dr. Etienne B. Roesch (Coordinator)
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http://cocoon-project.eu

COC🏠ON
emotion psychology
meets cyber-security

SCIENTIFIC BACKGROUND

In Cocoon, we want to **understand** and **build** from the User's experience, as a central part in the definition of intrusion detection systems.

Home is a sacred, safe, warm haven.

A user's experience is **emotional** at its core. Anything that goes wrong, will go.. horribly wrong.

Emotions go beyond happy/sad. They are cognitive **processes** that allow us to interpret the world and colour our lives.

- Appraisal of the situation
- Motivation, personality, goals
- Reasoning
- Expressed in a wide range ways
- ...
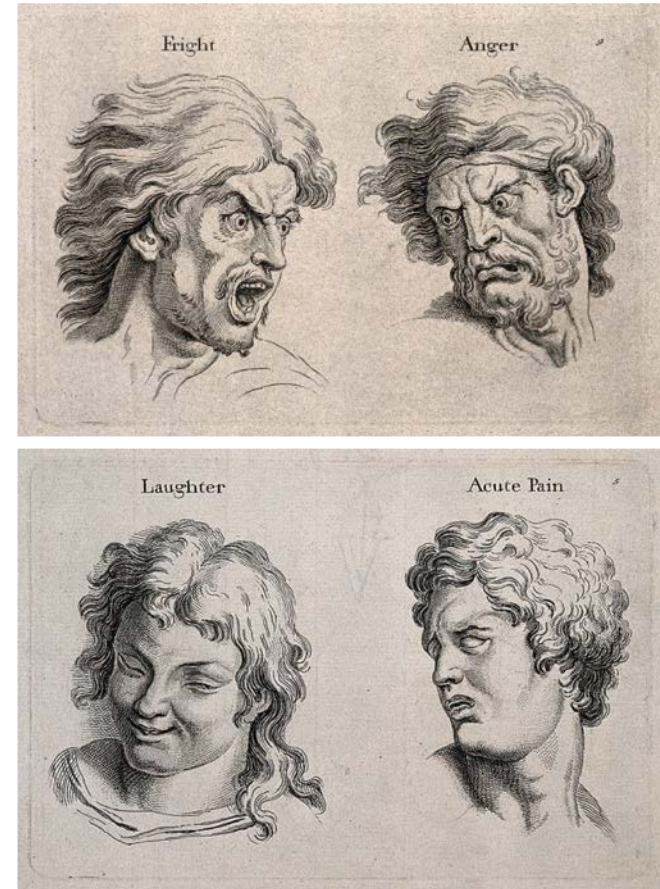
Top: A frightened, an angry face. **Bottom:** Faces of laughter and pain. Engraving, c. 1760, after C. Le Brun. Wellcome Images.

WHEN A USER'S HOME IS ATTACKED...

Would users **notice** at all?

Would they **identify** the irregularities in the behaviour of their IoT network?

To what would they **attribute** these irregularities?

Would it **hamper their goals**? Would home not be as a safe haven any more?

What emotions would they **experience**?

How would they **cope** with the situation?

How do **personal variables moderate** these reactions?

...

… CAN WE USE THE USER AS AN INTEGRAL PART TO AN INTRUSION DETECTION SYSTEM?

Different people will react differently

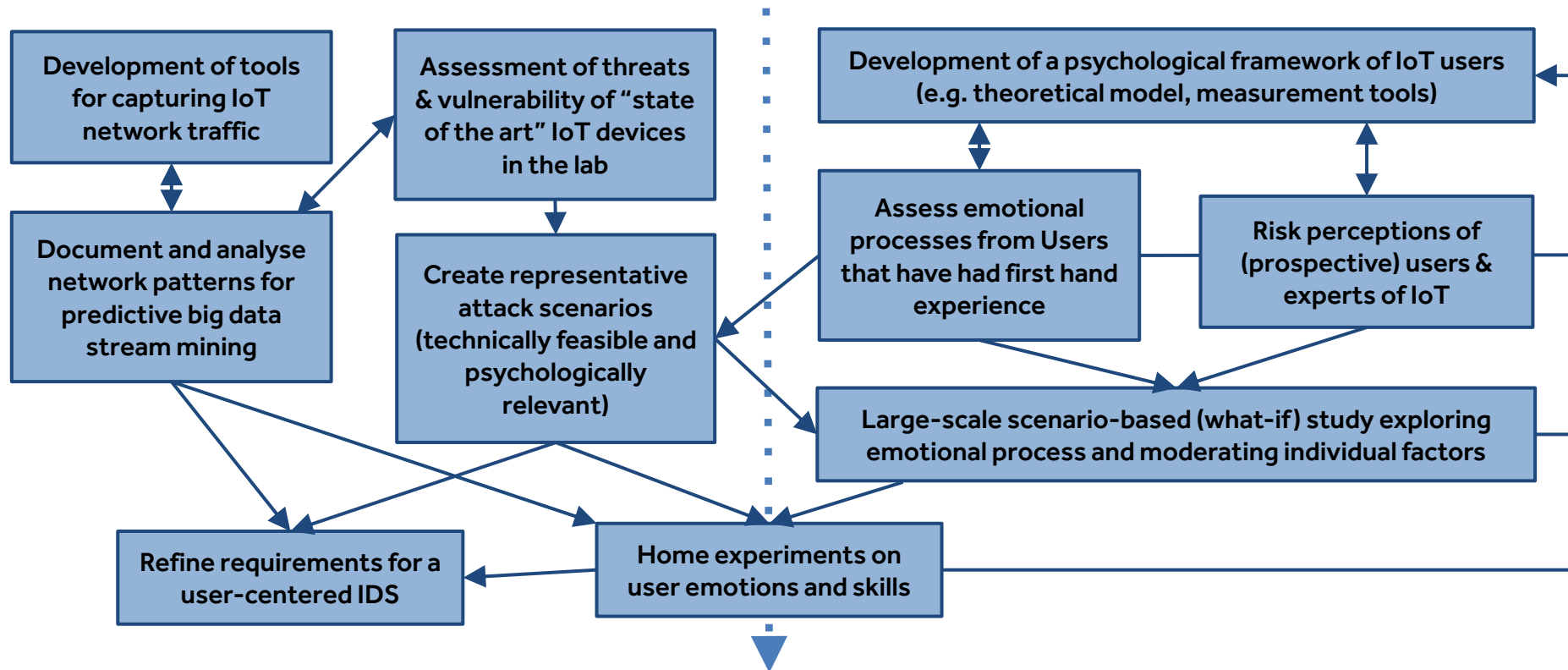Different people will need different kinds of information
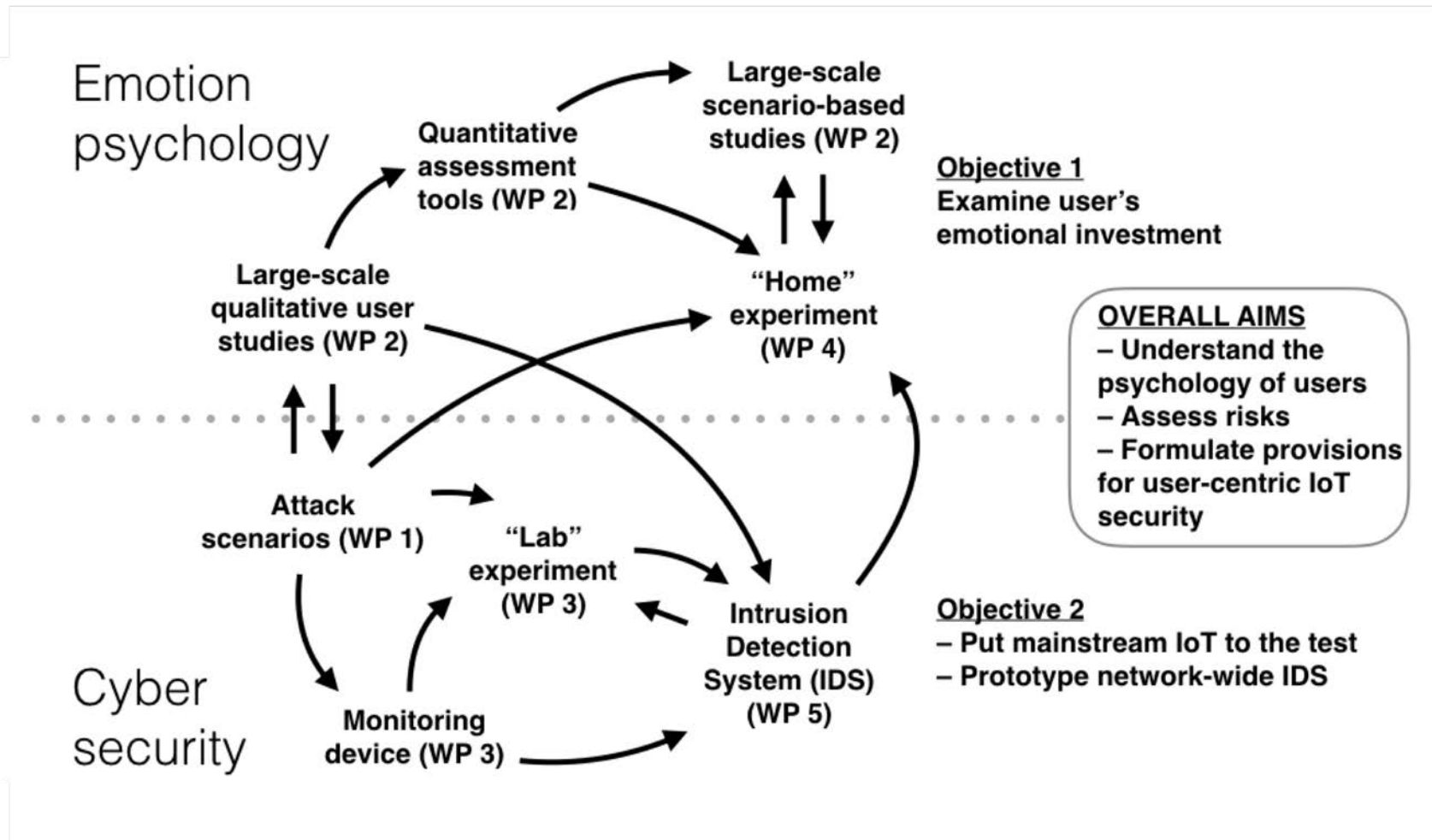
Different people will have different levels of tolerance

KEY CHALLENGES & IMPACT

Objective 1   Examine the User's emotional experience

Objective 2   Put mainstream IoT to the test & develop a new kind of IDS

COCOON: THE CONSORTIUM

Prof. Johnny Fontaine
Emotion psychology; psychological assessment; social and cultural anthropology

Dr. Sanja Budimir (PDRA)
Cognitive Scientist

Ghent's speciality lies in the measurement of emotional experiences. They will develop several assessment tools to help characterise and measure IoT user's experiences.

LIMITLESS **POTENTIAL** | LIMITLESS **OPPORTUNITIES** | LIMITLESS **IMPACT**

Prof. Wijnand Ijsselsteijn
Dir. Research Center for Humans & Technology

Dr. Antal Haans
Environmental psychologist

Dr. Nicole Huijts (PDRA) — start 03/2018
Psychologist; public acceptability and
acceptance of technology

Eindhoven has run several life-size IoT
experiments in cities and living labs.

Prof. Thomas Gross
Network-aware applications

Dr. Stefan Mangold
Wireless communication and mobile computing;
digital toys

Ivano Ras (RA) — start 04/2018
Software engineer

Zurich will evaluate the hardware requirements for
a network-wide intrusion detection system (IDS)
for IoT protocols, and supervise development.

Dr. Georgos Loukas
Cyber-security; Cyber-physical security

Dr. Avgustinos Filippoupolitis
Networks & Emergency management systems

Dr. Ryan Heartfield (PDRA)
Dr. Anatolij Bezemskij (PDRA)
Cyber-security

Greenwich has unparalleled expertise in cyber-physical security, and renewed expertise in the design of IDS.

Dr. Etienne Roesch
Emotion psychology & technology; affective computing

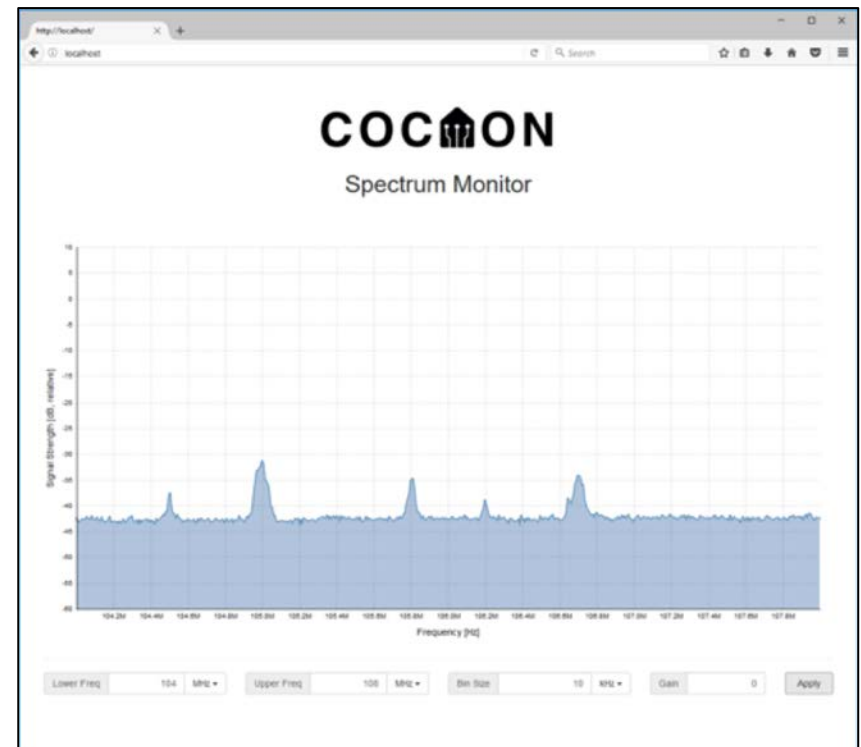**Dr. Frederic Stahl**
Big data; data stream learning

Dr. Timothée Dubuc (PDRA)
Machine learning

Reading is an expert in the analytics of data streams, and coordinator of Cocoon.

RESULTS SO FAR

THE "COCOON NODE" CAPTURES IOT NETWORK TRAFFIC

"LAB" EXPERIMENTS: ASSESSMENT OF THREATS

Assess vulnerability of current "state of the art" IoT devices
Gather and label network patterns

Cocoon staff already revealed two zero-day exploits in off-the-shelf IoT devices

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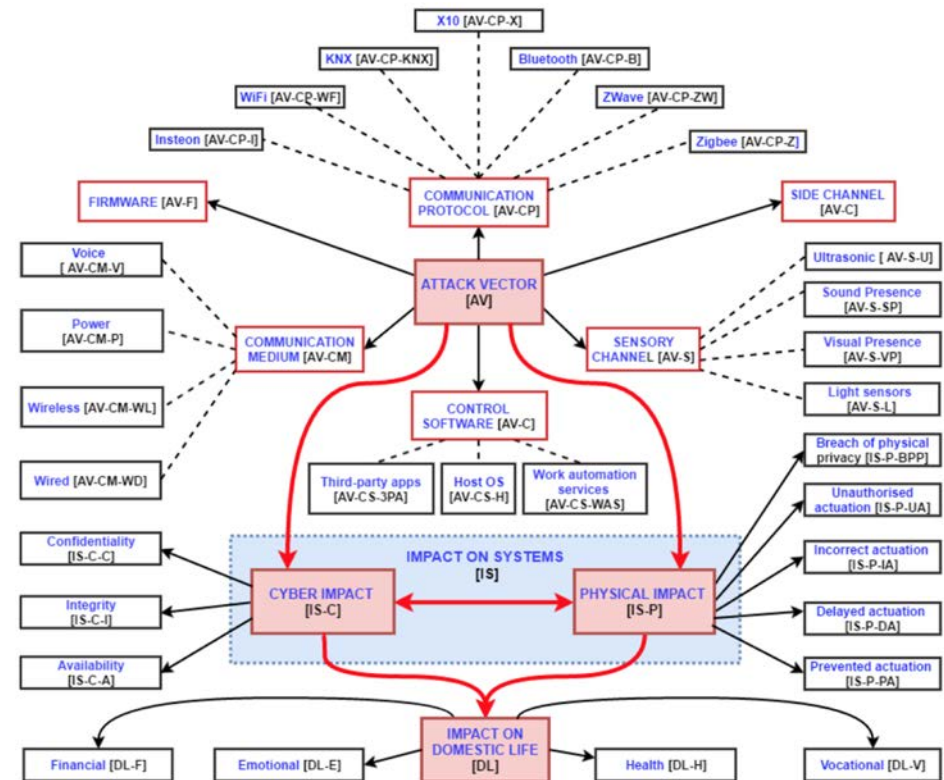
FROM THE LAB TO REALISTIC SCENARIOS

Taxonomy of cyber threats

Benchmarking

Impact

- cyber (confidentiality, integrity, availability)
- physical (access, actuation)
- domestic life (emotional, financial, health)

(PROSPECTIVE) USERS DON'T FULLY COMPREHEND THE RISKS

Table 6.2 Mean judgments of risk and benefit about 13 technologies

Technology	Perceived benefit	Perceived risk	Risk adjustment factor[a]	Acceptable level
Online banking*	66	79		
Email over public network*	46	74		
Network camera	42	60		
Door/window sensor	32	44		
Smart speaker	24	43		
Smart smoke detector	53	36		
Smartphone navigation app*	60	35		
Smart plug	24	35		

- Participant perceived risks (and benefits) of smart home IoTs to be lower then online banking or e-mailing over public network

- Are (prospective) users underestimating risks?

WHAT DETERMINES RISKS?
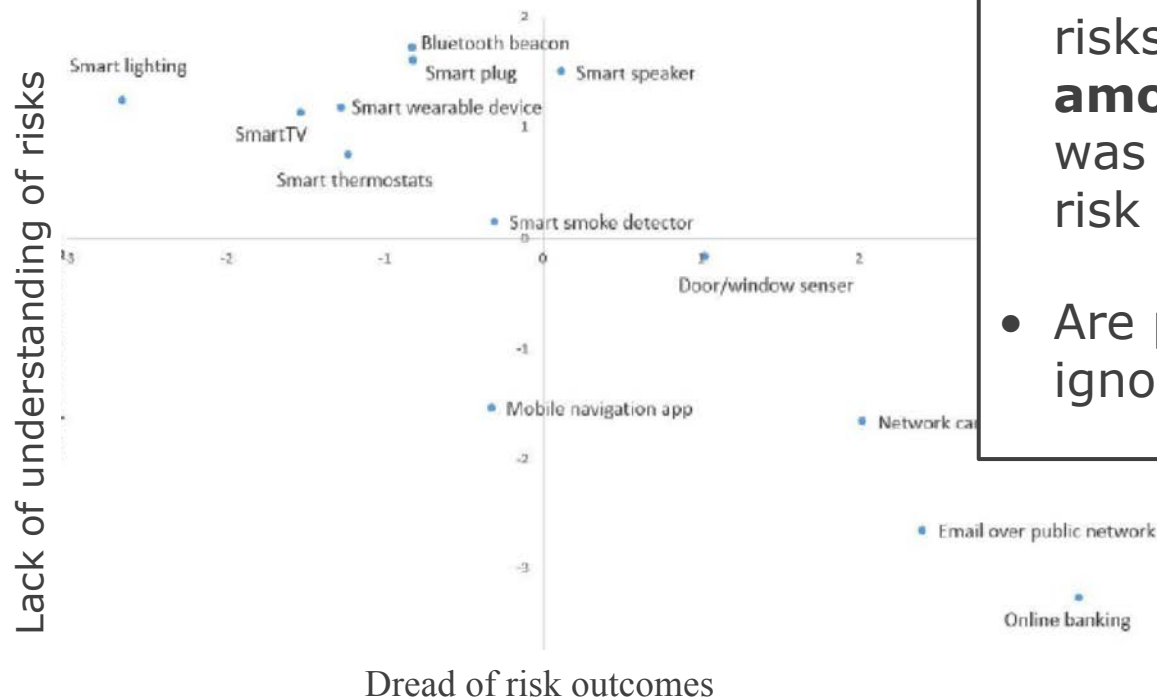
- Lack of perceived understanding of IoT risks (**societal** and **amongst engineers**) was most predictive of risk perceptions!

- Are prospective users ignorant of the risks?

WHAT'S NEXT FOR COCOON? THE "HOME" EXPERIMENT

Volunteering households fitted with Cocoon IoT network of devices

"irregularities" == simulated attacks

Diary & real-time qualitative assessment

– How do users respond to irregularities?
– How do personal characteristics moderate such responses?
– Can **users be sensors** of the health status of their IoT network?

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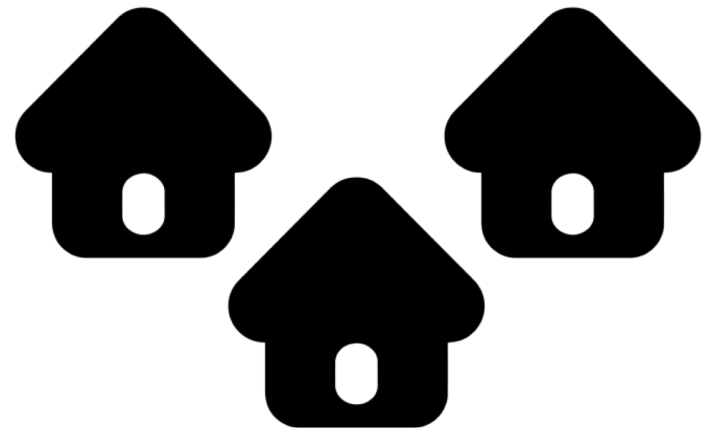
WHAT'S NEXT FOR COCOON? A NETWORK-WIDE INTRUSION DETECTION SYSTEM

Burma DDoS Attack
November 1 -2, 2010
All Times EDT
Credit: Arbor Networks
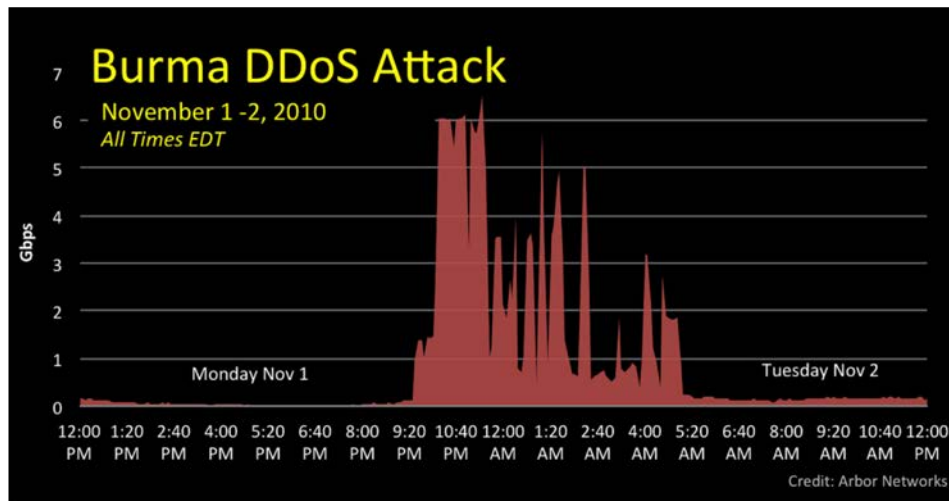
Heterogeneous streams

Stream is infinite and cannot be stored easily

Stream is not easy to label and changing

Predictive data stream mining: Concept drifts, classification with sparse class labels

The successful and safe inclusion of technology can only be based on how users interact with available systems.

Emotion psychology could / should help inform manufacturers, policy makers, legal and judicial systems.

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N°	Title	Nature	Delivery date (month)		Partner in charge
			Contractual	Actual	
D1.1	Taxonomy of cyber threats in smart homes	Article	M3	M4	Greenwich
D1.2	Smart home Cyber Range	Article	M6	M6	Greenwich
D2.1	Identification of prototypical IoT emotional situations, emotional reactions and behavior	Questionnaires	M6	M9	Ghent
D2.2	Two psychological instruments for assessing emotional experiences in IoT context	Questionnaires	M12	M13	Ghent
D3.1	State of the art report about commercially available popular	Article	M3	M4	Greenwich
D3.2	Cocoon smart IoT node	Documentation	M6	M6	Zurich
D3.3	Device specification and performance evaluation of the smart Cocoon IoT node	Documentation	M12	Ongoing	Zurich
D4.1	Functional application to interact with users and instructions	Software	M12	Ongoing	~~Greenwich~~ Reading
D6.1	Guidelines for partner's applications to Ethics Committees	Documentation	M6	M13	Eindhoven
D6.2	Specifications of methodology to recruit and engage with participants before and after "Home" experiments	Documentation	M6	M13	Eindhoven
D7.1	Internal project website and collaborative mechanisms		M1	M1	Reading

DELIVERABLES

University of Reading

VALORISATION

- Presentation at Housing Technology 2017
- Presentation at Dcypher symposium (Dutch Parliament)
- Housing Technology IoT conference 2017 + Proceedings
- Interview by Thomson Reuters, taken up by MSN, Yahoo, Sydney Morning Herald, Malay Mail Online, WA Today and others, including Polish national news report, March 2018
- CERE Symposium on Technology and Emotions, April 2018 (including 2 presentations of results from 2 WP from Cocoon)

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THANK YOU FOR YOUR ATTENTION!

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