Exposure of sensitive information can be harmful on its own and in addition could enable further attacks. A rigorous and unambiguous definition of information exposure bugs can help researchers and practitioners identify them, thus avoiding security failures. Information Exposure (IEX) is a new class in the Bugs Framework (BF). The BF comprises rigorous definitions and (static) attributes of bugs classes, along with their related dynamic properties, such as proximate and secondary causes, consequences and sites. 

Definition of IEX: Information is leaked through legitimate or side channels.

- **BF Model of Information Exposure**
- **IEX Taxonomy**
- **CVE-2007-5172**
- **CVE-2017-5754 (Meltdown)**

### BF Model of Information Exposure

- **Source**: CPU, Memory, Storage
- **Session**: User, Person, System
- **Data**: In I/O, Memory, Registers
- **Data Exposure**: Taint, Selective, Covert

### IEX Taxonomy

#### Causes
- Failure to Properly Sanitize Sensitive Data (unleaked before release)
- Failure to Properly Protect Sensitive Data

#### Attributes
- Data Type: Any
- Data Sensitivity: High/Low
- Data State: Stored
- Data Size: Huge
- Exposure: Selective
- Frequency: On-Demand
- Channel: Legitimate

#### Consequences
- ATN

### CVE-2007-5172

**IEX₁**: of password leads to ATN leads to **IEX₂**

**IEX₁**

- **Cause**: Improper Details
- (password in error message)

**Attributes**
- Data Type: Credentials
- Data Sensitivity: High
- Data State: Stored
- Data Size: Little
- Exposure: Selective
- Frequency: On-Demand
- Channel: Diagnostic
- Use: Indirect

**Consequences**: ATN.

**IEX₂**

- **Cause**: Failure to Properly Protect Sensitive Data
  - (password)

**Attributes**
- Data Type: Any
- Data Sensitivity: Low/High
- Data State: Stored
- Data Size: Huge
- Exposure: Selective
- Frequency: On-Demand
- Channel: Legitimate
- Use: (valueable on its own)

**Consequences**: Any IEX consequence

### CVE-2017-5754 (Meltdown)

**Cause**: Hardware Behavior
- (CPU out-of-order execution)

**Attributes**
- Data Type: Any
- Data Sensitivity: High
- Data State: Stored
- Data Size: Huge
- Exposure: Selective
- Frequency: On-Demand
- Channel: Covert

**Use**: Any

**Consequences**: Any IEX consequence