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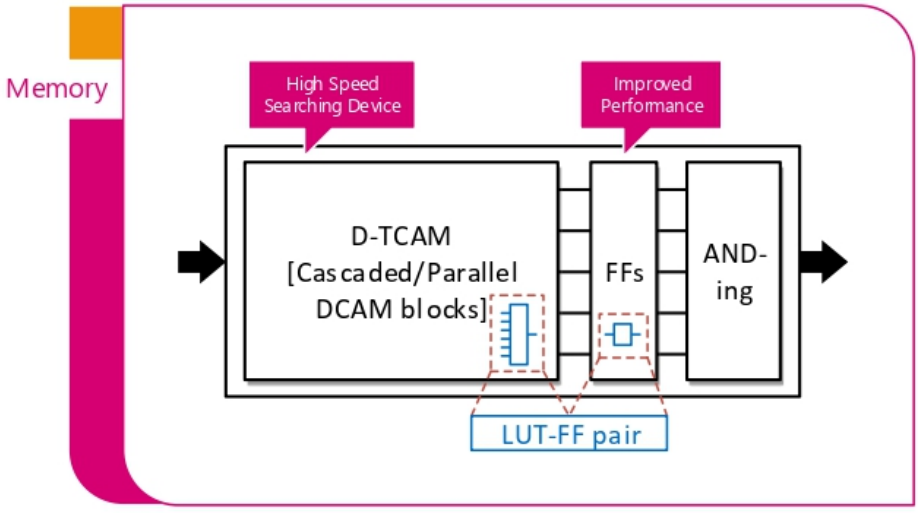
# Efficient Ternary Content-addressable Memory Based on Lookup Tables and Flip-flops

Communications & Information

Computer/AI/Data Processing and Information Technology




**IP Status**
Patent granted

Technology Readiness Level (TRL) 3

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## Opportunity

Field programmable-gate array (FPGA) vendors are likely to release the hard core of ternary content addressable memory (TCAM) in future FPGA devices. The invented design can be adopted in future FPGA devices. Xilinx is a big giant in the field of FPGAs, and the evaluation is based on Xilinx FPGA devices. The application of emulated TCAM inside FPGA includes its deployment as Routers, Switches, etc., in software-defined networks (SDNs).

## Technology

Ternary content-addressable memory (TCAM) is a high-speed searching device that searches the entire memory in parallel in deterministic time, unlike random-access memory (RAM) which searches sequentially. A network router classifies and forwards a data packet with the aid of a TCAM which stores the routing data in a table. FPGAs, due to its hardware-like performance and software-like reconfigurability, are widely used in networking systems where TCAM is an essential component. TCAM is not included in modern FPGAs which leads to the emulation of TCAM using available resources on FPGA. Several emulated TCAM designs are presented but they lack the efficient utilization of FPGA's hardware resources. In the design, there is a novel TCAM architecture, distributed RAM based TCAM (D-TCAM), which uses D-CAM as a building block. One D-CAM block implements a 48-bytes TCAM using 64 lookup tables (LUTs), which is cascaded horizontally and vertically to increase the width and depth of

TCAM, respectively. The invented design achieves a tremendous improvement in throughput without using additional hardware resources and can be updated only in 64 clock cycles.

## Advantages

- More efficient by exploiting its physical structure.
- Improve throughput without using additional hardware resources.
- Reconfigurable according to different application.

## Applications

- Network routers
- Access control systems
- Pattern recognition
- Artificial Intelligence
- Translation lookaside buffers (TLBs)