Hardware-Optimized Checkpointing for Intermittent Devices

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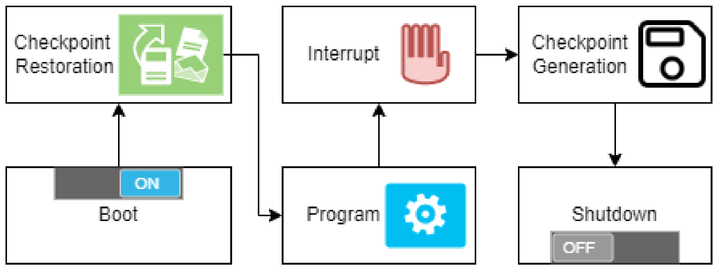
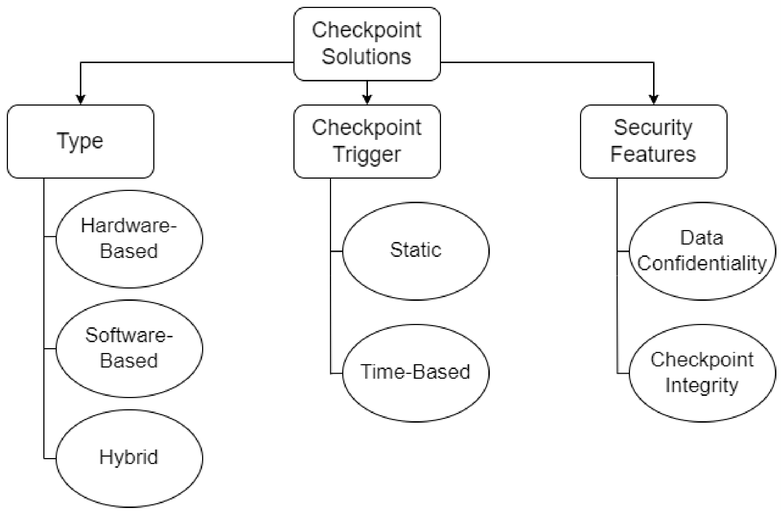
BACKGROUND



What is checkpointing?

RELATED WORK

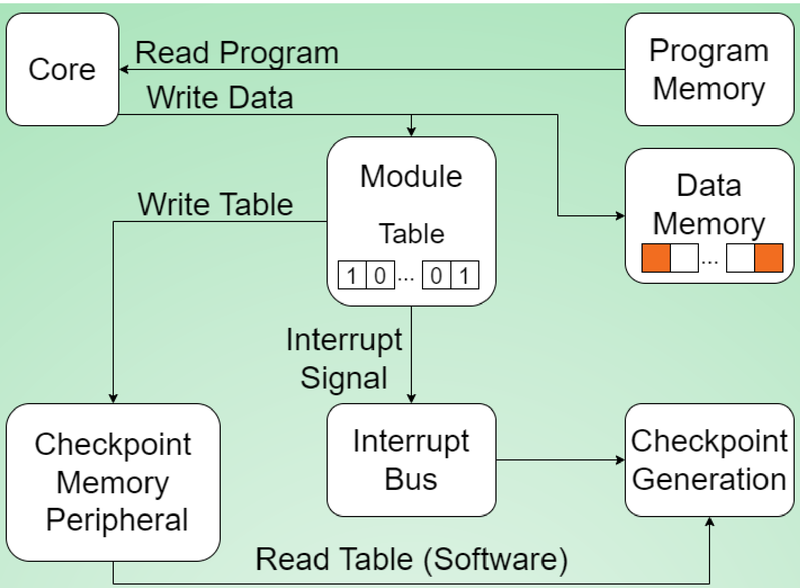


- ❖ Leading solutions are fully software-based but come with high overhead and energy consumption.
- ❖ Hardware solutions come with higher costs, while existing hybrid solutions are insecure.

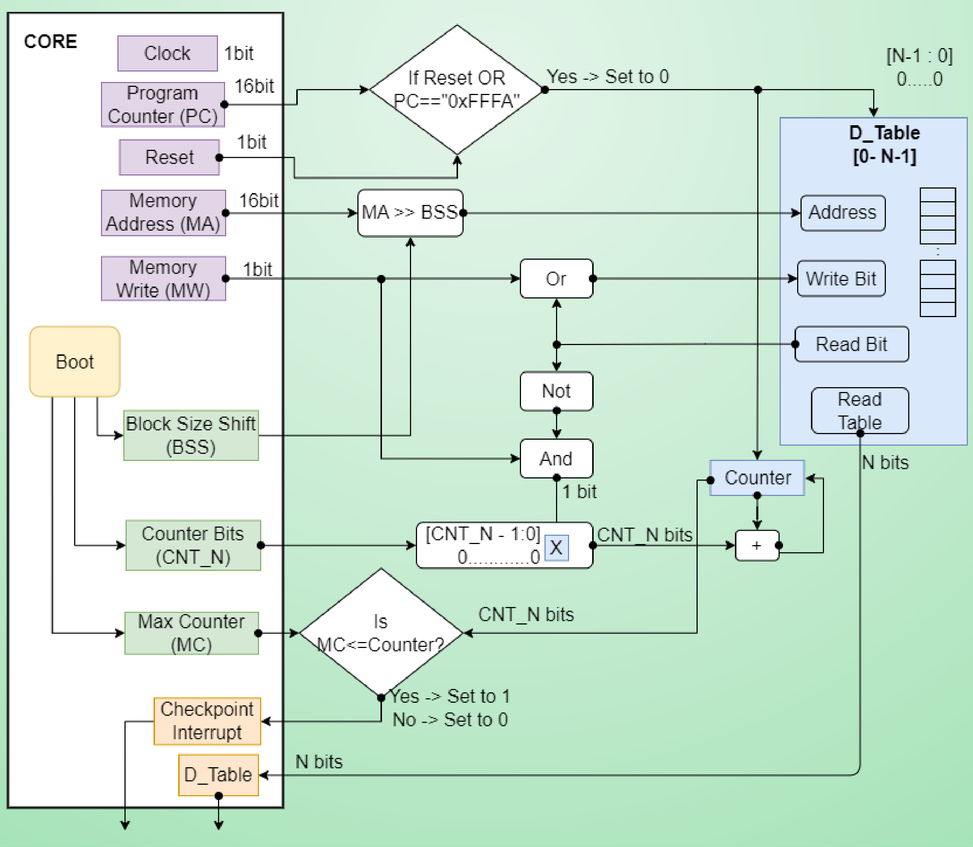
CONTRIBUTIONS

- ✓ This design more efficiently tracks volatile memory usage and checkpoints only **modified** memory blocks.
- ✓ This design also includes a mechanism to trigger checkpoint generation based on a **threshold** which is a predetermined number of modified memory blocks.
- ✓ This design **does not rely on instrumentation** to monitor memory changes, resulting in reduced energy consumption.

DESIGN OVERVIEW



MODULE PROCESSES



EXPERIMENTAL RESULTS

Resource Utilization	Module
Slice LUTs	11 (0.00005%)
Slice Registers	44 (0.001%)
F7 Multiplexer	2 (0.0001%)
F8 Multiplexer	1 (0.0001%)
Power Consumption	< 0.001 W

The designed module requires minimal hardware resources in comparison to the total resources used by the device.

CONCLUSION

- ✓ **The proposed design tracks used memory portions better as blocks, conserving time and energy during the checkpoint process.**
- ✓ **This hardware approach fits into a hybrid checkpointing scheme, which is flexible and allows general or purpose-specific software solutions to work with higher optimization.**

FUTURE WORK

- ❖ **Research into more effectively determining the threshold value by estimating power supply and energy consumption.**
- ❖ **Further experiments to measure the efficiency of this design combined with leading software checkpointing solutions.**

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