Brandenburg
University of Technology
Cottbus

9th November 2012

THE FUTURE OF PAST PERSISTENCE MODELS

NOVOS PROJECT

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OUTLINE

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1. Past Persistence Models

2. NOVOS

3. The Future

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PERSISTENCE

Definition

- data outlives its creating process
- data is reused

Today

- (memory mapped) files
- data persistent after sync operation
- file system assures consistency of meta data

OVERVIEW

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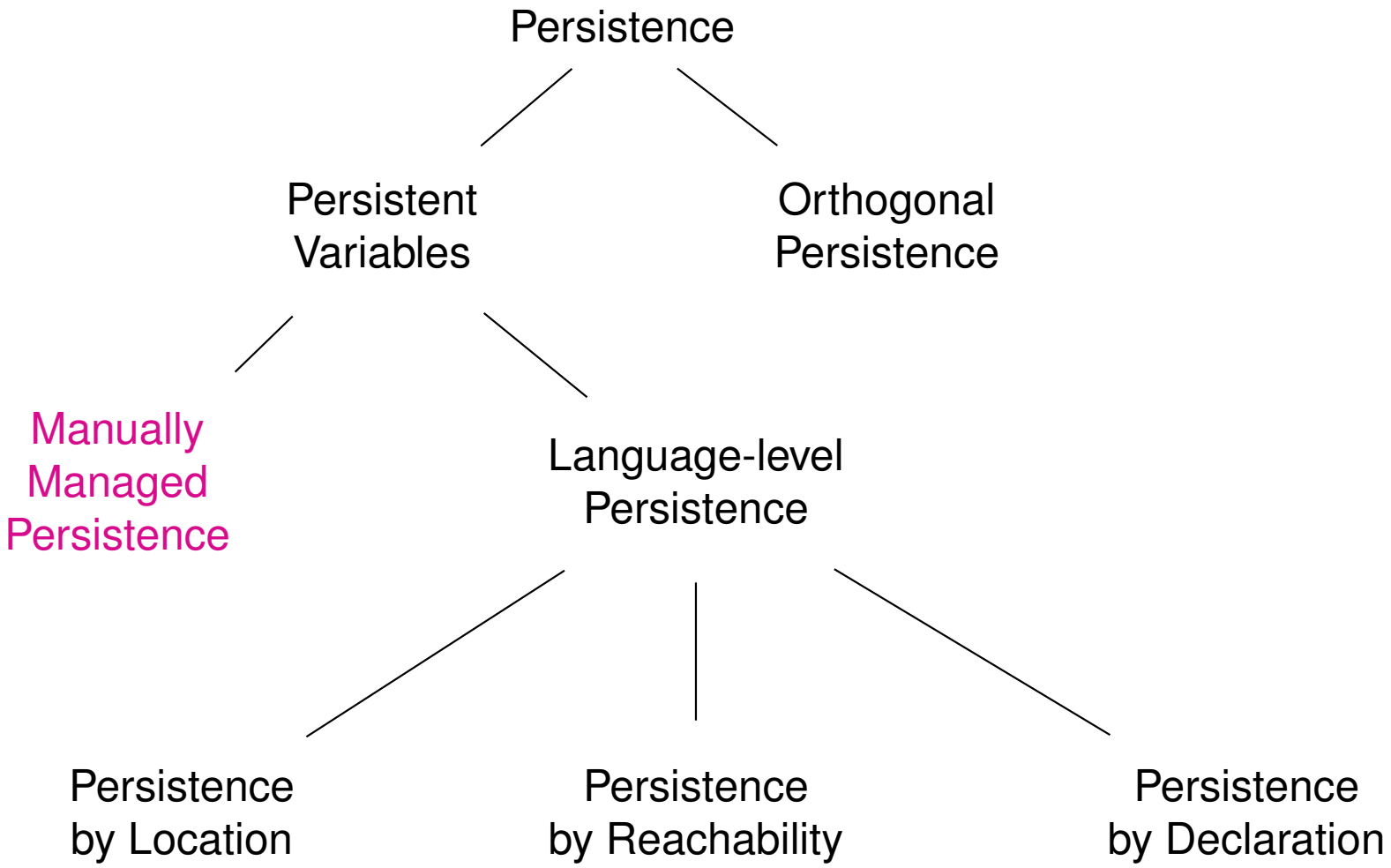

OVERVIEW

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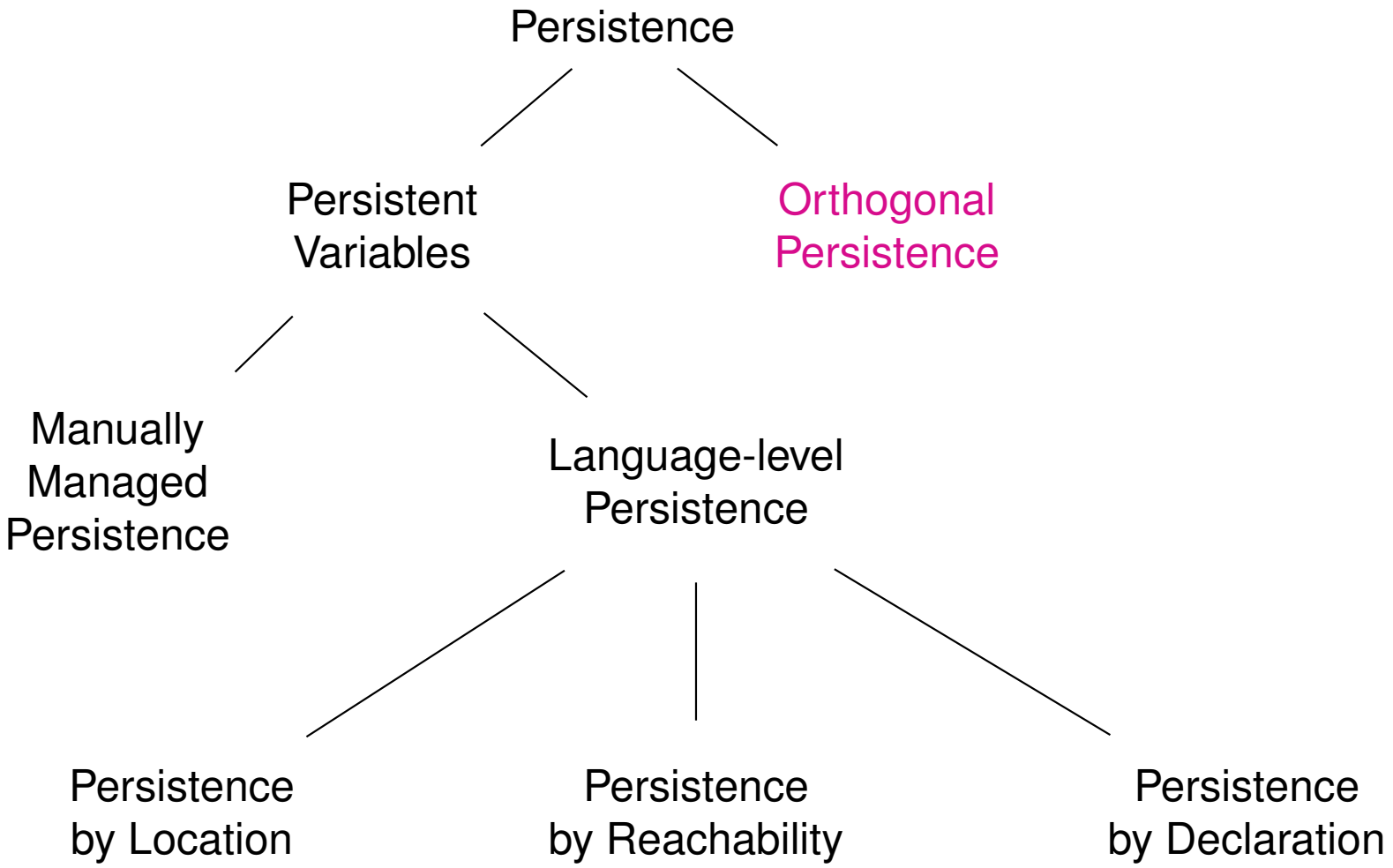

OVERVIEW

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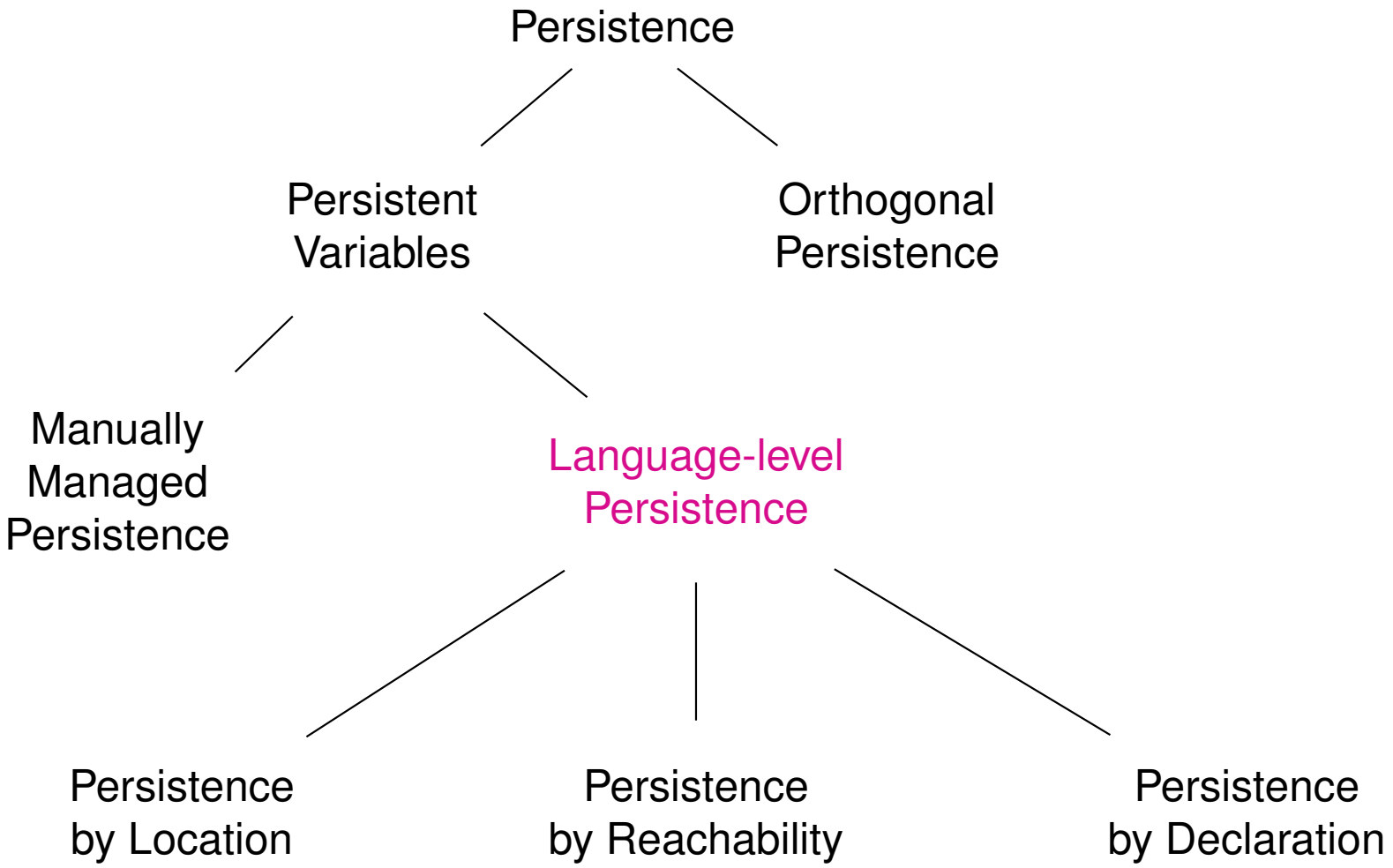

PERSISTENCE BY REACHABILITY

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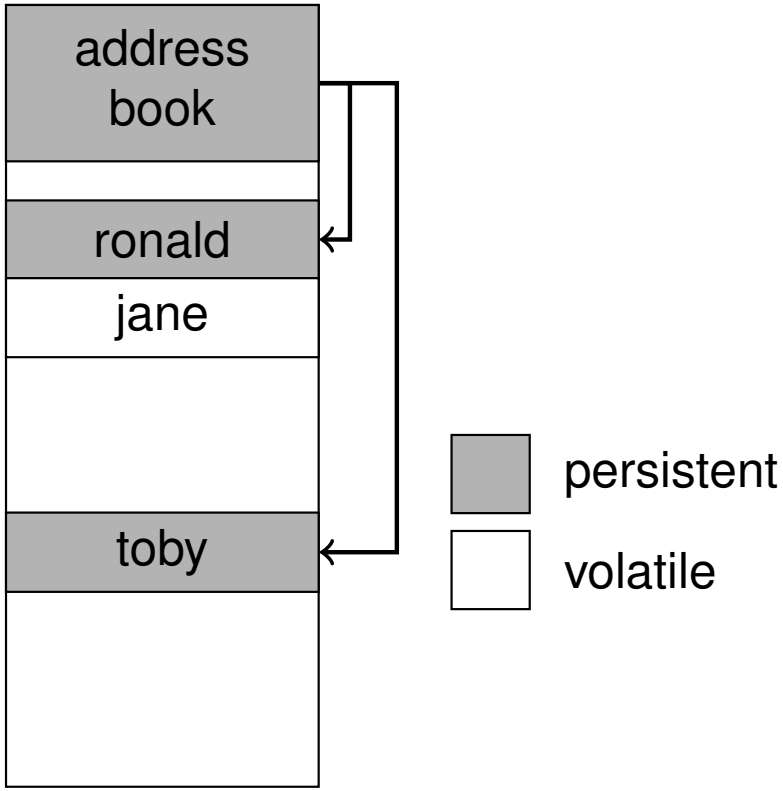
Napier88:

```
type person is structure (name,
     address : string)

let ps = PS()

project ps as X onto
 person:
  begin
   X(name) := 'Ronald Morrison'
   X(address) := 'St Andrews'
  end
 default: {} ! This is the catch
       all and ps has type any
      here
```



PERSISTENCE BY LOCATION

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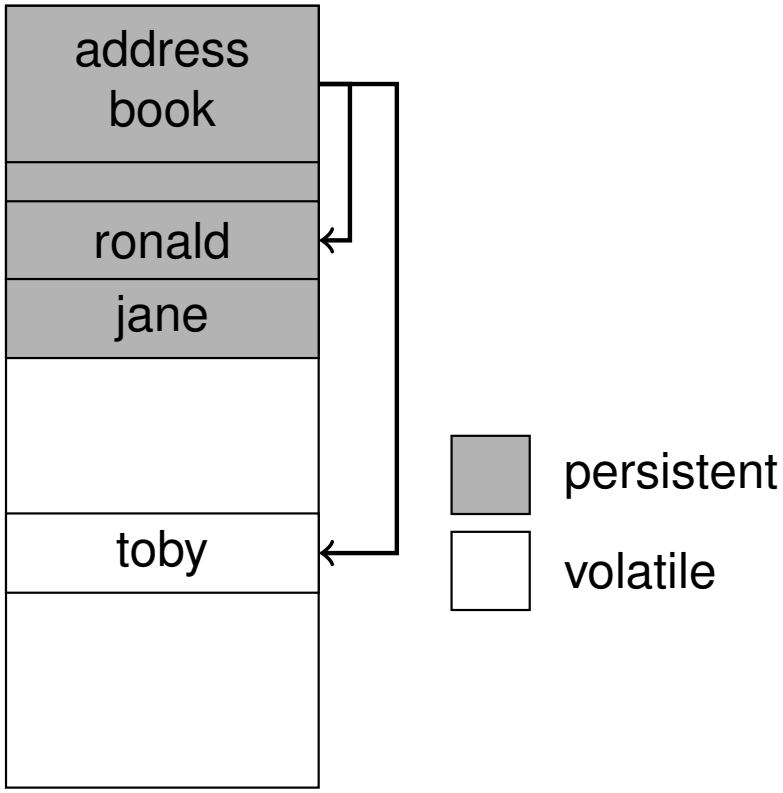
ObjectStore:

```
main() {
 // declare a database and an 'entrypoint' into it
 database* db;
 persistent(db) Adressbook* book1;
 // open the database
 db = database::open('/books/book1');
 // start a transaction
 transaction::begin();
 Person* jane = new (db) Person ('Jane');
 book1->add_person(jane);
 // commit all changes to the database
 transaction::commit();
}
```



PERSISTENCE BY DECLARATION

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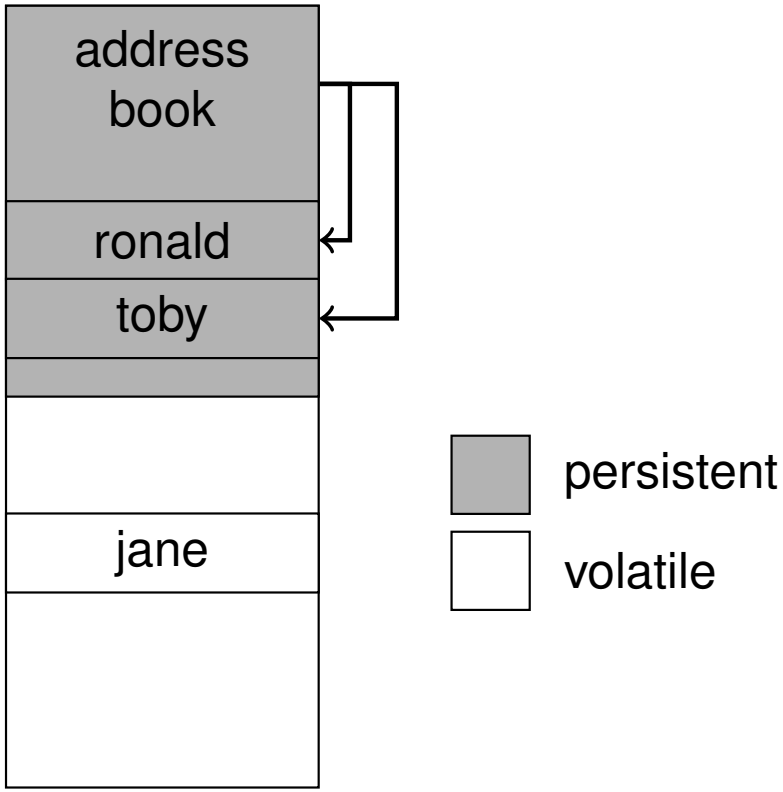
E:

```
dbclass Person {...};
dbclass Addressbook: collection[
      Person];
persistent Addressbook book1;
Person* ronald = new (book1)
      Person('Ronald');
Person* toby = new (book1,
      ronald) Person('Toby');
```



SUMMARY

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Manually Managed Persistence

- explicity conversion
- error prone

Orthogonal Persistence

+ data lives as long as it is referenced
- even volatile data is preserved

Persistent Variables

- error prone or
- reachability detection

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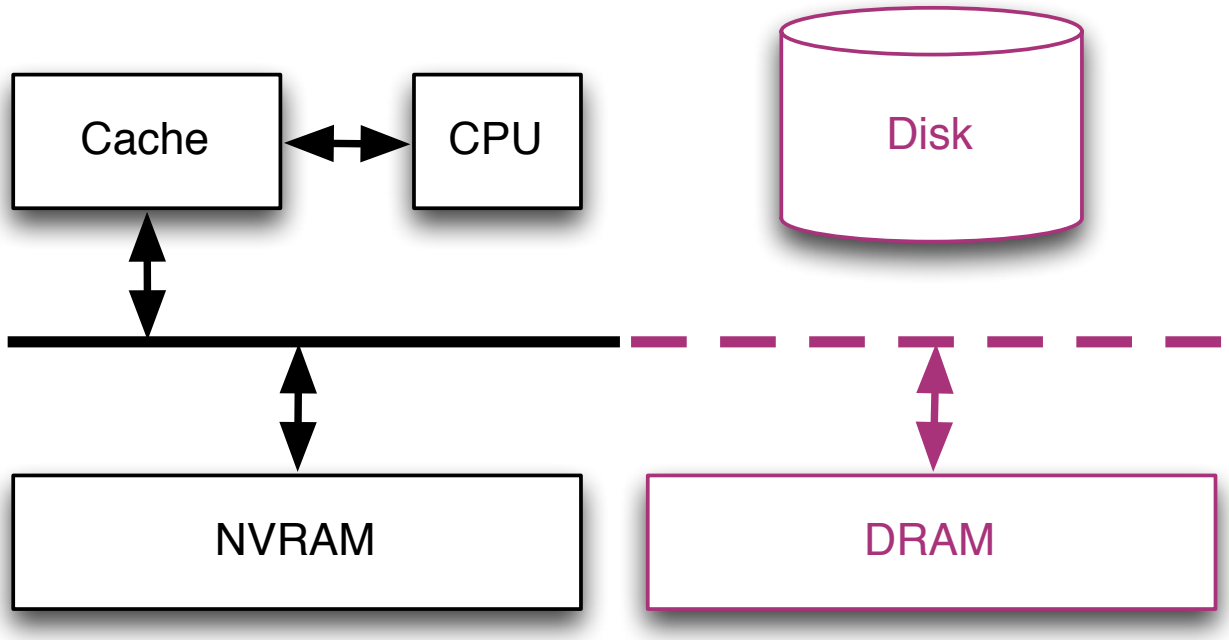
NON-VOLATILE MEMORY

Properties

- byte-addressable
- non-volatile
- access latency comparable to DRAM



NVRAM USE CASE 1

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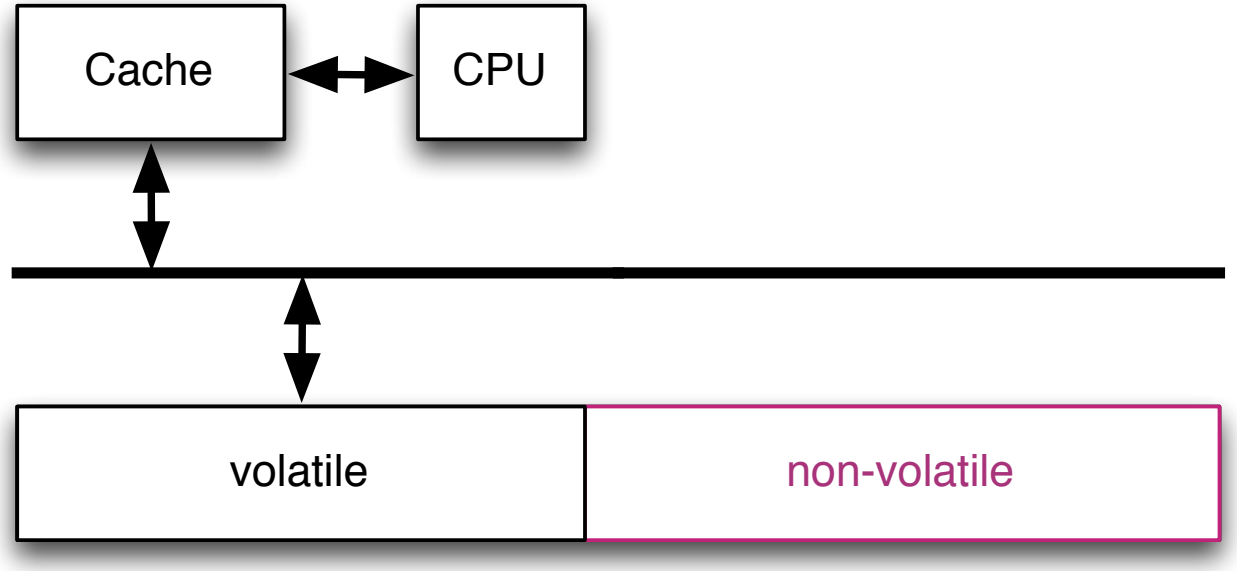
NVRAM as a Fast Disk

- block abstraction
- lower access latency
- persistence limited to files



NVRAM USE CASE 2

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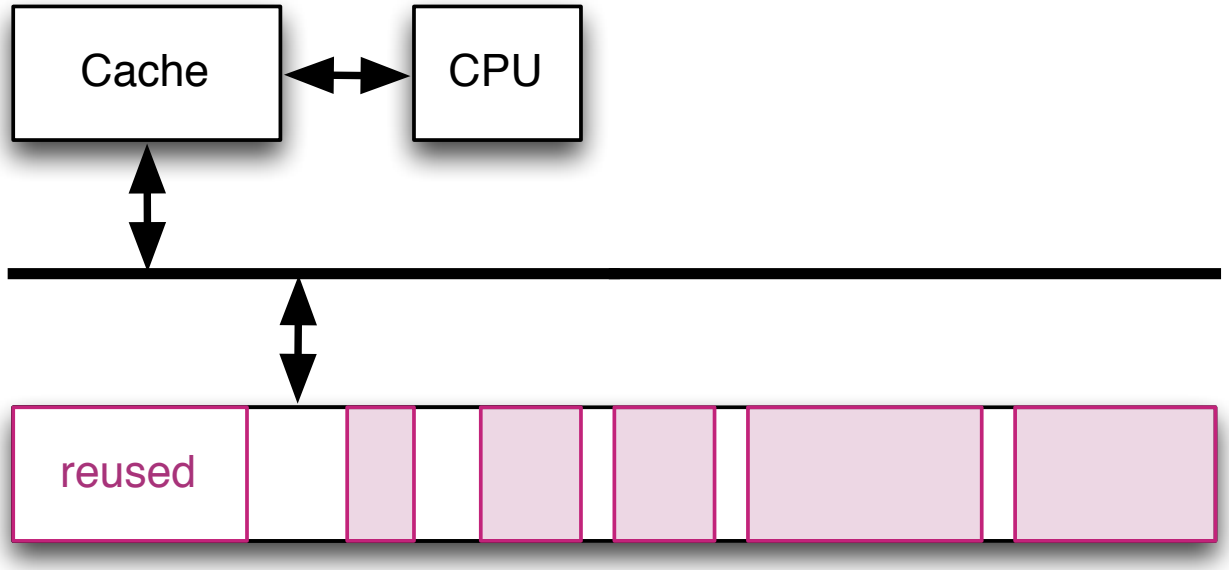
NVRAM as an Object Store

- completely disk-less
- reuse data structures
! power outages ⇒ transactions?



STORAGE CLASSES

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Storage Class	Requirements	Examples
Recoverable	transactional semantics	object store/file system meta data
Resettable	corruption detection	file system name cache
Transient	reset on boot	state of device drivers
Volatile	reset on power loss	keys

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PERSISTENCE MODELS APPLIED I

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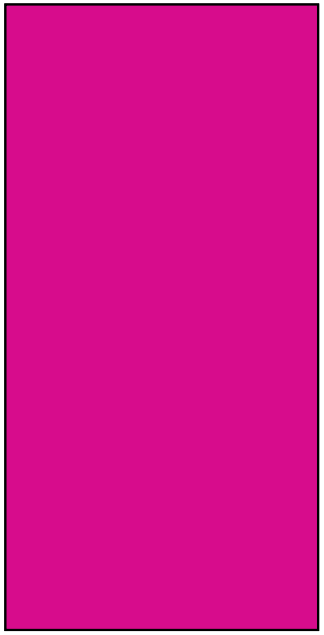
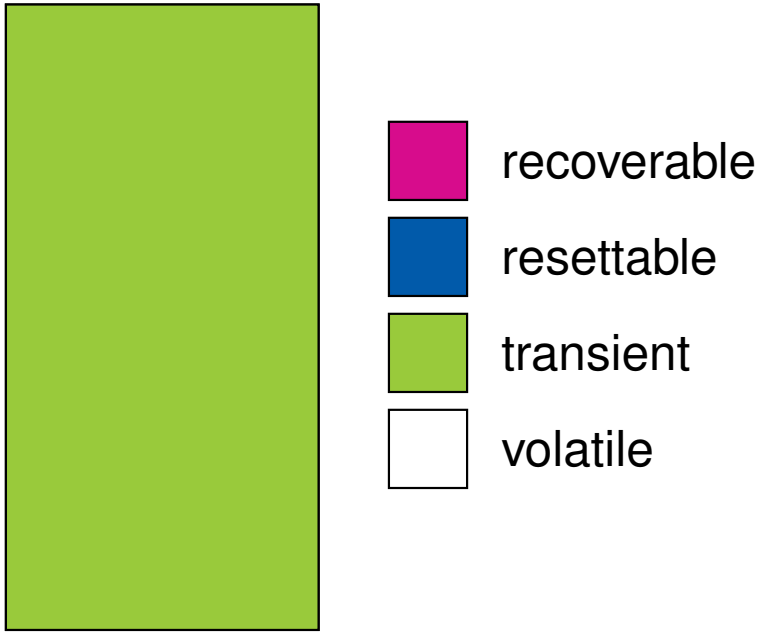
Orthogonal Persistence



Manually Managed



PERSISTENCE MODELS APPLIED II

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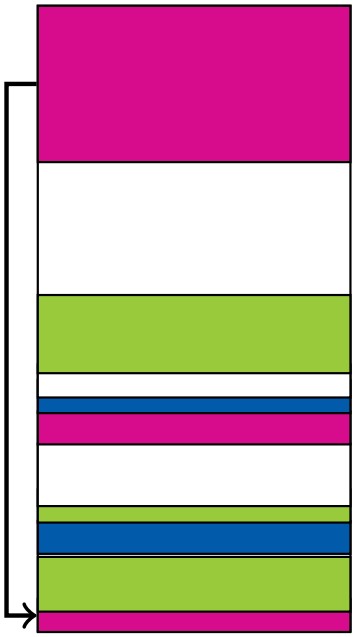
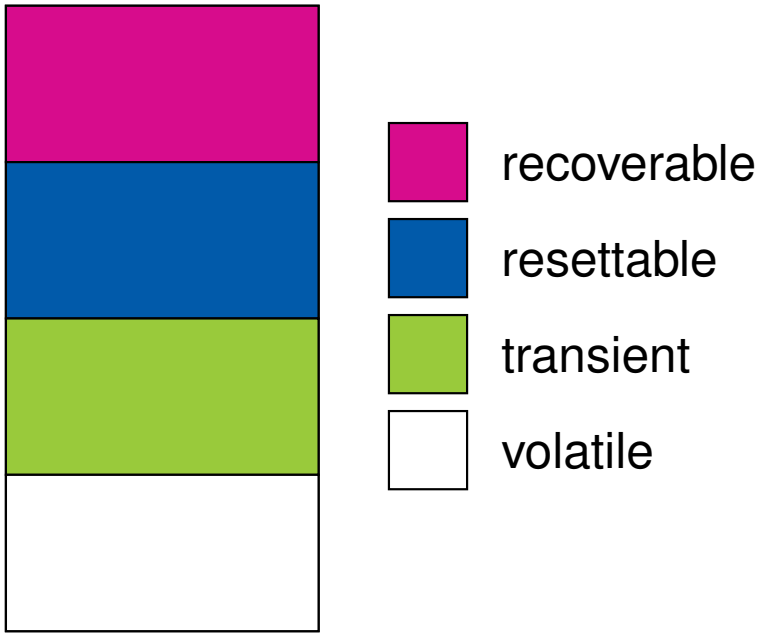
Persistence by Reachability



Persistence by Location



THE END

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Questions?