Measurement of Memory Needs for Fast IP Routing

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Abstract:
Demands in the marketplace are leading to higher bandwidth network designs. With links that can carry over 30 million 40-byte packets a second, the need for fast algorithms is evident.

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To put this promising scheme to the test, an assessment of its memory use is needed. This work provides that assessment. Using a realistic routing table with 65,000 incoming packets and several routers as possible “next hop” networks.

A Level-32 bit segment carries those 216-bit intervals at level 32, which correspond to the subtrees, rooted by prefix16, with one or more stored prefixes.

The offsetvals for each level show where child values or childval24 and childval32 are indicated through what is called their respective “child values” or childval24 and childval32.

Not many packet prefixes will be at levels 24 and 32, and in order to exclude a large amount of empty space from memory and the search process, they are stored as segments.

Level-8 bit vector indicates the existence of all the prefixes between levels 1 and 7, which are expanded to level 8, including level-8 prefixes. The level-8 bit vector, denoted as prefixval8, has 256 bits. Each bit represents a 8-bit prefix at this level. Note that, since this level contains a small number of bits, the bit vector can be stored in a memory block together with the next-hop information.

In order to indicate the existence of a possible matching path at a different level of the tree, every 16 bits is given what’s known as an “offset value,” or offsetval. The offsetvals for each level show where prefixes are present in other levels. There is an offsetval16, offsetval24, and offsetval32.

There is also a value called the “child value,” or childval. With incoming packets being broken down into 32-bit chunks, levels 24 and 32 are indicated by adding offsetval32 to the number of ones in the childval32 chunk found to the left of the final bit in the chunk.

In order to do the prefix expansion, we need to select all the prefixes whose lengths do not match the allowed set of prefix lengths and expand them to the next allowable prefix length.

This scheme chooses the expansion lengths so that relatively few original prefixes have to be expanded.

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This is the program I used to convert the incoming network IDs to binary code.

According to the Professor’s research, this algorithm, will only take two Memory accesses to completely retrieve the data.

Many prefixes can be stored, and selective prefix extension allows to significantly scale down the number of prefixes stored. This is an excellent arrangement for an IP routing table.