Towards A Unifying Framework of Computation on Encrypted Data

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Exciting Times

- Explosion of primitives that enable computing on encrypted data
  - Identity based encryption, Functional encryption (FE), FHE, Obfuscation, Witness Encryption, Property Preserving encryption, Bilinear Groups/über assumption, …

Exciting Times, But..

- Each primitive has many different definitions of security
  - FE : IND [BF01,SW05..], Non-adaptive SIM[O'N'10], Adaptive SIM[BSW'11], Fully-adaptive security [MM'13], SS2/SS3[BO'N'13] , Bounded-key IND/SIM[GVW'12], Unbounded SIM [AGVW'13], Relaxed SIM[AKS'14], …
- In addition, each primitive has many variants
  - FE: Symmetric key/Public key, With or without function hiding (function hiding has 3 different definitions!), public/private index, bounded/unbounded key…

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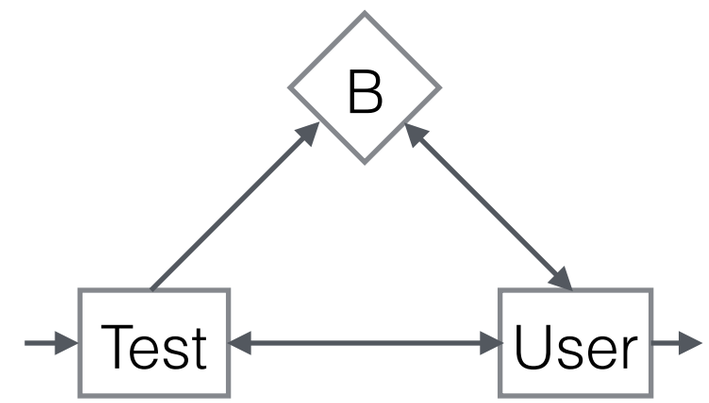
What are the "best" achievable definitions?	**Are these primitives all that different from each other?**

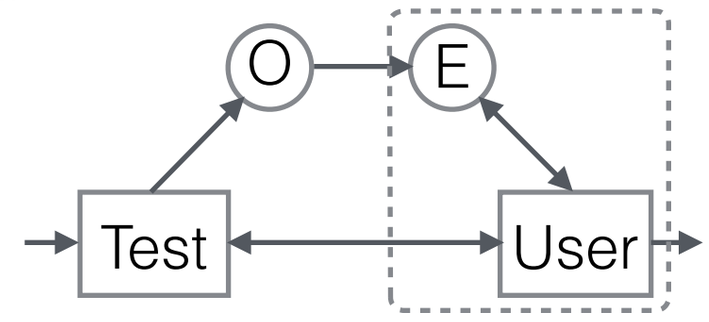
We present…

- **Unifying framework for "cryptographic objects"**
  - Models Obf., FE, FHE, (limited) Generic Group, …
    - Different "schemas" in the framework
  - Easy to define new variants
    - e.g., obtain iO, DiO as variants of Obf. schema
- **Indistinguishability-Preserving (IND-PRE) security**
  - Avoids many known impossibility results, but sometimes stronger than definitions in use today
  - Strong enough for composition (often)



ideal

real



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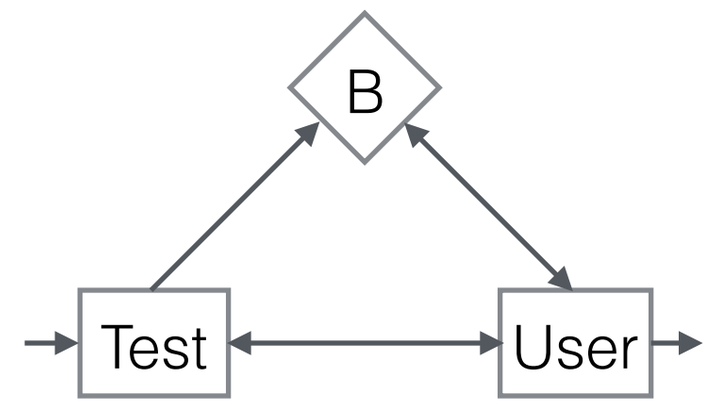

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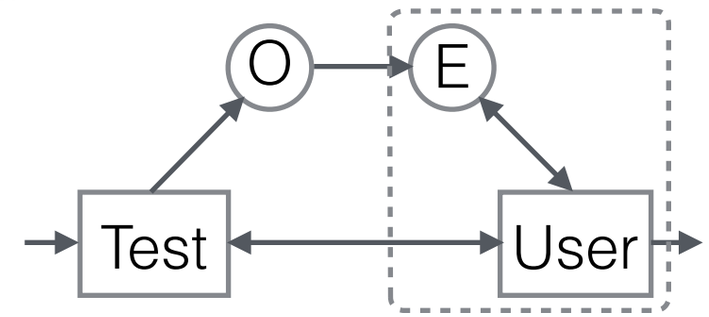

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