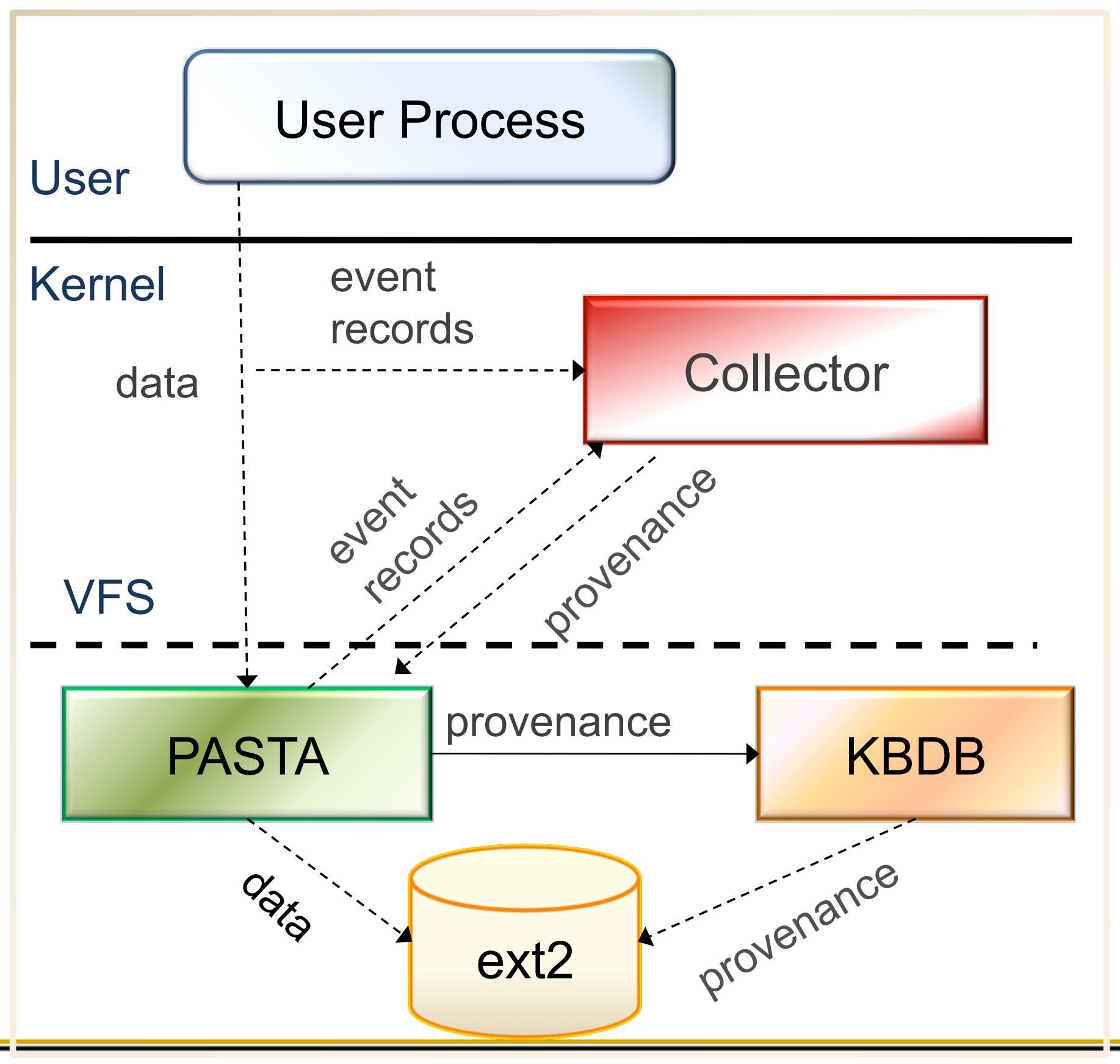
CERIAS
The Center for Education and Research in Information Assurance and Security

# FiPS – A File Provenance System

Salmin Sultana, Elisa Bertino

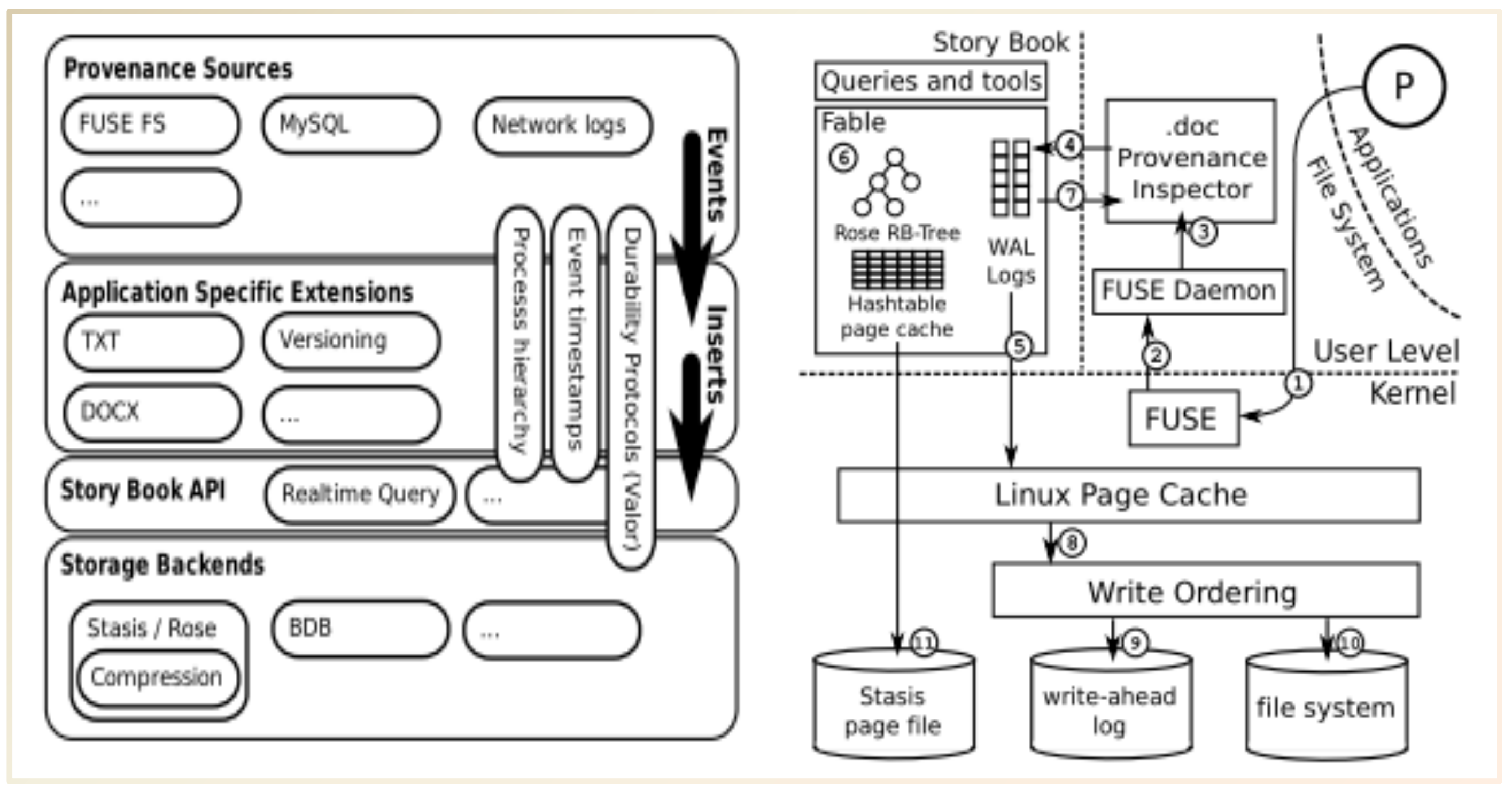
## Motivation

**PASS**



- ❑ Captures unnecessary Provenance Information
- ❑ Cannot trace memory-mapped I/O
- ❑ NFS server-side operations cannot be tracked

**Story Book**



- ❑ Slow due to FUSE
- ❑ Security Concerns due to user space capturing

## Design Objectives

**Portability**
- Provenance for any file system without significant change to the OS or file system.

**Efficiency**
- Not too much overhead in terms of time and space

**Granularity**
- User preferences to customize provenance capture

**Security**
- Security and Access control to provenance storage

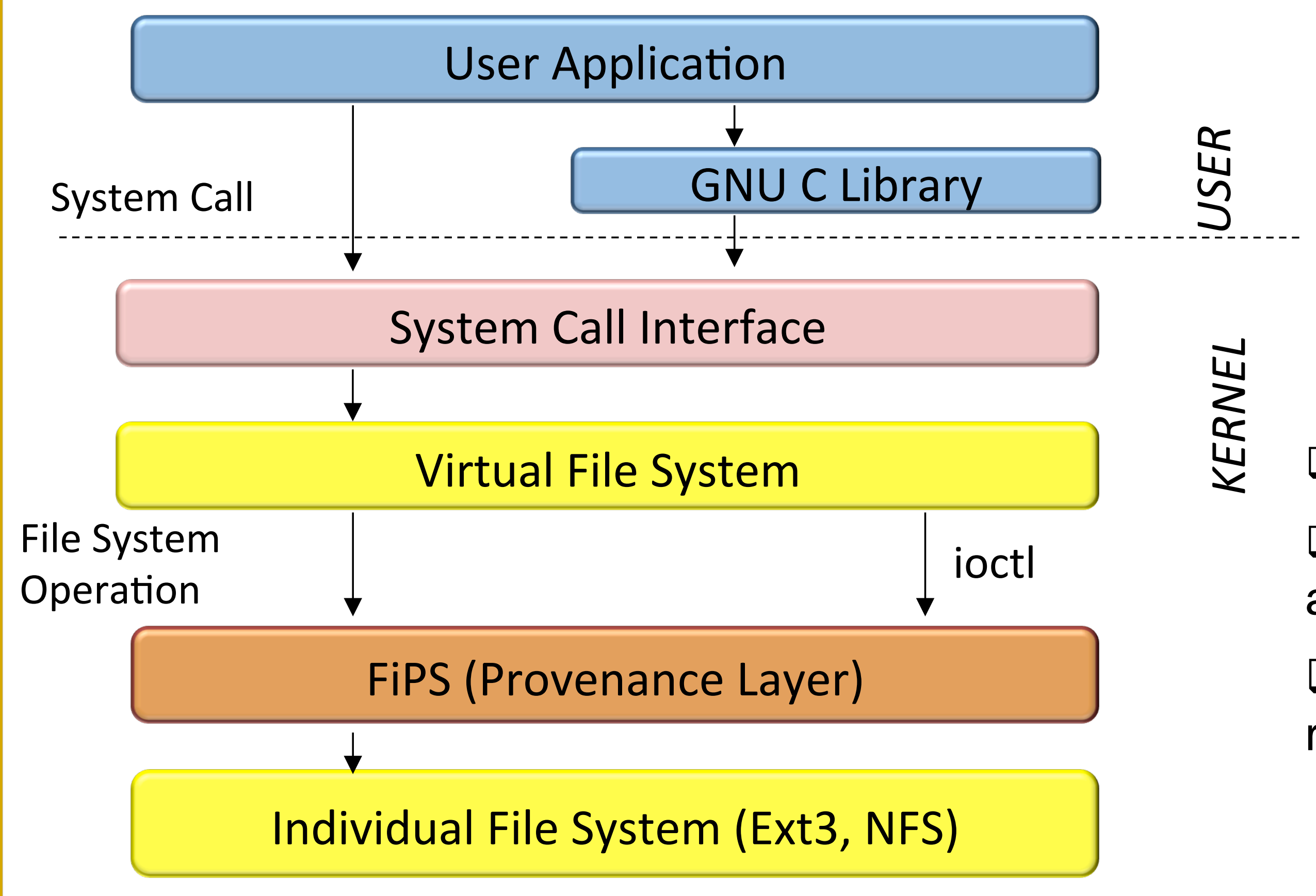
**Query Management**
- Quick response to queries

## Provenance Model

*The provenance of a data object is the documented history of the actors, process, operations, inter-process / operation communications, environment, access control and other user preferences related to the manipulation of the object. The relationships between the entities form a provenance graph (DAG) for the data object.*

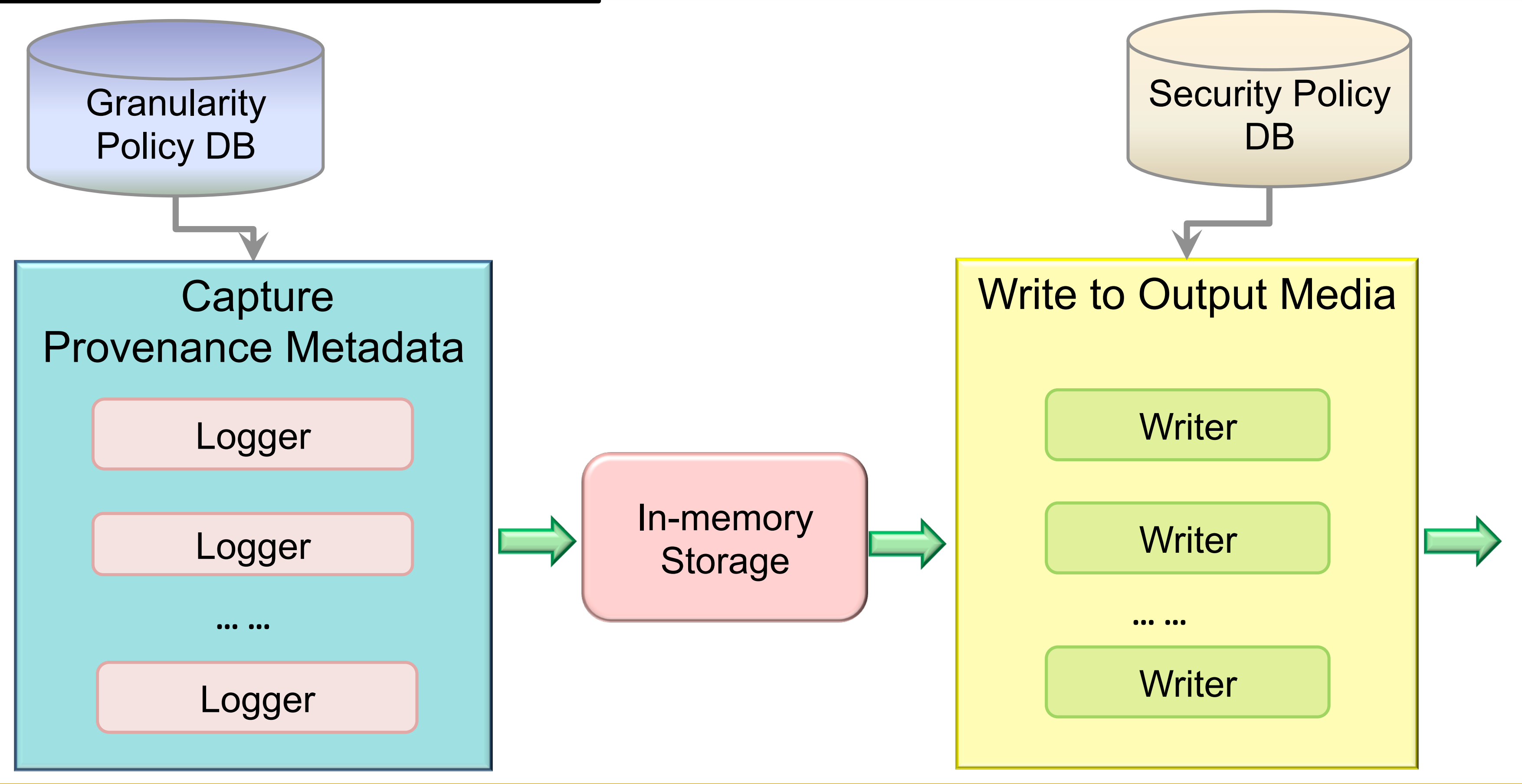
**Entities**
- Process
- Operation
- Communication
- Lineage
- Environment
- Actor
- Access Control Policy
- Granularity Policy

## Proposed Framework



- ❑ Intercepts **file system** calls
- ❑ Extracts provenance metadata and stores in-memory
- ❑ Writes provenance to a local or remote persistent storage

## FiPS Layer



## Implementation

| | |
|---|---|
| **Virtual File System** | • Built on the stackable wrapper file system *Wrapfs* |
| **Policy Databases** | • In-kernel Berkeley DB (KBDB) |
| In-memory Storage | • Buffer or KBDB |
| Redundancy Elimination | • *Redactor* to compress and prune long term history for older files |
| Security | • Secure interface between the modules |

## Future Works

- Finish the implementation
- Incorporate with Networking File System (NFS)
- Extend FiPS to be placed at virtual machine monitors

CERIAS
PURDUE UNIVERSITY