$ denote the value v signed by ι.

CrAbC: Cryptographic AbC

In CrAbC, we consider a larger set of expressions to integrate cryptographic primitives:

e	::=	v	Value
	|	$\mathtt{x}$	Variable
	|	a	Attribute
	|	this.a	
	|	e_1 *bop* e_2	Binary Operator
	|	*uop* e_1	Unary Operator
	|	$\mathsf{enc}(e_1, e_2)$	Encryption
	|	$\mathsf{dec}(e_1, e_2)$	Decryption
	|	$\mathsf{sign}(e)$	Signature
	|	$\mathsf{whois}(e)$	Identity Checking
	|	self	Self reference

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Unfortunately, a malicious agent can acquire info about the state of another component. Indeed, predicates can be used to test the values of attributes!

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The compliance with a policy Π can be statically checked via a type systems!

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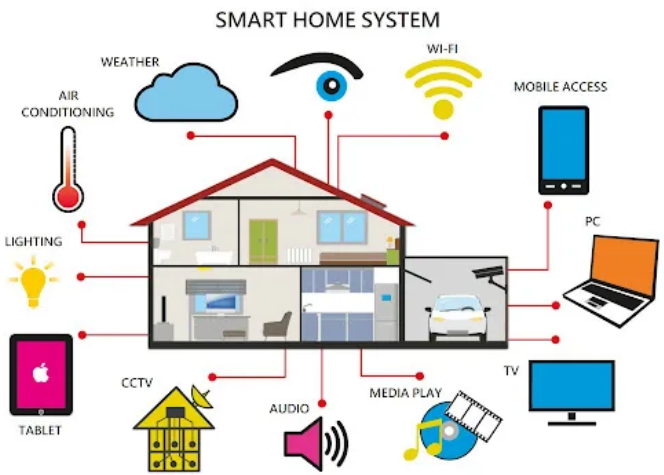

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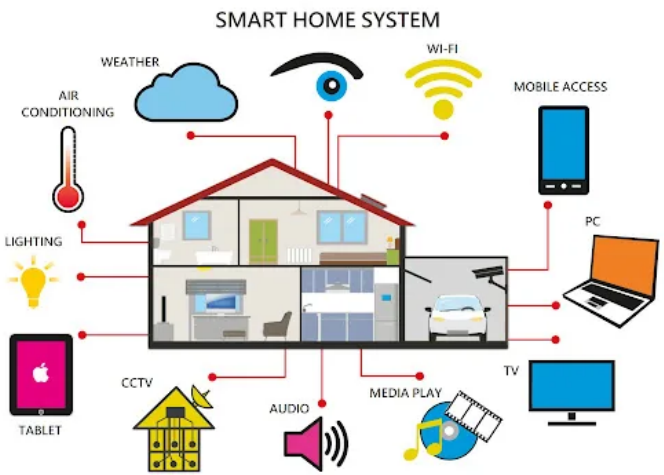

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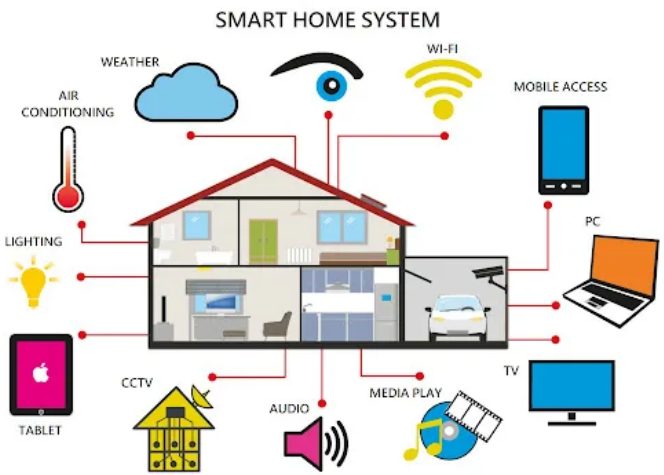

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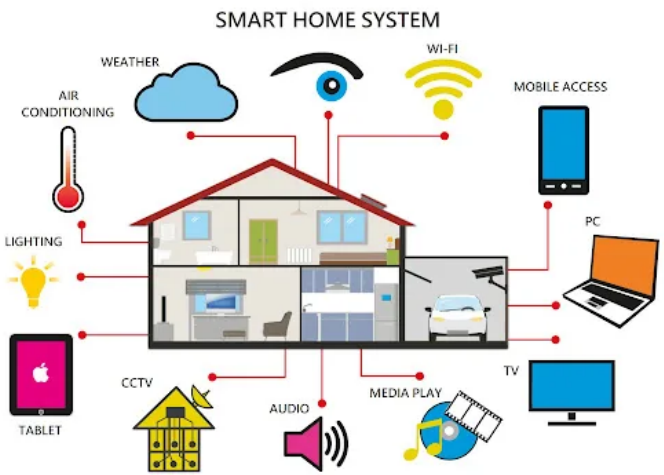

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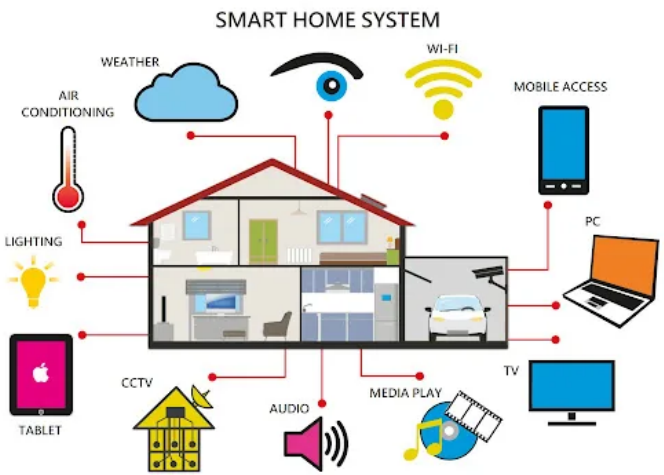

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New devices can be integrated by registering them in the policies.

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Question: How can we implement/execute CRABC?

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A framework secure attribute-based publish subscribe has been proposed.

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- A *Broker*, that has the responsibility of:
  - coordinating agents' interactions;
  - register subscriptions;
  - store values of agent attributes;
  - deliver messages.

SecPubSub in a nutshel...

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Correctness of translation has been proved to show that...

- any computation is CrAbC is mimiked by the implementation in SecPubSub;
- computations experienced in SecPubSub are related to ones in CrAbC.

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- An implementation of SecPubSub in Python is under development.
- We are generalising the approach to consider multiple Certification Authorities and Brokers to avoid single points of failure.


thank
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