Hibernus

Here, it is illustrated the behaviour of Hibernus in response to a variable supply voltage. When the voltage falls below \( V_{\text{th}} \), the system saves a snapshot and hibernates. When the voltage rises above \( V_{\text{th}} \), the system restores a snapshot and continues operation.

**Variable and Unpredictable Source**

To accommodate this variability, systems incorporate large energy buffers such as rechargeable batteries or super capacitors.

**Hibernus Software structure with mbed**

**Supported Platforms**

- **Freescale KL05Z**
  - Cortex M0+
  - Internal Comparator
  - Flags stored in a separate Flash area
  - Small RAM capabilities (4MB)

- **LPC11U24**
  - Cortex M0
  - External Comparator
  - Flags stored in Ram memory
  - Higher RAM capabilities (32MB)

**Addressed Challenges**

- Memory Layout
- Memory configurations and sizes
- Flash IAP for different boards and manufacturers
- Presence of an internal analog comparator
- Use of an external analog comparator
- Saving the flags in RAM memory when the Flash size is limited
- Peripheral registers restoration
- Avoid fixed memory addresses conflicts
- Create a general library that can be easily used and modified in order to work with all boards that offer support for mbed or mbed OS

**Hibernus Core**

**Drivers**

- Flags in RAM
- Flags in Flash
- Internal Comparator
- External Comparator

**Support Platform**

- Platform Independent
- Platform Dependent

**ARM mbed ecosystem**

To address this challenge, transient computing can be integrated as part of IoT programming frameworks such as ARM’s mbed IoT Device Platform.

**mbed Requirements for Transient**

- **mbed requirements**
  - Memento
  - QuickRecall
  - Hibernus
  - Hibernus++

- No compiler-level modification required
- No specific architectures and extra HW
- Applicable to Flash memory

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