Homomorphic Encryption and our current research

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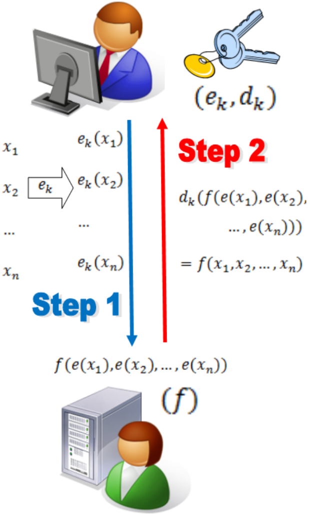
Homomorphic Encryption

What is it?

- Privacy homomorphism – Rivest, Adleman, Dertouzos.



(e_k, d_k)
x_1
x_2
...
x_n
e_k
$e_k(x_1)$
$e_k(x_2)$
...
$e_k(x_n)$
Step 1
Step 2
$d_k(f(e(x_1), e(x_2), \ldots, e(x_n)))$
$= f(x_1, x_2, \ldots, x_n)$
$f(e(x_1), e(x_2), \ldots, e(x_n))$
(f)

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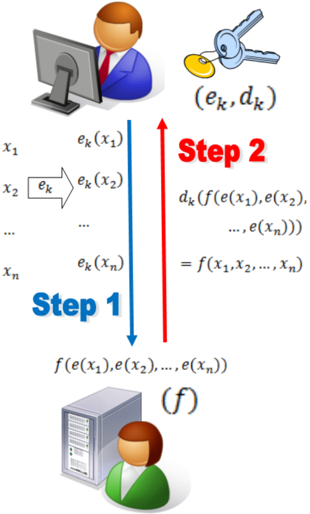
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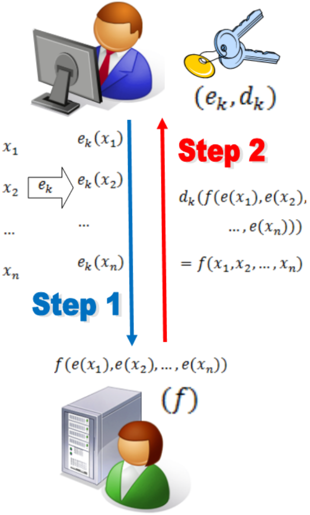

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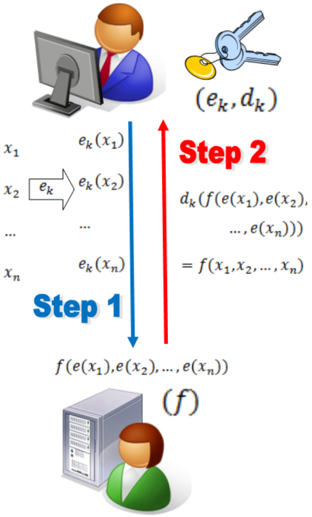

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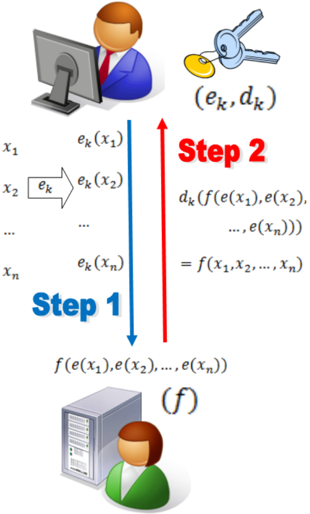
- Addition – Pailler's cryptosystem
- Gentry and FHE.
- The future...



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Fully Homomorphic Encryption

General goal:

Further the developments of fully homomorphic encryption (FHE).

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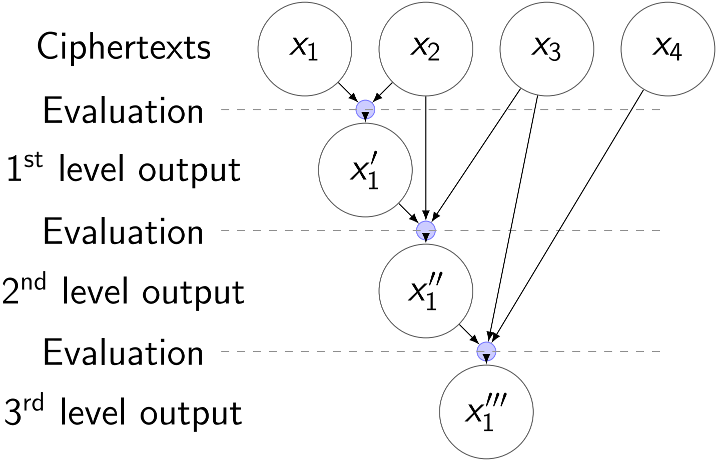
- Not immediately clear.
- We do have other types:
  - Somewhat
  - Levelled
  - Fully

FHE, appealing to intuition

Evaluating evaluation... by example



Ciphertexts

Evaluation

1st level output

Evaluation

2nd level output

Evaluation

3rd level output

FHE, appealing to intuition

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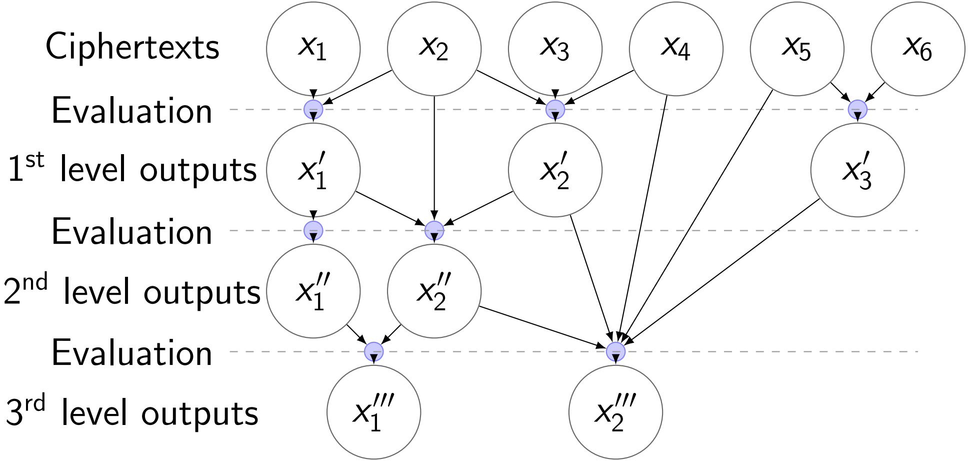

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Abstract Homorphic Scheme

Three Musicians – Pablo Picasso

Our research

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- Collaboration between NTNU and the University of Mannheim.

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  - Characterization of FHE.

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- Research direction:
    - What are the fundamentals of FHE schemes?
- Results:
    - Generalisation of definitions.
    - Implications.
    - Characterization of FHE.
- Outcome: Paper due in November. Hurrah!

That's all Folks!