

## Motivation

The growth of Internet traffic and speed of network links has direct impact on the required performance of core routers. To handle network traffic with **100 Gbps throughput**, routers have to process millions of packets per second. The most time-critical operation in core routers is the **Longest Prefix Match (LPM)**. Current IP lookup algorithms have high memory demands when representing **IPv6** prefix sets or introduce very high pre-processing overhead. Therefore, we propose a **new LPM algorithm** which is able to provide **very low memory demands** for IPv4/IPv6 lookups.

## Summary

- Proposed prefix set representation has the **lowest memory requirements** in comparison to all existing LPM algorithms
- Large routing tables can fit into the **on-chip memory**
- HW architecture for this algorithm was also designed and proposed
- The architecture was implemented on Xilinx Virtex-6 FPGA with **140 Gbps throughput**
- Published on **IEEE conferences**:
  - DDECS
  - FPL

## Analysis

### LPM algorithms analyzed:

- Unibit Trie
- Controlled Prefix Expansion
- Lulea Compressed Tries
- Level Compression Trie
- Tree Bitmap (TBM)
- Shape Shifting Trie (SST)
- Prefix Partitioning

### IPv6 prefix sets analysis (using TBM):

Identified 2 significant groups of nodes:

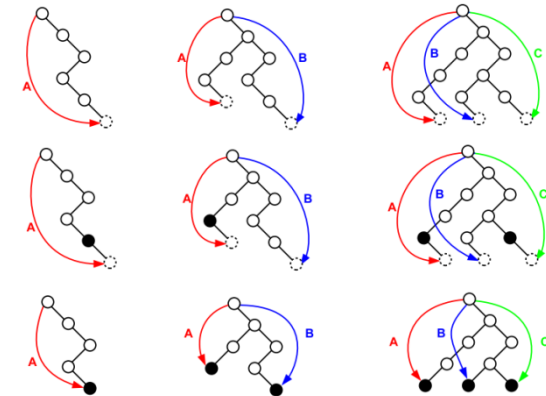
- Leaf nodes with no children
- Internal nodes without prefixes

Prefixes	Child Nodes								
	0	1	2	3	4	5	6	7	8
0	0	11303	1666	812	538	184	145	131	249
1	8965	547	142	19	17	3	2	1	1
2	193	21	14	4	3	0	1	0	0
3	50	3	3	3	1	0	1	0	0
4	29	3	1	1	3	1	1	0	0
5	0	1	0	1	0	0	0	0	0

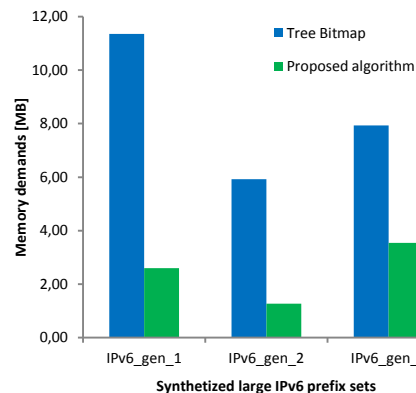
## Design

### Algorithm properties:

- Using fixed set of **node-types**
- Nodes optimized based on analysis results
- Variable length and shape** of nodes
- Nodes are mapped to the prefix tree in order to find **best coverage** of the tree
- In every part of the tree is used the node with the **lowest price**



## Results



Protocol	Prefixes	Memory requirements [kB]			Memory savings	
		TBM	SST	Proposed algorithm	Compared to TBM	Compared to SST
IPv4	220779	712,76	510,13	446,42	37,37%	12,49%
	442748	1492,76	1096,87	972,48	34,85%	11,34%
IPv6	10518	159,43	73,56	59,47	62,70%	19,16%
	10814	165,82	77,14	61,73	62,77%	19,98%

Real IPv4/IPv6 prefix sets