Advanced Threat Models for Symbolic Evaluation

Design and Verification of Security Protocols and Security Ceremonies

Programa de Pós-Graduacão em Ciências da Computacão
Dr. Jean Everson Martina

August-November 2016

Programa de
Pós-Graduação
em Ciência da
Computação
UFSC

UNIVERSIDADE FEDERAL
DE SANTA CATARINA

Disclaimer

Disclaimer!

This is not a Lecture, but a keynote I given in CSF 2013 in New Orleans for a workshop called STAST 2013.

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Historical facts

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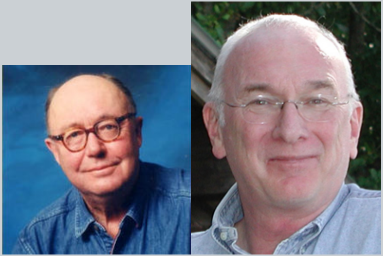

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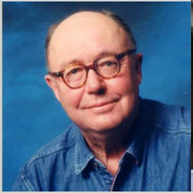
    - Modify messages;
    - Copy messages;
    - Replay messages;
    - Create messages.



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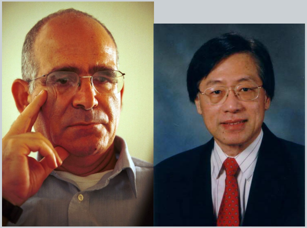

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- Research in human-centred computing has multiple goals;
- Focus on the ways that human beings adopt, adapt, and organise their lives around computational technologies;
- This inherently brings a social aspect to computing!

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Motivation for Human Centric Protocol Security

- When put in practice, protocols' assumptions that involves human-device and human-human interaction have to be implemented;

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- They are then replaced by dynamic user-interactions

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  - Clear usability problems – the user must have unrealistic capabilities to perform his activities;
  - The assumptions are too big/strong or too generic – it is often necessary to assume that previous steps were successfully performed, or that the user is capable of performing some kind of operation.

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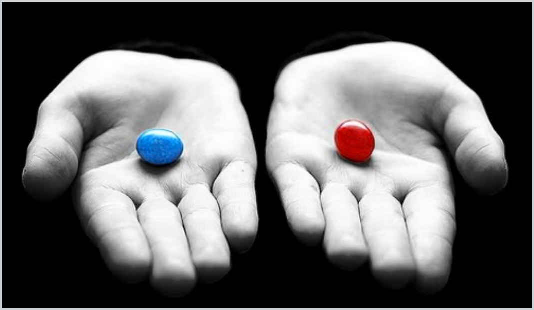
How do we sort this out?



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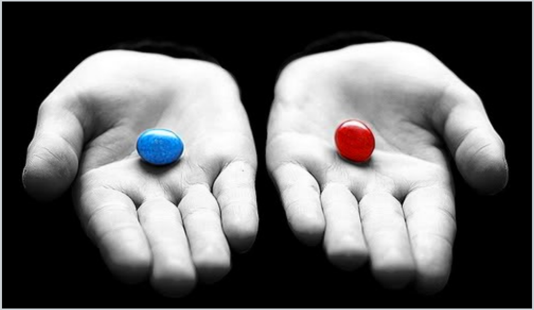

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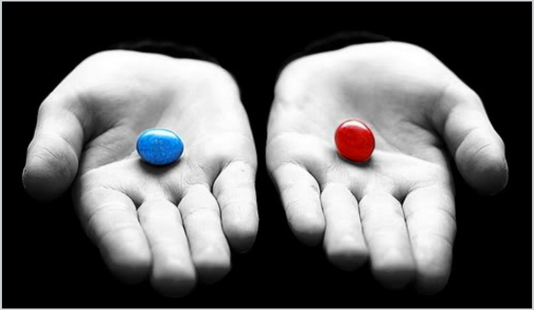

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- User interaction is per se unpredictable;
- Modelling the user is very hard;
- Constructing a tool for that is complicated;
- The user is not part of the problem, but part of the solution!

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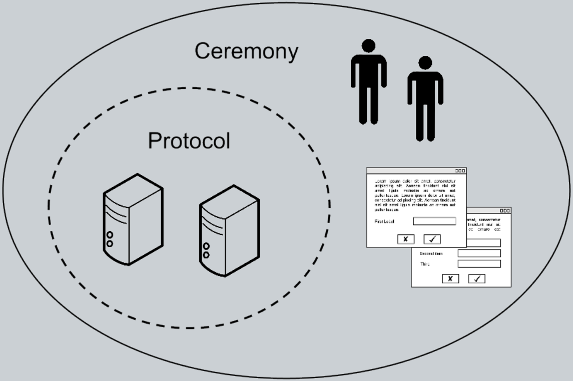

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- Assumptions are more precise and well described
- A Dolev-Yao attacker for ceremonies is not always consistent with real world threats
- The description attacker capabilities for ceremonies scope requires finer granularity in its description

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- However, to guarantee that a ceremony is secure against a such powerful attacker, we have to include very complex mechanisms.

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- A more realistic threat model can prevent the user from being overloaded, and consequently make the ceremony more usable and secure

Premises for Ceremonies Threat Modelling

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- Humans are capable of performing basic information recall or mathematical operations;
- One should never use more crypto than needed.

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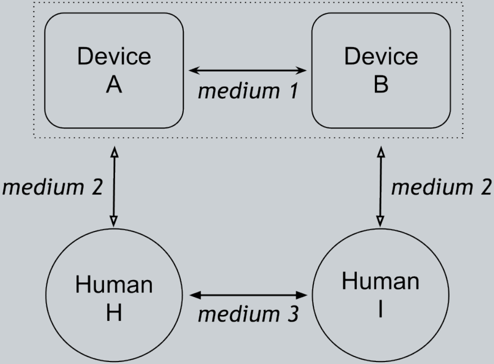

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- Humans make decisions regarding their security based on the evaluation of the threat level they are subject to:
  - Humans had to decide whether to engage into attacks to become hunters or keep a way of life of gatherers;
  - Inherent faculty of human nature;
  - Some attacks may be thwarted, but inherently this will attract the human nature.

Human Centred Threat Model

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- A threat model for ceremonies must be ceremony-dependent and context-dependent.

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- Verify that ceremonies are secure against a realistic attacker.

Proposed Threat Model

Capabilities

- Eavesdrop

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- Initiate

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Some of the characteristics are achieved by the combination of our definitions (e.g. Replaying = Eavesdrop + Initiate)

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- Human agents executing security ceremonies are constrained by the laws of physics and usual capabilities expected from human beings;

Concluding Remarks

- The use of a worst-case scenario threat model is justifiable in security protocol scenarios;
- However, the same cannot be said for a human centric approach;
- Human agents executing security ceremonies are constrained by the laws of physics and usual capabilities expected from human beings;
- The existence of a extremely powerful agent is not plausible in some real-world scenarios.

Discussion

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- Is it reasonable to use this threat model for security protocols?
- Can you describe a situation where you could gain leverage by using this threat model?

Questions????

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